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Gender Analysis Of Cassava-Maize Intercrop Production Activities In Ekiti State, Nigeria

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Abstract

Studies have shown that women produce between 60 and 80 percent of food in African countries and are responsible for half of the World's food. It is therefore important to pay substantial attention to the contribution of both male and female members of households to agriculture for sustainable agricultural development. Multi stage sampling technique was use to select 120 respondents consisting 60 males and 60 females for the study. The result showed that all the respondents have other income generating activities apart from farming. Land preparation (99.2%), heap making (100.0%) and chemical spraying (95.0%) are mostly carried by the male members of households. Activities such as processing (87.5%), packaging (70.8%), transportation (76.7%) and marketing (72.5%) are mostly carried out by female members of households. Tobit regression result showed that female members of the households usually make more income from off-farm activities, on the other hand, male members of households make more income from their cassava-maize intercrop farms than their female counter parts. The study recommends that both male and female members of households should be given equal opportunities in relation to agricultural activities.

Keywords: Gender, cassava-maize intercrop, production activities and food security

Introduction

Gender and sexual distinction between male and female are commonly used interchangeably with sex, within the academic fields of cultural, gender and social sciences. The term, gender, refers to a social construction rather than a biological condition (Reddy, 2005). Gender is a socio-economic variable used to analyze roles, responsibilities, constraints, opportunities and incentives of people involved in agricultural activities (Poats, 1991). It is nearly three decades called into question if women and men benefited equally from economic development. Since then gender issues in agriculture have become an important subject of enquiry. Gender analysis in mixed farming system is required to understand the various roles of men, women and children in farming systems and the way these roles are affected by new interventions. Particular attention has been given to roles of women because in many cases they undertake major responsibilities in agricultural production, processing and marketing in addition to performing household chores, reproductive and child rearing activities. Abdullahi (1990) categorized women's role in agricultural activities into three: some are farmers while others help on their husband's farms particularly in planting, fertilizer application and harvesting. Some process farm produce into various farm products while others market various farm products. In most communities in the study area there is practice of shifting cultivation which necessitates preparation of new plots every year.

Owing to the rapid growth of population combined with shortage of capital, the total demand for female labour is likely to increase. In every sparsely populated region, men do little farm work while the women do the most. In regions of intensive cultivation of irrigated land, both men and women put hard work into agriculture in order to earn enough to support a family on a small piece of land; and in more densely populated regions, where the agriculture system is that of extensive plough cultivation, women do little farm work and men do much more. It has been recorded that women produce between 60 and 80 percent of the food in African countries and are responsible for half of the world's food production (FAO, 1998). Women produce and process food and use diverse coping strategies for ensuring food security for their households. Quisumbing (1995) reported that women are the key to food security for their households.

Most of women specialize on the cultivation of food crops such as maize, cassava, vegetables, peppers, plantains etc. These food crops are often grown for both food and cash purposes. They also work on various cash crops owned by men and women because in many cases they undertake major responsibilities in agricultural production, processing and marketing. Women have been participating in development and socio-economic changes as far back as the pre-colonial days. These socio-economic changes are mainly weeding, hoeing, harvesting and processing. Processing is an essential part of agriculture which is a potent activity upon which an economy's development revzolves. Unprocessed farm produce leads to wastage during harvesting periods, and this can draw back the wheel of economic progress by creating disincentive to produce.

Women work on the farm throughout the year, growing root crops like cassava, potatoes and some other food crops like maize that are usually being consumed within the households. They also engage in light job like planting of seeds, harvesting crops and transportation of these produce to their homes. Men on the other hand, work for short period during planting season. Women's productivity as a result of contribution to agriculture remains unvalued, unrecognized and unappreciated because they share less in the economic rewards. This happened when subsidized inputs, such as fertilizer, were distributed mainly to male farmers, who are often

favoured in such policies but are less active in farming activities but not to female farmers who are very active in farming activities and are often over looked by public policies.

Men on the other hand play important role in agricultural production in Nigeria and they must not be cut off from participating actively in agricultural development programmes. FAO (1998) recorded that men have been largely responsible for bush clearing, land preparation, staking of crops and hunting. With the introduction of cash crops in Africa, men grew many cash crops such as cocoa, oil palm, tobacco and sisal. Men tend to control capital that is used to buy technological inputs such as ploughs or tractor, improved seed and chemicals etc. Even when men do not have sufficient capital, they can obtain credit using titles to land as a means of collateral which is not available to women. Agricultural extension is a major factor for agricultural development which aims at providing farmers necessary education, skill and innovations to enable them improve their productivities is also mainly towards men. This is due to the fact that men suppose to share agricultural knowledge received through extension with their wives. Male task in agriculture are declining owing to the following: the decrease in forest cover and game reserves, the greater participation of men out-migration and male predominance in export crop production. This exclusion of women from new technologies and capital scheme has negatively affected the cassava-maize production in the developing countries including Nigeria. Anyawu and Agu (1995) observed that there is a tendency to neglect and ignore women farmers in the delivery of extension messages for food production. While religious, cultural and social norms constrain women right and activities, reproduction and household responsibilities impinge on their time and mobility. Women's contribution to agricultural activities can never be overemphasized.

There is a need therefore to assess the participation of both men and women in cassava-maize intercrop activities so as to reveal gender roles and assist programmers to properly target to right audience in cassava based developmental programmes. This study was therefore designed to identify the socio-economic characteristics of the respondents, examine the activities involved in cassava-maize intercrop production and determine male and female involvement in these activities.

Methodology
The study was carried out in Ekiti State, which is one of the six States in the southwestern Nigeria. Six Local Government Areas were randomly selected from the State. Multi stage sampling techniques was adopted for data collection. Two communities were randomly selected from each of the six Local Government Areas making 12 communities from the State. Ten households involved in cassava-maize farming were selected from each of the communities making a total of 120 respondents for the study. Data was collected using interview schedule. Descriptive analysis such as percentages, frequency count, standard deviation were used to present the data while probit regression was used for inferential analysis.

Result and Discussion
Socio-economic Characteristics of the Respondents
Table 1 reveals age distribution of respondents. Average age of the respondents is 46.32 ± 12.68. About 54 percent were married and 37.5 percent were single. Fifteen point seven percent of the respondents had no formal education while 12.5 had tertiary education. Religion of the respondents showed that 73.3 percent were Christians while 15.0 percent were Islams and 11.7 percent practiced traditional religion. The implication of this finding is that cassava-maize intercrop production is against any religion.

Respondents' other occupation showed that 37.5 percent of the respondents were civil servants, 29.2% were traders and 20.8% were craftsmen About 57.5 percent of the respondents had between 1,500 and 5,500 heaps of cassava and maize intercrop while only 2.5% of them had between 13,501 and 17,500 heaps which are less than two hectares as their cassava-maize intercrop. This shows that the farmers are cultivating under small scale which will be difficult to mechanize but use manual labour for its cultivation and maintenance. Land acquisition of the respondents showed that 70.0% of them inherited their cassava-maize intercrop farm land, 14.2% of them leased their land while 15.8% of them purchased their land. This may be the reason why the farm size is very small since they do not have control over the size of land that would be given to them as inheritance. Source of transportation of farm produce from farm to house showed that 16.7% use motor cycles, 8.3% use motor vehicle while the majority (75.0%) transported their produce through walking. Respondents' sources of labour revealed (75.0%) used family labour and only 16.7% of them often used hired labour on their farms. Distance from farm to the market was measured and 24.2% of the respondents indicated that their farms are less than 10km from the market while 12.5% of them indicated that their farms are more than 40km from their markets. Place of marketing of farm produce showed that majority of the respondents (73.3%) market their produce at the village market, 16.7% at farm gate while only 7.5% market their farm produce at the city market.

Table 1: Frequency Distribution of Socio-economics Characteristics among Respondents

Socio-economics characteristics	Frequency	Percentages (%)
Age		
= 30	12	10.0
31-40	21	17.5
41-50	37	30.8
51-60	44	36.7
Above 60	6	5.0
Marital status		
Single	45	37.5
Married	65	54.2
Divorced	7	5.8
Widowed	3	2.5
Level of education		
No education	20	16.7
Non-formal education	9	7.5/

Primary education	45	37.5
Secondary education	31	25.8
Tertiary education	15	12.5
Religion		
Christian religion	88	73.3
Islam religion	18	15.0
Traditional religion	14	11.7
Other occupation		
Civil services	45	37.5
Trading	35	29.2
Artisan	10	8.3
Crafting	25	20.8
Others	5	4.2
Farm size		
1,500 - 5,500	65	57.5
5,501 - 9,500	39	29.2
9,501 13,500	13	10.8
13,501 17,500	3	2.5
Land acquisition		
Inherited	84	70.0
Leased	17	14.2
Purchased	19	15.8
Source of transportation		
Motorcycle	20	16.7
Public transport	--	---
Motor vehicle	10	8.3
By walking	90	75.0
Source of labour		
Hired	20	16.7
Family	90	75.0
Aaro	10	8.3
Distance to market (km)		
= 10	29	24.2
10.5 20	29	24.2
20.5 30	35	29.2
30.5 40	12	10.0
Above 40	15	12.5
Place of marketing		
Farm gate	20	16.7
Village market	88	73.3
City market	9	7.5
Produce merchant	3	2.5

Source: Field survey, 2010

Cassava-Maize Intercrop Activities among Male and Female Household Members of the Respondents

Table 2 shows that majority of the respondents (99.2%) indicated that their male members of their households usually prepare land for cassava-maize intercrop. All households (100.0%) make heaps for planting and indicated 95.0% males spray chemicals. On the other hand, majority of the respondents indicated that female members of their households (87.5%) process their farm produce while 70.8% of females package their farm produce. Majority of the females (76.7%) also transport farm produce and 72.5% engage in marketing their farm produce. The respondents indicated that there are no clear cut differences between male and female who usually carry out activities such as planting, weeding, water fetching and fertilizer application. The implication of this study is that both male should be more involved in technologies development. Women should be the focus of processing technology, market information and transport technology or services. Both genders should be focused on with regards to input distribution.

Table 2: Frequency Distribution of Production Activities among Male and Female household members of Respondents

Production activities	**Male (%)**	**Female**	**Both**
Land preparation	119 (99.2)	1 (0.83)	-----------
Heap making	120 (100.0)	----------	-----------
Planting	34 (28.2)	37 (30.8)	49 (40.8)
Weeding	33 (27.5)	39 (32.5)	48 (40.0)
Water fetching	36 (30.0)	39 (32.5)	45 (37.5)
Fertilizer application	33 (28.5)	39 (32.5)	48 (40.0)
Spraying	114 (95.0)	5 (4.2)	1 (0.8)
Processing	6 (5.0)	105 (87.5)	9 (7.5)
Packaging	11 (9.2)	85 (70.8)	24 (20.0)
Transportation	10 (8.3)	92 (76.7)	18 (15.0)
Marketing	33 (27.5)	87 (72.5)	----------

Source: Field survey, 2010

Distribution of Problem Encountered by the Respondents during Cassava-Maize Intercrop Activities
Most of the respondents (40.8%) indicated that they usually have cassava and maize glut, 26.7% and 20.0% of the respondents indicated that they usually encounter pest and diseases infestation and low rainfall respectively during cassava-maize intercrop. The low rainfall might be as a result of climate change which usually manifests either too early rainfall or too late rainfall. This is a worldwide problem and each country is now been charged with the responsibility of developing climate change adaptability strategy for its citizenry. The problem of glut can be mitigated by developing and using highly efficient post-harvesting technologies for cassava-maize intercrop farmers that would result into better products with high acceptability among the consumers.

Table 3: Frequency Distribution of Problem Encountered by the Respondents

Problem encountered	Frequency	Percentages (%)
Pest and Distance	32	26.7
Low rainfall	24	20.0
Theft	4	3.3
Poor yield	10	8.3
Glut	49	40.5
Others	1	0.8

Source: Field survey, 2010

Probit regression was use to test for significant relationship between gender and agronomic practices involved by cassava-maize intercrop farmers. The regression showed that harvest to market (0.107, p = 0.0690), income apart from farm activities (0.00001, p = 0.0353), income from farm activities (-0.0006, p = 0.0073) and fertilizer use (0.193, p = 0.0005) are all significantly related to gender participation in the study. Harvest to market and off-farming income are significant at 10% and 5% level of significant respectively while farm income and fertilizer use were significant at 1% level of significant.

All the significant variables have positive coefficient except off-farm income. The positive coefficients indicate that female members of households have cassava and maize to market than the male farmers, female member of households have more off-farm income compared with the male and female farmers use fertilizer than the male farmers. On the other hand, Male members of households have income from farm produce than the female farmers. This finding may be due to the fact that female farmers use most of their farm produce for family consumption and the rest is usually processed for sale and to buy other food items that they cannot produce on their farm to increase food security of the family. On the other hand male members of household would like to sell their produce in bulk to use for their household capital projects.

Conclusion

It has been realized from the foregone study that gender is a social construction rather than biological condition. Gender issue has gained attention in agricultural research for three decades. Women produce between 60 and 80 percent of food in Africa countries and are responsible for half of the World's food. Some cassava-maize intercrop activities such as land preparation, heap making and chemical spraying are mostly carried out by male members of the households. On the other hand, activities such as processing, packaging, transportation and marketing are carried out mostly by female members of the households. Some activities such as planting, weeding, water fetching and fertilizer application can be carried out by male or female or both.

Result of Tobit regression analysis showed that female members of the households have more cassava and maize harvest for sale than male. Female members of the households apply fertilizer and realize more income from their off-farm income generating activities than male members. On the other hand, male farmers make more income from their cassava-maize intercrop farms than the female farmers.

Recommendation

The following are recommendations that emerged from the study;
i.   Female members of the households should be directly involved in all agricultural programmes and benefits to enable them contribute more to agricultural development in their countries.
ii. Female members of the households should be the target of any programme towards sustainable food security since they contribute more to households' food security than male.
iii. Post harvest production technologies that is meant for dissemination should target women as they are more involved than the males in such activities.

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Effect Of Planting Date And Inoculation Date On Bacterial Blight Incidence And Yield Components Of Cowpea

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Abstract

Yield of cowpea remains low in all producing areas of Africa. The low yield is associated with numerous abiotic and biotic factors. The major biotic constraints to optimum cowpea production are insect pests and several devastating diseases caused by fungi, nematodes, viruses and bacteria. Bacterial blight caused by Xanthomonas campestris pv vignicola is the most economically important bacterial disease of cowpea. Cultural management practices such as adjustment of time of planting could have a profound effect on management of cowpea by the blight pathogen. The present study examines the effect of planting date and inoculation date on incidence of bacterial blight in Ife Brown cultivar. The cowpea was planted at two-week intervals while inoculations were carried out at 4 and 6 weeks after seedling emergence. Field comparison was based on disease incidence, pod length, number of pods per plant and number of seeds per pod. Findings from this study showed that blight infection was greatly influenced by weather conditions, particularly temperature and rainfall, as slight blight development prevailed in the inoculated plants throughout the duration of the trial. Planting on June 2 resulted in a significantly lower disease incidence (17.6) compared with plantings on June 16 and June 30, both of which showed no significant difference in blight incidence when inoculation was carried out at 4 weeks after seedling emergence. Plants from seeds sown on June 16 gave a significantly lower seed number (5.3) than those sown on June 30 when both plants were inoculated at 4 weeks following seedling emergence. The generally lower temperatures and drier conditions experienced during the trial adversely affected plant physiology and chemistry, thereby manifesting in low blight incidence. The weather conditions' effect was also obvious in the yield component parameters assessed.

Key words: Bacterial blight, cowpea, *Xanthomonas campestris* pv *vignicola,* planting date, inoculation date, disease incidence.

Introduction

Cowpea is the cheapest and the major source of protein for the urban and rural populace in West Africa. The crop is primarily consumed as a favourite food in the form of dried seeds, either as flour or split (23). Cowpea is cultivated worldwide with an annual production of over 3 million tonnes in 2001 with Nigeria alone accounting for over 2.1 million of this production figure (10). However, the average yield of cowpea remains low in all producing areas owing to a complex of abiotic and biotic constraints. The biotic factors limiting optimum cowpea production include insect pests, parasitic plants, viral, fungal, nematode and bacterial diseases (9, 2).

Bacterial diseases are of considerable importance, causing substantial economic losses owing to implementation of expensive control measures and decreased productivity arising from their effects on the quality and quantity of seeds (1, 19). Bacterial blight and bacterial pustule are the two important bacterial diseases of cowpea in Nigeria (9). However, cowpea bacterial blight (CpBB) is of greater economic importance than bacterial pustule in the cowpea-growing areas of the humid tropics (17).

Bacterial blight caused by *Xanthomonas campestris* pv *vignicola* (Burkholder) Dye is widely distributed in cowpea-growing areas of the world (22, 18, 14, 11). The pathogen is seed-borne (18, 12) and causes discoloration of seeds and cotyledons, mortality of seedlings, stem cankers, bushy and stunted growth, leaf and pod blight (20, 3), and high yield losses in severely infected crops (14, 11, 4, 15).

Adoption of certain cultural practices such as modification of time of planting could be of immense contribution to reducing the incidence of blight pathogen on cowpea. This study was therefore conducted to examine the effect of planting date and inoculation date of *Xanthomonas campestris* pv *vignicola* on the incidence of bacterial blight and yield components of cowpea.

Materials And Methods

Seeds of Ife Brown cowpea were obtained from the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria.

Sterilization of materials: The glassware were washed in detergent solution, rinsed clean in tap water, air-dried and wrapped in aluminium foil. They were then placed in an oven at a temperature of 160^0C for two hours to ensure complete sterilization. Metal wares were dipped in 70% alcohol and flamed in a slanting position to red-hot over a spirit lamp. Distilled water was poured into conical flasks, plugged with non-absorbent cotton wool and autoclaved at 121^0C for 15 minutes. The isolation chamber was washed first with tap water and detergent, followed by scrubbing with 50ml sodium hypochlorite.

Preparation of inoculum: Twenty three grams of Difco nutrient agar was added to 1 litre of distilled water in a conical flask and heated to dissolve. The medium was then dispensed into a 250ml conical flask and autoclaved at 121^{0}C (1.06 kgcm^{-2}). The medium was allowed to cool before pouring into sterile Petri dishes.

Isolation and purification of inoculum: The pathogen was isolated from naturally-infected cowpea leaves of Ife Brown cultivar, freshly collected from IITA Research Farm. The diseased leaves were washed in sterile distilled water to rid the specimens of secondary invaders and contaminants. Using a flame-sterilized pair of dissecting scissors, pieces of diseased tissues were removed aseptically from the edges of a lesion at the boundary with the healthy-looking tissues. These were placed in a small quantity of sterile distilled water and incubated for 15 minutes. A loopful of the suspension was streaked out on the nutrient agar medium in Petri dishes. The plates were incubated in an inverted position at 28^{0}C for 30 minutes. Colonies of *Xanthomonas campestris* pv *vignicola* obtained were purified by making a dilute suspension of isolated colonies in sterile distilled water and streaking a loopful onto nutrient agar medium again. This sub-culturing procedure was repeated several times until a pure isolate of the bacterium was obtained. The genus *Xanthomonas* is identified by the production of a yellow, non-water soluble pigment on agar medium.

Inoculum preparation: Bacterial colonies from 48-hour old cultures were washed off with sterile distilled water into sterile conical flasks and shaken thoroughly to obtain a homogenous suspension. With the aid of a haemocytometer, the suspension was adjusted in sterile distilled water to a concentration of approximately 10^{7} colony forming unit (cfu) per ml. A 500ml hand-operated plastic sprayer was filled with the bacterial suspension.

Field experiment: The experiment was conducted in the Teaching and Research Farm of University of Ibadan, Nigeria, between June and September, 2001. A plot of land measuring 15m by 18m was marked out for the trial. The experimental layout was a split-plot randomized complete block design with three replicates. The subplots were partitioned into 5m by 0.5m alleys in between. Each subplot consisted of 4 rows spaced 60cm apart. The cowpea cultivar (Ife Brown) was the main plot and the subplot treatments were the planting dates and inoculation dates. Seeds of Ife Brown cowpea were sown at an in-row spacing of 30cm at two-week intervals on 2nd, 16th and 30th June, 2001. Two seeds were sown per hole manually at a depth of about 2.5cm. Plots were isolated from one another by two border rows of maize planted to check inter-plot spread of inoculum. The seedlings were thinned to one plant per stand at one week after emergence, leaving 9 plants per row. The plots were weeded manually at 3 and 7 weeks after seedling emergence. Cypermethrin (an insecticide) was sprayed twice to control insect damage.

Bacterial suspension (10^{7}cfu/ml) was prepared from two-day old cultures in sterile distilled water. Leaves of the cowpea cultivar were spray-inoculated at 4 and 6 weeks after seedling emergence. Plants from seeds sown on June 2 were inoculated on July 4 and July 18; those from seeds sown on June 16 were inoculated on July 18 and August 1, and those from seeds sown on June 30 were inoculated on August 1 and August 16. Leaves were held against the palm and inoculated to the point of run-off on the lower surfaces from a distance of about 2cm using a 500ml hand-operated plastic sprayer. The treatment produced water-soaked dots.

Data on temperature and rainfall distribution during the period of the trial were obtained from IITA, Ibadan (13).

Symptom observation and disease rating: The plants were observed periodically for disease symptoms. Disease rating which was carried out at four weeks after inoculation was based on visible macroscopic symptoms characteristic of bacterial blight, which are necrotic lesions surrounded by yellow halos.
Blight incidence was assessed on all plants in the two middle rows on a descriptive scale of 1-5 according to (8), where;
1 = represents no plant with symptoms
2 = 2-20% of plants with distinct necrotic lesions surrounded by yellow halos
3 = 21-40% of plants with blight symptoms
4 = 41-60% of plants with symptoms, and
5 = greater than 60% of plants with blight infection

Yield components' determination: The number of pods per plant was determined by randomly selecting 10 plants from each subplot and counting the number of pods on each of the plants. Thirty pods were randomly selected from each subplot to determine pod length and number of seeds per pod.

Statistical Analysis
The data obtained were subjected to analysis of variance (ANOVA) and the means separated by Least Significant Difference (LSD) at 5% level of significance.

Results
The temperatures during the period of disease assessment in July, August and September 2001 varied between 21^{0}C and 31^{0}C, 21^{0}C and 29 ^{0}C and 19 ^{0}C and 31 ^{0}C respectively. The amount of daily rainfall during the period of study in June, July, August and September varied between 2 and 143, 2 and 52, 1 and 53, and 2 and 85mm respectively.

Effect of planting date and inoculation date on incidence of bacterial blight: The influence of planting date and inoculation date on bacterial blight incidence of Ife Brown cowpea is shown in Table 1. Results obtained from this study showed that bacterial blight incidence varied significantly (P< 0.05) among planting dates and between inoculation dates.

Table 1: Effect of planting date and inoculation date on bacterial blight incidence

Planting date	DI for plants inoculated at 4WASE	DI for plants inoculated at 6 WASE
June 2	17.6e	20.7de
June 16	27.4a	22.3abcd
June 30	26.8abc	27.1ab
LSD$_{0.05}$	5.28	

$^y=$ Percentage of diseased plants in the two centre rows of each plot. Means of three replicates
    DI= Disease incidence
    WASE= Weeks after seedling emergence
    Means followed by the same letter are not significantly different (P < 0.05) by LSD test

Planting on June 2 resulted in a significantly lower disease incidence (17.6) compared with plantings on June 16 and June 30, both of which showed no significant difference in blight incidence when inoculation was carried out at 4 weeks after seedling emergence. Blight incidence recorded for June 16 planting did not differ significantly from plantings on June 2 and June 30 when the plants were inoculated at 6 weeks after seedling emergence. However, a significantly higher blight incidence of 27.1 was observed in June 30 planting compared to June 2 planting when plants from both plots were inoculated at 6 weeks after seedling emergence. Inoculation at 4 and 6 weeks after seedling emergence showed no significant difference in blight incidence at the respective planting dates.

Effect of planting date and inoculation date on pod length: The effect of planting date and inoculation date of Ife Brown cowpea on pod length is shown in Table 2. There was no significant variation in mean pod lengths of the cowpea cultivar among the three planting dates and between the two inoculation dates. Pod lengths of plants inoculated at 4 weeks after seedling emergence varied between 9.3cm and 9.7cm while those from plants inoculated 6 weeks after seedling emergence varied between 9.3cm and 10.0cm.

Table 2: Effect of planting date and inoculation date on pod length (cm)

Planting date	Pod length for plants inoculated at 4 WASE	Pod length for plants inoculated at 6 WASE
June 2	9.3a	9.3a
June 16	9.3a	10.0a
June 30	9.7a	9.3a
LSD$_{0.05}$	1.65	

WASE= Weeks after seedling emergence
Means followed by the same letter are not significantly different (P < 0.05) by LSD test

Effect of planting date and inoculation date on number of pods per plant: Table 3 shows the effect of planting date and inoculation date on number of pods per plant. Ife Brown planted on June 2, June 16 and June 30 yielded statistically similar pod numbers (5.3-6.0) per plant when plants were inoculated at 4 weeks after seedling emergence. Similarly, Ife Brown cowpea planted at the three different dates and inoculated at 6 weeks after seedling emergence gave statistically similar number of pods (5.7-7.0) per plant. Number of pods per plant of Ife Brown sown on June 2 and June 16 and inoculated at 4 and 6 weeks after seedling emergence also showed no significant variation. No significant difference was also observed in Ife Brown cowpea sown on June 30 and inoculated at 4 and 6 weeks after seedling emergence.

Table 3: Effect of planting date and inoculation date on number of pods   per plant

Planting date	Number of pods for plants inoculated at 4 WASE	Number of pods for plants inoculated at 6 WASE
June 2	6.0abc	6.7ab
June 16	6.0abc	7.0a
June 30	5.3c	5.7abc
LSD$_{0.05}$	1.33	

WASE= Weeks after seedling emergence
Means followed by the same letter are not significantly different (P < 0.05) by LSD test

Effect of planting date and inoculation date on number of seeds per pod:

The influence of planting date and inoculation date of Ife Brown on number of seeds per pod is shown in Table 4. Number of seeds per pod obtained from Ife Brown cowpea varied significantly (P < 0.05) among planting dates and between inoculation dates. Number of seeds per pod resulting from plants sown on June 2 (5.7) was not significantly different (P < 0.05) from those sown on June 16 (5.3) and June 30 (6.7) when the plants were inoculated at 4 weeks after seedling emergence. However, plants from seeds sown on June 16 gave a significantly lower seed number (5.3) than those sown on June 30 when both plants were inoculated at 4 weeks following seedling emergence. Number of seeds per pod obtained from plants sown on June 2 showed no significant difference from those sown on June 16 and June 30 when inoculation was carried out at 6 weeks after seedling emergence. However, sowing on June 16 gave a significantly higher seed number (6.7) than seeding on June 30 when both plants were inoculated at 6 weeks after seedling emergence. Inoculation at 4 and 6 weeks after seedling emergence showed no statistical difference at first planting date (June 2). Inoculation at 6 weeks after seedling emergence gave a significantly higher seed numbers than for plants inoculated at 4 weeks after seedling emergence when planting was done on June 16. Conversely, inoculation at 4 weeks after seedling emergence yielded higher seed numbers per pod (6.7) compared with inoculation at 6 weeks after seedling emergence when planting was done on June 30.

Table 4: Effect of planting date and inoculation date on number seeds per pod

Planting date	Number of seeds per pod for plants inoculate 4WASE	Number of seeds per pod for plants inoculated at 6WASE
June 2	5.7ab	6.0ab
June 16	5.3b	6.7a
June 30	6.7a	5.3b
LSD$_{0.05}$	1.19	

WASE= Weeks after seedling emergence
Means followed by the same letter are not significantly different (P< 0.05) by LSD test

Discussion

Findings from this trial reveal that planting date and inoculation date of Ife Brown had a significant effect on bacterial blight incidence and yield components of cowpea. This effect could be due to weather conditions, particularly temperature and rainfall. This result corroborates the findings of (8) who reported that temperature and rainfall distribution had significant effects on bacterial blight incidence. The slight blight development which prevailed in inoculated plants throughout the period of the trial may be attributed to low temperatures recorded during the study (19-32^{0}C) in contrast to optimum range of 25-30^{0}C reported to favour epidemics of cowpea bacterial blight (5). The low rainfall range (1-143mm) which was recorded during the study may have also accounted for the slight blight development. The rainfall effect is in agreement with the research findings of (8) who reported that a wetter condition is conducive to infection of cowpea by the blight pathogen, but the temperature effect contradicts his findings that a cooler condition is favourable to cowpea bacterial blight epidemics.

The results of this research work indicate that the effect of planting date and inoculation date on blight incidence and yield components' relationships depend on environmental factors. Cowpea reaction to artificial inoculation or natural infection with phytopathogenic *Xanthomonads* is often complex (16). It may manifest as incompatibility or hypersensitivity, tolerance or susceptibility. In leaf and pod reaction studies of the bean *Phaseolus vulgare*, (6) observed uniform, highly susceptible reaction on pods and foliage of some varieties while other varieties exhibited highly tolerant foliage and highly susceptible pods. This observation was confirmed by (7) when he reported that pods and foliage of both tolerant and susceptible bean cultivars may react independently to *Xanthomonas phaseoli* and *X. phaseoli* var. *fuscans* inoculations.

Conclusion

Ife Brown is a highly susceptible cultivar to cowpea bacterial blight. However, the generally lower temperatures and drier conditions recorded during this study adversely affected plant physiology and chemistry, thereby manifesting in low blight incidence which invariably affected the yield component parameters assessed.

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Prediction Of Yield Of Selected Nigerian Crops Under Weather Dynamism

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Abstract

In spite of rain-fed husbandry been the most established crop cultivation practice in Nigeria, crop yield predictions/forecasts from agro-climatological variables has not been given much attention. Hence, this study evaluated weather effects on the yield of selected crops (maize, cowpea, cassava, soybean and cocoa) in Nigeria for the period 1960 2009. Secondary data were obtained and analyzed using Parvin model approach. On the basis of econometric and statistical criteria, semi-log model was chosen for maize and cassava while exponential model was chosen as the lead equation for cowpea, soybean and cocoa. Cassava and soybean, of all the five crops considered, had positive yield growth rate throughout the years in the period (1960 2009) under review. The crop (cassava), of all the selected crops, had the lowest percentage potential yield gain (33.30%) if weather was consistently "ideal" and the lowest percentage potential yield loss (22.84%) if weather was consistently "un-ideal" for the period under consideration (1960 2009). In monetary terms, the revenue loss from cassava and cocoa as a result of less than "ideal" weather condition could have been N313,014,268.35 and N110,563,878.25 respectively while the revenue gained over "un-ideal" weather condition would have been N242,021,005.41 and N93,585,733.47 respectively. Therefore, for the realization of the policy objective of a resuscitated agro-allied driven economy, policy makers and scientists in Nigeria need pay more attention to the influence of weather variables on agricultural production.

Key words: Agriculture, crop yield, weather, rain-fed husbandry, revenue.
Word Count: 230.

Introduction

The agricultural sector remains very important in the economic development of Nigeria. The agricultural sector of the Nigerian economy contributes significantly to rural employment, food security, non-oil foreign exchange earnings and industrial raw materials (Shittu, 1997; Fashina, 1999; Oduwole, 2004; Sanusi and Oluyole, 2005). According to UNDP (2006), despite

the dominant position of the oil sector in foreign exchange earnings and government revenue generation (roles initially played by the agricultural sector in the pre-oil boom era), agricultural sector generates employment for over one third of the labour force, contributes about 30% of the gross domestic product (GDP) and around 80% of non-oil exports. Increased agricultural production and export have been a major catalyst to industrial development, increased national wealth, and improved living standard and poverty reduction (Oduwole, 2004). Therefore, agricultural production (particularly agricultural export) has always been a major concern of Nigerians and the Nigerian government(s).

These (foregoing facts), in addition to others, made Nigerian (agricultural) scientists undertake continuous research on all aspects of agriculture while the government addresses issues relating to agriculture through fiscal and monetary policy designs and implementations. The efforts of the Nigerian government and (research) scientists in sustaining agricultural production can be effective through controllable factors such as technology, material inputs and management. However, a single (uncontrollable) factor that can considerably erode the impact(s) of these efforts is weather. This is because weather variables are major factors influencing variations in crop yields, soil characteristics, as well as crop and animal distribution. Furthermore, weather can relegate all other factors especially the social and economic factors to relatively minor positions (Akintola, 1983) or magnify their deleterious effects. For example, the severe frost experienced by Brazil in 1994 led to a 10% drop in world coffee production and a price rise of about 118% (Dubois, 2006). Also, rainfall (one of the variants of weather and probably the most important) was reported to have exhibited some inconsistencies in the cocoa (producing) belt of Nigeria in year 2000, thereby heightening the fear of reduced cocoa output (Adhuze, 2000 and Oredein, 2000). Unfortunately, forecasts/studies on the influence of weather on crop yields are not well appreciated and are relatively few in many developing countries including Nigeria (Akintola, 1983; Akintola, 2000; Sanusi *et al*, 2005; Sanusi *et al*, 2006; Sanusi and Oloyede, 2007). Furthermore, majority of these studies either concentrate on a single crop or a single class of crops for crop-weather interaction analysis. Therefore, this study evaluated the effect of weather on arable (cereals, pulses, tubers and oil) as well as tree crop production (in Nigeria).

Objectives

The main objective of this study is to determine the influence of weather variables on maize, cowpea, cassava, soybean and cocoa yields in Nigeria. The specific objectives are to:
I.   determine the weather variables influencing crop yield;
ii.   evaluate the effect of "ideal" and "un-ideal" weather on crop yield;
iii. examine the differences in weather effect on arable and tree crops;
iv.   estimate the magnitude of the potential revenue gain or loss from crop yields as a result of "ideal" and "un-ideal" weather situations.

Methodology

Secondary data sourced from Food and Agricultural Organization (FAO) of the United Nations, International Coffee Organization (ICO), International Cocoa Organization (ICCO), Gills and Duffus, Central Bank of Nigeria (CBN) and former Federal Office of Statistics (FOS) now National Bureau of Statistics (NBS), were used for analysis in this study. The data used were yield data for maize, cowpea, cassava, soybean and cocoa as well as weather variables such as number of rain days, rainfall, humidity, temperature and sunshine.

The crops were selected on two basis. The first being the (broad) classification of crops into arable and tree cops. The second being the classification of the arable into cereals, pulses, tubers and oil crops. The last being the random selection of one out four most popular crops (in Nigeria) per sub-group using the food balance sheet of FAO (Table 1).

Table 1: The Most Popular Nigerian Crops on Demand and Supply Basis

SN	Cereals	Pulses	Tubers	Oil	Tree
1	Maize	Cowpea	Cassava	Soybean	Cocoa
2	Rice	Ground nut	Yam	Melon	Palm produce
3	Guinea corn	Beniseed	Potato	Cotton seed	Cashew
4	Millet	Pigeon pea	Cocoyam	Castor seed	Coffee

Source: FAO (1998 2007)

Parvin model of decomposing total yield variation into technology and weather effects (Parvin, 1973) was used. In a simplistic form, the Parvin model reveals the overall effect of composites of weather variables on (crop) yield.

The basic assumptions of the model are:
i.   yield series overtime can be conceptualized as a function of trend variable;
ii.   the trend represents the systematic change component that derives from "average" conditions such as "average" weather situation, technological change over time (if any), changes in soil fertility and management. In other words, the influence of weather and the non-weather factors are embodied in the trend variables and these influences could be estimated from linear, quadratic, or cubic trends (functions) as the case may be;
iii. the weather effect represents the unsystematic movement of yield around the trend line. This weather effect is, in effect, an abnormal effect since the trend incorporates a normal (or average) weather;
iv.   the non-weather components of the trend variable are controllable factors while the weather component is an uncontrollable factor.

From the assumptions above, the procedures adopted in executing the relevant computations are as follows
a.   yield data were regressed on time (trend) and weather variables to obtain linear, exponential, semi-log and double-log equations.
b.   the (chosen) lead equation was used to predict yields.
c.   deviations of actual yields from predicted yields were then obtained.
D.   the effect of "ideal" weather conditions was synonymous with "ideal" crop yield which was supposed to occur in the year when weather had its largest positive effects on crop yields.
e.   the effect of "un-ideal" weather conditions was synonymous with "un-ideal" crop yield, which was supposed to occur in the year when weather had its largest negative effects on crop yields.
f.   the potential loss in yield as a result of less-than-ideal weather conditions was estimated as the difference between the "un-ideal" weather yield and actual yield (expressed as a

percentage of actual yields).

G. the potential gain in yield as a result of better-than-unideal weather conditions was estimated as the difference between the "ideal" weather yield and actual yield (expressed as a percentage of actual yield).

Adopting a modified methodology of Akintola (2000) and Sanusi *et al* (2005), the first step involved the estimation of the lead equation(s) are as explicitly stated below:-

*   Linear model $Y_t = a_t + {}_t W_{tv} + {}_t L_o + {}_t T + \mu_t$ ....(i)
*   Exponential model $\ln Y_t = a_t + {}_t W_{tv} + {}_t L_o + {}_t T + \mu_t$...............................(ii)
*   Semi-log model $Y_t = a_t + {}_t \ln W_{tv} + {}_t \ln L_o + {}_t \ln T + \mu_t$.............................(iii)
*   Double-log model $\ln Y_t = a_t + {}_t \ln W_{tv} + {}_t \ln L_o + {}_t \ln T + \mu_t$..........................(iv)

Where:

a_t, ${}_t$, ${}_t$ and ${}_t$ = Parameter estimates;
Y_t = Crop (maize, cowpea, cassava, soybean and cocoa) yield in year t (tons);
W_{tv} = Weather variables in year t:-
R_d = rainfall (days),
R_n = rainfall (mm),
T_p = temperature (Centigrade),
R_h = relative humidity (%),
S_h = Sunshine (hours),
L_n = occurrence of La-Nina phenomenon (number of times),
E_n = occurrence of En-Nino phenomenon (number of times).
L_o = Lagged crop (maize, cowpea, cassava, soybean and cocoa) yield in year t (tons);
T = Trend value (1 50);
${}_t$ = Stochastic disturbance term.

The second step involved the estimation of weather induced on crop yield deviation as follows:
$Y^* = Y_t Y_p$ ....(v)

Where:-
Y^* = yield deviation;
Y_t = observed level of (crop) yield i.e. (crop) yield in year t;
Y_p = predicted crop yield.

The third step involved the estimation of the effect of "ideal" and "un-ideal" weather conditions on crop as follows:
(a) $Y_i = Y_t + \max. (Y^*)$ ....(vi)

Where:-
max. (Y^*) = "ideal" weather effect;
Y_i = adjusted "ideal" weather effect on observed yield;
Y_t and Y^* = as defined previously.

(b) $Y_u = Y_t + \min. (Y^*)$ ....(vii)

Where:-
min. (Y^*) = "un-ideal" weather effect;
Y_u = adjusted "un-ideal" weather effect on observed yield;
Y_t and Y^* = as defined previously.

The fourth step involved the computation of the percentage weather yield differential as follows:
(a) $Y^\bullet = Y_t Y_i$ ....(viii)

Where:-
$Y^\bullet$ = adjusted ("ideal") weather differential;
Y_t and Y_i = as previously defined.

(b) $Y^I = Y_t Y_u$ ....(ix)

Where:-
Y^I = adjusted ("un-ideal") weather differential;
Y_t and Y_i = as defined previously.

The last step involved the computation of the adjusted weather effects as percentages of actual (observed) yields as follows:
(a) $Y^0 = [Y^\bullet (Y_t^{-1})]100$...(x)

Where:-
Y^0 = index (percentage) of ("ideal") weather differential;
$Y^\bullet$ and Y_t = as previously defined.

(b) $Y^v = [Y^I (Y_t^{-1})]100$ ....(xi)

Where:-
Y^v = index (percentage) of ("un-ideal") weather differential;
Y^I and Y_t = as previously defined.

Results and Discussion

On the basis of econometric and statistical criteria, semi-log function was chosen as the lead equation for maize and cassava while the lead equation for cowpea, soybean and cocoa was the exponential function (Table 2). All the lead equation had significant F-value ($p < 0.01$), meaning that the models fit the (crops) data. Also, the D-W statistic (1.95, 1.82, 1.82, 1.82 and 2.09 for maize, cowpea, cassava, soybean and cocoa respectively) indicate absence of serious autocorrelation. Furthermore, the adjusted R-square of not less than 0.60 implies that 60% or more of the variations in the yield of the crops were attributable to variations in the weather variables and the trend value.

Table 2: Parameter Estimates of Weather Equations.

Crop	Model	R^2	Adj.	F-Stat.	D-W. R^2	SE Stat	K	1%	5%	10%
							Significant Variables			
Maize	Linear	0.92	0.90	51.06***	1.80	959.18	-7661.52	1	-	1
	Semi-log	0.87	0.84	30.29***	1.95	1212.48	-5472.30	1	1	1
	Exponential	0.87	0.85	30.60***	1.29	0.38	-2.52	-	2	-
	Double-log	0.94	0.92	65.46***	2.28	0.27	-5.04	1	-	1
Cowpea	Linear	0.93	0.91	56.11***	1.73	355.78	-3656.82	1	-	-
	Semi-log	0.85	0.82	25.49***	1.17	505.95	-11168.70	1	-	1
	Exponential	0.90	0.88	40.30***	1.82	0.25	3.45	3	-	-
	Double-log	0.91	0.89	44.74***	1.80	0.24	-0.43	1	-	1
Cassava	Linear	0.99	0.99	359.50***	2.08	1567.18	-12042.02	1	1	-
	Semi-log	0.98	0.98	262.22***	1.82	1830.87	-209602.86 ***	2	1	1
	Exponential	0.98	0.97	173.66***	0.74	0.11	7.58**	2	-	-
	Double-log	0.99	0.99	388.46***	2.23	0.74	-0.69	1	-	-
Soyabean	Linear	0.84	0.81	23.45***	1.79	173.02	-1952.92	1	-	-
	Semi-log	0.69	0.62	9.75***	0.89	242.55	615.87	-	1	-
	Exponential	0.92	0.90	48.95***	1.82	0.34	-7.36*	2	1	1
	Double-log	0.93	0.92	61.53	1.43	0.31	-20.39	1	-	1
Cocoa	Linear	0.64	0.53	7.74**	2.19	56.48	-52.18	1	-	1
	Semi-log	0.64	0.55	7.73**	2.14	56.50	-1313.53	1	-	1
	Exponential	0.63	0.54	7.40***	2.09	0.25	3.89	-	1	1

NB:- K   Constant, SE   Standard Error of Estimate, D -W   Durbin-Watson Statistic.

Table 3 shows that the constant was significant for cassava yield (p < 0.05) and soybean yield (p < 0.1) while the weather variables that (positively and) significantly influenced crop yields were rainfall for maize and cassava (p < 0.01), relative humidity for soybean (p < 0.1), sunshine for cowpea (p < 0.01), soybean (p < 0.01) and cocoa (p < 0.05). Furthermore as shown on   Table 3, the La-Nina weather phenomenon significantly affected the yield of cassava only   (p < 0.05) while the En-Nino phenomenon significantly affected the yield of cowpea (p < 0.01), cassava (p < 0.01), soybean (p < 0.05) and cocoa (p < 0.01). Table 3 also revealed that the trend variable (an embodiment of "average" weather, technological input, improved soil and

husbandry practices) was a significant determinant of yield of all the crops except cocoa (p < 0.01) while lagged output was a significant determinant of maize yield (p < 0.01) during the period under consideration.

Table 3: Determinants of Output of Selected Crops (1960 2009)

Variable	Maize		Cowpea		Cassava		Soybean		Cocoa	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Constant	-5472.30	53592.40	3.45	3.12	-209602.86**	91.36	-7.36*	4.35	3.89	3.09
Rain days	-1628.76	1965.56	-0.001	0.01	3072.54	3055.22	0.01	0.01	0.003	0.01
Rainfall	3316.82*	1772.15	0.0002	0.00	5338.29*	2704.48	0.0004	0.00	0.0001	0.00
Temperature	-11517.61	11651.36	-0.004	0.11	-17543.33	17589.34	0.18	0.15	-0.03	0.09
Humidity	1532.93	5403.57	0.014	0.02	2466.26	8234.99	0.04*	0.03	0.004	0.02
Sunshine	653.22	2810.21	0.02***	0.01	2645.98	5822.27	0.03***	0.01	0.01**	0.01
La-Nina	-21.61	51.04	0.005	0.01	226.82**	80.65	0.005	0.02	-0.002	0.01
En-Nino	-71.85	60.38	0.0002***	0.00	22838.38***	1427.74	0.0006**	0.00	0.002***	0.00
Lag. Output	2664.06***	306.23	0.01	0.01	59.48	81727.88	0.01	0.01	-0.0009	0.01
Trend	636.61**	298.56	0.02***	0.01	-2180.32***	738.51	0.04***	0.01	-0.004	0.00
R^2	0.87	-	0.90	-	0.98	-	0.92	-	0.63	-
Adj. R^2	0.84	-	0.88	-	0.98	-	0.90	-	0.54	-
D-W Stat.	1.95	-	1.82	-	1.82	-	1.82	-	2.08	-
F-Stat.	30.29***	-	40.30***	-	262.22***	-	48.95***	-	7.39***	-
Double-log	0.64	0.56	8.06***	2.21	0.24	-2.08	1	1	-	

A millimeter increase in the volume of rainfall will lead to an increase of about 0.95 ton (950kg) in maize yield and 3.84 tons (3,840kg) in cassava yield (Table 4). Also, a unit (1%) increase in relative humidity will lead to 2.25 tons (2,250kg) increase in soybean yield. Furthermore, an hour increase in sunshine will lead to 1.36 tons (1,360kg), 0.13 ton (130kg), 2.03 tons (2,030kg) and 0.68 ton (680kg) in cowpea, cassava, soybean and cocoa yields respectively (Table 4). Equally, a day increase in the number of occurrence of La-Nina phenomenon will lead to 0.01 ton (10kg) increase in cassava yield while a day increase in the number of occurrence of En-Nino phenomenon will lead to 0.001 ton (1kg), 1.14 tons (1,140kg), 0.002 ton (2kg) and 0.01 ton (10kg) increase in cowpea, cassava, soybean and cocoa yields respectively (Table 4). An increase of 1 ton in previous output of maize will lead to 0.76 ton (760kg) increase in yield of maize in the subsequent year while any unit improvement in the component of the trend value will lead to an increase of 0.18 ton (180kg), 0.51 ton (510kg) and 1.02 tons (1,020kg) of maize, cowpea and soybean yields respectively as well as a decrease of 0.11 ton (110kg) yield of cassava (Table 4).

Table 4: Elasticity Estimates for Determinants of Output of Selected Crops (1960   2009)

Crop	Rainfall (mm)	Humidity (%)	Sunshine (hrs)	La-Nina (days)	En-Nino (days)	Lagged Output (ton)	Trend
Maize	971.76	-	-	-	-	2523.19	4.63
Cowpea	-	-	0.001	0.03	0.0000005	-	0.0004
Cassava	3940.96	-	8.95	-	3.58	-	-2.77
Soybean	-	0.01	0.01	-	0.000007	-	0.004
Cocoa	-	-	0.003	-	0.00003	-	-

Table 5 revealed that of all the selected crops for the period under consideration (1960   2009), only cassava and soybean had positive growth rate in all the years of the period. However, with the exception of soybean, tree crop (cocoa) had a lower average growth rate than the arable crops (Table 5).

Table 5: Growth Rate of Yield ('000 M tons) of Selected Crops in Nigeria

Period	Maize	%	Cowpea	%	Cassava	%	Soybean	%	Cocoa	%
1960 - 1969	1,099.20	-	620.90	-	8,061.80	-	57.20	-	219.20	-
1970 - 1979	888.80	-23.67	683.50	9.16	10,454.80	22.89	66.30	13.73	213.30	-2.77
1980 - 1989	2,458.50	63.85	680.60	-0.43	12,714.70	17.77	100.50	34.03	141.59	-50.65
1990 - 1999	5,906.50	58.38	1,690.80	59.75	29,562.80	56.99	264.30	61.98	148.90	4.91
2000 - 2009	7,163.81	17.55	3,275.91	48.39	39,387.37	24.94	846.27	68.77	312.31	52.32
Total	3,503.36	29.03	1,390.34	29.22	20,036.29	30.65	266.91	44.62	207.06	0.96

In percentage terms, for the period under consideration (1960   2009), the yield gains that would have been recorded by the crops if the weather was consistently "ideal" was highest for soybean followed by maize, cowpea, cocoa and cassava respectively in descending order (Table 6).

Table 6: Average Actual and "Ideal" Weather Yields of Selected Crops ('000 M tons)

Year	Period	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1999	2000 - 2009	1960 - 2009
Maize	Actual Yield	1099.20	888.80	2458.50	5906.50	7163.81	3503.36
	Potential Yield	5576.88	5589.18	6790.71	10704.13	11402.10	8012.60
	%	411.88	618.43	313.01	82.17	78.70	300.84
Cowpea	Actual Yield	620.90	683.50	680.60	1690.80	3275.91	1390.34
	Potential Yield	2323.58	2478.91	2499.20	3246.36	5151.06	3139.82
	%	287.45	310.17	290.39	93.53	65.10	209.33
Cassava	Actual Yield	8061.80	10454.80	12714.70	29562.80	39387.37	20036.29
	Potential Yield	12591.08	15182.35	17081.67	34945.69	43357.22	24631.60
	%	56.42	45.39	34.98	18.68	11.01	33.30
Soybean	Actual Yield	57.20	66.30	100.50	264.30	846.27	266.91
	Potential Yield	1026.30	1048.03	1070.24	1212.55	1815.32	1234.49
	%	2121.87	1487.24	1344.43	422.24	163.80	1107.92
Cocoa	Actual Yield	219.20	213.30	141.59	148.90	312.31	207.06
	Potential Yield	374.32	355.69	294.15	311.21	442.34	355.54
	%	75.42	72.27	118.70	113.84	55.11	87.07

Furthermore, if the weather was consistently "un-ideal", the highest yield loss (in percentage) would have been recorded by soybean followed by cowpea, maize, cocoa and cassava respectively in descending order (Table 7).

Table 7: Average Actual and "Un-ideal" Weather Yields of Selected Crops ('000 M tons)

Year	Period	1960 - 1969	1970 - 1979	1980 - 1989	1990 - 1999	2000 - 2009	1960 - 2009
Maize	Actual Yield	1099.20	888.80	2458.50	5906.50	7163.81	3503.36
	Yield Loss	3428.75	3218.35	4788.05	8236.05	9493.36	5832.91
	%	213.48	302.12	176.44	39.82	37.76	153.92
Cowpea	Actual Yield	620.90	683.50	680.60	1690.80	3275.91	1390.34
	Yield Loss	2112.49	2175.09	2172.19	3182.39	4767.49	2881.93
	%	249.24	242.11	235.20	90.48	51.10	173.63
Cassava	Actual Yield	8061.80	10454.80	12714.70	29562.80	39387.37	20036.29
	Yield Loss	11211.75	13604.75	15864.65	32712.75	42537.32	23186.24
	%	39.32	30.39	25.40	10.92	8.15	22.84
Soybean	Actual Yield	57.20	66.30	100.50	264.30	846.27	266.91
	Yield Loss	368.16	377.26	411.46	575.26	1157.23	577.87
	%	676.04	471.23	423.32	136.82	49.65	351.41
	Actual Yield	219.20	213.30	141.59	148.90	312.31	207.06

In monetary terms, the revenue that could have been gained by the crops over the average weather yield (i.e. if weather condition was consistently "ideal") were N906,224,947.35 for maize; N507,238,660.58 for cowpea; N332,526,641.96 for cassava; N242,021,005.41 for soybean and N93,585,733.47 for cocoa (Table 8). However, with average weather situation, the revenue that could have been lost by the crops as a result of consistently less than "ideal" (i.e. "un-ideal") weather condition were N659,701,849.56 for maize; N465,575,295.67 for cowpea; N313,014,268.35 for cassava; N113,291,896.97 for soybean and N110,563,878.25 for cocoa (Table 8).

Table 8: Weather Effect Potential Revenue Gain and Loss of Selected Crops (N)

Year		1960 1969	1970 - 1979	1980 - 1989	1990 - 1999	2000 - 2009	1960 - 2009
Maize	Rev. Gained	630,744,646.19	632,135,911.91	765,029,338.32	1,210,637.169.73	1,289,577,670.60	906,224,947.35
	Rev. Loss	387,791,059.50	363,994,819.50	541,527,889.50	931,496,689.50	1,073,598,789.60	659,701,849.56
Cowpea	Rev. Gained	375,375,089.00	400,466,692.84	403,746,243.61	524,450,173.22	632,153.104.20	507,238,660.58
	Rev. Loss	341,271,962.11	351,384,992.11	350,916,497.11	514,114,307.11	770,188,719.91	465,575,295.67
Cassava	Rev. Gained	169,979,616.18	204,961,786.29	230,602,556.21	471,766,759.25	585,322,481.87	332,526,641.96
	Rev. Loss	151,358,602.05	183,664,102.05	214,172,752.05	441,622,102.05	574,253,783.55	313,014,268.35
Soybean	Rev. Gained	201,205,207.47	205,465,856.09	209,820,371.15	237,720,246.32	355,893.346.02	242,021,005.41
	Rev. Loss	72,177,336.57	73,961,391.57	80,666,301.57	112,779,291.57	226,875,163.57	113,291,896.97
Cocoa	Rev. Gained	98,529,149.93	90,623,749.59	77,425,980.51	81,916,802.43	116,432,964.88	93,585,733.47
	Rev. Loss	113,759,193.57	112,206,195.57	93,330,689.37	95,254,827.57	138,268,485.17	110,563,878.25

Summary and Conclusion

This study revealed that weather variables (except rain days and temperature) significantly influenced crop yields (i.e. rainfall for maize and cassava; relative humidity for soybean; sunshine for cowpea, soybean and cocoa) and a unit increment in the variables will increase the yields of the crops. Also, weather phenomena (i.e. La-Nina for cassava and En-Nino for cowpea, cassava, soybean and cocoa) significantly affected and (with a unit increase) can increase the yield of selected crops in Nigeria. The trend variable significantly influenced yields of all the crops except cocoa and a unit increase in any of its component will increase the yields of the crops except cassava while lagged output significantly affected (and with a unit increase can increase) maize yield during the period under consideration.

All the selected crops for the period under consideration (1960 2009), except cassava and soybean had negative growth rate and with the exception of soybean, tree crop (cocoa) had a lower average growth rate than the arable crops in all the years of the period. The selected tree crop (cocoa) had a lower potential yield gain than the arable crops (except cassava) if the weather

had been consistently "ideal" (Table 6) while it has the lowest potential yield loss than the arable crops (except cassava) if the weather had been consistently "un-ideal" (Table 7). Furthermore, soybean had the highest potential yield gain and losses of all the selected crops. The fact that cocoa and cassava had the lowest potential yield gains and losses while soybean had the highest for both gains and losses showed that the three crops require special attention with regards to weather effects on crop production in Nigeria. This means that in terms of potential yield gains due to inconsistencies in weather, soybean, cocoa and cassava could be worse-off in deleterious effects of weather on crop production than other crops. On the other hand, in terms of potential yield losses as a result of inconsistencies in weather soybean could be worse-off while cocoa and cassava could be better-off than other crops. The three crops are highly important to the Nigerian economy in the sense that cocoa is a major source of foreign exchange while cassava is a staple food crop that had a wide geographical spread in the country and soybean has significant nutritional importance as a substitute for animal protein.

Recommendation

The influence of weather variables and phenomena, the growth rate trend and the losses in yields and, consequently, revenue for all the crops as a result of inconsistencies in weather conditions calls for a pragmatic approach to evolving (essentially scientific) strategies in mitigating the deleterious effects of weather on crop production in Nigeria. Hence, the crops (particularly cassava that is regarded as being tolerant of vagaries of weather) deserve a better attention from Nigerian policy makers and scientists. This is in the sense that with a good and well executed action plan, the losses from the crops as a result of weather variants could be adequately mitigated by taking advantage of the supposed tolerance of cassava to weather inconsistencies and managing the damages on soybean and cocoa by vagaries of weather. This could be achieved by redesigning, reviewing and strengthening existing initiatives as well as evolving newer and sustainable initiatives on the crops in particular and agriculture in general based on sound research and development efforts.

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Effect Of Land Slope Gradation On Soil Fertility And Yield Of Two Op Maize Lines (*zea Mays* L.)

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Abstract

The menace of soil erosion is not only felt in Africa but the world over. Poor land management in Africa resulted into 46% of soil losses due to water erosion, 38% loss from wind erosion, 12% loss from improper chemical use and 4% loss from soil compaction due to overgrazing. The need therefore arises for implementing farming practices that will preserve the soil properties and also ensure good farm yield. The fallow system that has helped in preserving the soil for several decades is no longer desirable due to inherent problem of land scarcity, hence land that has before been regarded as unsuitable for cultivation are recently reconsidered as farm lands. Various farm crops are now cultivated in farmlands with different degrees of land slopes against the general belief that sloppy lands suffer nutrient depletion usually at the top slope owing to nutrients being leached to the bottom slope. This study was carried out to evaluate variation in soil nutrient status between a top and a bottom slope and its inherent effect on plant growth and yield of two open pollinated maize varieties. Soil physico- chemical analysis result showed high significant differences due to slope effect (P<0.01) for pH, OC, N, P, K, Ca, and Mg. Although significant differences due to slope effect was also observed for growth and yield parameters (P<0.05) including plant height, cob length, cob diameter, stover weight and dehusked cob weight, yield differences due to slope effect is however minute. Thus, farm lands with minimal slope that range between 2 and 4% can still be considered suitable for cropping activities.

Keywords: Soil erosion, land slope, soil analysis, maize, growth and yield parameters.

Introduction

Topographic factors including slope has been known to directly influence the fertility of the soil due to effect of erosion on soil properties hence the seemingly negative impact on production and crop yield. The menace of soil erosion is not only felt in Africa but the world over. In Africa, poor land management have resulted into soil losses up to 46% due to water erosion, 38% loss from wind erosion, 12% loss from improper chemical use and 4% loss from soil compaction due to overgrazing.

Slope affects the movement of water on the land surface and through its soils and hence steep slopes experiences higher erosion effects than mild slopes. Water and nutrient availability to the plant therefore is greatly dependent on both the landscape positioning and land slope. Sloping terrain topographic positions was found to greatly influence below ground nutrient status (Spomer and Piest 1982). Landscape positions that receive surface and sub-surface water from higher elevations nearly always had higher yield than the high landscape regions (Stone et al., 1985). Soils on lower landscape positions thus have more available water than lands on higher landscape positions (Hana et al., 1982). Footslope positions have higher organic carbon content, greater aggregate stability, lower clay content than land located on the topslope position (Pierson and Mulla, 1990). Brubaker et al., 1993) showed that soil properties such as pH, CaCO3, extractable Ca and Mg and exchangeable Ca increased downslope, while organic matter was also found to decrease downslope. Spomer and Piest (1982) reported that yield on footslope were significantly higher than that of upslope and midslope section. The yield increased on footslope is attributed to the deposition of soil organic matter and nutrient eroded from upslope position.

Despite the seemingly negative impacts of cultivating lands with steep slopes, African farmers in a bid to solve the problem of food shortage and hunger in the continent have resulted to cultivating of lands under steep slopes once believed to be less suitable for agricultural production. The fallow system that has helped in preserving the soil for several decades is no longer desirable due to inherent problem of land scarcity, hence land that has before been regarded as unsuitable for cultivation are recently reconsidered as farm lands. Among such land are areas under very high slope where farmers believe that the fertility of such land would have been drastically reduced at the upper slope region due to run off and effect of erosion.

The need therefore arises for implementing farming practices that will preserve the soil properties and also ensure good farm yield. Various farm crops are now cultivated in farmlands with different degrees of land slopes against the general belief that sloppy lands suffer nutrient depletion usually at the top slope owing to nutrients being leached to the bottom slope. This study was carried out to evaluate variation in soil nutrient status between a top and a bottom slope and its inherent effect on plant growth and yield of two open pollinated maize varieties. Maize (Zea mays L.) is the third most important cereal in the world compared with wheat and rice and in Nigeria, particularly the Southern part, it is a major component of the cropping system serving as hunger breaker while other crops are yet to mature.

Materials and Methods

Two open pollinated maize varieties TZPBSR-N (IITA) and DMRLSR-Y (OSADEP), were evaluated on the field under varying land slope conditions, at locations within the Joseph Ayo Babalola University, Ikeji Arakeji, Osun State. The actual slope conditions were determined using a GPS equipment. The slope condition for upper slope ranged between 1-2% (moderate to low slope), while bottom slope ranged between 3-4%. Soil suitability classes in Nigeria based on

slope % shows that 45% of land are suitable, 14% marginally suitable and 28% unsuitable for cropping activities in Nigeria (Table 1).

Agronomy practices:
Planting was done at 2 seed per hole and later thinned to one per hole in 4 rows of 8cm length at an intra row spacing of 30cm and inter-row of 1m. Each plot (8X4)m has a plant population of 106 plants and the experimental design was a randomized complete block design (RCBD) in three replicates. Planting was rain fed and the plots were maintained free of weeds manually without application of herbicides or fertilizer. Morphological data were taken on plant growth parameters such as plant height, and stem diameter, and also on yield parameters including cob length, cob diameter, number of cobs, fresh weight husked, and fresh weight unhusked.

At harvest, data were taken from the two middle rows on five plants that were randomly selected from each row. Grain yield after grains were shelled and well dried were converted to tons/ha based on the plant population in a hectare.

Soil Analysis:
Soil physico-chemical components were determined in the soil analytical laboratory of IITA. Three core samples taken randomly from each rep from the top soil (0-15 cm) were composited together and were analyzed at the analytical service laboratory at IITA, Ibadan.

Slope Determination:
The degree of the slope condition was determined with geographic positioning system (GPS) equipment, using eight observation points for each slope condition.

Method for determining soil slope
The method of elevation was used in determining the slope
Slope = Vertical distance / Horizontal equivalent

Table 1: Soils Suitability Class for Nigeria

Suitability class	Slope %	Attribute	Land Area covered
Class 1 soils	nil	Very good land with no physical limitations to mechanical cultivation	Non exist
Class II soils (SI)	0-2%	*Fairly highly Suitable:*Nearly level to gently undulating plains	27.51%
Class IIs Soils (S2)	2-6%	*Moderately Suitable:* Gently undulating to undulating plains	17.38%
Class IIIe,s soils (S3)	6-13%	*Marginal Suitability:* Undulated hilly topography with scattered rocks	14.03%
Class IVe,s Soils (N1)	13-55%	*Currently not suitable:* Hilly or steep topography, shallow depth and stoniness (severe erosion hazards)	27.51%

Source: FAO, (2002)

Slope = VD / HE
Vertical distance = differences b/w two elevation points on land (m)
Horizontal equivalent = actual distance b/w 2 points (m)

Upper Slope

A=	335.52
B=	336.15
VD=	336.15 - 335.52 = 0.63
HE=	40.2
SLOPE=	{0.63/40.2}% =1.56%

Bottom Slope

A=	339.15
B=	337.7
DV=	339.1- 337.7 = 1.45
HE=	40.5
SLOPE=	339.1- 337.7 = 3.58%

Statistical Analysis

Data were subjected to analysis of variance using the general linear model procedure (GLM) for randomized complete block design (RCBD) in SAS (SAS Institute, 1995). Analysis of variance was computed to determine the significance of both slope and varietal effects on the parameters evaluated.

Results and Discussion

The result of the soil physical and chemical analysis under the two slope conditions revealed that the bottom slope has significantly higher accumulation of nutrient elements (Table 2) than the top slope, thus topographic positions of 2-4% also significantly influences below ground nutrient status (Stone *et al.*, 1985), although most of the nutrient elements falls below the critical range levels that is prevalent of tropical soils due to their low inherent soil fertility status. Significantly higher organic carbon, pH, N, P, K Ca and Mg (P<0.05) that were obtained for bottom slope as compared with the top slope (Table 3) is indicative of washing away of such nutrients from the top slope to the bottom slope as a result of erosion effects evidenced even at lower slope conditions of 2-4% (Brubaker *et al.*, 1993). Slope effect was also found to be highly significant (P<0.01) for plant height, cob length, grain yield and stover weight (Table 4). The increase in yield and growth parameters in the bottom slope is evidently attributed to the deposition of organic matter and nutrients eroded from the topslope as was also reported in the findings of Spomer and Piest (1982). The percentage difference observed for growth and yield parameters at bottom slope though statistically significant is however minimal (Table 5), and a difference of less than 5% was obtained for grain yield. Varietal effect was also found to be significant and the IITA variety performed better than the OSADEP variety (Fig.1.) though yield difference between the two variety was also minimal. The grain yield of the IITA variety was increased by 4% above the OSAPEP variety, hence slope effect and varietal effect observed in this study though significantly significant were still within an acceptable threshold that can ensure sustainable production of maize crop. The grain yield obtained could possibly be increased with fertility measures that further increase the inherent soil fertility.

Table 2. Means, CV and STD Error for soil physical and chemical properties under different slope conditions.

Variable	BOTTOM Slope	TOP Slope	% Diff	SE	CV	Range	Min	Max
Ph	6.3	5.03	20.16	0.29	12.41	1.5	4.9	6.4
OC *(1.5)*	1.43	1.23	13.99	0.04	8.28	0.21	1.22	1.43
N *(0.15)*	0.15	0.12	20.00	0.01	9.19	0.02	0.12	0.15
P *(10-15)*	14.75	5.88	60.14	1.99	47.22	9.37	5.39	14.76
K *(0.6-0.8)*	0.41	0.31	24.39	0.02	15.49	0.13	0.28	0.41
Ca *(1-5)*	2.45	2.16	11.84	0.07	7	0.35	2.12	2.47
Mg *(0.2-0.4)*	1.87	1.42	24.06	0.1	14.77	0.46	1.42	1.88
ExAcidity	0.03	0.08	-62.50	0.01	46.91	0.06	0.02	0.08
ECEC	5.02	4.17	16.93	0.19	10.2	0.91	4.13	5.04
Zn *(12-100)*	2.34	2.17	7.26	0.04	4.28	0.24	2.12	2.36
Cu *(2-7)*	1.46	1.27	13.01	0.04	7.51	0.21	1.26	1.47
Mn *(10-100)*	80.36	37.19	53.72	9.66	40.25	43.94	36.52	80.46
Fe *(10-100)*	85.31	34.84	59.16	11.3	46.07	53.3	32.94	86.24
SAND (%)	80	78.67	1.66	0.67	2.06	4	78	82
SILT (%)	6.67	11.33	-69.87	1.13	30.63	6	6	12
CLAY (%)	13.33	10	24.98	0.8	16.85	4	10	14
Textural class	Sandy Loam							

Critical values of nutrient elements in bracket

Table 3: Mean squares from ANOVA for soil physical and chemical properties

Parameters	Source of Variation Slope	Rep	Error
Ph	2.41**	0.026ns	0.006
OC	0.06***	0.001ns	0.001
N	0.001**	0.001ns	0.001
P	118.01**	0.13ns	0.135
K	0.014*	0.001ns	0.001
SAND	2.66ns	0.667ns	4.66
SILT	32.66ns	0.001ns	2.667
CLAY	16.67*	0.667ns	0.667
Ca	0.12**	0.003ns	0.001
Mg	0.294***	0.001ns	0.001
Na	0.001ns	0.001ns	0.001
ExAcidity	0.003*	0.001ns	0.001
ECEC	1.09**	0.001ns	0.001
Znppm	0.04*	0.001ns	0.002
Cuppm	0.05**	0.001ns	0.002
Mnppm	279.9***	0.42ns	0.8
Feppm	382.32***	0.45ns	0.541

*,**, *** significant level at *P* < 0.05, 0.01 & 0.001, ns= not significant

Table 4: Mean squares from ANOVA for growth and yield parameters

Source	DF	pltht	cobno	coblth	grainyld	Cobdia	seedwt	stover	(Husked) cobwt1	(dehusked) cobwt2
Slope	1	0.211**	0.017ns	1411.35**	0.008**	0.62*	0.004ns	3.85***	0.008ns	0.204**
Rep	2	0.45ns	0.017ns	18.05**	0.068*	0.233ns	0.026*	0.24***	0.053*	0.008ns
Var	1	0.001ns	0.017ns	0.81ns	0.004**	0.006ns	0.008ns	0.41ns	0.001ns	0.002ns
Error	55	0.31	0.017	10.24	0.005	0.116	0.006	0.025	0.011	0.007

*,**, *** significant level at *P* < 0.05, 0.01 & 0.001, ns= not significant

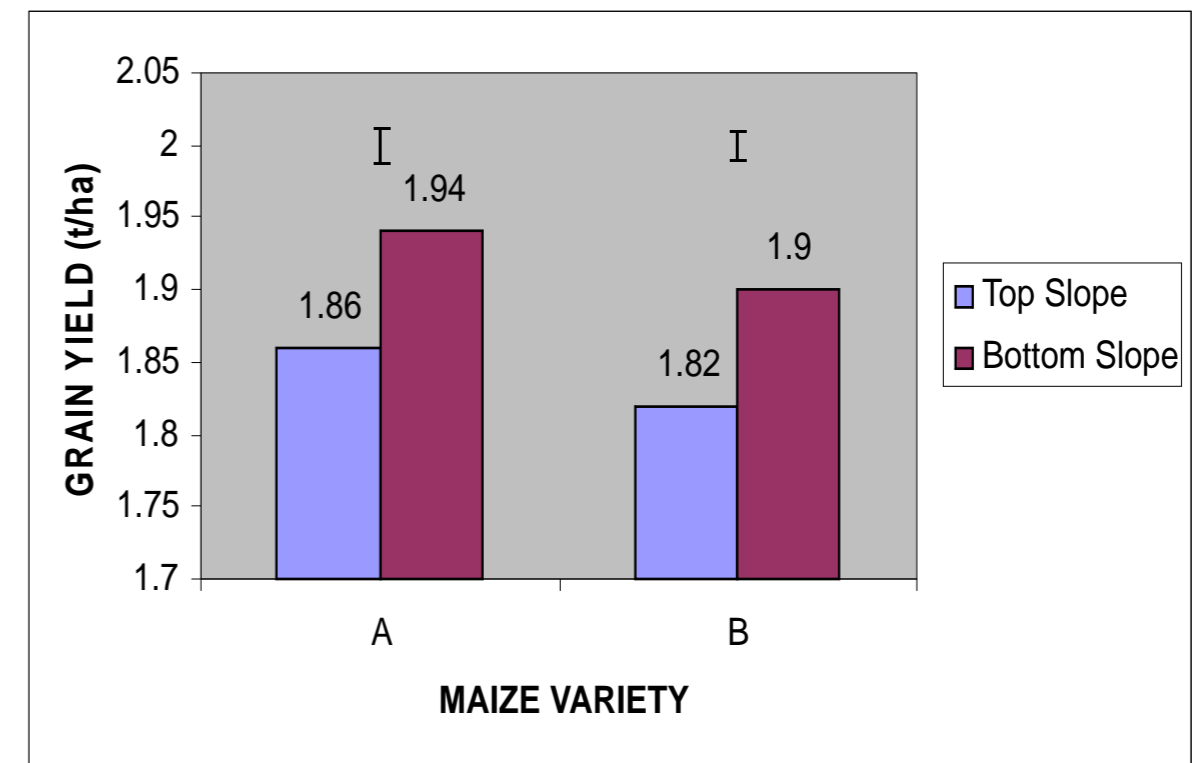| Variable	BOTTOM SLOPE	TOP SLOPE	% diff	SE	CV	Range	Min	Max
pltht	2.35	2.19	6.81	0.02	8.24	0.92	1.76	2.68
cobno	1.07	1	6.54	0.02	12.7	1	1	2
coblth	42.6	33	22.54	0.75	15.43	23	26	49
cobdia	6.43	6.25	2.80	0.05	5.6	1.7	5.2	6.9
seedwt	27.52	27.56	-0.15	0.01	0.3	0.3	27.4	27.7
stover	2.73	2.21	19.05	0.04	12.64	1	2	3
cobwt1	0.50	0.49	1.01	0.01	5.57	0.4	1.8	2.2
cobwt2	0.29	0.27	7.76	0.01	8.84	0.4	1	1.4
Grainyld	1.92	1.84	4.20	0.01	2.40	0.12	1.82	1.94

Table %

Fig 1. Variation in grain yield for two maize varieties at different slope conditions

Conclusions

The overall slope effect though significant resulted in grain yield reduction by only 4.2%, For the 2 OP maize varieties, Variety A was reduced by 4.1% and variety B by 4.2%. Significant slope effects was observed for most soil nutrient parameters The increase in maize yield at the bottom slope, and higher soil nutrient observed is indicative of the increase in deposits of soil nutrient largely due to erosion impacts that wash away nutrients from the upper slope and deposited at the bottom slope. However, cultivation on land with slope between 2-4% (moderately suitable) can still be sustainable for maize production as the reduction in yield though significant is minimal. A better understanding of the soil physical and chemical properties under different slope conditions will therefore assist in developing more comprehensive field management strategies that will enable adequate of soil fertility sustainability and also establish appropriate erosion control techniques.

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Economic Analysis Of Duck Production In The Deciduous Rain Forest Zone Of Nigeria.
(A Case Study Of Ekiti State)

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Abstract

The study was carried out on duck production and management system in the deciduous rain forest zone of Nigeria. A multistage random sampling procedure was used to select 115 respondents from the study area; a structured questionnaire was used to collect data on personal characteristics of the respondents; type of duck reared; flock size, composition and management; flock productivity; health management; feed resources and profitability of duck farming. The study showed that female owned and managed most of the duck flocks (58.3 %). 60 % of the farmers kept duck as a source of income and 40 % for other purposes. Flocks were mainly composed of growers and chicks (57.87%) while breeding hens and cocks constituted 27.59 % and 14.54 %. The study showed that about ninety percent of the farmers kept the birds under a free-range production system with ad hoc supply of household food leftover (kitchen wastes) and grains such as maize and food scraps. Majority of the farmers reported that ducks were tolerant to most poultry diseases. Budget analysis showed that duck production is profitable with the farmers making an average profit of N30, 636.02k per farming season. Due to its profitability and low capital investment nature, it is recommended for farmers without substantial capital, unemployed and those aspiring to augment their income.
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Key words: duck production, duck management, deciduous rain forest, duck,

Introduction

FDLPCS (1992) reported that the meat supply situation in Nigeria remained critical in spite of the relatively large animal production of over 13 million cattle, 34 million goats, 24 million sheep, 1.7 million domestic rabbits, 3.4 million pigs and 104.3 million local poultry and about 20 million exotic poultry. In rural areas of Nigeria like in other parts of sub-Sahara Africa, several species of poultry abound and these species include chickens, guinea fowls, turkeys, ducks and pigeons. However, a good number of the birds in this class had been neglected by poultry operators. Village poultry production has been recognized as a tool that could be used to reduce poverty and promote gender equality in rural households (Dolberg and Petersen, 1999) and as a

potential source for ameliorating animal protein deficiency gap prevailing in Nigeria. Extensive work has so far been carried out in Nigeria and elsewhere in Africa on village chickens, being the predominant poultry species. Frustratingly, very little attention had been paid to duck production in terms of research and development. This has resulted in a scarcity of information on the status of duck production in Nigeria. Ducks are mainly reared to improve the livelihoods of the farmers through improved nutrition, income generation by selling of eggs and birds, employment creation and through eco-tourism. Therefore, duck production has a great potential not only to alleviate poverty and improve the rural economy but also to encourage smallholder farmers to conserve the natural resources in conservancies close to the communal areas.

Ducks are tough animals and good scavengers. They can be reared for eggs and meat, for own use or for sale. Other products from ducks, which can also be sold, include down feathers and fattened livers (van der Meulen and den Dikken, 2004).

Ducks are tougher than chickens; they require less attention than chickens and are less likely to be sick than chickens. Ducks are larger than chickens, so if they are reared for meat there will be more to sell. Duck eggs are also larger than chicken eggs. Ducks do not necessarily need supplementary grain and maize but are good grazers. Duck is a good source of animal protein, B-vitamins and iron and are generally easier and cheaper to keep than chickens. These factors make duck keeping for the production of eggs and meat an attractive enterprise (Leo, 2009). However, ducks are water birds and live best on or near water (lakes, ponds, streams), and ideally need to spend part of each day swimming.

In spite of these benefits, most backyard poultry farmers do not consider duck farming to be a worthwhile venture probably because of the uncertainty and fear concerning the demand and sale of duck meat and largely because of their relatively high levels of feed wastage when kept in confinement because of the shovel-shape of their bill, making their use of feed less efficient. At present, there is scant information in documented form for adoption by intending farmers on traditional duck production and management practices. Information on duck production is necessary in order to identify opportunities to exploit and promote duck production by smallholder farmers and enhance income generation, ensure food security and contribute to poverty alleviation in smallholder farming communities. In view of the above problems, there is the need to analyze the economics of duck production in Ekiti State, Nigeria. Specifically, this study seeks to:

(i)   identify the socio-economic characteristics of the respondents
(ii)   examine the flock size, management and production efficiency of ducks
(iii)   determine the cost and returns of duck production;

Materials and methods
Study area
The study was carried out between June and September 2009 in the deciduous rain forest zone of Nigeria (Ekiti State).

Data collection
An informal survey was conducted in the study site to identify duck farmers. Simple random sampling was used to select 115 duck owners in Ekiti State, Nigeria. The selected farmers were interviewed and a structured questionnaire completed. Information collected through the structured questionnaire included: personal characteristics of the respondents; reasons for adoption of duck rearing; composition and management; flock strains; flock productivity; product utilization; health management; feed resources and farmer's recommendations on how to improve duck farming.

Data analysis
The Statistical Package for Social Sciences (SPSS, 1998) was used for entry and analysis of quantitative data to generate descriptive statistics (means and standard error) The analytical techniques employed include:

- Descriptive statistics, such as frequency counts, percentage and mean which were used to measure socio-economic characteristics of the respondents, and that of the duck comprising of number of breeding hens, growers and chicks as well as their management.
- Budgetary techniques were used to determine the gross margin and net farm income obtained from duck production in the study area.

$$GM = TR \ TVC$$
$$NFI = GM \ TFC$$
$$Profit = TR \ TC$$

Where GM = Gross Margin
TR   = Total revenue
TVC = Total Variable Cost
NFI   = Net Farm Income
TFC = Total Fixed Cost
TC   = Total Cost

Mean was used to compute the cost of the various inputs such as cost of land, feeds, equipment and labour employed, cost of water and cost of housing used in the production process. All equipment used was depreciated using straight line method of depreciation in order to guide against over valuation of the cost incurred in each production year.

- Profitability ratio analysis such as Benefit Cost Ratio (BCR), Gross Revenue Ratio (GRR), Expense Structure Ratio (ESR) and rate of Returns (ROR) was used to measure the profitability of the duck farms and also to ascertain that duck production is a worthwhile venture.

Results and Discussions
Socioeconomic Characteristics of the Respondents-
The results of the socio-economic characteristics of the duck farmers such as gender, age, marital status, educational status, religion, social organization, years of experience, major occupation and source of capital is presented in Table 1. Table 1 showed that 58.3% of the duck farmers are

female while 41.7% were male. This shows that duck farming is a female dominated venture in the study area. Female owned and managed most of the duck flocks. This result is in agreement with the work of Kusina and Kusina (1999) and Gueye (1998) who reported that women ownership is dominant where family poultry is involved. The Table also shows that about 33.9% of the respondents were in the age bracket of 50-59 years with a mean age of 58years. This suggests that most of the duck farmers are in their old age group. The reason for this could be that duck farming is an old business in the study area and as such older people are more involved in the rearing of duck not probably on commercial basis, rather for family consumption and as a way of getting themselves busy. Majority of the duck farmers (69.6%) are married while 30.4% were single. This indicates that married people are more involved in duck farming in the study area probably to increase household income. This study is in line with findings by Yusuf (2002). Majority (52.2%) of the duck farmers had primary education while just 13.0% had tertiary education. Implying that education is not necessarily vital to duck rearing. 63.3% of the respondents were Christians, 33.9% were Muslims while 2.6% were traditional worshippers. This implies that there is no religious prohibition against duck rearing. About 88.7% of the respondents belong to social organization such as cooperative society, farmers' development union, farmers' congress and community development associations. These fora can serve as media of interactions among duck farmers if the awareness is created to increase productivity through sharing of experiences and exploiting such for increased productivity and profitability.

Data in Table 1 also reveals that 14.8%, 71.3% and 13.9% of the respondents have years of experience ranging between 5 to 9, 10 to 14 and 15 to 19 respectively. This further confirms that duck rearing is an old business. About 73.9% of the respondents practice duck farming on part-time basis while the remaining 26.1% practiced duck farming on full-time basis. Of the part-time farmers, majority (53.9%) were traders, 32.2% were civil servants while 3.5% and 10.4% were students and contractors respectively. This implies that apart from duck rearing activities, owners still have other activities they attend to and this is possible since duck rearing is not time consuming. Additionally they were involved in duck rearing as a source of increasing household income and for household consumption. The data in Table 1 also shows that 95.7% of the initial source of capital used in setting up duck production in the study area is from personal savings while the remaining 4.3% is from relatives and friends. This finding agrees with the findings of Raheem (2001) that 96% of the duck farmers used their personal saving as a source of initial capital. 60 % of the farmers keep duck as a source of income as they sold breeding stock and eggs to other farmers and traders and 40 % for other purposes which include keeping them as pet, domestic consumption, ritual and gift among many other reasons. This is in agreement with the study of Aini (1990) and Gueye (1998) but contradicts the finding of Moreki (2000). Culled growers and breeders were the main classes of duck that were marketed. Live duck were sold any time the need arises or on emergency should the farmer needs money while eggs were sold or disposed during the breeding season. The farmers reported that duck was used as a source of organic fertilizer for gardening projects. Thus, duck production if improved can boost the economic base of the rural populace especially women who are majorly the owners and managers of the enterprise.

Table 1: Socioeconomic Characteristics of the Respondents

Social-economic Characteristics	Frequency	Percentage
Gender		
Male	48	41.7
Female	67	58.3
Age		
20-29	15	13.0
30-39	22	19.1
40-49	17	14.8
50-59	39	33.9
60 and above	22	19.1(Mean age=58)
Marital Status		
Single	35	30.4
Married	80	69.6
Educational Status		
No-formal Education	0	0
Primary Education	60	52.2
Secondary Education	30	26.1
NCE/OND	10	8.7
HND/University	15	13.0
Religion		
Christianity	73	63.5
Islam	39	33.9
Traditional	3	2.6
Member of Social organization		
Yes	102	88.7
No	13	11.3
Years of experience		
5-9	17	14.8
10-14	82	71.3
15-19	16	13.9
Mode of Practicing		
Full-time	30	26.1
Part-time	85	73.9
Major Occupation		
Civil service	37	32.2
Trading	62	53.9
Student	4	3.5
Contracting	12	10.4
Source of Capital		
Personal saving	110	95.7
Relations and friends	5	4.3
Reasons for rearing duck		
Income generation	69	60.0
Others	46	40.0

Source: Field survey, 2009.

Flock structure, Management and production efficiency

Table 2 revealed that their flocks were mainly composed of growers and chicks 57.87% while breeding hens and cocks constituted 27.59 % and 14.54 %, respectively, resulting in a sex ratio of 1.90 duck to 1 drake. The reason for higher number of growers and chicks in the rural population of duck rearers might be as a result of the fact that adult birds were most often disposed for money or any other purpose. Nearly ninety percent of the farmers kept the birds under a free-range production system with *ad hoc* supply of household food leftover (kitchen wastes) and grains such as maize and food scraps. The scavenging production system practiced by the majority of the farmers (89.56 %) in this study was similar to the system adopted on village poultry by smallholder farmers not only in Nigeria but also in most sub-Saharan African countries (Idi, 1996; Kusina and Kusina, 1999; Badubi *et al.* (2006). 53 % of the respondents housed all species of poultry they own in the same place and 95.7 % housed all age groups of the same species in the same place. However, the houses were not meeting hygienic standards (dry and clean bedding, size of houses and easy to clean walls and floor) required to prevent the build up of parasites and control of parasitic infestation. This system is not healthy as disease transfer is highly encouraged by this method. This could be ascribed as one of the major reasons while mortality is high in rural poultry. This result is in agreement with the works of Idi, 1996 and Ekue, 2002. 100 % of the respondents provided small amounts of supplementary feed in the form of crushed maize for chicks and whole grains for growers and breeders. The dietary pattern of the supplementary feed for the duck was difficult to estimate because of the inconsistent feeding practices. The inconsistent feeding system could be a major contributor to under-nutrition and malnutrition leading to poor productive capability of the birds. All the farmers allowed their birds to have access to drinking water. Although majority of the farmers reported that ducks were tolerant to most poultry diseases, high mortality of chicks was however noted. The major causes of chicks' mortality were drowning and straying. In addition to these, poisoning by agro-chemicals or alleged poisonous insects also caused adult bird mortality. 100 % of the respondents neither treated nor vaccinated the birds.

Table 2: Flock structure, Management and Production Efficiency

	Frequency	Percent	Cum%
Types of flock			
Growers and chicks	64	57.870	57.87
breeding hens	15	27.59	85.46
cocks	8	14.54	100.00
Production systems			
Free range	103	89.56	89.56
Semi intensive	12	19.44	100.00
Intensive	0	0	100.00
Housing at night			
All species housed together			
Yes	54	47.0	47.0
No	61	53.0	100.0
All age group housed together			
Yes	5	4.3	4.3
No	110	95.7	100.0
Health			
Mortality			
Yes	102	88.7	88.7
No	13	11.3	100.0
Health			
Causes of mortality			
Disease	3	2.6	2.6
Others	112	97.4	100.0
Treatment			
Yes	0	0	0
No	115	100	100
Vaccination			
Yes	0	0	0
No	115	100	100
Give water			
Yes	115	100	100
No	0	0	100
Give supplements			
Yes	115	100	100
No	0	0	100

Gross Margin and Net Farm Income Analysis-

Table 3 shows the result of the gross margin and the net farm income. Duck farmers made profits from their production with gross margin of N39, 052.44k and Net farm income of N 30, 636.02k per farming season. This shows that duck production in the study area is a profitable business.

Table 3: Gross Margin and Net Farm Income Analysis for One Farming Season

Items	Cost (N)
Total Revenue	39,628.13
Variable Cost	
Feed cost	338.49
Water cost	92.45
Transport	144.75
Total Variable cost	575.69
Gross margin	39,052.44
Fixed cost	
Housing cost	5,628.66
Cost of equipment	2787.58
Total fixed cost	8,416.24
Net farm Income	30,636.2

Source: Field survey, 2009

Profitability Ratio of Duck production

The data in Table 4 shows that BCR is greater than one. Judging from investment decision criteria, this implies that duck production is profitable. The gross revenue ratio was found to be 0.388, which implies that from every N1.00 returns to the duck production, 38.8k is spent. The expense structure ratio was found to be 0.181, which also implies that 18.1% of the total cost of production is made up of fixed cost component, thus making the business worthwhile to invest in. Also, the rate of returns was found to be 1.574 which shows that for every one naira invested in duck production 157k is gained. From all these profitability ratios duck production is a profitable business in the study area.

Table 4: Profitability Ratio of the Duck

Ratios	Values
Benefit Cost Ratio TR/TC	2.574
Gross Revenue Ratio TC/TC	0.388
Expense Structure Ratio FC/TC	0.181
Rate of Returns NR/TC	1.574

Source: Field survey, 2009

Problems Encountered in Duck Farming

The major problems faced by the duck farmers in the study area are drowning and straying (43.4%), Predators such as snakes, bird (13.2%), theft (18.9%), lack of finance (3.8%), Diseases

and parasites (9.4%). This implies that the major problem faced by the duck farmers in the study area is that of swimming away (Table 5).

Table 5: Distribution of Respondents According to Problems Encountered in Duck Production

Problems	Frequency	Percentage
No Problem	13	11.3
Predators	15	13.2
Diseases & parasites	11	9.4
Theft	21	18.9
Drowning and straying	51	43.4
Lack of finance	4	3.8
Total	115	100

Source: Field survey, 2009

Conclusion and Recommendation

Based on the major findings of this research, the following conclusions were drawn. Duck farming is a profitable venture if carried out with adequate management. Duck farming can be handled as a part-time business because it is not time consuming; A large number of feed consumed by Ducks come from domestic waste and green feed which made the cost of feeding to be low; and the main problems of Duck production is the swimming away of the chicks especially under free ranging conditions. In addition, the information on diseases and parasites affecting the bird, which is necessary for designing disease control strategies, is lacking. Therefore, there is need for research on current smallholder duck management practices and productivity under the current management systems. There is also need to experiment whether improving the current management system has any significant effect on the productivity of the birds.

In view of this, this study therefore recommends that; more people should venture into duck production and the already involved farmers should enlarge their production; farmers should take great care of the chicks by caging until they are old enough to weather the hazard of being swept away by river; and due to duck's profitability and its low capital investment nature, it is recommended for farmers without substantial capital, unemployed and those aspiring to augment their income.

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Empirical Consideration of the Link between Poverty and HIV/AIDS epidemics in Nigeria

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Abstract
This study examined the pragmatic link between HIV/AIDS and poverty using data collected by the 2006 Nigerian Demographic and Health Survey. This survey employed a probability sample of approximately 9550 women aged between 15 and 49 who were selected from all the six zones in Nigeria, but only 8264 sample size was useful for subsequent analysis. Poverty decomposition analysis revealed that about 42% (3448) of the respondents were categorized as "very poor", 21% (1768) as "poor" and 37% (3048) were categorized as "non-poor". The results also indicated that about 66% of the very-poor category lives in the rural areas of Nigeria. In addition, increased risk of HIV infection among the poor was due to poverty-related characteristics such as low education and low knowledge of the means of avoiding HIV infection, as opposed to the non-poor. Moreover, the poor and the less educated were found to engage in risky sexual relation of not using condom during every round of sexual intercourse than the non-poor. This difference was only marginal as the results revealed at the intricacy of the poverty-HIV/AIDS relationship, summary of this finding shown that not only low socio-economic status that increased susceptibility to HIV infection but also high socio-economic status. Low socio-economic status robs the poor of the knowledge necessary for the prevention of infection with HIV/AIDS, and also increases susceptibility to infection by making them more likely to practise unsafe sexual behaviour.

Keywords: HIV/AIDS, poverty, HIV knowledge, condom use.

Introduction

Literatures have widely shown positive relationship between poverty and disease; and their empirical linkages, as evident from the mounting novel on the subject (Caldwell, 1995; Barnett & Whiteside, 2002; Booysen, 2004; Wojcicki, 2005; Kanki and Adeyi, 2006; Oyefara, 2007, Apata *et al*, 2008), in addition to public lectures, conferences/workshops and debates on the issue (HERFON, 2008; World Bank, 2008). Several studies and research have broadened the link between HIV/AIDS and poverty (Cohen, 1998; Cross 2001; Thulissle and Seager, 2005; Kanki and Adeyi, 2006). However, only a few studies have theoretical this link, whereas empirical linkage has not yet been carried out in Nigeria. Some of the studies that have carried out this link

outside Nigeria are Tladi, (2006), Barnett &Whiteside (2002), Thulissle and Seager, (2005). These studies argued that HIV/AIDS epidemic aggravates poverty and vice versa. Attempts to explain this dual link between poverty and HIV/AIDS have employed either of the two approaches: behavioural or lifestyle approach, and the material or structural conditions approach.

Researchers and past studies pledging to these schools of thought argued that different levels of poverty (individual, household and community) and their related characteristics (low education levels, low marketable skills, lack of knowledge or information regarding the risk of infection and the lack of resources to act on this knowledge, lack of capacity to negotiate sex, and high population mobility) create a 'fertile terrain' for HIV/AIDS to flourish at the different stages of infection (Alban, 2001; Barnett & Whiteside, 2002; Booysen, 2002, 2004;Whiteside & Sunter, 2001; Wojcicki, 2005, among others). Past works (Cohen, 1998; Booysen, 2004; Thulissle and Seager, 2005) on poverty, knowledge of HIV/AIDS, risky sexual behaviour and related toil, found that it was only a small percentage of women (less than 4%) were knowledgeable about HIV/AIDS and had engaged in risky sexual behaviour, however, the likelihood of engaging in risky sexual behaviour was higher among women from poorer households relative to those from more comfortable ones.

These studies concluded that majority of the poorer women (92%) lack control over decisions pertaining to financial issues. In addition, they were also deficient on knowledge of whether condoms were used at last the sexual intercourse. However, women of higher economic status have a positive perception about condom use. Contrary to these findings, the conclusions of Booysen's logistic regression model suggested that poverty had little role to play in explaining risky sexual behaviour (Booysen, 2004), in which women with some primary education as well as those with secondary education were found to be likely engaged in risky sexual behaviour relative to their non-educated counterparts. The same results were observed for women residing in urban areas relative to those from non-urban areas.

This therefore insinuates the complexity of the poverty-HIV/AIDS cycle (linkage). The obscure nature of this relationship is further highlighted by the works of Wojcicki's (2005) and Tladi (2006) which addressed the link between socioeconomic status (SES) and HIV sero-prevalence and or sero-conversion in sub-Saharan Africa and Southern Africa. However, some studies have described how HIV/AIDS can aggravate poverty by making it hard for the poor to mitigate its impact (Cohen, 1998; Steinberg *et al*; 2002; Oyefara, 2007). These studies not only confirm the complexity of the HIV/AIDS-poverty relation, but also suggest that while HIV/AIDS might be pushing households into poverty, at least in the short term, households are also moving out of poverty following illness or death of the infected person (Webb, 1997; Booysen, 2002; Tladi, 2006).

In an attempt to escape the ruin of the effects of poverty, households adopt the following strategies: alter household composition, draw on savings, sell assets or use assistance from other households or from other informal rural institutions (Desmond *et al*, 1999; Topouzis, 1999;

Oyefara, 2007). However, at times when people reach the point of destitution, the range of strategies they adopt may become unpredictable. A study by Nattrass (2004) illustrated how destitution as a result of a combination of HIV/AIDS, high poverty and unemployment rates can lead people to behave in ways that they would not adopt in more favourable conditions. The findings of this study suggest that the high unemployment rates and poverty experienced in Nigeria fuelled the high HIV infection levels currently experienced in the country (Oyefara, 2007; HERFON, 2008; World Bank, 2008; AIDS Global Estimates, 2008).

Consequently, this study intends to gain a smooth understanding of the complex relationship between poverty and HIV/AIDS as well as the factors that fuel this link using the 2006 Demographic and Health Survey. Therefore, the study hypotheses are as follows: poor individuals are more susceptible to HIV infection than their non-poor counterparts, for the following reasons: poverty and its associated factors, such as low education, lack of access by the poor to good knowledge of the means of preventing HIV infection poor women are less likely to use condoms or to negotiate condom use due to both low education levels and economic dependence on their partners.

Notional Framework
Numerous theories have described the theoretical framework in explaining the poverty-HIV/AIDS cycle. Some of these are the "drive theory" and "social epidemiology" (Krieger, 2001), however, the purpose of this paper, the 'drive' theory is adopted. This theory arises from the idea that drives the motivating force behind human behaviour. The theory dates back to 1930 during the heyday of behaviourism and indicates that there are certain necessities of life without which human beings cannot survive, and that the drive to obtain these necessities is part and parcel of the human life. Therefore when a need arises, e.g. basic survival need like hunger and thirst, it leads people to act in ways that are aimed at satisfying that need (Jordan & Jordan, 1989).

This theory proved that the dependent variable (HIV/AIDS infection rates) can be hypothetically referenced and are influenced or explained by factors such a socio-economic characteristics and poverty among others. It has also been proved that poverty deprives people of the necessities of life, e.g. food and shelter, thus causing them to respond in ways that, although harmful, will ensure at least that they obtain these necessities (Caldwell, 1995; Tladi, 2006; Oyefara, 2007). The extent to which people can protect themselves from HIV infection depends on their knowledge of perceived risk; their capacity to apply that knowledge, as well as the amount of power a person has to negotiate for safer sex. Tladi (2006) argued that although cultural, societal and religious norms have influence on sexual behaviour, yet person's sexual behaviour is mostly influenced by his educational levels and financial status. Thus, suggesting that low level of education can push people to behave in the ways they would not in the absence of poverty.

The argument above thus suggests that HIV/AIDS is exclusively confined to poverty, low levels of knowledge of HIV/AIDS risk and level of educational status. Studies have also shown that a rise in income levels can also place individuals at a higher risk of infection (Caldwell, 1995; UNDP, 2002; Tladi, 2006; Oyefara, 2007). In most African setting where multiple partners are

kept just because the individual has a good financial situation and can therefore afford to have several sexual partners, thus increasing their risk of infection. In other words, the freedom of choice regarding sexual behaviour is circumscribed by external factors such as social norms and values and one's socio-economic position in the society. Hence the assumptions of mutual consent and power in negotiating for safer sexual intercourse as contained in the safer mode of ABC (Abstain, Be faithful and Condomise) prevention strategy when sexual activity is seen as a strategy to survive; for exchange for money or goods(Webb, 1997; UNDP, 2002).

Methodology

This paper makes use of the 2006 Nigerian Demographic and Health Survey (NDHS) which covered the population living in private households. This survey employed a probability sample of approximately 9550 women aged between 15 and 49 selected from all the six zones in Nigeria, however, but only 8264 sample size was useful for subsequent analysis. The sampling frame constituted a list of approximately 212,080 Enumeration Areas (EAs) with households and population information (from the 2006 census) for each EA, this methodology was evaluated as a potential sampling frame for the 2006 NDHS. The EAs were grouped by States, by LGAs within a State, and lastly by localities within each Local Government Area (LGAs), stratified by urban and rural areas. Any locality with less than 20,000 populations constitutes a rural area.

Also available from the 2006 census were maps showing the location of the EAs. These maps were studied to indicate areas needed in the field before the final household selection and were thus used as the sample frame. The Primary Sampling Unit (PSU), or cluster, for the 2006 NDHS is defined as one or more EAs from the 2006 census frame. A minimum requirement of 50 households per cluster was imposed on the design; in the case of less than 50 households. The number of cluster in each state was not allocated in proportion to the state's population because of the need to obtain estimates. The enumeration areas ranged from 100 to 250 households and were stratified rural and urban areas accordingly. There were a total of 26 sampling strata and within each stratum, a two-stage sample was selected.

Analytical Procedure

Poverty measure which was used to capture the poverty decomposition was borrowed from the work of Foster-Greer-Thorbecke (FGT) (1984) poverty analysis. The Food Energy Intake (FEI) method is adopted in obtaining the food poverty line in this study in order to determine a threshold for categorization of household poverty status. This is because of its amenability to data requirements and availability. FGT poverty procedure method utilized the household income generated in meeting the needs of the household and uses it to construct the poverty line. Other works that have used this model are the work of Greer and Thorbecke (1986) and Okurat *et al*; (2002).

The FEI poverty line is represented as

Z   = $e(a+bK)$ --(1)

Where Z   =   Food Poverty Line
          K   =   Recommended daily allowance of calories intake (World Bank)

2,350 Kcal is the daily per capita household food energy intake recommended by the World Bank for the study of poverty (see Schubert, 1994)

a and b are estimated parameters to be obtained from equation (2) below.

The parameters are obtained from the relationship

In Ei = a + bCi   (2)

Ei = total food expenditure per adult equivalent by household i

$$(Ei=E*I$$
$$Hj$$

Where E*i   = total value of food consumed by the jth household
          Hj   = adult equivalent for jth household (proxy by the household size)
          Ci   = total calorie consumption for different household per adult equivalent by household i

a and b are parameters to be estimated. a = intercept, b = coefficient

Ci is the calorie equivalents of the different types of foods consumed by the different households and converted to calories.

Here few assumptions were made,

The quality difference of each food item was ignored.

The food items under consideration were assumed to be homogenous for all households.

Local units were assumed to be fixed per community, although they may vary across communities.

Therefore, Foster, Greer and Thorbecke (FGT) index, P (Foster *et al*; 1984) was used to measure poverty status among the households.

The FGT index (P) is given as:

$$P \quad = \quad \frac{I}{N}_{I=1}^{q} \quad \frac{Z - Yi}{Z}$$ (3)

Where Z   = *Poverty line*
          Yi   = Income of the household i (i = 1, 2, …., q)
          q   = No of household below the poverty line
          N   = Total number of sampled households
               = ßarameters of the FGT index (P). a > 0 and it can take three values of 0,1 and 2. These values give different implications.

Implications

If   = 0, the FGT index Po measures poverty incidence.

This represents the index of the households that are impoverished.

(i) If   ß= 1, the FGT index P1 measures the poverty depth of the households.

This denotes the proportion of the poverty gap that the average poor will require to get to the poverty line.

(i) If   = 2, the FGT index P2 measures the severity of poverty .

This gives more weight to the poorest of the household poverty.

The FGT index (P / = 0,1,2) is bounded between zero and one. The closer the FGT index is to one, the greater the poverty level. The FGT index has been widely used to determine level of poverty (Greer & Thorbecke, 1986; 2000; Okurat et al; 2002; and Apata, 2006). Generally, the higher the Po, the worse the poverty condition can be. Similarly, the higher the P_1 value the greater is the depth of poverty. In the same vein, the higher the P_2, the more severe the poverty situations will be.

Results and Discussions

It is significant that the respondents' background characteristics be provided before continuing with analysis, so as to allow the reader to identify group dynamics. These are presented in Table 1. An examination of the results in Table 1 according to age group seemed to indicate significant major urban-rural differences of respondents particularly in the 15-19 and 19-24 age brackets (Table1). It is higher in rural area of 15-19 age brackets, while 19-24 age brackets show a higher percentage in the urban centres. This therefore, explain that at this age brackets (19-24) the youth tend to move to urban areas for livelihood activities search (this call for research to look at what factors attract the age brackets from rural areas to urban areas), while the rest of the age brackets seemed to show no major differences.

As was expected, there was variation in the highest level of education by place of residence. Most of those with no education were concentrated in the rural areas (53.4%) of the total compared with 31.9% in the urban areas. Furthermore, while the percentage of those with incomplete secondary education and primary school was almost similar between urban and non-urban areas, only a few (7%) of those residing in urban areas had attained a higher education compared with only 2% of rural dwellers. With these observed differences in educational level between urban and rural dwellers, there is the need for policy of basic education to be more focussed in the rural areas.

More than half of respondents in both urban and non-urban areas have been married, about 25.3% for urban and 44.7 % rural areas had never been married (Table 1), while less than 3% were cohabiting and a further 2% or less were either divorced, living alone or separated. It is not surprising that high number of respondents not working was observed as over 40% for both areas were recorded at the time of the survey (Table 1).

Table 1: Background Description by place of Dwelling (Rural and Urban)

Description	Urban Areas (%)	Rural Areas (%)
Age Group		
15-19	14.4	21.4
19-24	17.6	11.0
25-29	21.3	06.5
30-34	11.7	17.1
35-39	09.0	15.0
40-44	12.2	13.6
45-49	13.8	15.4
Educational Status		
No functional education	31.9	53.4
Some primary school	21.3	20.4
Primary School Completed	09.6	07.9
Some secondary school	18.6	10.7
Secondary school completed	10.8	04.4
Some post secondary school	06.8	01.7
Post secondary school completed	01.0	01.4
Marital Status		
Never married	25.3	44.7
Married	68.0	50.8
Living together	02.0	02.3
Divorced	01.7	01.0
Separated	01.2	00.8
Widowed	01.8	00.5
Employment Status		
Currently employed	57.8	55.3
Not currently employed	02.2	02.2
Not employed in the last 12 months preceding the survey	40.0	42.5
Total	100	100

Poverty and sexual behaviour

To measure poverty status, monthly earnings of N3549.25 (about $29.95, this reflected less than $1 per day) was computed to be the threshold. Consequently any respondents whose monthly earnings fall below this figure were categorized as poor.

Table 2 provides the distribution of poverty according to economic status and place of dwelling. The over all results indicated that about 42% (3448) of the respondents were categorized as very poor, 21% (1768) as poor and 37% (3048) as non-poor (Table 2). The results also indicated that about 66% of the very-poor category lives in the rural areas of Nigeria, while more of the poor category were shown to reside (60%) in the urban areas. As expected, the non-poor were prevalent in the urban areas of Nigeria (64%), however, the study found out that there were exceptions, for instance in the North West Zone of the country, the result showed that there were more of the very-poor category in the urban area than in the rural areas (Table2). Moreover, in the

South east region, there are non-poor in the rural areas than in the urban areas. This would be due to the fact that there are more business opportunities and flourishing livelihood activities that attract a reasonable income for family/individual or that families or individuals spend less than their counterparts in the big cities, e.g. maintaining of mobile phones among others. Other factors would be due to large number of family members and dependants (that are not working) coupled with a lot of heavy taxes that are paid in the urban areas, this practises not so common in the rural areas. In addition the habit of buying varieties of food and consumables is more prevalent in the cities than in the rural areas. These food varieties and consumables chops off a large part of family income. However, this calls for future research to look at the determinants or factors that prompt the propensity to spend in both rural and urban areas of Nigeria as this will elucidate facts and policy direction of what takes away family/individual income in urban areas than in the rural areas.

The study then adopted the methodology of Tladi (2006) to measure the risk of HIV infection and transmission. The risk of HIV infection and transmission was measured at two levels: the knowledge base and the sexual behavioural level. The independent variables that were used in establishing the link between poverty and HIV/AIDS at level I (the knowledge base) were: poverty status, level of education, media exposure, and place of residence. The variable 'media exposure' is employed in analysis due to the important role that media plays in educating people about HIV/AIDS and the ways of protecting oneself from infection.

Studies have shown that knowledge of HIV/AIDS varies according to place of residence, hence the inclusion of the variable 'place of residence' (Tladi, 2006; Oyefara, 2007). The sexual behaviour was measure using the influence of economic status on the 'adoption' of safer sexual behavioural practices. To date, condoms are the most effective means of avoiding HIV infection, in the absence of abstinence, while the number of sexual partners is an important risk factor for HIV infection. Studies have argued that even when the number of sex partners is high, the risk is significantly reduced with consistent condom use (Caldwell, 1995; Tladi, 2006; Oyefara, 2007). Emphasis here was on the effect of economic status on condom use. The variables that were used were 'condom use last sex', 'didn't use: low risk' and 'didn't use: partner disliked'. Independent variables used in establishing the link between poverty and risky sexual behaviour were 'poverty status'; 'level of education'; 'marital status'; 'extent of household hunger' as well as 'husband provided money'.

Table 2: Cross Tabulation of Economic Status by Zone and Place of Dwelling

Zone/Place of Dwelling	Very Poor P_2	Poor P_1	Non-Poor P_0	Total
North Central	**43.3% (541)**	**24.1% (302)**	**32.6% (408)**	**100.0% (1251)**
Rural	71.7% (388)	57.3% (173)	21.8% (89)	
Urban	28.3% (153)	42.7% (129)	78.2% (319)	
North East	**45.0% (834)**	**22.3% (413)**	**32.7% (608)**	**100.0% (1855)**
Rural	74.9% (625)	32.0% (132)	31.4% (191)	
Urban	25.1% (209)	68.0% (281)	68.6% (417)	
North West	**46.0% (710)**	**20.5% (316)**	**33.5% (518)**	**100.0% (1544)**
Rural	44.5% (316)	52.9% (167)	24.1% (125)	
Urban	55.5% (394)	47.1% (149)	75.9% (393)	
South East	**49.8% (618)**	**17.0% (211)**	**33.2% (413)**	**100.0% (1242)**
Rural	62.9% (389)	42.2% (89)	60.3% (249)	
Urban	37.1% (229)	57.8% (122)	39.7% (164)	
South South	**36.6% (405)**	**28.8% (319)**	**34.6% (383)**	**100.0% (1107)**
Rural	72.4% (293)	46.7% (149)	45.7% (175)	
Urban	27.6% (112)	53.3% (170)	54.3% (208)	
South West	**26.9% (340)**	**16.4% (207)**	**56.7% (718)**	**100.0% (1265)**
Rural	70.9% (241)	33.3% (69)	31.3% (225)	
Urban	29.1% (99)	69.7% (138)	69.7% (493)	
Total	**(3448)**	**(1768)**	**(3048)**	**(8264)**

Source: Poverty profile analysis results

Influence of economic status on knowledge of HIV/AIDS and sexual behaviour practises
This section explores the relationship between economic status and knowledge of HIV/AIDS, sexual behaviour practises and seeks to determine whether low economic status was associated with low knowledge of the means of avoiding HIV/AIDS. In addition, the relationship between economic status and high-risk HIV-related sexual behavioural practices was examined too, with the aim of determining if low economic status was indeed a driving force behind risky sexual behavioural practices.

Table 3 examines the relationship between knowledge of HIV/AIDS and various socio-economic indicators. To test this relationship, poverty status was first entered into the model, followed by other variables that were assumed to be likely influences the relationship between knowledge of HIV/AIDS and economic status: educational level, media exposure, marital status and place of residence. Two models were produced. In model 1 the last category for the variables 'poverty status' and educational level' was the reference category, whereas in model 2 the first category was the reference category. This was done to allow thorough testing of the earlier hypothesis, namely that the poor are less likely to have good knowledge of the means of preventing HIV infection than the non-poor, thus increasing their risk of HIV infection.

Regression model equation:
ln(Odds)= + ?1X1 + ?2X 2+?3X 3 + ?4X 4 +…+?kXk
where   = model constant; ? is the parameter estimate for the independent variables and Xk represent each independent variable.

Model 1 equation:
ln(odds of having good knowledge of HIV/AIDS) = .912 + (.413) very poor + (.219) poor + (1.913) no education + (1.526) primary education + (.782) incomplete secondary + (-.413) complete secondary + (.432) reads + (.215) listen to Radio + (.732) rural + (0.113) urban

Model 2 equation:
ln(odds of having good knowledge of HIV/AIDS) = -1.618 + (1.738) (non-poor) + (.612) primary + (1.483) incomplete secondary + (1.218) complete secondary + (1.718) Post secondary + (.628) reads +(.315) listen to Radio + (.138) rural + (-283) urban

Table 3: Odds of Having and HIV knowledge by Selected Socio-economic Status

	Model	Model
Constant	3.503 (0.912)*	0.314 (-1.618)^{NS}
Poverty Status		
Very Poor	2.713 (-0.413)**	
Poor	1.908 (-0.219)***	
Non-poor		1.738 (0.413)***
Educational Status		
None	0.164 (-1.913)***	
Primary	0.394 (-1.526)^{NS}	1.814 (0.612)***
Incomplete secondary	0.513 (-0.782)^{NS}	3.210 (1.483)*
Complete secondary	2.112 (-0.413)**	3.481 (1.218)*
Post secondary		5.212 (1.718)*
Media Exposure		
Reads		
Newspapers/Magazine	1.718 (0.432)***	1.482 (0.628)^{NS}
Watches T.V.		
Listen to Radio	2.218 (0.215)**	2.308 (0.315)**
Place of Dwelling		
Rural	3.532 (-0.732)*	2.115 (-0.138)
Urban	2.248 (0.113)**	2.013 (0.283)
Model Chi-Square	(315.142)*	(294.305)*

Source: Regression Analysis Computer Results
Coefficient in Parenthesis, NS Not Significant
* Significant at 1% level, ** Significant at 5% level, *** Significant at 10% level,

The model chi-square for the regression model testing the relationship between poverty and knowledge of HIV/AIDS was significant at a 1% significance level, thus indicating the overall importance of the set of predictors in predicting the log odds of having good knowledge of HIV/AIDS. Generally poverty had a significant effect on the odds of having good knowledge of HIV/AIDS. However, it was only in model 1(reference category = the non-poor) where that the effects of different components of poverty contributed to the prediction of the outcome variable. Being very poor and non-poor had the same effect on the odds of having good knowledge of HIV/AIDS, serving to increase the odds by a factor of -0.413, at a 95% level of certainty, controlling for the effects of education, media exposure and racial group. Being non-poor, on the

other hand, had a higher effect on the odds of having good knowledge of HIV/AIDS, increasing the odds by a factor 1.738 compared with the very poor, controlling for the effects of education, place of dwelling and media exposure.

A comparison of the results of model 1 and model 2 highlighted the importance of economic status further. This was illustrated by the effects of educational level (an indicator of economic status) on the odds of having good knowledge of HIV/AIDS. In model 1, in which high education was the reference category, the odds of having good knowledge of HIV/AIDS increased with the increase in the level of education, albeit at a lower rate. However, in model 2, when 'no education' was the reference category, the odds increased greatly.

The odds of having good knowledge of HIV/AIDS were 0.164 times higher for those with no education compared with those with higher education (model 1), whereas the odds of having good knowledge of HIV/AIDS were 5.212 times higher for those with higher education as opposed to those with no education at all (model 2), controlling for the effects of economic status, media exposure and race. This relationship between educational attainment and having good knowledge of HIV/AIDS was linear an increase in education was associated with an improvement in the knowledge of the means of preventing HIV infection.

Looking at the variables measuring media exposure, it can be said with 90% accuracy that reading a newspaper or magazine improved the odds of having good knowledge of HIV/AIDS by a factor of 1.718. Since the ability to read is dependent on education, it can be said that those with no or low education were less likely to have good knowledge of HIV/AIDS than their educated counterparts. Majority of those with no education and with low literacy levels are in the poor category, these findings therefore imply that the poor were less likely to have good knowledge of HIV/AIDS prevention methods than the non-poor.

Influence of economic status on sexual behaviour
It was hypothesised earlier that low economic status increases the risk of HIV infection, since the poor are more likely to have unsafe sexual behaviours, due partly to lack of knowledge as a result of poverty as well as harsh circumstances that could force them to resort to unsafe sexual practices for economic survival. This section aims to establish if poverty can indeed be held accountable. Table 4 represents the regression model testing the relationship between economic status and condom use, using the variable 'condom use during last sexual intercourse' as the dependent variable.

Model 1 equation:
ln(odds: condom use last sex) = .5.182 + (.782) non-poor + (3.143) primary education + (1.513) complete secondary + (1.013) post secondary + (1.738) knows condom + (.418) knows someone with/who has died of AIDS + (.718) AIDS: condom use.

Model 2 equation:
ln(odds: condom use last sex) = 4.813 +(1.025) primary education + (1.327) complete secondary + (1.732) post secondary + (1.318) knows condom + .308 knows someone with/who has died of AIDS + (.715) AIDS: condom use + (1.381) never married + (.819) widowed + (1.034) divorced + (1.038) living alone

The model chi-squares for both model 1 and model 2 are significant at 1% level, implying that the sets of predictors (independent variables) in each model contributed to the prediction of the log odds of the outcome variable. In model 1, on the whole poverty had a significant effect on condom use. However, when looking at different components of poverty, it was only being non-poor that had a significant effect on condom use. Those who were non-poor were 0.8 times more likely to have used a condom during their last sexual encounter compared with those who were very poor, controlling for educational level, knowledge of condoms and knowledge of someone with, or who had died of, HIV/AIDS.

As anticipated, educational level was linearly related to condom use, whereby the odds of having used a condom during the last sexual encounter increased with an increase in the level of education attained, controlling for poverty, and knowledge of condoms and knowledge of a person who died of or had HIV/AIDS. The highest effect was produced by having a higher education, which increased the odds by a factor of 6.132 when controlling for poverty, knowledge of condoms and of someone who had died of AIDS, and by a factor of 3.928 when marital status was included in the model. The reduction of the odds with the inclusion of marital status indicates the importance of social factors in sexual behavioural practices. This shows that social factors take precedence over economic factors in influencing sexual behaviour, such that even when an individual is not poor, they might practise unsafe sexual behaviour as a result of the social norms within which they exist. An example could be that of married people not using condoms because the use thereof is associated with infidelity.

Table 4: Condom use During Last Sex on Some Selected Socio-economic Status

	Model	Model
Constant	-5.182 (0.912)*	-4.813 (0.814)
Poverty Status		
Poor	NS	
Non-poor	1.913 (0.782)	
Educational Status		
Primary	3.143 (1.209)*	1.873 (0.025)***
Complete secondary	5.031 (1.513)*	5.128 (1.327)*
Post secondary	6.934 (1.013)*	6.137 (1.732)*
Condom Use		
Knows condom	6.148 (1.738)*	5.128 (1.318)*
Used with someone/has died of AIDS	1.982 (0.418)***	1.839 (0.308)*
Used condom to avoid HIV/AIDS	2.228 (0.718)**	2.285 (0.715)**
Marital Status		
Never married		3.928 (1.381)*
Living together		NS
Widowed		2.618 (0.817)**
Divorced		3.482 (1.034)*
Living alone		3.291 (1.038)
Model Chi-Square	(103.253)*	(158.118)*

Source: Regression Analysis Computer Results

Coefficient in Parenthesis, NS Not Significant
* Significant at 1% level, ** Significant at 5% level, *** Significant at 10% level,

Economic status and HIV knowledge
It was hypothesised that low economic status increases the risk of HIV infection through its associated factors like low education which reduces the likelihood of having the knowledge necessary to adopt safer sexual behaviours. The results of data analysis provide support for this argument. As was hypothesised, the non-poor were more likely to have good knowledge of the means of avoiding HIV infection as opposed to the poor. The same applied to level of education an increase in the level of education was associated with an increase in the likelihood of knowing the means of avoiding AIDS. These results are supported by a multitude of articles, both in Africa and elsewhere. The results also indicated that even with similar levels of education, the poor were less likely to have good knowledge of effective means of avoiding HIV infection. The results do not, however, provide reasons for this and as such further research is required to establish the factors at play.

Economic status and sexual behavioural practices
This section tried to provide evidence for the hypothesis stated earlier that the poor were less likely to adopt safer sexual behaviour due to low levels of education and financial dependence on their partners, which reduce their sexual negotiating power. This claim was supported by the results of the data analysis which showed that the non-poor were more likely to use condoms than the very poor. As with knowledge of the effective means of avoiding HIV infection, the chances of having used a condom during last sexual intercourse improved with an increase in the level of education attained.

The relationship between economic status and sexual behavioural practices is perhaps better reflected by the association between economic status and non-use of condoms as a result of a partner's dislike of condoms. Respondents who received money from their partners, as well as those who came from households where hunger was a common phenomenon, were more likely not to use condoms because their partners dislike them than those who did not, that is, controlling for level of education and economic status, among other factors.

Conclusion
Poverty and its associated factors, low education and lack of decision-making power, can indeed increase the risk of HIV infection. Thus, low socio-economic status robs the poor of the knowledge necessary for the prevention of infection with HIV/AIDS, and also increases susceptibility to infection by making the poor more likely to practise unsafe sexual behaviour. However, the stereotypes associated with high economic status, such as the view of AIDS as a disease of the poor, increase susceptibility to infection among the non-poor, as they discourage the adoption of safer sexual behaviours. While the results contained in this study do not provide direct evidence of the role of such labels, the increase in the odds of non-use of condoms due to low perceived risk among the educated and those who never experience household hunger or poverty hint at this relationship.

The continued growth of the Nigerian AIDS epidemic is evidence of a dodge taken by the Nigerian government in the current strategies to combat the spread. The evidence contained in this study has proven the inseparable link between poverty and diseases are in this case HIV/AIDS in Nigeria. Poverty and its related factors, such as low education and financial dependence on partners, are the main culprits responsible for the escalating HIV prevalence in Nigeria, since the poor are not likely to sacrifice the future to ensure a better today. Therefore HIV prevention programmes that aim to tackle the problem successfully in Nigeria need to take this into serious consideration. Likewise poverty reduction programmes aiming at success should also take HIV/AIDS into consideration.

However, non-use of condoms among the non-poor due to low perceived risk of HIV infection implies that HIV prevention programmes are not really succeeding in removing the stigma associated with HIV/AIDS. Much still needs to be done in order to avoid a catastrophe in the future.

The key challenge here in the race of HIV/AIDS is to find effective and sustainable methods of changing unsafe sexual behaviours. This requires an intense exploration of the economic, social, cultural and political factors that influence such behaviours. Direction can be sought from existing studies as well as from public opinions regarding the way forward.

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Nutritive Values And Sensory Evaluation Of A Potential Weaning Diet Formulated From Sorghum (*Sorghum Bicolour*) And Spot Prawns (P*andalus Platyceros*)

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Abstract
Good knowledge of child feeding practices and quality weaning food are powerful factors that influence child growth and development. In many part of developing countries protein-energy malnutrition is increasing, particularly among children belonging to low-income families, due to inaccessibility of mothers to quality weaning food. In view of this, this study aimed at formulating weaning food from sorghum bicolor and spot prawns that are locally avaible. The materials (Sorghum bicolor and spot prawns) were obtained from the local market in Akure Township, Ondo State of Nigeria. The sorghum bicolor was soaked for 24 hours, drained, oven-dried at 60^0C for 24 hours, milled and sieved through a 0.4mm wire mesh screen. The dried spot sprawn was trimmed and winnowed to remove impurities and further oven dried at 60°C for 24 hours, and milled. The sorghum bicolor and spot prawn flour were mixed in the ratios of 90:10, 80:20, 70:30, 60:40, and 50:50 grammes respectively. The blended samples were subjected to proximate and mineral analyses using AOAC methods. The sensory attributes of the formulations were evaluated relatively with cerelac (a commercial weaning formula) using standard methods. The result of the chemical analyses showed the following ranges: Protein 29.750.29 50.750.06g, carbohydrate 11.8844.41g, Fat 12.00.0114.600.04g and ash 2.250.03 10.230.02g. The sorghum-spot prawn blends contain appreciable amount of mineral that could adequately provide some of the daily mineral requirements of the children. The SSP_2 and SSP_3 were rated next to the control food sample, but there was no significance difference between the SSP_2 and SSP_3, therefore, the SSP_2 was recommended for the production of sorghum-spot prawn complementary food with the maximum amount of 317.5g/day of SSP_2 to supply the energy and other nutrients required by the children. In conclusion, the formulated weaning formula, particularly SSP_2 that contained 80% sorghum and 20% spot prawn flour, is nutritionally adequate in terms of protein content and essential minerals to support child growth and development, therefore, it could be used as a substitute weaning food for the high cost commercial weaning formula for the children belonging to low-income families.

Keywords: Sorghum, spot prawn, weaning diet, nutritive.

Introduction

Nutrition is a fundamental pillar of human life, health and development across the entire life span. From the earliest stages of foetal development, at birth, through infancy, childhood, adolescence, adulthood and old age, good nutrition is essential for productivity, physical growth, mental development, health and well-being [1]. Quite a numbers of epidemiological studies conducted in various parts of the world established that malnutrition during the early years of life is a threat to the normal growth, cognitive development, and subsequently, poor academic performance of many poor children in developing countries [2, 3]. In recent studies evidences have shown that one of every five persons in the developing world is chronically undernourished, 192 million children suffer from protein-energy malnutrition and over 2 000 million experience micronutrient deficiencies. In fact several studies have reported that the number of underweight children worldwide has risen from 195 million in 1975 to an estimated 200 million at the end of 1994, which means that more than one-third of the world's under-five population is still malnourished.

Failure to grow adequately is the first and most important manifestation of protein-energy malnutrition in children. Protein-energy malnutrition is often results from consuming low quality and inadequate food, and is frequently aggravated by infections and is the main cause of death among children in developing counties [4, 5]. Retardation in growth rate and cognitive development sequel to protein-energy malnutrition is attributed to adverse socio-economic and environmental conditions, which are associated with poverty, inadequate food supply, parasitic and infectious diseases [3, 6]. Studies have shown that there are three necessary conditions to prevent malnutrition or growth failure in children: adequate food availability and consumption; good health and access to medical care; and adequate care and feeding practices [7]. If any one of these is absent, protein-energy malnutrition is a likely outcome.

Epidemiological studies have shown that families with limited finances are under pressure to buy low quality foods that are deficient in quality protein and also are more likely to consume unhealthy food and insufficient amounts of food [8, 9]. In recent studies it was revealed that the ability to pay for particular types of food often dictates type of diets that are ultimately consumed in households [10, 11]; and that those children belonging to low socioeconomic groups commonly suffer from inadequate nutrition [12, 13]. Among nursing mothers, despite a strong desire to feed their children healthy food and awareness of the components of a healthy diet, income limitations forced them to choose meals with lower nutritional content. Having to make such choices was very stressful for these mothers. Along with being obliged knowingly to feed their children cheaper, less nutritious food, they made personal sacrifices, such as skipping or reducing meals for themselves in order to give the most to their children [14].

In many parts of developing countries, Nigeria inclusive, several investigators have formulated complementary diets from locally available food materials, such as cereals legumes, etc., in order to solve the problem of protein-energy malnutrition, particularly among the children belonging to low-income families [15, 16]. However, legumes which form the major sources of protein in these formulated diets contain a number of antinutritional or toxic components (17, 18), such as protease inhibitors, lectins, goitrogens, antivitamins, saponins, tannins, phytoestrogens, flatulences factors [19], lysinoalanine, allrgens, phytate [20], soytoxin [21] which pose some restrictions on the use of legumes as food and animal feed. Legumes consumption has been related to various deleterious effects, such as growth retardation [22], lowered digestibility and absorption of dietary nutrients [23] and physiological, metabolic and immunological disturbances [24]. In view of these, the present study was undertaken to develop low cost formulations, using sorghum bicolor and animal protein (spot prawns) with locally available technology and an attempt was made to evaluate the product nutritionally.

Materials and Methods
Preparation and chemical analysis of food samples

Food samples
The food materials were purchased from the local market in Akure, Ondo State. The sorghum [*Sorghum bicolor*] and spot prawn (***Pandalus platyceros***), were locally available at affordable prices. The processing method was a familiar one to the mothers.

Preparation and processing methods
Sorghum flour: Sorghum was sorted to remove impurities, washed with clean water, and soaked in water for 5 days. After soaking, it was thoroughly rinsed with clean water and drained. The clean samples were then dried at 60°C for 24 hours in an air-drought oven. The dried seeds were milled with a laboratory hammer mill (DIETZ-7311 Dettingen-Teck) and then sieved through a 0.4-mm mesh screen. The sorghum flour was kept in airtight containers prior to chemical analysis (Fig. 1).

Spot prawn (Procambarus *acutus*) *flour*: Dried spot prawn was sorted to remove impurities. The spot prawn was further dried at 60°C for 24 hours in an air-drought oven. The dried spot prawn were milled and stored as described below (Fig. 1).
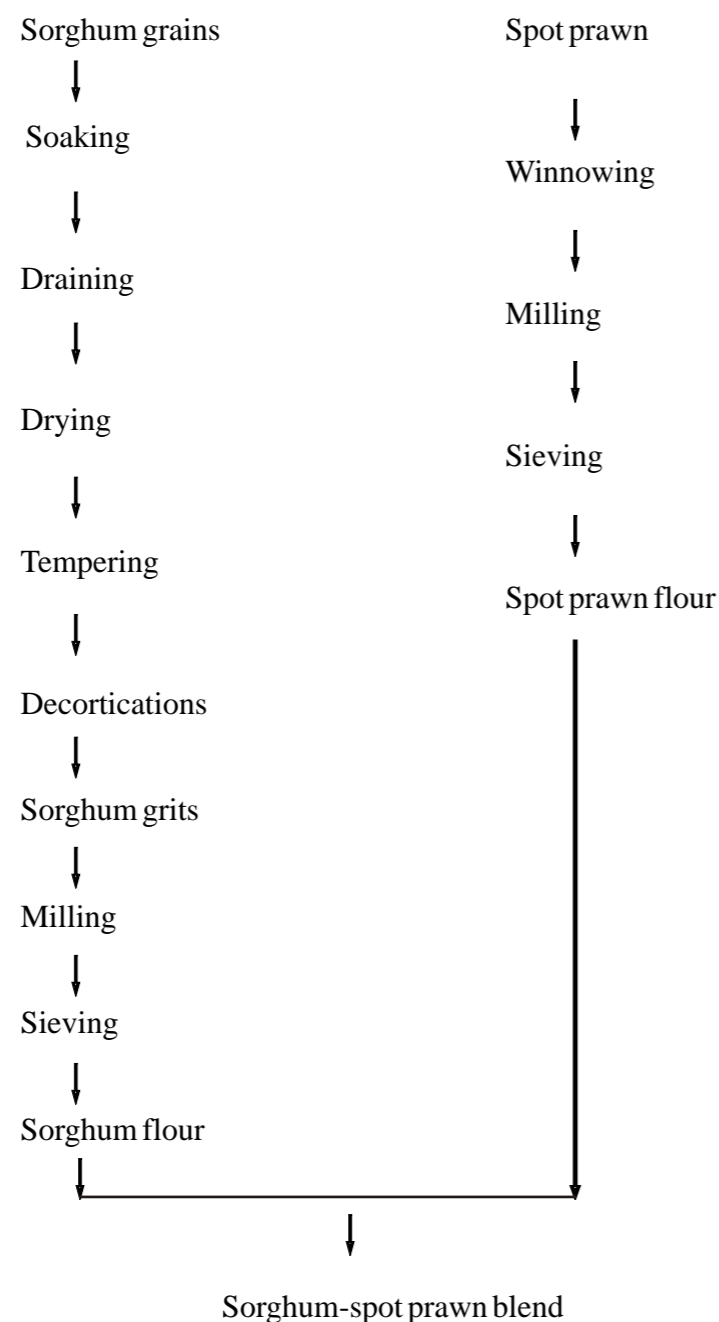
Sorghum grains   Spot prawn

↓   ↓

Soaking   Winnowing

↓   ↓

Draining   Milling

↓   ↓

Drying   Sieving

↓   ↓

Tempering   Spot prawn flour

↓

Decortications

↓

Sorghum grits

↓

Milling

↓

Sieving

↓

Sorghum flour

↓

Sorghum-spot prawn blend

Figure 1: The flowcharts for the preparations of sorghum and spot prawn flours

Food formulation

The sorghum flour and spot prawn were mixed in five different ratios and designated as SSP_1, SFC_2, SSP_3, SFC_4 and SFC_5. The processing flowchart and formulation of the sorghum flour and spot prawn flour are shown in Table 1 and Figure 1 respectively.

Chemical analyses

The nutritional compositions of the food samples were determined. The methods of sample treatment and analyses were the standard procedures recommended by the Association of Official Analytical Chemists [25]. Triplicate samples of each blend were determined for moisture content in a hot-air circulating oven (Galenkamp). Ash was determined by incineration of known weights of the samples in a muffle furnace (Gallenkamp, size 3). Crude fat was determined by exhaustively extracting a known weight of sample in petroleum ether (boiling point, 40° to 60°C) in a Soxhlet extractor. The ether was volatilized and the dried residue was quantified gravimetrically and calculated as percentage of fat. Protein (N × 6.25) was determined by the Kjeldahl method. Crude fiber was determined after digesting a known weight of fat-free sample in refluxing 1.25% sulfuric acid and 1.25% sodium hydroxide. The carbohydrate content was determined by subtracting the total crude protein, crude fiber, ash, and fat from the total dry weight (100 g) of the food sample differences. The gross energy was determined with a Gallenkamp ballistic bomb calorimeter.

Determination of mineral content

Sodium and potassium contents were determined by flame photometry with a Jenway photometer, and phosphorus was determined by the vanado-molybdate method [25]. The calcium, magnesium, zinc, copper, lead, aluminum, and iron contents were determined after wet digestion with a mixture of nitric, sulfuric, and hydrochloric acids by atomic absorption on an ash sample using a Buck Model 200A flame atomic absorption spectrophotometer.

Sensory evaluation

The formulations were evaluated organoleptically using nine (9) point hedonic scale. The formulations were rated relatively with a commercial formula (Cerelac) in terms of taste, texture, aroma colour and overall acceptability using ten (10) panelists.

Statistical analysis

The statistical significance of the observed differences among the means of triplicates readings of experimental results were evaluated by analysis of variance (ANOVA), while means were separated by using Duncan's Range Test. These analysis were carried out using SPSS (12) computer programme.

Results

Table 2 shows the chemical composition of sorghum (ogi, a traditional weaning food), spot prawn (*Procambarus acutus*) and the sorghum-spot prawn blends. The results showed that the moisture contents of the food samples ranged between 5.08 0.01 g for spot prawn protein and 10.43 0.04 g for SSP_5; protein was between 11.09 0.5 g for sorghum and 50.75 0.06g for SSP_5; fat content ranged between 11.9 0.01 g for sorghum and 14.60 0.14g of SSP_5 blend; ash content ranged between 1.24 0.04g for sorghum and 10.23 0.0g of SSP_5 while crude fiber was between 0.68 0.01 g for sorghum and 2.11 0.65 g for SSP_5 and carbohydrate was between 0.82 g for spot prawn and 65.19 g for sorghum. The energy value of food samples was between 1.75 MJ for sorghum and 1.70 for SSP_1. The mineral composition of the food samples are shown on Table 3.

The mineral composition of the food samples ranged as follows: magnesium (Mg) 136.95 169.75 mg, calcium (Ca) 112.64117.81 mg, potassium (K) 105.49 123.24 mg, sodium (Na) 71.74 117, zinc (Zn) 1.96 3.4 mg, iron (Fe) 2.74 12.96 mg, manganese (Mn) 0.26 0.82 and phosphorus (P) 110.85 566.33 mg. The result of sensory attributes of experimental diets rated relatively with ogi (a traditional weaning food) and cerelac (a commercial weaning food) is presented in Table 4.

The result showed that the experimental food samples were significantly (p<0.05) rated higher compared to traditional weaning food (ogi) but significantly low when compared with the commercial weaning formula (cerelac) in terms of colour, taste, aroma, texture and overall acceptability. For the sorghum-spot prawn food samples, the samples SSP$_2$ and SSP$_3$ were significantly rated next to the cerelac in terms of overall acceptability. Table 5 shows the amount of sorghum-spot prawn (SSP$_2$), ogi and cerelac that would be needed to supply the daily energy and nutrient requirements of the growing children (0.5 5 years). These amounts of food samples were as follows: for energy; 202.4 - 452.4 g for SSP$_2$, 194.3 434.3 g for traditional weaning food (ogi) and 196.5 439.3 g for commercial weaning food (Cerelac), protein 42.1 - 60.3 g for SSP$_2$, 117.6 168.1 g for ogi and 96.3 g for cerelac were needed to meet the protein requirements of the children (0.5 5 years) and also, lesser amounts of experimental food sample were for the provision of essential minerals for the children compared to ogi. The estimated cost of local food materials for the production of the experimental diet was ninety-four Naira per 500grammes ($0.72); and this amount was relatively low compared to the price of commercial weaning formulas (=N= 700 1500) per 500 grammes (i.e., $ 6.0 11.54 per 500 grammes).

Discussion

In the present study, it was observed that the protein content of the experimental food samples was significantly higher compared to ogi (a traditional weaning food) and cerelac (a commercial weaning food). This could be attributed to the fact that the experimental food samples were fortified with animal protein, that is, spot prawn, and unlike the commercial weaning food (cerelac) that the protein source was from soybean (a plant based protein). It is well known that the biological values of animal based diets are higher compared to plant based food materials [7, 26]. Several scientific studies have reported that a diet fortified with animal protein, such as spot prawn, would contain high quality protein content; and that such a diet could adequately support growth and development of a child [7, 26]. Therefore, it is evident that the formulated diet in this present study would capable of providing the protein requirements of under five children; and thereby preventing protein deficiency syndrome that is common among the children belonging to low-income families.

In recent time, quite a number of studies have reported on the increase of malnutrition among under five children belonging to low-income families in many parts of developing countries, Nigeria inclusive [27, 28]. This could be attributed to economic restructuring undertaken by many of these developing countries, thereby reducing the purchasing power of many families, hence poor feeding practices leading to an inadequate energy and protein intake. It was observed in this study that the fat content of the experimental diets were progressively increased as the amount of spot prawn increases. The increased in the fat content of the diet as the spot prawn

increases would improve on the energy dense of the formulated diets. Several studies have reported that the low energy-dense that characterized the traditional weaning food (ogi) are the main factors that responsible for the high prevalence of malnutrition among under five children, particularly the weaning aged children, in many parts of developing countries [29, 30]. The energy value of formulated diets was relatively high compared with commercial weaning food. This shows that the formulated diet could adequately provide the necessary energy requirement for the infant fed with the formula compared with an infant fed with the commercial weaning formula. Also, the mineral composition of the experimental diets showed that it contains an appreciable amount of vital minerals that could adequately meet some of the mineral requirements of the growing children.

The overall assessment of sensory attributes of experimental diets showed that the sorghum-spot prawn blends, particularly SSP$_2$ and SSP$_3$, were significantly rated higher (p<0.05) compared to traditional weaning food sample (ogi); however, the commercial weaning food (Cerelac) was significantly rated higher above the sorghum-spot prawn blends (p<0.05). This observation could be attributed to the fact that the consumers have been used to the consumption of the commercial food (cerelac), a cereal based, and besides, the cerelac (a commercial weaning formula) would have been fortified with many substances in order to improve on its sensory quality, such as colour, taste and aroma. The disparity between the nutritional quality of a commercial weaning food and that of traditional weaning foods have been reported by several investigators [18, 19]. In the present study it could also be deduced that supplementation of sorghum above 20% of spot prawn only causes minimal alteration in the nutritive value of the blend; therefore, it is suggested that 20% spot prawn supplementation (i.e., mixing two parts of spot prawn with eight parts of sorghum flour) could be used for sorghum-spot prawn complementary diet formulation. Besides, the amount of overall acceptable blends SSP$_2$ that could supply the protein requirements for the under five aged children was relatively lower than that of commercial weaning formula. The estimated cost of local food materials for the production of the experimental diet was ninety-four Naira per 500 grammes ($0.72/50g); and this amount was also relatively low compared to the price of commercial weaning formulas that available between the price range of seven hundred and eighty and one thousand five hundred Naira (=N= 700 1500) per 500 grammes ($ 6.0 11.54).

Table 1: Sorghum spot prawn blends ratio (100g)

Formulation	Sorghum (g)	Spot prawn (g)
CF	-	100
SF	100	-
SSP$_1$	90	10
SSP$_2$	80	20
SSP$_3$	70	30
SSP$_4$	60	40
SSP$_5$	50	50

CF= Spot prawn; SP= Sorghum flour (ogi, a traditional weaning food);
SSP= Sorghum-spot prawn blends.

Table 2: Proximate chemical composition of sorghum, spot prawn and sorghum-spot prawn flour and commercial food (Cerelac) (g/100g)

Sample	Moisture	Protein	Fat	Ash	Fiber	Carbohydrate	Energy (MJ)
Sorghum (ogi)	9.900.03	11.090.50	11.90.01	1.240.04	0.680.01	65.19	1.75
S/ prawn	5.080.01	65.250.08	15.050.21	12.10.03	1.590.03	0.82	1.63
SSP$_1$	9.940.04	29.750.29	12.000.01	2.250.03	1.270.03	44.41	1.70
SSP$_2$	9.970.14	33.250.03	12.800.07	3.900.01	1.650.04	38.02	1.68
SSP$_3$	9.990.13	40.250.01	13.200.01	5.870.01	1.860.03	29.42	1.67
SSP$_4$	10.250.14	46.380.09	14.010.14	8.050.01	2.060.16	19.36	1.64
SSP$_5$	10.430.04	50.750.06	14.600.04	10.230.02	2.110.65	11.88	1.60
*Cerelac	2.5	15.00	9.00	3.30	ND	67.4	1.73

* As libeled by the manufacturer, ND = Not determined

Table 3: Mineral composition of sorghum, spot prawn and sorghum-spot prawn blends (mg/100g)

Sample	Mg	Ca	K	Na	Zn	Fe	Mn	P
Sorghum (ogi)	150.73	114.55	123.24	117.05	3.40	12.96	0.82	110.85
Spot prawn	136.95	117.81	105.49	110.77	1.96	11.85	0.26	485.67
SSP$_1$	152.17	112.64	121.60	116.55	2.72	9.59	0.55	216.30
SSP$_2$	156.33	116.91	122.91	71.83	2.85	8.93	0.29	481.88
SSP$_3$	161.76	116.57	121.90	71.74	2.12	5.26	0.28	345.43
SSP$_4$	161.19	118.07	117.59	72.62	2.13	5.93	0.57	541.74
SSP$_5$	169.75	117.68	115.53	72.87	2.11	2.74	0.57	566.33
*Cerelac	ND	540.0	ND	170.0	ND	ND	ND	ND

*ND (Not determined), Mineral composition of Cerelac as on the label of product

Table 4: Sensory attributes of sorghum-spot prawn, cerelac (commercial weaning food) and ogi (local fermented sorghum).

Sample	Colour	Taste	Aroma	Texture	Overall acceptability
Cerelac	8.7[a]	8.7[a]	8.4[a]	8.6[a]	8.7[a]
Sorghum (ogi)	1.9[e]	1.8[e]	5.2[b]	4.5[b]	4.1[bc]
SSP$_1$	7.1[b]	6.2[b]	3.2[b]	4.9[b]	5.1[bc]
SSP$_2$	5.9[c]	5.8[bc]	4.2[b]	5.1[b]	5.4[b]
SSP$_3$	5.2[c]	4.6[c]	4.6[b]	4.6[b]	5.4[b]
SSP$_4$	3.2[d]	3.2[d]	4.2[b]	3.4[bc]	4.3[d]
SSP$_5$	2.7[de]	2.0[de]	4.6[b]	2.1[c]	2.5[e]

 *Mean scores with identical letters expressed, as superscripts are not significantly different from each other at the 5% statistical level; CW = Commercial Product, CWS = Local commercial weaning sorghum

Table 5: Amount of Sorghum-spot prawn blend (SSP$_2$), sorghum (ogi, a traditional weaning food) and cerelac (a commercial weaning food) needed to meet RDA of children (0.5-5years)

Nutrient	RDA(0.55 yrs)	Amount of SSP$_2$ Needed to Meet RDA (g)	Amount of sorghum Needed to Meet RDA (g)	Amount of cerelac Needed to Meet RDA (g)
Energy Value (MJ)	3.4 - 7.6	202.4 - 452.4	194.3 434.3	196.5 439.3
Protein (g/100g)	14 - 20	42.1 - 60.3	117.6 168.1	93.3
Na (mg/100g)	120	167.1	102.5	70.6
K (mg/100g)	500	406.8	405.8	ND
Mg (mg/100g)	40 - 200	25.6 - 127.9	16.9 132.9	ND
Ca (mg/100g)	400 - 600	342.1 - 513.2	349 523.6	74.1 111.1
P (mg/100g)	300 - 800	62.6 - 166	290.5 721.3	ND
Zn (m	5 - 10	175.4 - 350.9	147.1 294.1	ND
g/100g)	5 10	55.9 - 111.9	40.3 80.6	ND
Fe (mg/100g)				

Conclusion

This study has shown that the nutritional and sensory attributes of sorghum could be enhanced through spot prawn flour supplementation up to 20% and the sorghum-spot prawn formulated diets were nutritious, inexpensive and could easily be prepared from locally available raw food materials by using simple domestic processing techniques. Therefore, this formulated diet could be utilized by mothers for the prevention and management of protein- energy malnutrition in children, especially those belonging to low social economic class.

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Comparative Assessment Of Honey Production Technologies In Ekiti State, Nigeria.

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Abstract

One of the problems currently facing beekeepers in Ekiti State is the use of hives that are less efficient in the domestication of bees. In an effort to solve the problem of low-yield associated with the subsistence level of honey production, framed top-bar which is a modification of the Kenya top-bar was recently introduced to enhance the relocation of hives for abundant nectar collection during dearth period. The honey yield of the newly adopted framed top-bar, Kenya top-bar and langstroth were therefore compared in this study. Structured questionnaire was used to obtain data from 21% (60) of the registered beekeepers with the Independent Beekeepers Association of Nigeria (IBAN) in Ekiti State. Data were analyzed using descriptive statistics, ANOVA and option ranking. Honey yield per annum varied significantly (P<0.05) among the three hives studied with Kenya top-bar having the least yield of 8.3kg, followed by framed top-bar with 9.8kg while langstroth had the highest yield of 20.3kg. The Least significant different test at 0.05 probability level revealed that the honey yield of Kenya top-bar was not significantly different from that of framed top-bar. Langstroth was however significantly different from that of Kenya top-bar and framed top-bar. The low yield of honey obtained for framed top-bar was linked to lack of technical knowledge required by the beekeepers in relocating hives colonies during dearth period to get abundant nectar in a conducive environment

Keywords: Honey, Production technology, Framed top-bar, Kenya top-bar, Langstroth

Introduction

Honey is a sweet viscous liquid that is produced by honey bees from the nectars of flowers and from the secretions of living parts of plants for the purpose of feeding their larvae and for the subsistence of the colony during adverse condition. The honey bee (*Apis mellifera*) collects the nectars of flowers and secretions of the living parts of plants, combines them with their own secretions, transforms and leaves them in honey comb of the hives to mature. At maturity, the composition of the honey formed depends on the plant species on which the bee forages while the constituents are approximately the same in all honey. On the average, Tan *et al.* (1988); Singh and Kuar Bath (1997) gave the composition of honey to be: moisture (17.6%), fructose (37.2%), glucose (31.3%), sucrose (1.3%), maltose (7.3%), higher sugars (1.5%) and other minor components such as gluconic acid, lactone, nitrogen, palmitic, oleic, linolenic and vitamins B-group (3.8%).

Human beings have exploited honey bees resources to a large extent for nutritional and medicinal purposes. For instance, the report of White *et al.* (1963) showed that from the Ancient Greeks to the second world war, honey was used for its antibacterial properties in treating wounds. However, with the advent of penicillin and other antibiotic drugs in the twentieth century, the medicinal value of honey took a back seat. In recent times, as bacteria become antibiotics resistant there has been a gradual increase in the awareness of honey for effective treatment of wounds. In treating wounds, honey is non-irritating, non-toxic, self sterile, nutritive, comfortable and can be easily applied than other forms of wound dressings. Bulman (1973) is of the opinion that the treatment of wounds with honey rendered bacteria sterile within 3-7 days of commencement of the treatment and promoted healthy granulation of tissue. On the other hand, wound treatment with wet dressings have been found to moisten the tissues of the wound area and therefore delaying healing while dry dressings adhere to the surface, causing pain and injuries to the granulating surface every time they are changed. Oily dressings also prevent the surface secretions from escaping freely and may spread to surrounding skin surfaces leading to infection. Presently, in modern day medicine in Nigeria, honey is used in treating wound in all hospitals including the teaching hospitals since it facilitates healing of wound. Thus, with increased awareness in the use of honey, the demand for honey has out-stripped its supply and this has led to the sales of honey at exorbitant prices (Oluwatusin, 2008).

Over 90% of the African honey is produced by *Apis mellifera adansonii* bee. According to Crane (1990) *Apis mellifera adansonii* is a subspecies that is native to African region only. It has been found to be associated with forest as many forest tree species provide ample nectar and pollen for bee forage (Ayers, 1992). The honey bees have a pronounced, defensive behaviour and they are prone to swarming and absconding. *Apis mellifera adansonii* bees are known with unique features of division of labour and they live in colony. A bee colony consists of one fertile queen with the main activity of laying eggs; 30,000 to 75,000 sterile female workers that do every work in the colony; 400 to 700 fertile males (drones) whose work is to mate with the queen; about 40,000 eggs and 25,000 to 40,000 immature bees (brood) in various stages of their development (Free, 1977; Fasasi and Malaka, 2005).

To exploit honey bees' resources at will, honey bees are kept by human beings. This practice is called beekeeping (Apiculture). In beekeeping, honey bees are kept in containers known as hives, which can be modern or traditional. Traditional hives are also known as fixed comb hives because the combs of the bees are attached to the ceiling of the hives as in the case of the wild nest. They are made from locally available materials such as gourds, pots, logs of wood and drums. Unlike traditional beekeeping, modern beekeeping is done in movable comb hives. The comb can be removed by the beekeeper to examine the condition of the colony. Movable comb hives can be in form of frames or top-bars. In top-bar hives, bees build their combs inside a rectangular wooden box with attachment on the bar. All modern hives are variations of a basic design discovered by an American Bee Scientist, Rev. L.C Langstoth (Mutsaers, 1993).

The modern hive that has been adopted by the bee keepers in Ekiti State prior to this time was Kenya top- bar hive (Arowosoge and Ajibefun, 2006). This method of domestication has been found to be less efficient and effective in the production of honey when compared to langstroth. The average yield from langstroth was given as 35kg compared to 15kg obtained from Kenya top- bar (Adjare, 1990; Sikiru, 2004). Sikiru (2004) reported that langstroth hive is the best in terms of yield, but that it is less commonly used in Nigeria than Kenya top- bar because it is more expensive and it is therefore not within the reach of most poor beekeepers. In an effort to solve the problem of low-yield associated with subsistence level of honey production in Ekiti State, Independent Beekeepers Association of Nigeria in 2006 introduced the use of framed top-bar which is a modification of the Kenya top- bar for beekeeping. This study therefore undertake a comparative assessment of this new technology with the old technology of using Kenya top- bar, which has been in use since the introduction of modern beekeeping in Ekiti State (Arowosoge and Ajibefun, 2006). This will help to determine their relative performance and also serves as reference point for their utilization by beekeepers.

Methodology
The research was conducted in Ekiti State, Nigeria. The State is located in the South Western part of the country between longitudes $4^0 5^1$ and $5^0 45^1$ East of the Greenwich Meridian and latitudes $7^0 15^1$ and $8^0 5^1$ north of the equator with distinct wet and dry seasons. The wet season begins in March and ends in November, but intensive rainfall lasts from April to October while dry season lasts from December to February. Mean annual rainfall and temperature range from 1500mm to 2500mm and 21^0C to 28^0C respectively while humidity varies between 35% and 80% (Uni-que Solutions, 2006; Wikipedia, 2010). Ekiti State shares boundaries with Kwara State in the northern part, Osun State in the western part, Kogi State in the eastern part and Ondo State in the Southern part of Nigeria. The State is made up of sixteen local government areas (LGAs), which covers a land mass area of approximately $6,353km^2$ with a population of 2,737,186 (NPC, 2005). The state has two distinct vegetations namely the tropical forest in the south and guinea savannah in the northern peripheries. There are ten forest reserves covering about $297.20km^2$ of land in the state, representing 4% of the total land area (Arowosoge and Ajewole, 2006). The forest which consists of many tree species, plants, shrubs, weeds, climbers and the various plantations provide nectar and pollen for bee forage.

The data for this study were obtained through the administration of structured questionnaire on 21% (60) of the total number of the registered beekeepers (285) with the Independent Beekeepers Association of Nigeria (IBAN) in Ekiti State. The 60 beekeepers were randomly selected and the selection cut across eight LGAs of the16 LGAs of the state as shown in Table 1. The questionnaire was designed to collect information on the types of hives used for honey production and yield from hives from 2007 to 2009. Sources of information for improving beekeeping and constraints on beekeeping were also obtained.

Two-way analysis of variance was carried out using Randomized Complete Block Design to test for the significant differences in yield variation among the hives over a period of three years. The model is as stated below:

$$Y_{ijk} = + b_i + t_j + e_{ijk.} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \textit{Equation 1}$$

Where: = General mean
  b_i = Effect of ith hives (i=1- 3)
  t_j = Effect of jth year (j=1-3)
  $e_{ijk.}$ = Experimental error containing all uncontrolled sources of variation
  $y_{ijk.}$ = Individual observation made in hives (i), and year (j)

Information used for improving beekeeping and the constraint facing beekeeping were used to compute the option ranking. The analysis of the ranking involved the summation of the product of the number of respondents for a particular option and the weight given and this was expressed as a percentage of the maximum score point. The maximum score point is the product of the number of respondents and the maximum point any option can have. For the 6 and 5 options presented for sources of information and constraint facing beekeeping respectively, the respondents were to score between 1 and 6 for each source of information option and between 1 and 5 for each constraint option in increasing order of importance, and zero for non applicable options. The option with highest percentage score was considered to have the highest rank than those with lower percentage score. This relationship which was adapted from Popoola and Galaudu (2000) and used by Tee and Verinumbe (2007) is as follows:

$$\text{Option ranking} = \sum_{i=1}^{n} FS_i / nSM \times 100/1 \dots\dots\dots\dots\dots\dots\dots\dots Equation\ 2$$

Where F   = Number of respondents who obtain the same score for an option
  Si   = Respondents score for an option and it ranges from 1 to 6 for sources of information and 1 to 5 for constraints in beekeeping.
  nSM =   Product of the number of respondents interviewed and the maximum scorable point of a determinant.
  n   =   Number of respondents interviewed

Table 1: Sampling layout of beekeepers in Ekiti State.

Local Government Areas	No. Sampled
Ikole	13
Ise	2
Ekiti - West	5
Gbonyin	2
Ekiti - East	10
Ijero	2
Ido - Osi	4
Ado - Ekiti	12
Ikere	10
Total	60

Source: Field work, 2010

Results and Discussions

Honey production technique

The result of honey production technique shows that most beekeepers (65.0%) produced their honey through modern beekeeping method. This is followed by traditional beekeeping coupled with honey hunting with 26.7% while traditional beekeeping had 8.3% (Table 2). The preference for modern beekeeping may be due to high yield with which it is known when compared with others (Arowosoge and Ajibefun, 2006; Ikediobi *et al.,* 1995). Modern beekeeping is generally preferred by the educated beekeepers. It is defined as the art and science of rearing bees in which the knowledge of the biology of bees, their social behaviour and the climate as well as the use of suitable equipment are combined to maximize the production of honey and other beehive products (Oduntan, 1999).

Table 2: Honey production technique

S/N	Production technique	Frequency	Percentage
1	Traditional Beekeeping	5	8.3
2	Modern Beekeeping	39	65.0
3	Traditional Beekeeping and Honey hunting	16	26.7
	Total	60	100

Field work, 2010

Types of hives used for honey production in Modern Beekeeping

Further analysis of the types of hives used for modern beekeeping was carried out since it formed the major technique (65%) used for honey production in the study area (Table 2). The study shows that Kenya top-bar, framed top-bar and langstroth hives were used for honey production (Figure 1). The trend shows that the use of Kenya top bar and framed top bar increase from year 2007 to 2009 while15 langstroth hives were only used in 2008. The high rate at which Kenya top-bar was used in each year could be due to the fact that it is simple, relatively inexpensive and very easy to construct while it can be conveniently managed by beekeepers. The yearly increment observed with the use of framed top-bar shows that the hive is gaining increasing prominence. Reason that could be adduced for the none utilization of langstroth in 2007 and 2009 and its low utilization in 2008 is the fact that it is expensive to construct, while the extraction of the honey produced required a centrifugal equipment which is also expensive and not within the reach of most beekeepers. Based on Kentucky Sate Beekeepers Association (2007) estimates for effective beekeeping and honey production, a small scale beekeeper will require initial capital of N577,500.00 ($3,750) to purchase 20 langstroth hives and honey extractor with associated equipment.
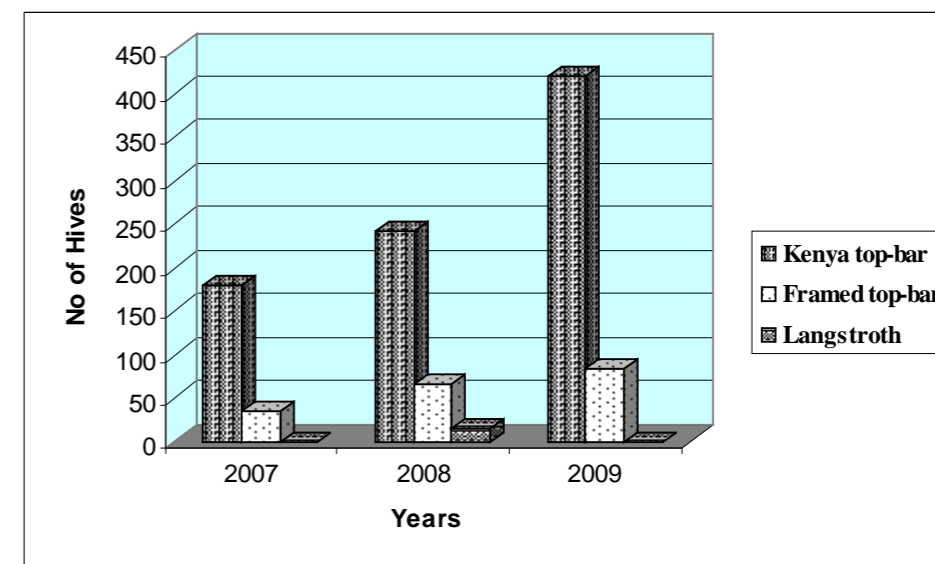
Figure 1: Types and No of hives used for honey production

Honey yield by hive types

The mean yields of honey from the three hives considered for the study are as presented in Table 3. The mean yield per hive did not follow a definite trend for both Kenya top-bar and framed top-bar for the three years of study. The mean yield per hive for Kenya top-bar decreased from 2007 to 2008 and thereafter increased in 2009. For framed top-bar, the mean annual yield increased from 2007 to 2008 and thereafter declined. The trend for langstroth could not be ascertained because data were only available for year 2008 (Table 3). Framed top-bar had the lowest percentage annual change of -37.6% in 2009 while Kenya top-bar had the highest percentage annual change of 56.5%. Lowest honey range of 5.4kg to 6.7kg was observed for Kenya top-bar in 2008, while langstroth had the highest range of 18.5kg to 27.2kg. The irregular pattern in the trend of the honey yield could be due to variations in the location of the hives which also varies with vegetations, flower boom and the strength of the bees' colony. According to Hamzat and Abanikanda (2006) a colony that is strong with active queen and devoid of diseases, pests and predators will yield high quantity of honey compared to a weak colony.

The results of the analysis of variance show that honey yield varied significantly (p<0.05) among the three hives studied with Kenya top-bar having the least yield, followed by framed top-bar and langstroth the highest yield. The follow-up test conducted to separate the means at 0.05 probability level using least significant different reveals that the honey yield of langstroth was significantly different from that of Kenya top-bar and framed top-bar. Kenya top-bar was however not significantly different from framed top-bar (Table 4). The insignificant differences in the yield of Kenya top-bar and framed top-bar indicates that the main reason for introducing framed top-bar in the study area has not been achieved. Framed top-bar was introduced to ensure the ease of moving hive from one environment to another in order to get enough nectar. Mobility is very important for increasing honey yield because flowering plants vary between seasons of

the year. For instance fruiting of cashew is between December and April while mango starts fruiting in May. Hence, the need to relocate hives when flowers are not in abundance in a particular environment. In Israel, langstroth hives are moved five times in a year to increase honey yield (Hamzat and Abanikanda, 2006). The introduction of framed top-bar was to prevent the breaking of honey comb during movement as the honey combs that are attached to the top-bars are supported by a rectangular frame (Plate1). In Kenya top-bar the honey combs are attached to the top-bars without any support (Plate2). Hence they cannot be moved without the honey combs been broken. As observed during the course of this study, none of the beekeepers moved their hives to get abundant nectar because they lack the technical knowledge of how to move hives without losing the colony and been stung.

Analysis of variance further shows that variation in honey yield was significant (p<0.05) for the three years considered for Kenya top-bar and framed top-bar (Table 5). The least significant different (LSD) test shows that the honey yield in 2007 for the two hives were not significantly different from that of 2009, while honey yield of 2008 was different from that of 2007 and 2009. Reason that may be adduced for the trend in variation is climate which could have effect on flower bloom and on the strength of the colony and on the long run, the yield in a particular year. In earlier study Oluwalana (1999) opined that variation in honey yield over a period of time in the same location is mainly accounted for by changes in climate.

Table 3: Mean Annual yield of honey by hive type

Hive type	Year	No of hives	Average yield (Kg)	Average yield/ hive (Kg)	% Annual change
Kenya top-bar	2007	180	1601.4	8.9 (7.9-9.2)	0
	2008	241	1494.2	6.2 (5.4-6.7)	-30.3
	2009	420	4074.0	9.7 (8.2-11.7)	**56.5
Framed top-bar	2007	35	322.0	9.2 (6.3-12.4)	0
	2008	66	825.0	12.5 (7.0-14.8)	35.9
	2009	84	655.2	7.8 (7.2-8.5)	*-37.6
Langstroth	2007	0	0	0	0
	2008	15	307.5	20.5(18.5- 27.2)	0
	2009	0	0	0	0

Note: Values in bracket are ranges of honey yield
     * is the lowest % annual change
     ** is the highest % annual change
Source: Field work, 2010

Table 4: ANOVA and LSD results for honey yield by hive type

Hive type ANOVA/LSD	Mean honey yield (Kg)	Ranges (Kg)
Kenya top –bar	8.3$_a$	5.8 - 11.7(0.125143)
Framed top-bar	9.8$_a$	6.3 – 14.8(0.17253)
Langstroth	20.3$_b$	18.5 – 27.2(0.22715)
F Cal.Prob Level	45.9P<0.05	

Note: Means with the same letters are not significantly different.
     Values in bracket are standard errors
Source: Field work, 2010

Table 5: ANOVA and LSD results for honey yield from 2007 to 2009

Years ANOVA/LSD	Kenya top bar	Framed top bar
2007	8.9$_a$	9.2$_a$
2008	6.2$_b$	12.5$_b$
2009	9.7$_a$	7.8$_a$
F Cal	35.2	42.7
Prob. Level	P<0.05	P<0.05

Note: Honey yield with the same letters in the same column are not significantly different.
Source: Field work, 2010

Plate 1: Framed top-bar hive   **Plate 2:** Kenya top-bar hive

Sources of Information for beekeeping
83.6% of beekeepers obtained information for up to date knowledge on beekeeping through IBAN, information through fellow beekeepers ranked second with 65.6% while information from books ranked third with 30.3%. Information through extension agents ranked fourth with 6.9% while none of the beekeepers used to get information through Television/Radio and

Internet (Table 6). The fact that the highest percentage of the beekeepers obtained information on beekeeping through IBAN suggests that the association is very strong in the study area. Moreso, that it was discovered during the course of the study that the fellow beekeepers who passed information to other beekeepers also get their information through IBAN, while the books that are used as sources of information are books sold by IBAN to beekeepers. The reason that could be adduced for the low percentage obtained for extension agents in the dissemination of information to beekeepers may be due to shortage of staff in the Extension Department of Ministry of Agriculture or that the extension agents are generally weak in carrying out their duties. Internet which could have been a good source of information was not used as the beekeepers claimed to lack fund and skill for the usage of internet.

Constraints to Beekeeping

Fund ranked highest (97.0%) as a major constraint faced by the beekeepers in increasing their yield, this is followed by absconding (70%), while lack of training (63.3%) ranked 3rd (Table 6). Theft and bush burning constraints ranked 4th and 5th with 40.3% and 35.0% respectively. Lack of fund as a major constraint suggests the reason for the low adoption of langstroth hive which even though is more expensive has been found to be more efficient and effective for beekeeping (Adjare, 1990; Sikiru, 2004). The effective use of langstroth hive require the use of centrifugal equipment for honey extraction as the honey combs are not expected to be crushed as it is being done during honey extraction from combs of top-bar hives. This equipment is also expensive for the subsistent beekeepers in the study area.

The reason for bees absconding as it was discovered during the cause of this study is the fact that bees are not fed during dearth periods with sugar syrup. Bees need to be fed during dearth periods of prolong dry and rainy seasons when flowers are not in abundance. This is because during these periods, bees abscond from the hives in search of sites with better forage for survival. Oduntan (1999) is of the opinion that to prevent bees from absconding, a large colony of bees may be fed with 1.4 kg of sugar in three days. The sugar is dissolved in water to make sugar solution of 3litres. Lack of training in form of workshops and seminars suggests why many beekeepers could not perform routine management activities such as colony inspection for predators, pests, diseases, actively performing queen and swarming tendencies; catching of swarm and hives colony relocation. With respect to bush burning, the construction of fire breaks round the apiary by weeding and raking of dry leaves and fallen branches that serves as fuel conductor could prevent fire outbreak. Hamzat and Abanikanda (2006) suggested siting apiary not too far from the beekeeper's residence to facilitate easy inspection and monitoring. It should however be 200 to 300 meters away from houses and roads.

Table 6: Option ranking of sources of information and constraints to beekeeping

Variable/Categories	TS	NSM	RV(%)
(i) Sources of Information			
Independent Beekeepers Association of Nigeria (IBAN)	301	360(60)	83.61(1)
Fellow Beekeepers	236	360(60)	65.56(2)
Books	109	360(60)	30.28(3)
Extension agents	25	360(60)	6.94 (4)
Television/Radio	0	360(60)	-
Internet	0	360(60)	-
(ii) Constraints to Beekeepers			
Fund	291	300(60)	97.00(1)
Absconding	210	300(60)	70.00(2)
Lack of training	196	300(60)	65.33(3)
Theft	121	300(60)	40.33(4)
Bush burning	105	300(60)	35.00(5)

Note: Figures in brackets under NSM are the numbers of interview conducted
             TS = Total Score, NSM = Maximum score-able point, RV = Rank Value (%)
Source: Field work, 2010

Conclusion

The study has revealed that honey yield from the newly introduced framed top-bar hive compared favourably with that of Kenya top-bar hive, while that of langstroth was significantly higher. The findings in this study further showed that the main reason for introducing framed top-bar in the study area has not been achieved. This is because none of the beekeepers moved their hives to get abundant nectar due to lack of technical knowledge of how to move hives. Hence, the relative performance of the framed top-bar hive in increasing honey yield could not be ascertained. From the foregoing, the State Ministry of Agriculture in collaboration with IBAN should organize training for beekeepers in management routine activities such as hives colony relocation, colony inspection and swarm catching. The fact that langstroth had the highest honey yield, suggests the need to provide fund in form of loan to beekeepers so that honey can be produced at small scale using langstroth and centrifugal rather than producing at subsistence level.

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Resource Use Efficiency In Sustainable Egg Production In Ogun State, Nigeria.

By

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Abstract

This paper deals with the issue of resource use efficiency in sustainable egg production. This is prompted by the problem of food insecurity especially with respect to insufficient animal protein intake which has resulted in malnutrition, poverty and hunger among the population in the study area. Animal protein through egg consumption can readily be of assistance in solving these problems. The multi-stage sampling procedure was applied in selecting the forty egg producers from which data were collected through structured questionnaire for the analysis. The analytical tools of descriptive statistics, gross margin and Cobb Douglas regression analysis were used. The aged populations of 40 years and above that were mostly of the male gender and highly educated were found to be mostly involved in egg production. The business was profitable (with a net farm income of N109, 633.88/month or net farm income/bird of N130.05) though the resources were mostly inefficiently used (highly over utilized). Profit therefore could be enhanced with optimal use of resources. Extension education that emphasizes the basic economics of resource allocation needs to be put in place to effect this. Such technical efficiency in egg production if achieved will go a long way to bridging the gap that currently exists in the FAO (Food and Agricultural Organization) required protein intake to maintain a healthy population.

Key Words: Resource use efficiency, Food insecurity, Gross margin, Optimal use of resources.

Introduction

CBN (2004) asserts that the production of food in Nigeria has not increased at the rate that can meet the increasing population. It claims while food production increased at the rate of 2.5% per annum, food demand increased at a rate of more than 3.5% per annum due to the high rate of population growth which she claims to be 2.83%.

This apparent disparity between the rate of food production and demand for food has led to the increased resort to food importation. With the current high foreign exchange rate in Nigeria, there has been a resultant increases in food prices. This has caused a lot of concern on the part of various stakeholders. Government on its part has come up in the past with various agricultural programmes - National Accelerated Food Production programme (NAFPP). Operation Feed the Nation (OFN), Directorate of Food, Road and Rural Infrastructure (DFRRI) and Green Revolution among many others. Other concerned stakeholders that have committed their efforts towards the upliftment of the food sector include development agencies/partners, non-governmental organizations, community based organization and farmers.

In spite of these efforts, food security seems to have worsened as poverty and hunger are on the increase. Child malnutrition, the single most important index for assessing any nation's welfare, is on the increase (Food Security Magazine, 2006). Malnutrition in general has been attributed partly to the failure of the livestock sector of agriculture to provide enough animal protein for the teeming population. Poultry, an important component of the livestock sector can be made to play the role of meeting the demand for animal protein through the supply of eggs and meat.

This is very essential as the Food and Agricultural Organization (FAO) recommendation of minimum in-take of protein by an average person of 65 gm per day, of which 36gm (i.e. 40%) should be from animal sources, has not been met in the country. The current average animal protein consumption in Nigeria is less than 8gm per person per day (Niang and Jubrin, 2001). Eggs, if efficiently produced can be a way of alleviating this problem.

Poultry refers to all birds of economic value to man, which has been successfully domesticated by man to supply meat and eggs for his consumption. It equally has the added value of supplying fiber through the feathers. Domestic fowl (chickens), ducks and turkeys are the three most common species of domesticated poultry in the world. FAO (1999) estimated poultry population to be 114,000 million consisting mainly of chickens and turkeys. Poultry keeping has a lot of advantages over other livestock in being able to bridge the national gap in FAO protein consumption requirement in that they are efficient feed converters into usable protein through meat and eggs. In addition, they are tender, palatable and so more acceptable to consumers. It has a short production cycle and so a quick pay-back period. Chicken egg protein has biological value of 1.0 and so shares with human protein the distinction of being a perfect protein. Furthermore, egg is easily affordable and accessible to all than other livestock sources as it is sold cheaply by hawkers in all public places.

Chicken eggs provide a significant amount of protein and various other nutrients to one's diet. They provide 12.58g protein from 100g (edible portion) of chicken eggs, 650kj of energy, 1.12g of carbohydrate, 10.6g of fat and 1.13g of sugar. In addition, very important vitamins and minerals are also provided by same value of 100g of edible portion of chicken egg. These include 0.66mg of thiamin (vitamin b_1), 0.153 of riboflavin (vitamin b_2) and 0.064mg of niacin (vitamin b_3). It also supplies 0.398mg of pentatonic acid (vitamin b_5) and 0.121mg of vitamin b_6. Furthermore, foliate (vitamin b_9) vitamin C and minerals like calcium, iron, magnesium; phosphorous, potassium and zinc are also present in various appreciable quantities in the edible portion of egg. Eggs are been noted as important in meeting the FAO consumption requirements of protein, and so essential in maintaining good health status in human beings, it becomes very pertinent to understudy the resource use efficiency of egg production. It is in this light, this paper sets to examine the following objectives:

i.   Describe the socio-economic characteristics of poultry egg farmers in the study area.
ii.   Determine the profitability status of egg farmers.
iii.   Assess their resource-use efficiency.
iv.   Identify production constraints and proffer policies for enhanced resource productivity.

Concept of Resource Use Productivity And Efficiency.
Amaza (2000) asserts that efficiency measurement is very important for monitoring productivity growth. Efficiency studies therefore benefit economists by ascertaining the extent to which it is possible to increase productivity using present resource base and available technologies. The source claims that such studies provide a foundation for the development and adoption of new technologies which could push the frontier of efficiency still higher. Ajibefun (1998) defined efficiency of a production system or unit as comparism between observed and optimal values of its output and input. The comparism can take the form of the ratio of observed to maximum potential output obtainable from the given input, or the ratio of minimum potential to observed input required to produce the given output or the combination of the two.

The first analysis of efficiency measure started with Farrell (1957) who drew inspiration from Debreum (1950) and Koopmans (1951). He proposed a division of efficiency into two components - technical efficiency and price (allocative) efficiency. Technical efficiency represents a firm's ability to produce a maximum level of output from a given level of input. It is the physical ratio of product or output to the factor or input. The greater the ratio, the more will be the magnitude of technical efficiency. An important assumption relating to efficiency is that firms operate on the outer bound of production function i.e. on their efficiency frontier. When they do not operate as such, they are said to be technically inefficient. Scully (1962) proposes three ways of achieving improvement in techniques which may imply a change in factor proportions through factor substitution under a given technology. This manifest as a change along the given production functions. Secondly, it could be through an improvement in the production technology. This represents a change in the production function itself such that the same amount of output is derived from smaller quantities of resources than before. Third, is improving technical efficiency through production techniques and technology.

Price efficiency is the ability of a firm to use inputs in optimal proportions, given their respective price and available technology. Heady (1952) related the price efficiency to the optimal condition in which the marginal physical product (MPP) of any input used is equal to the ratio of the input and output price i.e.

$MPP_i = P_i / P_0$ ………………………….. (1)
Where:
MPP_i =   Marginal Physical product of input i
P_i =   Price per unit of input i
P_0 =   Price per unit output.

Such that
$MPP_i \times P_0 = P_i$
i.e $MVP_i = P_i$………………………………….. (2)

These theoretical concepts have very important application in the way we mange our resources if human condition is to change positively. Higher efficiency levels and productivity gains from technological innovations remain of critical importance in Nigerian agriculture especially in the livestock sector where 40% of the FAO protein per caput requirement is mandatory. This gives justification for this paper.

Methodology
Study Area
The study area Ogun State lies between longitude $2°45'E$ and $3°55E$ and latitude $7°0N$ and $7°18'N$ about $16,085km^2$. It has a population of 3.70 million inhabitants (The News, 2007). The rainforest is the largest ecological belt running through the centre of the state from the east to the west. The fresh water swamp with mangrove forest is in the southeast and the woody Guinea savannah is in the northwest. There are two main seasons - the rainy season (middle of March to late October) and the dry season (November-February). Rainfall is between 1600mm (forest areas) and 900mm (woody Guinea savannah). The temperature is between $28°C$ and $35°C$ humidity is between 58% and 90%.

Sampling Procedure and Size.
The multi-stage sampling procedure was applied in selecting the forty egg producers used for the study. The first stage involved stratified random sampling into four strata - Remo, Ijebu, Yewa and Egba (RIYA) based on the provincial structure of the state. The second stage involved simple random sampling of each stratum to select a Local Government Area each. This resulted in the random selection of Shagamu from Remo Province, Ijebu-ode from the Ijebu province, Ado-Odo/Ota from Yewa and Abeokuta north from Egba provinces respectively. Purposive sampling was then used to select ten poultry egg producing farmers from each of the local Government Areas to give a total of forty respondents.

Data Collection
Primary and secondary data were collected to generate the necessary information for the paper. The primary data were obtained through the administration of structured questionnaire while the secondary data were obtained from several journal articles and other publications. Information on cost and revenue components were derived from the product of prices of inputs with that of the inputs levels on one hand and the prices of output with that of the output levels on the other hand.

Analytical techniques
The analytical tools of descriptive statistics, gross margin and regression analysis were used. The descriptive statistics involved the use of tables, frequencies and percentages to summarize and describe socio-economic characteristics of the farmers.
The gross margin analysis was applied for the assessment of profitability of egg producing farmers. The gross margin (GM)/ farmer is the difference between the total value product (TVP) and the total variable cost (TVC) as follows.

GM/farmer = TVP TVC……………………...…………………… (3)

It provides an index for the level of profitability of a particular farm unit.

The regression analysis was used to show the relationship between egg output and inputs used. In implicit functional form, it is shown as;

$Y = f(X_1, X_2, X_3, X_4, X_5, U)$

Where:

Y = Egg output per crate (N)

X_1 = Quantity of feed used (kg)

X_2 = Labour input (man days)

X_3 = Stock size (number of layer birds)

X_4 = Quantity of water used (liters)

X_5 = Cost of medication and veterinary charges (N)

U = Random error.

The explicit forms of the production function - linear, semi-log and double log are as shown in equations 4, 5 and 6 in that order.

$Y = b_0 + b_1 X_1 + b_2 + b_3 + b_4, + b_5 + U$……………………………………..…(4)

$Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + U$………...……(5)

$\log Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + U$…………(6)

Where:

b_0 = constant

b_1, b_2, b_3, b_4, b_5 = regression coefficients (elasticity of each input) i.e. for the double log functional form

The Cobb Douglas function was adopted here as it is a production process and the logic of production is best represented by this function. Measure of resource use efficiency was then carried out from estimates derived from this equation. The marginal value productivity of resources for the linear, semi-log and double-log (Cobb Douglas i.e. CD) functional forms are as shown in the following order though that of the CD is adopted for this paper:

MVP xi = bi. Py………………………………(7)

MVPxi = bi/Xi. Py …………………………(8)

MVP xi = bi Y / X. Py………………………(9)

Where:

Y = Geometric mean of Y

X = Geometric mean of $X_1 …..X_5$

bi = Regression coefficients.

Py = Unit price of output.

Pxi = Unit price of input

The criteria for determining resource use efficiency were as follows.

MVPxi / Pxi >1 technically inefficient (under-utilization of resources)

MVPxi/Pxi<1 technically inefficient (over-utilization of resources)

MVPxi/Pxi = 1 technically efficient (optimal usage of resources).

Results and Discussion

The age distribution of poultry farmers, sex, marital status, educational level attained, farming experience, contact with extension agents and distribution of respondents according to management practices adopted were issues treated under socio-economic characteristics of poultry farmers (table 1).

On age distribution of respondents, poultry farmers of between age 40 49 years and 50 years and above were in high proportions in the study area. They occupied 42.5 and 37.0 percent in that order and constitute 79.5 percent of total respondents in egg production. The male gender represented 32.5 percent. Majority of the poultry farmers were married and occupied 90 percent of the total respondents while 10 percent were single. The farmers had mainly tertiary education with 52.5 percent proportion. Secondary and primary education levels occupied 42.5 and 5 percent respectively. Many of the poultry farmers (72.5 percent) had from one to ten years experience and about (90 percent) had no contact with extension agents. The total mean variable cost per farmer was N143, 310.63, the total value product (TVP) / farmer was N257, 970.25. The gross margin per farmer in the business was N117, 659.62 per month while the net farm income per farmer was N109, 633.88 per month. This was equal to N130.05 net farm income per bird (table 2). This indicates profitability in the business of egg production in the study area.

The signs of the coefficients of feed intake and labor use were negative in the double log function adopted. This is against the sound logic of theory and must have resulted from poor record keeping by farmers (table 3). The coefficients of the variable representing the stock size (number of layers raised) was positive and significantly related to the total value product of egg (p<0.01). The quantity of water administered to the birds and veterinary charges however moved in the same positive direction but were not significant. There was generally inefficient use of resources feed, labour and stock size by poultry egg farmers. The ratios of marginal value product to marginal factor cost (MVP/MFC) for the use of these three resources were all lesser than one indicating overutilization of resources (table 4). Constraints as identified and ranked by farmers that militate against increased and sustainable production of eggs are in the order of importance as follows: lack of financial power, diseases out break, high cost of feed and medication, egg pilfering and lack of social amenities in the production areas that lower cost effectiveness in the production process.

Table 1; Socio-Economic Characteristics of Poultry Farmers

Socio-Economic Variable	Frequency	Percentage (%)
1. Age of Poultry farmer		
20-29	2	5.00
30-39	6	15.00
40-49	17	42.50
50 and above	15	37.00
Total	40	100.00
2. Sex		
Female	13	32.50
Male	27	67.50
Total	40	100.00
3. Marital Status		
Married	36	90
Single	4	10
Total	40	100.00
4. Education level		
Primary	2	5.00
Secondary	17	42.50
Tertiary	21	52.50
Total	40	100.00
5. Years of experience		
1-5	13	32.50
6-10	16	40.00
11-15	7	17.50
16-20	1	2.50
21-25	3	7.50
Total	40	100.00
6. Extension Agent contact		
None	36	90.00
Weekly	1	2.50
Monthly	1	2.50
Yearly	2	5.00
Total	40	100.00

Source: Computed from Field Survey, 2007

Table 2: Profitability Analysis in Egg Production

Cost Item	Amount (Naira)	Percentage (%)
Value Product/month		
Crack eggs	670.00	
Whole eggs	257,120.25	
Total Value Product (TVP)	257,970.25	
Variable Cost/month		
Feed	119,180.13	53.93
Labor	11,950.00	5.41
Drug & veterinary services	5,312.00	2.40
Transportation	1.196.00	0.54
Electricity	555.00	0.25
Water	87.50	0.04
Miscellaneous	2,030.00	0.92
Total Variable Cost	140,310.63	
Gross Margin/month	117,659.62	
Fixed cost		
Cages	5,475.38	29.73
Feeders	184.92	1.00
Drinkers	180.54	0.98
Shovels	104.79	0.58
Cutlasses	46.15	0.25
Wheel barrows	335.42	1.82
Hoes	31.04	0.17
Rent	1,667.50	0.75
Total Fixed Cost (TFC)	8,025.74	
Net Income (TVP TFC)	109,633.88	
Number of layers	842.98	
Net Income/bird/month	130.05	

Source: Computed from Field Survey, 2007.

Table 3: Multiple Regression Coefficients of the Double Log Production Function Adopted and Other Functional Regression Analyses

Function	b_1	b_2	b_3	b_4	b_5	Constant	R^2	Adjusted R^2	F-value
Linear model	-6.98 (0.55)	-31381,87** (-2.27)	338.718*** (7.66)	86.554*** (2.86)	-4.985	1510.04 (0.61)	0.935	0.925	98.04
Semi-Log model	-204595.8** (-2.755)	-88448.06 (-1.53)	498278.3*** (4.57)	124012.9*** (2.71)	-74662.24 (-1.29)	-1518561 (-4.09)	0.8042	0.7754	27.92
Double log model	-0.07432 (-1.312)	-0.556 (-1.30)	1.025*** (2.77)	0.183 (1.18)	-0.032 (-1.17)	5.374 (4.27)	0.774	0.740	23.22

Source: Computed from Field Survey, 2007.

Table 4: MVP to MFC Ratio of Resources Used in Production

Inputs	b_1	MFC	MVP	MVP/MFC
Feed	.07432	54	11.89	0.22
Labor	.556	150	9.91	0.066
Stock Size	1.025	200	0.071	0.00036

Source; Computed from Field Survey, 2007.

Summary and Conclusion

The aged populations that were mostly of the male gender and highly educated were found to be mostly involved in egg production. The egg production business was highly profitable. Gross margin of N117,659.62/farmer/month was realized in the business. This translates to a net income of N109,633.88/farmer/month or N130.05/bird/month though the profit realized could be improved upon with reduction in the utilization of resources. The order of importance of production constraints was lack of finance, disease outbreaks, and high cost of feed, medication and egg pilfering by hired labor.

There is the need to motivate the younger generations to go into poultry farming. Extension education that border on resource use efficiency especially with reference to feed, labor and stock size should be put in place. There is the need to reduce the scale of resources used feed, labor and stock size to maximize profit realizable in poultry egg production. Proper record keeping need to be imbibed by the poultry farmers. These will go a long way to enhancing sustainable profitability in the egg production business. The extension service should also sensitize the government on the provision of early and adequate credit facilities and veterinary

services that is affordable. The farms should also put effective security system that will minimize egg pilfering by hired laborers in place. These if effected will go a long way in facilitating efficient resources use and enhance profitability and sustainability in the poultry egg production industry.

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Influence of Breed and Season on Reproductive Traits of Three Strains of Commercial Layers in the Derived Savannah Zone of Nigeria

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Abstract

Egg production, feed efficiency and mortality data obtained from Isa Brown, Bovan Nera and Dominant Black commercial layers were subjected to least square analysis to determine the effects of breed and season. It was observed that breed had highly significant (P<0.01) effect on egg production and feed efficiency but the reverse was the case for mortality. Isa Brown and Bovan Nera recorded 5.37±0.11eggs/hen/week and 5.41±0.11eggs/hen/week, respectively. The two genotypes had similar mean values but superior to Dominant Black which had 4.94±0.11eggs/hen/week. Isa Brown and Bovan Nera also recorded higher (P<0.01) mean values over Dominant Black in feed efficiency. Furthermore, season significantly (P<0.01) affected egg production, feed efficiency and mortality. Early dry recorded highest mean (5.73±0.13eggs/week) values and the lowest was early rain (4.91±0.13eggs/week). In addition, mortality was highest (P<0.05) in late rain and early dry but lowest in late dry. The result of this study showed that Isa Brown and Bovan Nera genotypes are superior (P<0.01) in terms of egg production and feed efficiency to Dominant Black. However, the three breeds recorded lower and insignificant (P>0.05) mortality mean values presumed to be an indication of their adaptability to the prevailing environmental conditions. Strain x season interaction has no significant (P>0.05) effect on all the reproductive traits. For profitable and efficient egg production therefore, Bovan Nera and Isa Brown are better and could be recommended as choice breeds to farmers in this zone.

Keywords: Breed, season, egg production, mortality, feed efficiency

Introduction

Eggs are the major source of income in a commercial layer farm enterprise. The higher the percentage hen-day or hen-house egg production, the more the profit accruable to the stockholder. There is positive association between egg production and net profit in broiler breeder hens (Farooq *et al.,* 2001). Verma and Singh (1997) reported 87.3% contributions of eggs to total returns. Presently, there are new strains of commercial layers in the poultry industry developed basically for high productivity and increased returns on investment. Egg production is a reproductive trait, lowly heritable and is affected by several factors such as strain of chicken, feeding, mortality, health, management practices, age at point of lay and persistency of lay. Petek (1999), Tolimir and Masic (2000), Lai and Khan (2000) and Farooq *et al.* (2002) observed differences in egg production for various strains of domestic chickens. Akhtar *et al.* (2007) found significant effect of breed on egg production and feed efficiency among Lyallpur Silver Black, Fayoumi and Rhode Island Red birds. On stocking rate effect, Adams and Craig (1985) reported a decrease in egg production with increased stocking rate while Carey *et al.* (1995) observed higher incidence of cracked eggs in overcrowded houses as compared to optimal stocking rate. Persistency of lay is a key factor determining the overall performance of laying birds. Akyildiz *et al.* (1993) and Tanaka (1993) reported that flocks with high persistency of lay produced more eggs than those with poor persistency. Housing type is also an important factor in egg production industry and contributes largely to business success or its failure. Horne-Van and Van-Horne (1996) and Moorthy *et al.* (2000) found better egg production performance of birds reared in cages than on deep litter.

The fluctuating environmental temperature has been a source of concern to poultry farmers in tropical countries because of its negative effect on birds' performance. Bawa *et al.* (2001) found significant effect of season on egg production and mortality rate in a laying flock. Keener *et al.* (2006) posited that throughout the whole range of practical environmental temperature, laying birds have physiological responses that affect their productive performance. The relationship between ambient temperature and egg formation and egg production had been much studied in birds. Rozenboim *et al.* (2007) reported decrease in egg production, egg weight and shell thickness as a result of high temperature. High temperature has a direct but negative association with feed intake and the latter had been reported as having positive influence on egg production. Elsayed (2009), Ipek and Sahan (2004) and Wohr and Erhard (2005) found significant effect of month of production on egg production in Ostrich hens. In chickens, Malau-Aduli *et al.* (2003) reported seasonal variation in egg production and mortality rate in a commercial laying farm and in layer breeders, Olawumi (2007) observed significant effect of season on egg production, fertility, hatchability and mortality rate. There is inadequate information in literature regarding seasonal influence on reproductive performance of commercial laying birds in the Derived Savannah zone of Nigeria. This study therefore, compared the productivity of three strains of commercial layers at different seasonal periods.

Materials and Methods

Study location: The study was carried out at the Animal Breeding Unit, Teaching and Research Farm, University of Ado-Ekiti during August, 2007 August, 2008. The city is situated along latitude $7^0 31^1$ and $7^0 49^1$ North of the Equator and longitude $5^0 71^1$ and $5^0 27^1$ East of the Greenwich meridian. The rainfall pattern in the agro-climatic zone had been reported by Olawumi and Dudusola (2011).

Experimental birds:
The three strains used for the research are Isa Brown (IB), Bovan Nera (BN) and Dominant Black (DB) which are popular in this zone among the poultry farmers. 100 birds of each strain of the same age at the time of commencement of laying were reared on deep litter for a period of one year. The birds were vaccinated against Newcastle and Fowl Pox diseases while antibiotics were administered against bacterial diseases on regular basis. The birds were dewormed at three months interval and multivitamins given regularly to ameliorate the effect of vaccination and heat stresses. All other bio-security measures were taken to ensure high level of hygiene on the farm. Season of production was divided into four divisions namely, early rain (ER: May-July), late rain (LR: August-October), early dry (ED: November-January) and late dry (LD: February-April).

Feed ration: Commercial layer feeds are given *ad libitum* containing 16%CP and 2650kcal/kg/ME from 5% production to the end of the experiment. The mash was fortified with micronutrients and synthetic lysine and methionine in order to ensure good performance in terms of egg number and size. Water was also given *ad libitum.*

Data collection: Records of egg production, feed intake and mortality for individual strain were taken on daily basis and these were pooled together at the end of one year for the purpose of analysis and comparison among the three strains. Feed efficiency was also calculated for the three strains and it refers to the ratio of hen-day egg production to feed (gm) consumed, that is,

Feed efficiency (FE) = $\dfrac{\text{hen-day eggs/bird/week}}{\text{Feeds (gm)/bird/week}}$

Data analysis: The data were subjected to analysis of variance (ANOVA) and the treatment means separated by Duncan New Multiple Range Test (DMRT) using SAS (2001).

The statistical model used was:

Y_{ijk} = $\mu + G_j + S_i + ?_{ijk}$

Y_{ij} = observation of the kth population, of the jth genotype and i^{th} season

μ = common mean

G_j = fixed effect of jth genotype (j=3)

S_i = fixed effect of ith season (i=4)

$?_{ijk}$ = random error

Results and Discussion
Analysis of variance showing the effects of breed and season on egg production, feed efficiency and mortality rate was presented in Table 1. Breed and season had significant (P<0.05) effect on egg production and feed efficiency. Whereas, breed has no significant (P>0.05) effect on mortality rate, but the reverse was the case for season. Moreover, strain x season interaction effects were not significant (P>0.05) on these traits.

Table 1: Analysis of variance showing the effects of Breed and Season on Egg production, Feed Efficiency and Mortality

Source	DF			MS			F-ratio		
	Egg	Feed Efficiency	Mortality	Egg	Feed efficiency	Mortality	Egg	Feed efficiency	Mortality
Strain	2	2	2	3.62	0.5×10^{-5}	0.14	5.81^{x}	6.05^{x}	0.64
Season	3	3	3	5.35	0.4×10^{-5}	0.63	8.58^{x}	5.01^{x}	2.78^{x}
Strain x Season	6	6	6	0.15	0.2×10^{-6}	0.24	0.24	0.20	1.08

Effect of Breed
Table 2 shows the least square means for the effect of breed on egg production. There was highly significant (P<0.01) effect of breed on egg production during the one-year production cycle regardless of the season of production. BN genotype recorded the highest mean (5.41+0.11eggs/hen/week) values but similar to IB (5.37+0.11eggs/hen/week) while DB produced 4.94+0.11eggs/hen/week, being the lowest. BN and IB are therefore, more productive than DB. The significant breed effect on egg production had been previously reported (Petek, 1999; Tolimir and Masic, 2000). In contrast, Duduyemi (2005) found no significant (P>0.05) effect of breed on egg production. The differences in genetic make-up coupled with the birds' innate abilities to adjust and adapt to fluctuating weather conditions are the major factors determining the reproductive efficiency of any breed of chickens reared in any production environment.

It was equally shown in Table 2 that breed has highly significant (P<0.01) effect on feed efficiency. IB and BN genotypes recorded the same mean values, that is, $0.006+0.1 \times 10^{-3}$ and $0.006+0.1 \times 10^{-3}$/hen/week, respectively. DB however, had the lowest ($0.005+0.1 \times 10^{-3}$) mean values. This implies that IB and BN utilized the feeds given efficiently to produce dozens of eggs than DB birds. In effect, the former genotypes are feed efficient and produced more eggs with lesser feed intake than the latter. The obtained result corroborates the findings of Akhtar *et al.* (2007) who reported genetic differences in feed efficiency among three strains of commercial layers.

Breeds' effect on mortality rate was presented in Table 2. There was no significant (P>0.05) effect of breed on mortality. The three breeds recorded: IB- 0.14+0.06; BN- 0.14+0.06; DB-0.21+0.06/breed/week during the observed period. The result contradicts the findings of Olawumi *et al.* (2008) who reported breed differences in mortality rate of layer breeders. The three breeds recorded very low mortality and this might be due to their inherent abilities to tolerate harsh weather conditions.

Table 2: The Least square means showing the effect of Breed on Egg Production, Feed Efficiency and Mortality

Traits	No. (Weeks)	LSQ	SE
Egg production			
IB	57	5.37[a]	0.11
BN	58	5.41[a]	0.11
DB	56	4.94[b]	0.11
Feed efficiency			
IB	57	0.006[a]	0.1×10^{-3}
BN	58	0.006[a]	0.1×10^{-3}
DB	56	0.005[b]	0.1×10^{-3}
Mortality			
IB	57	0.14[a]	0.06
BN	58	0.14[a]	0.06
DB	56	0.21[a]	0.06

a,b- means along columns with different superscripts are significantly different
IB: Isa Brown   BN: Bovan Nera   DB: Dominant Black

Effect of Season

The effect of season on egg production was presented in Table 3. There was highly significant (P<0.01) effect of season on egg production. ED recorded highest mean (5.73±0.13eggs/week) values, LD (5.35±0.13eggs/week) and LR (5.05±0.11eggs/week) have intermediate mean values and are the same while ER (4.91±0.13eggs/week) was the least. ED, LD and LR seasons appeared favourable for egg production while the trait was depressed at ER season. The degree of seasonal influence on birds' performance is hinged on their genetic potentials, adaptability to the environment, and other environmental factors such as nutrition, health, obesity and physiological factors (Cooper, 2000; Aganga et al. 2003). Bawa et al. (2001) reported similar findings in chickens. Wohr and Erhard (2005) and Elsayed (2009) observed that month of production significantly affected egg production, fertility and hatchability in Ostrich.

There is positive association between feed intake and egg production and the former had been reported to be negatively affected by high temperature (Rozenboim et al., 2007). The negative impact of high temperature on birds' productivity could be mitigated or reduced to the level whereby returns on investment will not be adversely affected by developing breeds of chickens adaptable to Tropical weather conditions and provision of improved management practices, quality feeds and good hygienic conditions. Feed efficiency mean values for various seasons were given in Table 3. The obtained result was similar to what was reported for egg production. Season has highly significant (P<0.01) effect on feed efficiency. The highest FE mean values were obtained during the seasons the birds gave the highest hen-day egg production regardless of the individual breed performance and this confirms the assertion that feed intake has direct relationship with egg production.

The effect of season on mortality was shown in Table 3. There was highly significant (P<0.01) effect of season on mortality in the Derived Savannah zone. LR and ED seasons recorded 0.26±0.06 dead/week and 0.26±0.08dead/week, respectively and were similar but higher than ER- 0.08±0.08 dead/week and LD- 0.03±0.08dead/week. ER and LD were the lowest and similar. This implies that mortalities were highest during LR and ED than the latter seasonal subdivisions. Similar findings were reported by Malau-Aduli et al. (2003) and Bawa et al. (2001). The months covered by LR and ED are August January which are usually characterized by high temperature and humidity. The negative effect of heat stroke on birds' performance during hot weather could not be underestimated or discountenanced and measures such as using breeds adaptable to this environment and building environmentally-controlled poultry houses should be given national consideration.

Table 3: The Least square means showing the effect of Season on Egg Production, Feed Efficiency and Mortality

Traits	No. (Weeks)	LSQ	SE
Egg production ER	39	4.91[c]	0.13
LR	54	5.05[b]	0.11
ED	39	5.73[a]	0.13
LD	39	5.35[a]	0.13
Feed efficiencyER	39	0.6×10^{-2}[c]	1.4×10^{-4}
LR	54	0.6×10^{-2}[b]	1.3×10^{-4}
ED	39	0.6×10^{-2}[a]	1.5×10^{-4}
LD	39	0.6×10^{-2}[a]	1.5×10^{-4}
Mortality			
ERLR	3954	0.08-0.26[a]	0.080.06
ED	39	0.26[a]	0.08
LD	39	0.03[b]	0.08

a,b,c- means along columns with different superscripts are significantly different
ER: early rain   LR: late rain
ED: early dry   LD: late dry

Interaction effects:

There were no significant (P>0.05) strain x season interaction effects on egg production, feed efficiency and mortality rate. These results disagreed with the findings of Olawumi (2007) who reported significant breed x season interaction effects on egg production, fertility and hatchability of layer breeders.

Conclusion

Both breed and season significantly (P<0.01) affected the reproductive performance of commercial layers in this zone. Bovan Nera and Isa Brown are more productive than Dominant Black in terms of egg production. As regards seasonal influence, early dry season favoured increased egg production than even both early and late rainy seasons. The former however, recorded higher mortality rate than the latter.

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Effectiveness Of *Chnootriba Similis* As A Vector Of Rice Yellow Mottle Virus

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Abstract

Despite extensive screening, no indica subspecies of rice cultivar with durable resistance to rice yellow mottle virus (RYMV) has been developed. This could be attributable to non-cognizance of the role of insect vectors as being the first agent to convey the virus to rice fields. There is thus a need to modify rice screening methodology using insect vectors in place of the conventional mechanical inoculation technique. This trial compared the vector transmission technique with mechanical inoculation method of screening rice cultivars for resistance to RYMV. Eight rice cultivars were sown in the screenhouse at a distance of 1.0m from infected rows. Adults of Chnootriba similis were introduced to feed on the infected rows in order to acquire and transmit the virus into the healthy test cultivars, following which disease severity was assessed and chlorophyll content measured. The results show considerable variations in the reactions of the rice cultivars to the isolate used for the screening. The behaviour of the rice cultivars tested indicated that the differences between the vector transmission method and the classical mechanical inoculation are significant for some cultivars but not for others. The lowest mean percent chlorophyll reduction (15.99%) was recorded in Moroberekan when C. similis was used for screening while the highest chlorophyll reduction (47.35%) occurred in PNAF4-56 with mechanical inoculation method. Mean percent disease severity varied between 11.11% with C. similis and 51.85% with mechanical inoculation.

Introduction

Rice yellow mottle virus (RYMV) is currently the most devastating disease of rice in Africa and has drawn attention for research owing to its threat to rice production. The disease has the propensity to lead rice to the verge of extinction in the continent (Joseph *et al*., 2009). Rice yellow mottle virus is indigenous to, endemic in and restricted to Africa and its adjoining islands (Nwilene *et al*., 2009). It is transmitted by several species of beetles, ncluding *Chnootriba similis*.

The use of resistant cultivars is the most effective and economical approach of managing rice yellow mottle virus However, high yielding *indica* sub-species of rice varieties with durable

resistance to the virus are not yet available despite extensive screening (Nwilene *et al.*, 2006). Although partially and highly resistant rice varieties have been identified, the disease has not been effectively controlled by the observed levels of resistance and as such, the incidence, severity and concomitant yield loss arising from RYMV infection are on the increase in the continent. Developing resistant crop varieties to a disease is a function of the effectiveness and reliability of the method of screening. Screening rice cultivars against RYMV under artificial inoculation conditions inside the screenhouse has persistently been carried out by mechanical inoculation of RYMV isolates into plant tissues using carborundum and allowing the inoculated young plants to grow, following which disease symptom scores and serological diagnostic tests would be conducted (Sere *et al.*, 2008). Such an approach may be highly criticized as not wholly representing how RYMV disease is transmitted or spread under field conditions since the vectors are the first agent to convey the virus to rice fields and alternative host plants (Kouassi *et al.*, 2005). As such, a holistic and reliable screening methodology against the disease needs to take cognizance of the insect vectors implicated in the transmission of the virus. Therefore, this study was carried out to compare the effectiveness of vector transmission technique using *C. similis* with mechanical inoculation method of screening rice cultivars for resistance to RYMV.

Materials and Methods
Isolate used
Two pathotypes of RYMV isolates exist in Southwest Nigeria (Sere *et al.*, 2008): pathotype-one which includes the highly pathogenic and virulent isolates while pathotype two consists of mildly pathogenic isolates. The RYMV isolates that are characterized as pathotype one has been recommended for use in vector-rice screening study (Sere *et al.*, 2008; Nwilene *et al.*, 2009). The pathotype one isolate of RYMV used in this study was obtained from the Plant Pathology Unit of Africa Rice Center, Cotonou, Benin Republic.

Insect vector used
Life adults of *C. similis* used for the trial were collected with a sweep net from Africa Rice Center rice fields at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria and maintained on BG90-2, a highly susceptible cultivar.

Rice cultivars evaluated
The eight differential rice cultivars evaluated (Table 1) were obtained from AfricaRice Plant Pathology Unit, Cotonou.

Isolate propagation
The pathotype one isolate was first propagated on BG90-2 following mechanical inoculation of 21-day-old rice seedlings in the screenhouse. Four weeks after inoculation, leaves showing typical yellow mottle symptoms characteristic of RYMV infection were harvested and used to prepare the viral inoculum. The inoculum was prepared by grinding the infected leaf samples in 0.01 M phosphate buffer (pH 7) in the ratio of 1:10 weight by volume, and the resulting homogenate filtered through cheesecloth. Carborundum powder (600-mesh) was added to the inoculum to aid the penetration of the virus into leaf tissues.

Planting and inoculation of border rows
Seeds of BG90-2 were sown in plastic pots as border rows and the seedlings were mechanically inoculated with the viral inoculum at three weeks after sowing. The inoculated rice seedlings metamorphosed to infected rows.

Planting of test cultivars
The test cultivars were planted at two weeks after inoculating the border rows. Two plastic pots of 20cm diameter, 19.5cm height and 5-litre capacity, filled with 2.5kg of sterile sandy-loam soil were used for sowing each test cultivar. The experiment was laid out in a randomized complete block design (RCBD) with 3 replicates. Nine seeds (three seeds per hill and three hills per pot) of each test cultivar were sown at a depth of 2cm. The plants were later thinned to three seedlings per pot at one week after emergence. Two days after planting the test cultivars, 120 adults of *C. similis* were introduced onto the infected rows in the screenhouse to feed, acquire and transmit the virus into the test cultivars. Weeds were removed regularly from the plastic pots by hand-pulling. Two split doses of 0.2g of urea were applied per pot as top dressing at 21 and 42 days after planting. In the control experiment, the susceptible cultivar used as border rows (BG90-2) and the test cultivars were planted in a separate screenhouse. However, no insect vector was introduced. Instead, the test cultivars were inoculated with the virus isolate at three weeks after planting.

Data collection
Data were taken on disease severity and chlorophyll content at 42, 56 and 70 days after sowing the test cultivars as follows:

Disease severity: - Plants were scored based on visual assessment of symptoms characteristic of RYMV infection on a Standard Evaluation System of 1, 3, 5, 7 and 9, according to IRRI (1996), *where*:

1	=	represents no symptoms (green leaves)
3	=	pale green leaves with sparse dots or streaks
5	=	pale leaves with mottling
7	=	pale yellow or yellowish-green leaves
9	=	yellow or orange leaves, coupled with height reduction and many dead plants

Chlorophyll count: - The chlorophyll contents of the leaves of both the test and control plants were measured using a SPAD 502 Chlorophyll Meter (Monje and Bugbee 1992; Martines and Guiamet, 2004).

Data Analysis
The percentage disease severity and chlorophyll reduction were calculated based on the visual scores and SPAD readings. IRRISTAT version 4.3 statistical software was used for all the analyses. Variance and mean comparison of percentage disease severity and chlorophyll reduction were carried out and the means separated using Duncan Multiple Range Test (DMRT).

Results
Table 1: Identity of rice cultivars screened

Code	Cultivar	Origin	Sub-species
V1	Gigante	Mozambique	*indica*
V2	Bouake 189	Cote d' Ivoire	*indica*
V3	FARO 11	Nigeria	*japonica*
V4	Moroberekan	Cote d'Ivoire	*japonica*
V5	LAC 23	Liberia	*japonica*
V6	ITA 235	Nigeria	*japonica*
V7	PNA 647F4-56	Peru	*japonica*
V8	H 232-44-1-1	Argentina	*indica*

Table 2: Mean percent chlorophyll reduction for interaction effect of variety by transmission method

Variety	Transmission Method	SPADR at 42 DAS	SPADR at 56 DAS	SPADR at 70 DAS
ITA 235	CS	33.01b	24.63a	22.16a
ITA 235	M	37.76a	22.34a	22.61a
Gigante	CS	16.87b	35.04a	31.99a
Gigante	M	37.85a	37.46a	36.04a
H232-44-1-1	CS	25.48b	36.46a	29.28b
H232-44-1-1	M	34.68a	42.09a	43.57a
Bouake 189	CS	22.63b	43.12a	20.32b
Bouake 189	M	39.73a	41.08a	41.18a
LAC 23	CS	24.71b	39.58a	25.82b
LAC 23	M	31.06a	39.18a	42.35a
FARO 11	CS	44.19a	18.35a	20.25b
FARO 11	M	17.65b	34.02b	31.95a
Moroberekan	CS	21.72a	21.86b	15.99a
Moroberekan	M	23.29a	31.42a	16.67a
PNA 647F4-56	CS	34.72a	20.07b	39.18b
PNA 647F4-56	M	19.61b	47.35a	45.14a

CS   =   *Chnootriba similis*
M   =   mechanical
DAS   =   days after sowing
SPADR =   chlorophyll reduction

In a column, means followed by the same letter are not significantly different at 5% level by Duncan's Multiple Range Test

Table 3: Mean percent disease severity for interaction effect of variety by transmission method

Variety	Transmission Method	DS at 42 DAS	DS at 56 DAS	DS at 70 DAS
ITA 235	CS	11.11b	31.48a	31.48b
ITA 235	M	20.37a	31.48a	38.89a
Gigante	CS	18.52a	31.48a	31.48b
Gigante	M	16.67a	40.74b	48.15a
H232-44-1-1	CS	22.22a	24.07b	24.07b
H232-44-1-1	M	18.52b	33.33a	50.55a
Bouake 189	CS	18.52b	33.33a	35.19b
Bouake 189	M	21.22a	25.93b	42.59a
LAC 23	CS	14.81a	29.63b	35.19b
LAC 23	M	18.52a	33.33a	51.85a
FARO 11	CS	14.81a	29.63b	35.19b
FARO 11	M	14.81a	31.48a	48.15a
Moroberekan	CS	18.52a	11.11b	24.07a
Moroberekan	M	18.52a	24.83a	27.98a
PNA 647F4-56	CS	11.11b	31.48b	37.04b
PNA 647F4-56	M	16.67a	46.36a	51.85a

CS   =   *Chnootriba similis*
M   =   mechanical
DAS   =   days after sowing
DS   =   disease severity

In a column, means followed by the same letter are not significantly different at 5% level by Duncan's Multiple Range Test

Discussion
This study compared the novel vector transmission technique with the conventional mechanical inoculation method of screening rice cultivars for resistance to RYMV. There were considerable variations in the reactions of the rice cultivars to the highly pathogenic RYMV isolate used for the screening. The reaction of the rice cultivars tested indicated that the differences between the vector transmission method and the classical mechanical inoculation are significant for some cultivars but not for others. Recent studies conducted by Nwilene *et al.* (2006) and Sere *et al.* (2008) revealed that viral transmission or inoculation using insect vectors is as effective and reliable as the conventional mechanical inoculation method of screening rice cultivars for resistance to RYMV. For instance, Nwilene *et al.* (2006) recorded a lower disease incidence and yield reduction of 21.7% and 41.1% respectively when rice varieties were screened with *Oxya hyla* (a RYMV insect vector) in contrast with mechanical inoculation technique that resulted in higher incidence (45.5%) and yield loss (77.8%). Similarly, a study conducted by Joseph *et al.* (2009) showed that *Oxya hyla* was more effective in the transmission of the virus than mechanical inoculation method.

Virus transmission by insects is a common way for viruses to travel between different host plants and this is possibly as a result of a protein coat that plant viruses attach to as they hitch an insect ride between plants (Uzest *et al*., 2007). *Chnootriba. similis* play an important role in transmitting RYMV within and between rice plants (Nwilene *et al*., 2009).

Conclusion

Findings from this preliminary investigation could be incorporated into RYMV management program under field conditions to forecast and monitor the insect vectors, and hence, RYMV incidence.

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Climate Change And Vunerability Of Fish Farmers In South Western Nigeria

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Abstract.
Production systems and livelihoods in South Western Nigeria are at risk of climate variability and change; the fisheries sectors are no exception. The study examined the vulnerability of fish farmers in Ondo and Ekiti States of Nigeria to Climate change. A total of 120 respondents were purposively selected, interviewed and used for data analysis. Result indicated that the fish farmers in Ondo and Ekiti States witnessed unprecedented change in weather conditions as reflected in unusual excessive downpour of rain thus affecting their productivity through flooding. Most of these fish producers were young, mainly males, literates, and experienced fish farmers but relied mainly on personal savings and money borrowed from friends and relatives for fish farming. They practiced the extensive system of fish culture, utilizing local feeds and depended mainly on streams, rivers and rainfall. Fish production is concentrated in wet season. Most farm sizes were below 1 hectare, and utilized earthen pond. About 65 percent experienced flooding with about 61.6 percent loosing within 3501 -5000 fishes at a time. All categories of fishes were flooded. Majority of the fish farms were not insured by any insurance company while the few that were insured experienced untimely and inadequate compensation, also very few received compensation from the Government. Climate change resulted in low productivity, low income, starvation, poor health as well as poor standard of living of the respondents.

Key words: Fish production, Climate change, vulnerability, fish farmers,

Introduction
Millions of people including many in developing countries derive their livelihoods from fishing while about 2.6 billion people get their protein from seafood Fishing provide employment for up to ten million people in Africa and provide a vital source of protein to 200 million people. About 30% (29.5 Mt) of the world fish catch is used for non-human consumption, including the production of fishmeal and fish oils that are employed in agriculture, in aquaculture, and for industrial purposes. Fishmeal and fish oils are key diet components for aquaculture production; depending on the species being cultured, they may constitute more than 50% of the feed. Despite the importance of fish to the World economy, reports around the World indicate vulnerability of fish production to climate change. According to Intergovernmental Panel on Climate Change (2001), Climate change could have dramatic impacts on fish production, which

would affect the supply of fishmeal and fish oils and that future aquaculture production could be limited by the supply of fishmeal or fish oils if stocks of species used in the production of fishmeal are negatively affected by climate change and live-fish production. Climate change according to Allison *et al.* (2005) can affect the productivity or distribution of fishery resources of both marine and inland waters in a variety of ways:

Changes in water temperature and precipitation affect the dynamics of ocean currents, the flow of rivers and the area covered by wetlands. This will have effects on ecosystem structure and function and on the distribution and production of fish stocks. In 2007 the United States National Academy of Sciences reported that increased temperature coupled with loss of snow pack, and lower spawning flows are likely to lead to increased mortality among juvenile salmon, particularly Chinook, in the Snohomish River Basin and hydrological similar watersheds Many species, such as salmon, cannot live in water over 21°C. In addition to direct effects of temperature, increased volume and changed timing of stream flows are likely to cause many river-spawned eggs to wash downstream.

On February 22, 2008 the United Nations Environment Programme, (UNEP), issued a report titled "In Dead Water: Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds, warning that three quarters of the world's key fishing grounds are at risk of being seriously impacted by rising temperatures. They reported potential consequences as changes in oceanic circulation patterns, currents that bring nutrients and remove waste from fisheries, rising surface temperatures that are expected to bleach and kill as much as 80% of the world's coral reefs - major tourist attractions and nurseries for many juvenile fish, and, the possible acidification of the ocean's waters as warmer water absorbs more atmospheric carbon emissions. Increased acidity would impact organisms that utilize calcium for shell-production. Increased incidence of extreme events such as floods, droughts and storms will affect fishing operations and increase damage and disruption to coastal and riparian homes, services and infrastructure.

Sea level rise, melting of glaciers at the headwaters of major rivers and other large-scale environmental changes will have unpredictable effects on coastal and wetland environments and livelihoods.

Complex links between climate change, fisheries and other sectors will have indirect effects on fisheries ranging from fisheries being affected by changing water demands from agriculture to diversion of government and international financial resources away from fisheries management and into emergency relief after extreme weather events.

In the short-term, climate change is anticipated to impact freshwater fisheries through incremental changes in water temperature, nutrient levels and lower dry season water levels. In the longer-term, larger changes in river flows are anticipated as glaciers melt, reducing their capacity to sustain regular and controlled water flows. There is a particular concern for river fisheries in downstream impacts from adaptations within other sectors. In particular, conflicts exist between agricultural irrigation needs and fish productivity in river systems.

The loss of coastal habitats and resources is likely through sea level rise, warming sea temperatures, extremes of nutrient enrichment and invasive species. Coastal fishing communities face a double exposure of reduced fisheries resources and increased risks of coastal flooding and storm surges. Fifty million people could be at risk by 2080 because of climate change and increasing coastal population densities. Projections suggest that these combined pressures will result in reef loss and a decline in fish availability for per capita consumption of approximately 15 percent by 2015 (U.N, 2008).

A recent study on the vulnerability of national economies and food systems to climate impacts on fisheries has revealed that African countries are most at risk. This according to the United Nations as reported by Defend Humans Right (2008) is because many African countries are semi-arid with significant coastal or inland fisheries. This gives them high exposure to future increases in temperature and linked changes in rainfall, hydrology and coastal currents. Also, these countries depend greatly on fish for protein, and have low capacity to adapt to change due to their comparatively small or weak economies and low human development indices. Countries in this category include Angola, Congo, Mauritania, Mali, Niger, Senegal and Sierra Leone. Other vulnerable African nations include Rift Valley countries such as Malawi, Mozambique and Uganda. (Defend Humans Right, 2008) Beyond Africa it is the Asian river dependent fishery nations including Bangladesh, Cambodia and Pakistan that are most at risk. The often overlooked links between fisheries and agriculture also make the semi-arid areas of Africa vulnerable. In these areas the higher-potential agricultural zones are around lakes, swamps and river-floodplains. Here fisheries often provide both safety nets and capital to invest in agricultural inputs and livestock. If the fishery system is under stress, the potential of the other components of the 'tri-economy' is reduced. The system as a whole is resilient to local-scale perturbation, but with reduced rainfall stressing both fisheries and crop agriculture, that resilience could be threatened by climate change.

According to FAO (2008), the world is likely to see significant changes in fisheries production in the seas and oceans. For communities who heavily rely on fisheries, any decreases in the local availability or quality of fish for food or increases in their livelihoods' instability will pose even more serious problems. Fishing communities located in the high latitudes and those that rely on climate change-susceptible systems, such as upwelling or coral reef systems, will have the greatest exposure to climate-related impacts. In addition, fisheries communities located in deltas, coral atolls and ice dominated coasts will be particularly vulnerable to sea level rise and associated risks of flooding, saline intrusion and coastal erosion. But countries with limited ability to adapt to the changes, even if located in low risk areas, are also vulnerable. FAO also noted however that the impacts of climate-related physical and biological changes in fisheries on the communities that depend on them will be as varied as the changes themselves. Both negative and positive impacts are likely, depending on local circumstances and the vulnerability and adaptive capacity of the affected communities' Environmental change, particularly climate change, will have a disproportionate impact on poor people in rural areas where livelihoods of the majority depend directly on natural resources.

Depletion of soil fertility and degradation of forest resources, water resources, pastures, and fisheries is already aggravating poverty in many developing countries. Global warming will affect the agro-ecological suitability of crops. The increasing atmospheric concentration of carbon dioxide will enhance plant photosynthesis and may contribute to improved water-use efficiency. It may also lead to increased pest and disease infestations. Responses to climate change can be of two broad types. The first employs adaptive measures to reduce the impacts and risks, and maximize the benefits and opportunities, of climate change, whatever its cause. The second involves mitigation measures to reduce human contributions to climate change. Both adaptive measures and mitigation measures are necessary elements of a coherent and integrated response to climate change. If future emissions are higher, the impact will be stronger, and vice versa. At the same time, no matter how aggressively emissions are reduced, climate change is a reality for the 21st century, since existing emissions in the atmosphere will remain for decades to come.

Thus adaptation to climate change is inevitable. In the absence of mitigation and response capacities, losses from damage to the infrastructure and the economy, as well as social turmoil and loss of life, will escalate and be substantial And this burden will fall on the poorest and in the poorest countries. It is only in poor countries that drought turns to famine, often resulting in population displacement, suffering, and loss of life. The social and economic costs of such occurrences may undo, in just a day or a month, the achievements of years of development efforts. Global environmental change is expected to have a significant impact on food systems worldwide. The nature and gravity of vulnerabilities of food systems are of utmost importance and the design of adaptive policies to cope with environmental Changes is critical. Global environmental changes pose the following challenges to agricultural research: changes in the flow and storage of materials, ecology of pests and diseases, dynamics of rainfall regimes and water accumulation, plant responses to temperature and CO_2 concentration, reduction of greenhouse-effect gases, plant salt tolerance affected by intrusion of saltwater due to sea-level rise, conservation of biodiversity, and adaptation of food production systems to extreme weather events.

Three major vulnerabilities were identified in relation to Climate Change. These are social economic and environmental vulnerability. Many factors contribute to social vulnerability, including rapid population growth, poverty and hunger, poor health, low levels of education, gender inequality, fragile and hazardous location, and lack of access to resources and services, including knowledge and technological means. And when people are socially disadvantaged or lack political voice, their vulnerability is exacerbated further. The economic vulnerability of agriculture is related to a number of interacting elements, including its importance in the overall national economy, trade and foreign-exchange earnings, aid and investments, international prices of agricultural commodities and inputs, and production and consumption patterns. All of these factors intensify economic vulnerability, particularly in countries that are poor and have agriculture-based economies.

Agriculture is at the core of environmental vulnerability and concerns the management of natural resources land degradation, water scarcity, deforestation, and the threat to biodiversity.

Climate change could cause irreversible damage to land and water ecosystems, and lead to loss of production potential. A lot Climate change in Nigeria, according to Nnimmo Bassey as reported by Paehler (2007) is a ticking time bomb and it exists little or even nothing to mitigate its effects.

Several literatures on climate change in Developing countries and particularly in Africa do not make any reference to Nigeria. Does it mean that Climate change have no significant effect on Nigeria? Nigerian is an Agrarian country whereby over 70percent of the inhabitants depend on Agriculture for their sustenance. There is a growing awareness of aquaculture in Nigeria with more than 100 private commercial fish farms currently in production. A lot of small scale fish farms are springing up everyday Fish farm in Nigeria presently covers an estimated 60,000 ha of the country and produces some 25,000 to 30,000 mt of fish per year (Moehl, 2003).   In recent times there is the incidence of sudden and unprecedented change in weather condition all over the south western Nigeria with the attendant problems of abnormal rainfall and flooding, excessive harsh sunlight and heat when not raining. A lot of houses, properties and farms were adversely affected. It is noted that a large percentage of the fish producers in Nigeria utilized earthen ponds usually cited at river banks, valleys and wet lands. This prompts investigating if the fish farmers in the area are also vulnerable to the unusual weather changes and if yes to what extent were they affected? What their features / characteristics are as relates to fish production? Are they experienced fish farmers? Do they insure their business in case of disaster? Do they receive any incentive from the government? What are their coping strategies?

It is on this note that this study is embarked on mainly to examine the vulnerability of fish farmers in Ekiti and Ondo States of Nigeria to Climate Change. Specifically, it aimed at examining: the socio-economic characteristics of fish farmers in the study area, the features and fish production practices as well as the effect of climate on fish production.

Methodology.
The study was carried out in Ondo and Ekiti States of Nigeria. Ondo state shares boundary with Ekiti in the west, Edo in the south, Ogun in the east and Osun in the north while Ekiti shares boundary with kwara in the North, Kogi in the West, Osun in the East, and Ondo in the South. Ondo state falls between the mangrove and the rain forest Zones. The area has a mean annual rainfall ranging from 3000-2000mm and a temperature range of 17.5 to 27 degree centigrade. The relative humidity of the state is above 60 percent. Ekiti State falls within the rain forest Zone. The mean annual rainfall of Ekiti state is 2400-2000mm while the temperature ranges from 20-27 degree centigrade.

Four Local Government Areas (Ado-Ekiti, Ayedire/Gboyin, Akoko South west and Akure south LGAs) were randomly selected from Ekiti and Ondo States. Efforts were made to find out the areas where fish production is concentrated in the selected LGAS thus three villages/communities were selected from each LGA. These are: Mugbagba, Oke-bola, Atikantan, Ode, Egbe, Aisegba, Oka, Akungba, Ikun, Aule, Oba-ile and Alagbaka. Due to the few Fish farms in the areas, "a purposive sampling technique" was adopted to select 120

respondents utilized in this study. A structured interview schedule was used in eliciting information from them. Data collected were analyzed using frequency counts and percentages. Pie chart was involved in data presentation.

Results and Discussions
A.   Socio-economic Characteristics of the respondents

Table 1 show that majority of the respondents were young with about 66.6 percent fallen within the age of 26-55 years, 80 percent were males, 70.8 percent were married, 14.2 percent were single, 8.3percent were divorced while 6.7percent were widowed. Majority of the respondents were literate with 38.3 percent having tertiary education, while 18.3 percent had secondary education. About 58.3 percent were full time farmers, 21.7 percent were retired civil servants, 11.7 percent civil servants, while 8.3 percent were politicians. About 93.3 percent derived the fund utilized for fish farming from personal savings, 50.0 percent borrowed from friends and relatives, 41.7 percent utilized co-operative loan, 23,3percent obtained bank loan, while 10.0 percent borrowed from the Government initiated micro-credit scheme. Majority (91.2%) have engaged in fish farming for more than six years.

It could be deduced from the above that fish farmers in the study area were young, mostly males, literate, and experienced farmers who utilized personal savings and money borrowed from friends and relatives for fish production.

Table 1: Socio-economic Characteristics of the respondents

Variables	Frequency	Percentage
Age		
<25years	14	11.7
26-35years	12	10.0
36-45years	28	23.3
46-55years	40	33.3
>55years	26	21.7
Sex		
Male	96	80.0
Female	24	20.0
Marital Status		
Single	17	14.2
Married	85	70.8
Widowed	08	6.7
Divorced	10	8.3
Highest Educational level		
No formal education	08	6.7
Primary education	28	23.3
Junior Secondary education	26	21.7
Senior Secondary education	22	18.3
Tertiary education	46	38.3

Years of experience		
1-5years	10	8.3
6-10years	38	31.7
11-15years	64	53.3
>15years	08	6.7
Source of fund for fish farming		
Personal Savings	112	93.3
Friends and relatives	60	50.0
Bank loan	28	23.3
Co-operative loan	50	41.7
Micro Credit Schemes	12	10.0

Source: Field survey, 2008.

B.   Fish production practices of the respondents

Data in Table 2 shows that majority (73.3%) of the respondents practiced extensive system of fish culture; 26.7percent practiced the semi-intensive system, while none of them practiced the intensive system. This might be due to the fact that personal savings and money borrowed from friends and relatives were their major source of fund, this invariably might be very small hence their inability to embark on the intensive system of fish rearing, which is capital intensive.

Majority (73.3%) had less than 1 hectare of fish farm, 25.0percent had 1-5hectares, while only 1.7percent had between 6-10 hectares (table 2). Majority, (64.2%) utilized earthen ponds for fish rearing; 10.8percent utilized both earthen and concrete tanks, 10.0percent utilized concrete pond only, 8.3percent made use of earthen pond, concrete pond and tanks together, while 6.7percent made use of tanks only. Thirty- three point three percent of the earthen ponds were established near streams and rivers, 20.8percent were established in contours, while 10.0percent were on marshy ground. Rivers, streams and rainfall were the major sources of water for fish production. When considering their feeding, 48.8percent of the respondents utilized locally formulated feeds for feeding their fishes, 37.5percent used imported fish feeds, 31.7percent relied on kitchen wastes while 26.7percent utilized poultry dung, pawpaw and other locally available feed stuffs that can be consumed by fishes.

It can be inferred from the findings that fish farmers in Ekiti and Ondo States of Nigeria engaged in extensive system of fish production with the use of earthen ponds being predominant, relied mainly on rainfall, streams and rivers as water sources and utilized local food and feed stuffs for fish production. The system practiced above cannot be divorced from the poor financial status of the fish farmers. They could not obtain credit for fish farming because most financial institutions view fish production as being relatively risky when compared to other farm enterprises such as poultry. They have the believe that fishes cannot be seen or assessed physically at any point in time, more also due to high interest rate of banks, bureaucratic bottlenecks and lack of collateral security, the fish farmers consider banks as the last resort for loan. This makes fish production in the environment to remain low.

Table 2; Fish production practices

Variables	Frequencies	Percentage
A. Cultural Practices	88	73.3
Extensive	32	26.7
Semi-intensive	0	0.00
Intensive system		
B. Size of fish farm	88	73.3
<1 hectare	30	25.0
1-5 hectares	02	1.7
6-10 hectares	0	0.00
>10 hectares		
C. Type of ponds	77	64.2
Earthen pond only	12	10.0
Concrete pond only	08	6.7
Tanks only	13	10.8
Earthen and concrete pond	10	8.3
All A, B &C		
D. Features of earthen ponds	12	15.3
Marshy	41	52.6
Near stream/rivers	0	0.00
Far from streams and rivers	25	32.1
Contours		
E. Sources of water for fish	60	50.0
Rivers	12	10.0
Streams	08	6.7
Wells	10	8.3
Spring	04	3.3
Boreholes	80	66.7
Rainfall	0	0.00
Tap water		
F. Type of food utilized for feeding fishes		
Locally formulated feed	45	48.8
Imported commercial feed	38	37.5
Kitchen waste	55	31.4
Poultry dung	32	26.7

Source: Field survey, 2008.

C.   Climate change and fish production.

There are two major seasons in the study area- wet and dry seasons. Depending on climate change, wet season may last for eight months while dry season covers four months. Due to total reliance on rainfall which also influences streams and rivers, fish farming in the study area is concentrated in wet seasons. According to table 3, majority, (80%), of the farmers indicated that fish production is not carried out in dry seasons due to insufficient rainfall or water, harsh sun dries off rivers and streams As well as pilfering. Table 3 shows that majority (65.0%) of the respondents have experienced flooding in their farm in 2008. About 61.6percent indicated 3500-5000 fishes were flooded from their farm, while 12.8percent indicated that 501-2000 fishes, 2000-3500 fishes well as above 5000 fishes respectively were flooded from their farm.

Table 3: Climate change and Fish production

Variables		Frequencies N=(120)	Percentage
A.	Production season		
	Wet season	96	80
	Dry season	06	05
	Both wet and dry season	18	15
B.	Reasons for not producing in both season		
	Water shortage	100	83.3
	High mortality rate	96	80.0
	Pilfering	88	73.3
C.	Number of respondents affected by flood		
	Yes	78	65.0
	No	42	35.0
D.	Average no of fish flooded		
	<500	0	0.00
	501-2000	10	12.8
	2001-3500	10	12.8
	3501-5000	48	61.6
	>5000	10	12.8
E.	Average size of fishes flooded		
	<200g	38	48.7
	200-600g	20	25.6
	601-1kg	06	7.7
	2kg	02	2.6
	>2kg	12	15.4
F.	Control measures against flood		
	Yes	12	15.4
	No	66	84.6
G.	Farm insurance		
	Yes	10	8.3
	No	110	91.7
H.	Incentives from insurance company		
	Yes	06	60.0
	No	04	40.0
I.	Incentives from Government		
	Yes	10	12.8
	No	68	87.2

Source: Field survey, 2008.

Efforts were made to find out the average weight of fish loss, Fig 1 shows that 48.7percent of the respondent had less than 200g fishes flooded, 25.6percent had between 200-600g flooded, 15.4percent had above 2kg of fishes flooded, and 2.6percent had about 2kg of fishes flooded. Fig 2 indicates that 59.0percent experienced flooding periodically; 25.6percent experienced flooding occasionally, while 15.4percent experienced it frequently. Table 3 also shows that only 15.4percent were able to find control measures against flood.

Efforts were made to find out if the fish farms were insured, only 8.3percent of the fish farms were insured. Out of the few insured, only 33.5percent were compensated by insurance company after the flood incidence and the compensation was delayed. Only 12.8percent received financial aids from the government after the flood. It should be noted that only 15.3percent of the fish farmers consulted Agricultural Extension Agents for Counseling. Effect of Climate change on the respondents include: low productivity, low income, starvation, poor health and poor standard of living (Fig3).

Fig 1: Frequency of Flooding
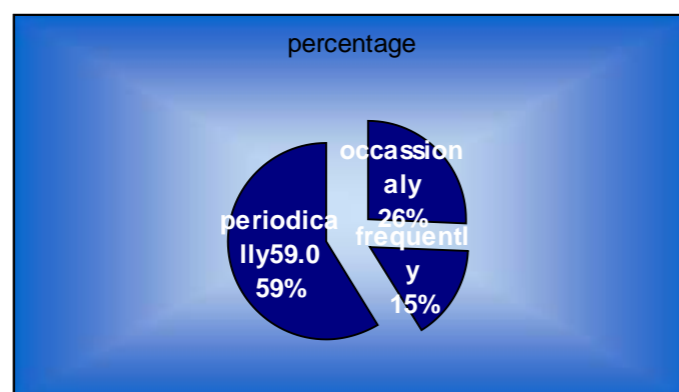
Fig 2: Average Sizes of Fish Flooded
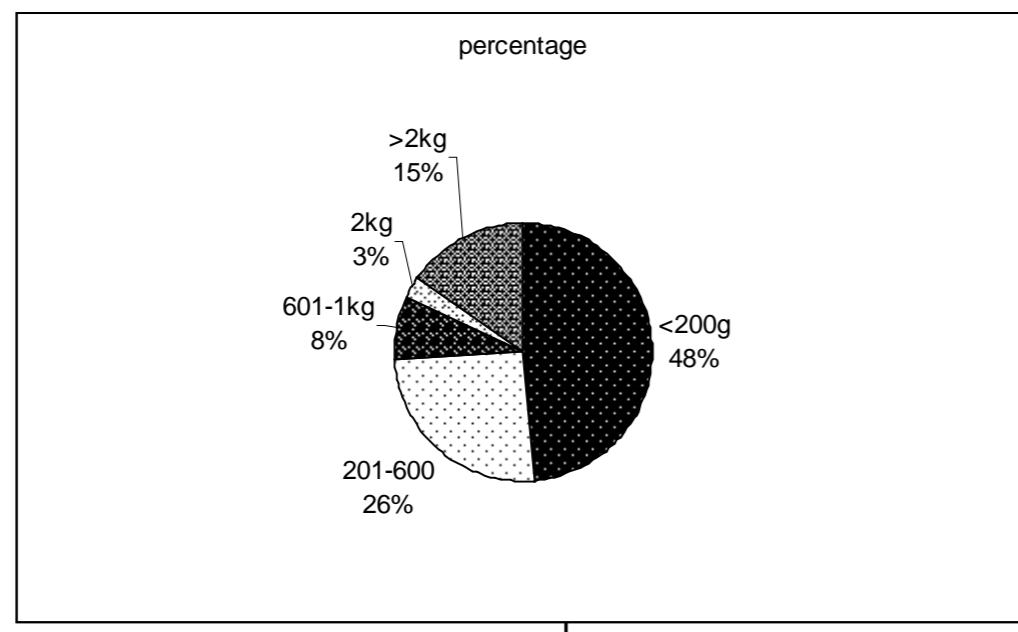
Fig 3: Effect of climate change on fish producers.
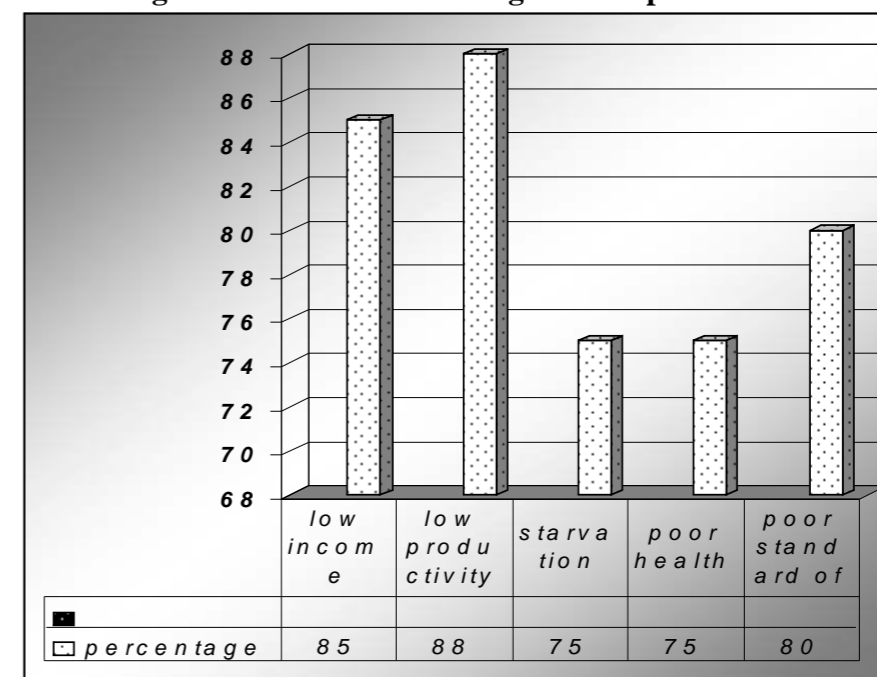
Conclusion and Recommendation

The study examined the vulnerability of fish farmers in Ekiti and Ondo State to climate change. A total of 120 respondents were purposively selected, interviewed and used for data analysis. Result indicated that the fish producers in Ondo and Ekiti States were young, mainly males, literates, experienced but relied mainly on personal savings and money borrowed from friends and relatives for fish farming. They practiced the extensive system of fish culture, utilizing local feeds and depended mainly streams, rivers and rainfall as their main source of water for fish farming. Fish production is concentrated in wet season. Dry season production was not popular due to water shortage, high mortality as well as pilfering. Most of the farm sizes were below 1 hectare, and utilized earthen pond. Majority experienced flooding resulting into great loss with about 61.6percent of the respondents loosing within 3501 -5000 fishes at a time. All categories of fishes were flooded .most of them did not embark on any control measures. Majority of the fish farms were not insured by any insurance company while the few that were insured only 33.3percent were compensated after the flood and such compensation was delayed, also very few received compensation from the Government. Climate change resulted in low productivity, low income, starvation, poor health as well as poor standard of living of the respondents.

Based on the above findings, there is urgent need for policy intervention to safeguard the situation. The following recommendations were made:

*   Government should encourage fish farmers in Ondo and Ekiti State to obtain loan from banks and micro-credit institutions. This can be done by reducing interest rate on loans for fish production as well as removing the stringent conditions attached to loans.

*   Fish farmers should engage in preventive measures such as building of strong barriers around their farms to prevent flooding

*   Use of concrete ponds and tanks. This can be stimulated through fund invested in fish farm.

*   Intensive system of fish rearing is a good way of escape from flood and losses.

*   Fish farmers should be encouraged to insure their farms with reputable insurance company to prevent future occurrences

*   Government should come early to the aids of fish farmers when cases of flood is reported, thorough investigation should be carried out after which such farmer should be bailed out of the problem.

*   Policies on food production in the country should pay special attention to fish farming and should evolve policies that will investment in fish production and improve farmers welfare

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Entrepreneurial Focused Academic Content In A Private Tertiary Institution: A Strategy For Achieving The Mdg's

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Abstract
The significance of Science and Technology education cannot be underscored if the millennium development goals are to be achieved. To this extent, Universities and other educational institutions in Nigeria have a dominant role to play in ensuring that their academic curricula are adequately structured. This in addition to achieving academic objectives will also facilitate the enhancement of the objectives of the millennium development goals. A well structured academic calendar should be able to provide effective theoretical knowledge, create enabling environment for job creators and increase entrepreneurial skills. This study intends to showcase how entrepreneurial focused academic content in Joseph Ayo Babalola University has contributed towards achieving the millennium development goals. The university strong desire for an entrepreneurship focused academic system resulted into the introduction of diverse vocational skills in addition to compulsory entrepreneurial courses taken by students at the undergraduate level. Such program provides opportunity for the student to develop an entrepreneurial spirit and also gives them the opportunity of starting the process of wealth creation while in school. This hands-on approach helps in creating self dependent and self sustained graduates that will be job creators rather than job seekers and invariably increases indigenous capacity and helps in nation building. This ultimately helps the nation in achieving the much desired millennium development goals.

Key words: Millennium development goals, entrepreneurial skills, academic content, job creators

Introduction

Nigeria, like other developing nations is faced with myriads of problems and challenges. These include embezzlement of public funds, endemic corruption at all facets of governance, unstable polity and government policies, inconsistency in administration and neglect of other economic sectors in favour of the oil sector. In addition, illiteracy, lack of basic infrastructural amenities, power problem, housing problem, unemployment, underfunding of basic sector such as Agriculture and Education, bad roads and poverty. These problems have led to national

economic decline which a well structured academic curriculum in tertiary institutions can help to arrest (Abani *et al.*, 2005). To this end, that the call for a robust functional educational system cannot be over emphasized.

The value of a country is measured by its productivity which depends on how effectively available skills and talents are deployed. Nigeria, which was one of the richest 50 countries of the world in the early 1970s, has retrogressed to become one of the 25 poorest countries at the threshold of the twenty first century. Despite the fact that Nigeria is the sixth largest exporter of oil, it has the third largest number of poor people in the world after China and India (Igbuzor, 2006). The incidence of poverty in Nigeria estimated on the basis of one US dollar per day that was 28.1 percent in 1980 suddenly increased to 46.3 percent in 1985, declined slightly to 42.7 percent in 1992 but increased again to an alarming rate of 65.6 percent in 1996 and 69.2 percent in 1997 (NBS, 2005). Nigeria's economic performance based on the average annual percentage growth of gross domestic product (GDP) was estimated to be 2.4 in 2000, while Ghana and Egypt both performed better with a GPD of 4.3 and 4.6 respectively (Igbuzor, *et al*, 2005). Nigeria is among twenty countries in the world with the widest distribution of income among individuals. The extent of the distribution of income among individuals in different countries as estimated by the *Gini index* (Table 1) showed that Nigeria has a high index value of 50.6 while other developing nations recorded a lower index values of 37.8 (India), 37.9 (Jamaica), 37.3 (Mauritania) and 28.9 for Rwanda (Igbuzor, 2006).

Past and present governments in the country have tried to salvage the country through diverse empowerment programmes, policy shifts and infusion of hundreds of billions of naira to execute projects without tangible success. Nigeria remains in abject poverty despite her rich and abundant human and natural resources. Despite the failures of the past regime, the present administration is however determined to use every machinery and modalities available to chart a way forward for the country. To this extent, the present regime has joined hand with the international community to embrace the Millennium Development Goals (MDG's) by setting up parallel machineries aimed at the same objective through the vision 2020 as captioned by the 7 point agenda.

The Millennium Declaration laid out eight time-bound development goals that seek to address issues of poverty, education, equality, health and the environment, to be achieved by the year 2015 (MDG, 2005). Likewise, the 7-Point Agenda focuses on revamping the Power and Energy sector, Food Security and Agriculture, Wealth Creation and Employment, Mass Transportation, Land Reform, Security plus Qualitative and Functional Education. One practical strategy towards eradicating poverty is by scaling up investments in infrastructure and human capital while promoting gender equality and environmental sustainability. Human capital development is further facilitated through a well structured academic curriculum that is entrepreneurial

focused. A nation with increased number of self-sustained and self-dependent graduates will record less number of unemployed graduates. Education particularly, an entrepreneurial focused tertiary education therefore plays a very vital role in moving the nation towards achieving the objectives of the MDG's. The more the number of young graduates that are able to be self dependent and self employed the more the poverty and unemployment is eradicated ant the faster the nation moves towards self sufficiency.

This review therefore examines the significance of an entrepreneurial focused academic content in tertiary institutions as a strategy for achieving the objectives of the Millennium Development Goals (MDG's). It considers the academic program of the Joseph Ayo Babalola University (JABU) and shows how the entrepreneurial based academic curricula in JABU have been focused towards enhancing the attainment of the MDG's. The paper also considers the status of graduate unemployment in Nigeria, and suggests possible interventions to solving the menace.

Higher Education In Nigeria

In order to accomplish the dictates of the 7-Point Agenda and bring forth the MDG's, the Nigerian Universities must produce world class manpower that can compete favourably with those in the developed nations. However this can only become a reality with the availability of world class physical infrastructure and instructional facilities. In the face of the current global economic meltdown, the critical need for a robustly functional educational system cannot be overemphasized. The Tertiary institutions and particularly the Universities have a role to play in preparing the youths for the world of self employment. The present critical unemployment/underemployment situation confronting the present day graduates of the Nigerian universities is partly the lack of adequate preparedness of the graduate for the employment market.

The needs therefore arise for our Universities, to look outward on global competitiveness and the challenge of continuous technological improvement (Hartnett, 2000). Recent technologies and developments in the information, communication and technology (ICT) world should be harnessed and utilised for innovative growth and development of the country. Research and development (R&D) should be transferred from the classroom into tangible and physical terms that can benefit the society as part of the process of preparedness.

The National Universities Commission (NUC) in Nigeria, as the body saddled with ensuring academic standard, should continually ensure that these standards are complied with holistically. It is however equally important for Universities to also look inwards at the millions of unemployed youth and devise a way of equipping undergraduates to be self reliant with the mind of job creators rather than job seekers (Aladekomo, 2004). There is therefore the need to introduce more entrepreneurial courses into the curriculum of Universities and other tertiary institutions just like JABU.

Significance of Tertiary Education In Nigeria

Tertiary education play significant role in producing skilled manpower necessary for nation building and sustained development in any nation. Skilled manpower contributes to nation building and capacity development through the following goals:

– contribute to national development through high level relevant manpower training;
– develop and inculcate proper values for the survival of the individual and society;
– develop the intellectual capability of individuals to understand and appreciate their local and external environments; and
– acquire both physical and intellectual skills which will enable individuals to be self-reliant and useful members of the society.

These goals are directed towards building graduates who are functional in the society and therefore nation builders. Current statistics of graduate unemployment in Nigeria however showed that these goals are still far from been fully achieved.

Graduate Unemployment in Nigeria

There are a total of 96 tertiary Universities in Nigeria (NUC, 2009). Twenty-seven owned by the Federal, thirty-five by State governments and thirty-four by private institutions. These institutions turn out thousands of young graduates every year. These young graduates who are supposedly skilled manpower are deprived from contributing to national development through the high job insecurity and unemployment resulting into colossal waste of human resources and capital. Graduate unemployment is endemic in Nigeria and there is need for immediate intervention at stemming down the high rate of unemployment currently being witnessed in the country.

Graduate unemployment could be caused by the following reasons:
i.   incompetence on the part of the student, lack of ingenuity and special skill
ii.   underfunding funding of universities resulting into lack of necessary infrastructure to facilitate learning, equipments, laboratories (about 15 -30 percent of the instructional and infrastructural facilities are non-functional, obsolete or dilapidated)
iii. inadequate teaching materials, library, books, computers etc
iv.   lack of trained personnel and qualified teaching staff
v.   Inadequate curricula with lack of emphasis on hands-on training
Source: Dabalen (2000)

Graduate unemployment can also be caused by inability of both the public and private sectors to absorb the number of graduates been turned out each year. This low absorptive capacity may have generated a high level of unemployment rate in the country. The sustained increase in graduate turnout over the years from various institutions across the country (Table 2) showed that Nigeria is richly blessed with abundant human resources. There is however an uneven

distribution in the spread of graduate turnout for different fields of specialisation in Nigeria, with largest turnout in the field of education and social sciences and the lowest in the field of Veterinary medicine(Table 3). The unemployment situation in Nigeria is however not limited to University graduates alone as available data (Table 4) revealed that in 2003, 14.7% of primary school leavers are unemployed, 53.6% in the Secondary School cadre and 12.4% of University graduates were equally unemployed (Al-Samarrai and Brighton, 2003). Recent World Bank report also revealed that 40 million Nigerian youths, age ranging between 19-25 years are jobless (Tribune, 2009). The large percentage of unemployed graduates reflected a poor social return on the investment and a massive waste of resources. The problem of low quality graduates resulting from insufficient facility or improper and insufficient academic content is being addressed effectively by the National Universities Commission, that ensure that minimum standard are complied with before accrediting any university or any academic programme.

The major problem resulting to graduate unemployment is that there are not enough provision for jobs in both the private and public sector. The very few ones who got employed are either through very strong connection or affiliation to the industry or through exceptional merit. The large number of unemployable graduates therefore reflects a poor social return on the investment and contributes negatively towards national growth and MDG's are delayed or not achieved at all.

Interventions to solving graduate unemployment in Nigeria

The possible interventions that can reduce the rate of graduate unemployment in Nigeria involves a shift in the focus of academic curriculum from being theoretical based, to a more practical approach directed towards creating graduate entrepreneurs. Such graduate entrepreneurs will be self sufficient, highly innovative and creative to transform acquired skill into virtual reality. They would have been sufficiently tutored to become job creators rather than job seekers. The issue of unemployment though is a universal problem, can be successfully managed and put under check in Nigerian. However, the lack of coherence between National Policies on education, industrialization and employment has made matters worse. The resultant effect is the educational institutions turning out graduates, without an effective national policy on job creation or adequate programmes to motivate them to create jobs for themselves. The continuous assemblage of a pool of unemployed educated youths therefore posed a serious threat to social security and stability of the country. Government agencies and other concerned stakeholders should therefore intensify efforts at creating more jobs and providing an enabling environment for investors including small, medium and large scale entrepreneurs. Financial institutions should also provide soft loans with minimal collateral requirements for young graduates willing to start a business of their own. Such strategies when implemented will help to reduce the menace of graduate unemployment in Nigeria and thereby assist the nation towards achieving the much sought after MDG's objectives.

The JABU initiative

Joseph Ayo Babalola University (JABU) is one of the private Universities in Nigeria. JABU is the 27th private University to be licensed and the first University in the country to offer Entrepreneurship as a degree programme. The peculiarity of the academic curricula of JABU and particularly the College of Agricultural Science lies in its hands-on approach that allows students to acquire entrepreneurial skills through actual involvement and active participation from the beginning to the end of such enterprises. Such a curriculum is targeted at equipping students with all the necessary tools needed to becoming self dependent and self reliant hence becoming an entrepreneur and job creators rather than job seekers after leaving the University.

Modality for JABU Initiative

The modality for the JABU initiative is linked with the vision of the College of Agriculture, which focuses on a hands-on approach where academic exercises are combined with entrepreneurial skill acquisition. The program is run in a way that creates an avenue for the students to get involved in wealth creation while still at school. The College operates an entrepreneurial activity at a time that does not encroach into normal school time hence academic activities are not disrupted. The program is structured at producing self-dependent and self-reliant graduates that will be self employed and employers of labour. This consequently will enhance nation building and poverty eradication in Nigeria. Every student in the University is expected to pass a minimum of 12 credit units of courses in entrepreneurship and in addition, students studying the entrepreneurship degree programme will also go through some basic skills from other Colleges such as the College of Agriculture, Natural sciences, and Environmental sciences.

The students in the College of Agriculture in addition to the 12 units of entrepreneurship courses will also get involved in different enterprises including; rabbitry, fishery and poultry. Each student spends a minimum of two hours each day outside the normal school academic hours on such enterprise. JABU students invariably are taught not only to be good intellectuals but also how to make money while in school. The programme entails all the practical applications of entrepreneurial skill beginning with the planning stage, sourcing for fund, project monitoring and evaluation, record keeping and documentation. While on the project, the students are trained on how to manage such risks and other uncertainties associated with such enterprise. Such exposure is intended to enables them become self sufficient and self reliant after graduating from the University. The program is currently being experimented under the College of Agricultural Science Student Entrepreneurial Project (CASSEP).

College of Agricultural Science Student Entrepreneurial Project (CASSEP)

Different aspects of Agricultural enterprise are introduced to the student. The students form various committees such as Investment, Procurement, Marketing and Audit Committee for proper management of their enterprises. The various committees are overseen by College a staff that coordinates the entire project and report to the Project Management Committee Headed by the Dean of the College. The students manage such investments on their own and the profits

accrued are shared among the students. Such activities as practiced in JABU include, poultry production, fish farming, snail rearing, and rabbit rearing.

What the program intends to pass across to students:

i.   Ability to be self dependent, learn how to get busy doing something worth-while
ii.   Ability of create wealth through harnessing any available opportunity at their disposal
iii.   Projecting a hands-on approach and developing a strong entrepreneurial spirit
iv.   Never be redundant, there is always something you can do, be broad minded
v.   Ability to develop innate skill and problem solving capability in the students
vi.   Develop an effective business management approach

Benefits from CASSEP:

In addition to the program creating an entrepreneurial spirit in the students, there is also the financial benefit to each of the student involved in the scheme. The students on the day of graduation will receive their initial capital invested into the program and well as individual share of accrued profit over the years. Each student contributes a sum of ?20,000 which is pooled together for starting any enterprise as decided by the students. Decisions are arrived at democratically and implemented jointly. Records are taken and challenges faced are documented and possible interventions for improvement sought. Available data for the first year of the student poultry business revealed that the business generated a net profit of N45,626 (Table 5) while the second year generated a higher net profit of N107,730 (Table 6). The pains of the first year have become the gains in the second year. The net profit made though little, but the practical experience acquired during the process is worth a lot more. The program has exposed the students coping mechanism and also the ability of not compromising any of the stages involved in the evolution of any enterprise. This assertion was evident in the improvement seen in the net profit in the second season over the first season (Table 7) where bird mortality that was very high in the first year was better managed in the second year.

Table 1: Country Poverty Indicators

Country	Gini index	Country	GPP@ 2000
Nigeria	50.6	Nigeria	2.4
India	37.8	Ghana	4.3
Jamaica	37.9	Egypt	4.6
Mauritania	37.3		
Rwanda	28.9		

Gini index measures the extent of the distribution of income among individuals.
Source: (Igbuzor, 2006)

Table 2: Graduates output in Nigeria by Institution and Year

Institution	86/87	88/89	91/92	95/96	96/97	Mean annual growth
Ibadan	3821	3040	3173	6813	6929	9.59%
Nsukka	4359	3826	5924	4259	4611	2.1
Kano	1060	983	1380	3922	4317	17.8
P.Harcout	817	2264	2107	3519	3826	6
Jos	1334	2181	2888	5961	3565	5.61
Ife	3269	2756	4397	3427	3427	2.45
Lagos	3436	4126	4709	3135	3372	-2.22
Benin	1453	3630	3392	3873	3299	-1.06
Maid.	1363	1279	1474	2706	3166	10.6
Ilorin	1382	1420	2750	3346	3162	9.3
Uyo	0	0	1404	1314	1314	-1.1
Awka	0	0	858	1274	1276	6.84
Calabar	1103	2447	1587	1208	1208	-7.54
Sokoto	711	817	749	1169	1066	3
Owerri	81	213	296	490	741	14.86
Akure	61	136	260	408	495	15.44
Bauchi	90	73	121	298	389	20.43
Abeok	5	0	123	369	369	20.09
Markurdi	85	57	224	298	353	22.46
Yola	0	45	169	334	334	24.95
Minna	0	23	124	120	120	20.15
Zaria	2872	2980	3249	0	0	20.8
Total	27312	32296	41358	48243	47339	4.34

Source: Dabalen and Oni, 2000

Table 3: Graduate output in Nigeria by Discipline and Year

Discipline	1986/87	1988/89	1991/92	1995/96	1996/97
Administration	1897	2088	2459	2233	2332
Agriculture	1120	1366	1681	2371	2453
Arts	3907	4072	4292	5569	5596
Education	7836	10686	13950	14449	12390
Engineering	1569	1871	2246	2867	3210
Environment	842	814	942	779	669
Law	1440	1714	1892	1264	1417
Medicine	1439	1593	1646	2205	2402
Pharmacy	292	298	551	421	405
Science	2582	3503	5109	6593	6989
Soc. Science	4190	4139	6383	9199	9201
Vet Medicine	195	152	207	293	275
Total	27312	32296	41358	48243	47339

Source: Dabalen and Oni, 2000

Table 4: Graduate Unemployment Rate in Nigeria

Country (group-year	Youth Unemployment rate (%)
Lesotho (total – 1997)	47.40
Malawi (total – 1987)	0.80
Namibia (total – 2002)	10.90
South Africa (total – 2000)	55.80
Swaziland (total – 1997)	55.20
Zimbabwe (total – 1999)	14.00
NIGERIA (pry school leavers -2003)	14.70
NIGERIA (sec school leavers -2003)	53.60
NIGERIA (tertiary graduates – 2003)	12.40

Source: (Al-Samarrai and Brighton, 2003)

Table 5: Income and Expenditure for 1st Year of investment

Expenditure 2007/2008)	N	Income	N
Poultry Feed	314,184	Eggs	570,000
Fish feed	140,600	Spent Layers @ N800 each	130,500
Cage & housing	65,700	Fish	280,000
Maize production	8,210	Fresh Maize	25,500
Drugs	1,880	Dry Maize	55,500
Juveniles	30,000	Asset worth	50,000
Labour	60,000		
Implements	14,200		
Transportation	29,100		
Layers POL	102,000		
Cash not spent			180,000
Total	765,874		1,291,500
Gross Profit			525,626
Starting Capital	480,000		
Net Profit	45,626		

Starting with 200 birds ending with 145 birds mortality =27.5% mortality
POT= Point of lay birds @ 16 weeks

Table 6: Income and Expenditure for 2nd Year of investment

Expenditure(2009/2010)	N	Sale	
Feed	288,650	Eggs	373,305
Transportation	11,750	Asset (present value)	148,000
Medication	8,175	185 birds @N800 each	
Labour	24,000		
Broilers	40,000		
Total	423,575		521,305
Profit			107,730

From 200 birds ending with 185 birds mortality = 7.5% mortality

Table 7: Rate of increase in profit margin over time

Investment	Profit	Mortality
First season	45,626	27.5
Second season	107,730	7.5
Profit increase	56.65 %	

Conclusion and Recommendations

The process of getting students involved in projects as seen in the CASSEP program demonstrate an increased enthusiasm on the part of the student signalling an entrepreneurial spirit in them. The attitude displayed by the students signals a strong desire to creative, industrious, accountable and ability to minimise risks. These are the potent criteria needed to becoming a successful entrepreneur. It therefore become evident that such a structured academic program will eventually produce results as such students are more likely to be self dependent after graduation. It therefore becomes evident that an entrepreneurial focused tertiary curriculum will play a significant role towards reducing graduate unemployment in the country. Skilled manpower serves as the pivot of development in any economy and still remains the only source through which the nation's research and development base can be fuelled. There is therefore the need for tertiary institutions to be more focused on developing entrepreneurial skills and abilities. This will drastically reduce graduates unemployment and provides for self dependent and self sustained graduates who can be employers of labour. This is possible through a paradigm shift in ideology and creating an entrepreneurial spirit geared towards becoming job creators rather than job seekers. This study therefore recommends the following:

* Academic curriculum for universities should incorporate entrepreneurial courses as compulsory courses so as to instil the spirit of entrepreneurship into the students.

* Universities across the country should produce highly skilled graduates who can move the nation forward towards achieving the MDG's.

* High rate of unemployment is reduced and poverty abated when graduates are adequately trained to be job creators rather than job seekers.

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Growth Performance Of Gold Gourami Fry (*Trichogaster Trichopterus*) Fed Live And Formulated Diets

By

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Abstract

The implementation of ornamental fish breeding and rearing still relies greatly upon fish sourced from the wild. Live Diet (LD) dependence and the lack of suitable Formulated Diet (FD) are major constraints for the expansion of larviculture of many fish species. The low digestibility and nutritional quality of formulated diets are factors that might explain their failure as a stand alone starter food. To determine whether formulated diet (coppens) in combination with live diet (Artemia) may efficiently increase the growth and survival of gold gourami (T. trichopterus) fry in comparison with initial mean weight of (0.006 ±0.002g) or either types of diet alone. A pair of brooders, male and female Gold gourami were kept in a glass tank of 45cm x 30cm x 30cm size and they bred after two weeks of been kept in a simulated environment. The fry were stocked into 10 glass tanks of 45cm x 30cm x 30cm at 10 fry per tank and replicated twice. Each diet was fed ad libitum to the fry for 56 days. Fry fed formulated diet alone presented significantly (p<0.05) lower growth rates as compared to fry fed live diet or a combination of both. In addition, fry fed live diet grew better than any of those fed with formulated diet and the combination of the two. Such better performance resulted from increased food intake, nutrient digestibility and assimilation of live diet of higher nutritional value.

Keywords: Breeding, Growth Performance, Gold Gourami, nutrient digestibility.

Introduction

Fish has been raised as food in pools and ponds for thousands of years. Brightly coloured or tamed specimen of fish in these pools has sometimes been valued as pets rather than food, many culturists kept fish for both functions. The critical aspects of breeding are maturity and condition of the brooders, environmental conditions, fertilization rate and hatchability of eggs, larva and post larval feeding and rearing. The method of breeding is based on the family characteristics of the fish, depending on the species, ornamental fishes are classified as live bearers and egg layers, these are further categorized as egg scatterers, egg placer, mouth brooder, nest-builder, egg hanger, egg buriers, George, (1976).

The implementation of ornamental fish breeding and rearing still relies greatly upon fish sourced from the wild, as wild populations are historically where the majority of ornamental fish have been sourced from with well established collection industries. However due to popular demand and pressure on wild resources, farming of ornamental fish is now an established industry in countries such as Singapore (N R C, 1993). This pressure on demand has now made the study of breeding, rearing and feeding important. About 80% of ornamental fishes are from fresh water and the rest from brackish and marine water.

The dietary requirements of this fish depend on their age, sex, weight, metabolic and physical activities. Nutrition been a process of furnishing the cells inside animal with that portion of the external chemical needed for optimum functioning of the numerous metabolic chemical reactions involved in maintenance, growth, work, production and reproduction (Eyo *et al.*, 2004).

Nutrition is a key factor to a successful aquaculture production from which aquarium culture is coined out, sound nutrition promotes reproductive success, healthy fish development and is essential in the production of high quality aquaculture products (Garcia, et al 2001). In fish, the yolk provides nutrition during embryonic development and early ontogenesis (Fiogbe and Kestemount, 1995). The transition from endogenous to exogenous food supply at first feeding marks a critical phase during which high mortality may occur. The development of manufactured feed could be considered as one of the contributing factors to the tremendous growth of this hobby's wide spread popularity over the past 50 years Earle, (1995). Formulated diets are feeds which are combined from different nutrients sources/ingredients so as to be richer in nutrients, palatable to the fish and allow for good digestibility. It helps in overcoming the failing of nutritionally imbalanced diets of food gotten from the wild (Koikovsky, 2001).

Live food are the primary basis for aquatic larviculture, but their inherent variability has brought about the search for a more controlled compounded feed technology during the last 25 years (Jones et al 1998).   Live foods are feeds which consist of living organisms that can be active or inactive. The diet of an organism is what it eats which is largely determined by the perceived palatability of the food.

The larval stage of fish is defined by the metamorphosis of external and physiological characters from hatchling until juvenile stage is attained. For practical purposes larval fish can be divided into 3 groups according to alimentary tract morphology, (Dabrowski and Glogovski, 1997). Those with immature digestive system at first feeding are more difficult to feed and usually require live feeds as a part of their diet. Most ornamental fishes are omnivores, while a few specimens are herbivores, blue and gold gouramis are omnivorous in nature. Despite the clear importance of nutrition in influencing growth and survivability, the nutrient requirements of these live jewels remain poorly studied. Omnivorous fishes need 45% crude protein and 5% fat for good growth while herbivores need between 30 35% crude protein and 3% fat; fibre content for omnivores is about 2%.

Major difference between the male and the female of gold gourami is, the male dorsal fin is pointed while in female, dorsal fin and anal fin are shorter and rounded. However some female may have a dorsal fin as long as that of a male. They are typical bubble nester and egg layer. They are characterized as labyrinth fish (Froese, *et al.,* 2007). This fish generally inhabit densely

vegetated water bodies, they are very hardy. Blue gourami grows best at pH 7 - 8.8, hardness, about 150ppm, temperature between 22^0C 28^0C (72F 82F). Gourami being omnivores will generally eat any aquarium fish food; they also take frozen food such as Daphnia and Brine Shrimp, and also should have some vegetable matter.

The early developmental stage, larvae exhibit high hydrolytic capacity, related to their weight (Person le Reiyet et al; 1993). Enzyme activity pattern is age dependent, but can be modulated by diet composition. Thus, larvae have the ability to digest and thrive well on compound diet, if this diet is well adapted. Larvae have different specificities in digestion and nutritional requirement when compared to juveniles. Taking these specificities into consideration, recent research has led to the formulation of a compound diet that was well adapted for larvae from mouth opening, and could totally replace live prey (Cahu and Zambonino, 2001). The importance of using combined live feed with formulated diets lies mainly in supplying a more suitable and well balanced diet to fish larvae in a digestive form (Peticam and Moodie, 2001). A number of other important aspects related to nutrition, species, fish biology and husbandry condition which determine the success of using combined feeding are not yet fully understood. For instance, there appears to be specific periods during development when fish larvae will feed on and metabolize formulated diets and that can be accounted for a behavioural and a physiological capacity (Cahu and Zambonino, 2001). Moreover, some fish species larvae apparently are better adapted to the utilization of nutrients from formulated diets than others.

Materials And Methods
Experimental Fish

Experimental fish for the study was 2 brooder stock (male and female) *Trichogaster trichopterus* which was purchased from Apostolic Faith Fish Farm, Anthony Village Lagos, Lagos State, and also the elodea weed used in conditioning the water. This fish were aerated during transportation to keep them in a stable condition and reduce stress, the fish were transported using plastic tank. Brood stock selection was based on the external morphological features as reported by Viveen et al (1985).

Experimental Diets

The feed ingredient used for the formulation of each diet treatments were purchased from Apostolic Faith fish farm, Lagos, Nigeria. The Artemia was in solid form which was factory packed and it served as live diet (LD), coppens, an imported product of size 0.2mm served as formulated diet (FD). They were packed in dry, airtight small containers.

Diet Characteristics

The diets were divided into three treatments
  Treatment 1 (T1) Diet containing 100% Artemia
  Treatment2 (T2) Diet containing 100% Coppens
  Treatment 3 (T3) Diet containing 50% Artemia and 50% Coppens.

Experimental Procedure

The brood stock was kept in a glass tank of 45 x 30 x 30cm size and conditioned with elodea weed. Also aquarium stones were put at the bottom of the aquarium to create a simulated environment for the fish to breed. There were bubbles next in the surface of the water. At this time, the water was reduced to half to allow eggs to stabilize three days after which the female laid up its eggs, and the female was removed after laying the eggs leaving the male to tend to the eggs and after 30 hours, the eggs hatched and the water was aerated to increase level of dissolved oxygen in the water, the pH and temperature of the water at this time were 8.6 and 24°C respectively.

Feeding of the Fry

This experiment was conducted in seven glass tanks of 45x30x30 cm size each (i.e. 3 treatments with two replicates). Before the commencement of the feeding experiment, fish were acclimatized for a week and fed with the combination of formulated and live diet. After acclimatization, the healthy fish were stocked into the tanks filled with 70% of water at 10 fish per tank; the fish were fed thrice daily for the period of 56 days. Temperature, pH and dissolved oxygen (DO) concentration in water were monitored and checked daily. The table below shows the temperature, pH and DO of each tank.

Care of the Fry

Water for the experimental fish was siphoned every day and changed once in a week until the third week when the fish started to develop their labyrinth and internal organs and the water was changed every three days and a pinch of salt added to the water to act as anti-stress.

The Physio-chemical Parameters of Water Used for the Experiment

Water sample was taken daily and analysed. Water in University of Ado-Ekiti environment had a high pH during the time this experiment was conducted. This led to sourcing water outside the University environment for the up keep of the experimental fish. The following parameters were determined: temperature, dissolved oxygen, pH and others such as NO_2 and NO_3 were not determined because of lack of equipment.

Table 1: Average Level of pH for 56 Days

S/No	T1	T2	T3	T4	T5	T6	T7
1.	7.60	7.75	7.81	7.82	7.68	7.70	7.74

Source: From Readings Taken 2011

Table 2: Average Level of Temperature for 56 Days

S/No	T1	T2	T3	T4	T5	T6	T7
1.	25.0	25.1	25.4	25.3	24.8	24.8	24.6

Source: From Readings Taken 2011

Table 3: Dissolved Oxygen values for 8 weeks (mg/l)

No of weeks	T1	T2	T3	T4	T5	T6	T7
1.	6.5	6.7	7.5	7.8	9.5	9.4	8.0
2.	5.7	5.5	9.1	9.2	8.1	8.5	7.5
3.	7.8	6.5	8.9	8.5	8.2	8.6	8.5
4.	8.0	7.0	8.5	8.5	8.5	8.5	8.5
5.	7.0	7.2	9.0	8.8	8.0	8.0	8.7
6.	7.5	7.5	8.5	8.5	7.8	8.4	8.5
7.	7.5	7.3	8.8	8.5	8.5	9.2	8.5
8.	8.0	7.5	7.5	8.5	8.5	9.0	8.0

Source: From Readings Taken 2011

Where T1 & T2 are tanks used for coppens, T3 & T4 are tanks used for Artemia, and T5 & T6 are tanks used for the mixture of live and formulated diet, while T7 is the control tank

Growth Parameters
The weight of the fish was checked once a week with the use of a sensitive scale because of their small size.

Table 4: Weight of Fish per Week (g)

Weeks	Artemia	Coppens	50/50	Control Diet
1	0.006±0.002	0.002±0.001	0.004±0.002	0.008±0.002
2	0.042±0.004	0.082±0.002	0.054±0.006	0.048±0.002
3	0.089±0.005	0.021±0.003	0.076±0.006	0.091±0.003
4	0.275±0.006	0.038±0.005	0.128±0.007	0.310±0.004
5	0.473±0.007	0.054±0.006	0.263±0.007	0.492±0.004
6	1.002±0.005	0.524±0.004	0.813±0.006	1.022±0.004
7	1.902±0.006	1.269±0.005	1.396±0.008	2.002±0.004

Source: From Readings Taken 2011

Growth Calculations
Mean Weight Gain (MWG), Specific Growth Rate (SGR), Protein Efficiency Ratio (PER), Feed Intake (FI), Feed Conversion Ratio (FCR) and Protein Intake (PI) were calculated according to the following equations:

MWG = Mean final body weight Mean initial body weight

$$\text{SGR per day} = \frac{(In\ Wt - In\ Wi)}{T} \times 100$$

Where T is the culture period in days
    Wt and Wi is the mean final and initial weights (g) respectively

$$FCR = \frac{Weight\ of\ dry\ feed\ (g)}{Weight\ of\ dry\ fish\ (g)}$$

$$PER = \frac{Gain\ in\ weight\ of\ fish\ (g)}{Protein\ intake\ (PI)\ (g)}$$

PI = Feed Intake (FI) x % protein in diet
FI = 3% body weight of fish per day

Statistical Analysis
Data (MWG, SJR, FCR, PER) resulting from the experiment were subjected to analysis of variance (ANOVA) using complete randomized design to determine significance between mean values. Duncan's multiple range test (Duncan 1955) was used to compare differences among means. Significant level was chosen at P less than 0.05 ($P<0.05$)

Results and discussion
Results
During the first phase of the experiment (breeding), it was discovered that as much as this fish can breed in captivity they will not do so if a simulated environment is not created for them, and parent stock should also be of equal size for them to reproduce. After hatching, some of the fry (30%) died due to pH fluctuations which was traced to water source, it was also discovered that ammonia build up as a result of excreta and excess uneaten food.

The Proximate Composition of the Experimental Diet
The proximate composition of experimental diets are presented in Table 5, which described the different ratio of live diet (Artemia) to compounded diet (coppens.) the value of the proximate composition of crude protein, crude fibre, crude fat, ash and NFE were reported.

Table 5: Proximate Composition of Experimental Diet

	Artemia 100%	Coppens 100%	Artemia/coppens 50/50
Crude protein	54	56	55
Crude fat	9	15	12
Ash	4	0.4	2.2
Fibre	6	10.9	8.45
N F E	27	17.70	22.35

Growth and Feed Utilization of Gold Gourami Fed with Experimental Diets for 56 Days
The growth parameters of the fry fed with experimental diets at different ratio of live feeds and compounded diet is presented in Table 6. Fry fed diet 1 had the highest mean weight gain (MWG) followed by that of diet 3and 2 respectively. The specific growth rate (SGR) of the fry administered the various diets has a significance difference between diet 1 and 2 but no significant difference between 1 and 3. Feed conversion ratio (FCR) was highest in diet 2 followed by 3 and 1 respectively. Protein efficiency ratio (PER) was highest in diet 1, then 3 and 2 respectively, having different significance. Protein intake (PI) was highest in diet 1, the final weight gain was highest in diet, 1, then 3 and 2 respectively and there were significant differences in the three diets.

The general trend is that fry fed with 100% formulated diet (diet 2) has the lowest growth and performance followed by fry fed with 50/50 (diet 3) and the highest growth performance was exhibited with fry fed diet 1, 100% live feed.

Table 6: Growth Performance of Gold Gourami Fed with Experimental Diet for 56 Days

Parameters	Artemia	Coppens	50/50	Control Diet
Initial Mean Weight	0.006±0.002	0.002±0.001	0.004±0.002	0.008±0.002
Final Mean Weight	1.902±0.006	1.269±0.005	1.396±0.008	2.002±0.004
Mean Weight Gain	1.896±0.002	1.267±0.002	1.392±0.003	1.926±0.003
Specific Growth Rate	3.386±0.004	2.263±0.002	2.246±0.004	3.426±0.004
Protein Efficiency Ratio	0.055±0.005	0.054±0.004	0.050±0.006	0.056±0.004
Protein Intake	34.31±0.007	23.69±0.006	25.59±0.008	34.42±0.006

Morphological and Behavioural Observations
Ten days after starting the experiment, fry fed only formulated diet were visually smaller than those fed live diet and the combination of both. Moreover, larvae fed formulated diets were less active and remained dispersed on the bottom of the aquaria, at half depth. Fry fed combination of live and formulated diets had better activity, it was also observed that fry fed live food seemed to be the most active.

Discussion
In the present study, creating a simulated environment for gold gourami increased the chance of reproducing in captivity when they are not induced, so also is the regular check on the water parameters which increased their survivability. Gold gourami fry fed live diet had the best utilization and growth followed closely by fry fed with the combination of lives diet and formulated diet. This is in agreement with other reports on different fish species which suggested that co-feeding strategy in some commercially important marine aquaculture species improved growth and survival rates (Canavate & Fernandez-Diaz, 1999). Formulated diet-fed fry had the lowest growth and feed utilization from this experiment.

Success on cultivation of gold gourami larvae, like many other fish species, is markedly improved when live diet is provided (Rottmann et al 1991). Feeding only formulated diet may result in physiological and, or morphological immaturity of the digestive system of fish larvae, and in the absence of proteolytic enzymes, supplied by live food in the digestive tract, or both (Ronnestad et al 1999; Kolkovski, 2001). A deficiency in digestive enzymes in young larvae explains the lack of success in formulated diet feeding (Dabrowski & Glogovski, 1997). A potential role of the enzymes of prey organisms in larval digestion has often been argued, but without conclusive result. Live feed consumed by the larvae assisted the digestion process by donating their digestive enzymes, either by autolysis or as zymogens, which activated the larval endogenous digestive enzymes (Kolkovski, 2001). There is no consensus on this subject, and proteases derived from live diet have been shown to make only a small contribution to enzymes found in some fish species (Cahu & Zambonino, 2001). Feeding prey organisms for a short time before formulated diet is offered may increase digestive activity and increase the ability of larvae to digest formulated diets. Additionally, the superior growth of larvae fed live diet may result from increased food intake, nutrient digestibility, and assimilation of live diets, instead of higher nutritional value (Cahu & Zambonino, 2001).

Conclusion
The result of this feeding trial revealed that gold gourami can be reared and perform well in a simulated environment that is well conditioned i.e. optimum temperature, pH and oxygen and that live food are best utilized for best growth and feed utilization of gold gourami, also a large number of the fry will survive if they are well catered for i.e. creating space for their movement and feed availability.

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Analysis Of Gender Dimensions Of Social Capital And Rural Households' Welfare In South Western, Nigeria

By

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Abstract

Social capital is a household welfare asset which has the potential to break the poverty cycle. There is also increasing recognition of gender disaggregation in research. However, there is little evidence on gender sensitivity in analysing the effect of social capital on welfare status in Nigeria. Hence, this study examines gender dimensions of social capital and their effects on rural households' welfare in Southwest Nigeria. A multistage random sampling technique was employed to select 370 respondents based on probability proportionate to size of the communities. Data were collected on socio-demographic characteristics, social capital dimensions (group and network, trust and solidarity, Social Cohesion and Inclusion -SCI, collective action and cooperation, Information and Communication -IC, and Empowerment and Political Action -EPA) and expenditure variables using a set of structured questionnaire. Data were analysed using descriptive statistics, multiple and Tobit regressions (p= 0.05). Male Household Heads (MHH) constituted 51.3% while Female Household Heads (FHH) constituted 48.7%. Index of density of membership in association was 0.30 for both sexes. Male household heads had 0.73 index of participation while FHH had 0.58. Female Household Heads were more involved in IC (0.69) compared with MHH (0.46). The SCI index was 0.47 for MHH and 0.65 for FHH. Male household heads participated more in EPA (0.67) compared with FHH (0.21). Aggregate social capital variables enhanced households' heads welfare by 5.0% for MHH and 6.8% for FHH. Social capital influenced welfare of female than male headed households. Participation in decision making and increase in education level enhanced household's per capita expenditure. Household size, meeting attendance and age negatively affected household welfare.

Keywords: Social capital, Gender dissaggregation, Household welfare, South-west Nigeria.

Introduction

The dimensions and the effects of social capital on rural households have been identified as key factors shaping people`s access to and use of resources that could improve their welfare (Agrawal, 2000; Cleaver,1998, World Bank, 1999). However, most discussions of social capital appear to have been almost gender blind (Molyneux, 2002) or even critical toward women's role in the formation and maintenance of social capital (Riddel *et al*; 2001, Wilkinson & Pickett, 2009). As a result, the analysis of gender biases of social capital is a collective action that (re)produces gender discrimination and reinforces male dominated power structures.

One area in which social capital literature is lacking is gender (Kilby 2002). Ethnic and gender dimensions of social capital remain under-recognized (Grootaert, 2002). In the literature, social capital is generally conceptualized as gender blind, paying little attention to gendered intra household issues of power and hierarchy (Norton, 2001). Silvey and Elmhirst (2003) argued that a more complete picture of social capital is specifically one that includes attention to the gendered and intergenerational conflict and hierarchies within which social networks are forged. Discussions on the gender aspects of development and environment has its origin in the theories of Women, Environment, and Development (WED), which highlight women as having a special relationship with the environment due to their responsibilities for the family and concern for the wellbeing of future generations (Maluccido *et al*, 2002, Uphoff *et al*, 2006, Waenecke, 2008).
With respect to social networks, a number of researchers have found that women often depend more on informal relations and so form stronger kinship and friendship relations than men, who tend to rely more on formal relationship (Rupasingha *et al*, 2002, Molyneux 2002). Molinas (1998) found that successful collective action is dependent on the degree of women's participation. This is consistent with the argument that women exhibit more cooperative behaviour than men due to greater interdependence and altruism (Forest & Kearns, 2001, Yusuf, 2008).

Gender differences in several aspects of social capital have also been identified or hypothesized, but these two strands of analysis in the literature have not been well integrated. Several important and unanswered questions have practical implications for policy and program design. For instance, to what extent do women and men demonstrate differences in household welfare outcomes based on collective action? Do women tend to build and use social capital more readily than men? and if so, is this associated with greater differences in household welfare improvement? The family is the main source of economic and social welfare for its members. It is the first building block in the generation of social capital for the larger society.(Bookman 2004, Hardin, 2006, Warmecke & DeRuyter, 2008).

Development programs are often criticized for failing to account for gender inequalities in decision making, task allocation and resource ownership and management, which has Implications for policy recommendations (World Bank, 2001, Quisumbing 2003). Gender inequalities almost always favor men, with women often being disadvantaged both in the control over household assets (Fafchamps and Quisumbing 2003) and in the division of responsibilities in the household and in the community. Even when a woman heads the household and is in charge of household resources, gender differences emerge across female-headed households and their male-headed counterparts. Significant heterogeneity among female-headed households has also been highlighted in the literature implying differential provision of resources and their use among rural settings (Peters 1983). Women and men also have different resource endowments when pursuing livelihood strategies, which could have far-reaching consequences on social capital formation and information exchange. To build and maintain a social network is costly in terms of both time and other resources (Dasgupta and Serageldin, 2000, Vankatesh 2006), imposing a barrier to social capital accumulation (Ioannides and Loury 2004, Yusuf *et al*, 1999).

Research documenting the role of social capital on information flows in developing economies has been growing. Limited attention has been given to gender aspects that may influence both social learning processes and accumulation of social capital. Emerging empirical evidence provides support for the role of gender in information exchange through different, gender-related stocks of information and usage of social capital (Maluccio *et al*. 2003, World Bank and IFAD, 2001). In many rural areas, where small-scale agriculture takes place, gender differences have been found to have a significant impact on resource allocation and productivity in agriculture (Alderman *et al*. 2003). This paper contributes to the literature by providing evidence of gender disparities in the access and exchange of information in south west Nigeria.

Therefore, the following research questions guide the execution of the study. What are the main components of social capital? How do some relevant socio economic variables influence social capital index being constructed? To what extent do social capital components affect household welfare based on gender? The specific objectives are to:-identify the social capital components from which to construct the social capital index, estimate the influence of relevant socio-economic variables on the social capital index, and ascertain the effects of social capital components and other factors on households welfare,.
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Theoretical Framework and Gender Social Capital Network
Women as primary care givers are seen as playing a critical role in the process of social capital formation. The social capital thus generated is an important means by which women gain access to resources and economic opportunities thereby helping them to find an exit path out of poverty. A gender analysis of the impacts of the improved groundnut production technology introduced in Mahanrastra, India during the 1980's led to the conclusion that gender is a key variable in relation to labour activity pattern, time use and crop product utilization and perceptions of needs of new technology development (Knack, 2002).

Information of this kind provides evidence that gender makes a difference in economic circumstances. The idea that society matters for economic growth is not a novelty in the economic debate. As pointed out by Coleman (1990), the interaction between the organization of a society and its economic performance was once considered the fundamental question of political economy." Despite its acknowledged importance, this issue has been neglected by the contemporary economic literature. During the last decade and due to spurs coming from the other social disciplines, the recent emergence of indigenous growth theories in economics, we have witnessed a real explosion of the number of studies addressing the social roots of growth often grouped together under the common label of social capital has been seen to have gone up. Scholarly interest in the concept of social capital is motivated essentially by the relationship between the stock of social capital and its relation to effective political institutions, economic development, low crime rates, and reduced incidences of other social problems. Coleman (1998) and Putnam (1993) argued that social capital is significantly positive on household welfare, economic growth and development. It promotes trust and cooperation among agents which in turn increases socially efficient collective action (World Bank 1996, Lawal and Shittu, 2006).

Few studies that investigated the causes of social capital did not examine the influence of socio-economic variables on social capital index (Brehm and Ralm, 1997: Alesina and Laferrara, 2000,

Glaeser *et al*; 2000, Council of Europe, 2006). They did not substantiate their claims empirically nor investigate the factors associated with variation in social capital levels. This study therefore used an array of individual and community-level factors as determinants of social capital. Previous empirical investigations of the determinants of social capital are based on surveys using quantitative method for data analysis, discussion and results (Putnam, 1995, Brehm and Rahn, 1997, Alesina and La Ferrora, 2000; Glaeser *et al*; 2002). Moreover, general social surveys which measures trust, civic engagement and association of individual were ambiguous and their results were not clear enough to vividly reveal the policy implications. Research documenting the role of social capital on information flows in developing economies has been growing. Limited attention has been given to gender aspects that may influence both social learning processes and accumulation of social capital. Emerging empirical evidence provides support for the role of gender in information exchange through different, gender-related stocks of information and usage of social capital (Maluccio *et al*. 2003). In many rural areas, where small-scale agriculture takes place, gender differences have been found to have a significant impact on resource allocation and productivity in agriculture (Alderman *et al*. 2003). This paper contributes to the literature by providing evidence of gender disparities in the access and exchange of information in the study area.

Methodology
Study Area.
The study was conducted in south western Nigeria. The region comprises six states namely Lagos, Oyo, Ogun, Osun, Ondo and Ekiti States. Osun state is one of the twelve pilot states for the Community Based Poverty Reduction Agency programme by the World Bank and Federal government of Nigeria (NPC, 2000; FOS 2000). It also has a relatively well organized Agricultural Development Programme ADP coupled with a large number of co operative societies and other formal and informal associations (World Bank, 2000). The state has a tropical type of climate marked by a distinct dry (November March) and wet (April - October) season. Its average temperature is 30^0 while relative humidity could be as high as 95 percent.

Osun State has thirty local government areas and Modakeke Ife area office. It covers an area of approximately 14,875 square kilometres and lies between longitude 0400E and latitude 05558 . It has a population of 3.4 million (NPC,2006) and falls in the humidity forest / derived savannah zone with elevation of between 200m to 1000m above sea level. It shares borders with Kwara state in the north, Ondo in the south, Ekiti in the East and Oyo/ Ogun in the west. The indigenes are Yorubas and are composed of the Oyos, Ifes, Ijeshas and Ibolos. Traditionally, the people engage in Agriculture and are into food crops such as cassava, yam, rice, plantain, banana, sweet potatoes, and vegetables while cash crops such as cocoa, kola nuts, oil palm and citrus are produced in large quantities. Other occupation of the people includes hand weaving, mat weaving, tie and dying, wood carving, drumming and drums making among others.

Ondo State is one of the oil producing states in Nigeria and one of the richest states in the south west with relatively high number of cooperative societies (NEEDS,2006, Ondo State, 2003). It has a land area of 14,769km^2 with a population of 3.44102 million people (NPC,2006) and consists of eighteen local government areas. Geographically, Ondo is located between longitude 4.30^{0}E and 6.00^{0}E of the Greenwhich and Latitude 5^0 45^1 and 8^0 15^1 of the equator. Kwara, Kogi

and Ekiti states bound the state to the North. Edo and Delta states to the East: Ogun and Osun states to the West and the Atlantic Ocean to the South.

Method of data collection
Both Primary and Secondary data are utilized in this study. Primary data were collected by means of well structured questionnaire and personal interviews. The study employed multistage sampling techniques. The first stage involved the purposive selection of Osun and Ondo states from the six States that made up the south west. The choice was based on the fact that they have the highest number of cooperative societies as well as organised professional and local associations (NEEDS, 2006). Osun and Ondo states have three senatorial districts each. Two of these districts were purposively selected in each state based on the number of registered cooperatives. (SEEDS, 2006) In Osun state, these are Osun central and Osun East while in Ondo state; they are Ondo central and Ondo north, making the first stage. The random selection of four local government areas each from the ten local government areas of Osun central and the ten LGAs of Osun East totaling eight and four LGAs each from the six Ondo central and the six LGAs of Ondo North. In all, the selection of 16 LGAs from the 38 LGAs in the two states formed the second stage. The third stage was the random selection of five communities each from the selected local government areas.

Finally, from Osun Central 90 respondents were randomly selected and 100, respondents were selected from Osun East, thereby making a total of 190 respondents from Osun State. Also, 90 respondents were randomly selected from Ondo central and another 90 from Ondo north. In all, 180 respondents were sampled from Ondo State. However, of the 190 respondents from Osun state, only 160 gave consistent responses. Also in Ondo state, only 160 out of the 180 respondents gave correct responses. In all, a total of 320 responses were analysed in this study. The remaining 50 respondents were excluded due to inconsistencies in their responses. This study measures social capital at the local government level, using households, to enable it compare the results with those obtained previously in the state level analyses. Also the study presents a production function for social capital using associational activities as well as other indicators of social capital. The work of Putnam (1993) which shows that associational activities enable communities to solve collective action problems by promoting cooperation will be adjusted to solve and modify productive resources problem in the study area. A more general household-level social capital index would be formulated using several measures including associational densities.

Methods of Data Analysis
The study employs analytical techniques based on its objectives. The tools include
1. Descriptive Statistics
2. Multiple Regressions : Social Capital Index, Household Welfare Model, Household Income model
The key feature of this model is the assumption that social capital is truly "cap *et al* ital" and hence has a measurable return to the household. Social capital has many "capital" features: it requires resources (especially time) to be produced and it is subject to accumulation and de-accumulation. Social capital can be acquired in formal or informal settings, just like human capital (e.g., schools versus learning-by-doing). Much social capital is built during interactions which occur for social, religious, or cultural reasons. The key assumption is that the networks

built through these interactions have measurable benefits to the participating individuals, and lead, directly or indirectly to a higher level of well-being. This is the proposition which we test empirically in the study by means of equations.

Various functions which determine access to credit, agricultural inputs or other factors which enhance the productivity of a household enterprise could be used but in these estimations, we focused on credit. The dependent variable of the equation is the natural logarithm of household income per capita. The explanatory variables consist of the asset endowment of the household, demographic control variables, and location dummy variables. Household assets are assumed to consist of human capital, social capital, land, and physical assets. Human capital is measured conventionally by the years of education of the adult members of the household. The LLI study data set contains information on land, crops, cattle and farm equipment owned by the household. Direct

Inclusion of these variables as regresses in equation is problematic due to possible endogeneity.

Social Capital Index is used to classify respondents in terms of their participation in the identified social capital dimensions. It is an input-based index that quantifies each level of participation of the respondent's priorities in terms of the degree of participation. This index will show the degree of participation of the respondents in the identified dimension.

A typical composite indicator (I) can take the following form:

$$I = \sum_{i=1}^{n} w_i X_i \qquad (1)$$

where:

X_i are normalized variables.

w_i are weights assigned to X_i, where $\sum_{i=1}^{n} w_i = 1$ with $0 \le w_i \le 1$ and $i : 1,...,n$.

I is the typical composite indicator of social capital index of the respondents

Wi`s are weights assigned to degree of participation of respondents to social capital dimensions.

Where n (number of identified social capital dimensions) = 6

The social capital dimensions used are GNY = Group and Network, TSY = Trust and Solidarity, CAC = Collective action and Cooperation, IFC = Information and Communication, SCX = Social Cohesion and Inclusion, and EPA = Empowerment and Political Action.

Before the method of standardization, re-scaled values are created in order to assign an identical range for the standardized scores for every indicator. Re-scaling ensures that the transformed indicators are given a value relative to the global maximum and that the re-scaled index takes a value from 0 (worst) to 1 (best) as follows:

$$y_{in} = \frac{x_{in} - \min(x_i)}{\max(x_i) - \min(x_i)} \qquad (2)$$

Where ? in = The Standardization score

In this example standardization is based on the range rather than on the standard deviation and the extreme values (minimum and maximum) may in fact be unreliable outliers. While the method

may be more robust where there are numerous outliers, the range for indicators with very little variation will increase and these will contribute more to the composite indicator than they would if the un-scaled method was used. This technique is therefore more dependent on the value of the weights for each indicator than the un-scaled method where the contribution of each indicator to the composite depends on both the weighting and the variance of the indicator. Thus the re-scaling method is linked to the issue of choice of weights. In other words, the overall index will be affected by the performance of the worst and best country.

Therefore the Social Capital Index SC is constructed as follows:

$$SC_{it} = (GNY_{it}) + a(TSY_{it}) + d(CAC_{it}) + ?(IFC_{it}) + ?(SCX_{it}) + D(EPA_{it}) \qquad (3)$$

Where the variables are as defined earlier.

Social Capital Index Model is used to estimate the effects of social economic variables on households' Social Capital. Social Capital Index (SCl) = this is an aggregation of the responses of each household to the questions on the various social capital dimension mentioned above, On each of the six dimensions', each household answered questions on it. Hence, for each of the factors a yes response is coded 1 while no response is coded 0. A maximum score of 10 for each association represents the highest level of heterogeneity. The scores by the six dimensions for each household are then divided by the maximum score of 60 to obtain an index.

Model Specification.

$Sc_1 = f (X_1, X_2, X_3, . . . , X_{18})$

The estimated linear equation arising from the functional form is

$Sc_1 = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_3 + . . . + B_{18}X_{18} + U_1$................................ (4)

Where S_{c1} = social capital index, U_i = error term, B`s = parameters to be estimated,

X_1 = sex of household head. X_1 = 1 if household is male and 0 otherwise

X_2 = Household size (number)

X_3 = Education level of household head (year)

X_4 = Household head membership of association (years)

X_5 = Age of household head (years)

X_6 = Marital Status of household head. X_6 = 1 if married and 0 otherwise

X_7 = Farm size which is a proxy for household wealth (hectares)

X_8 = Primary occupation of household head. X_8 = 1 if farming and 0 otherwise

X_9 = Cooperative society membership. X_9 = 1 if head is a member and 0 otherwise

X_{10} = Farmers`association membership. x_{10} = 1, if head is a member and 0 otherwise

X_{11} = Amount contributed by the household head to the associations (Naira)

X_{12} = Source of credit. X_{12} = 1 if from farmers` association and 0 otherwise

X_{13} = Source of credit. X_{13} 1 if from community association and 0 otherwise

X_{14} Source of credit. X_{14} 1 if from cooperative society and 0 otherwise

X_{15} Source of credit. X_{15} = 1 if I from roscas and 0 otherwise

X_{16} Source of credit. X_{16} = 1 if from Bank and 0 otherwise

X_{17} Source of credit. X_{17} = 1 if from friends and 0 otherwise

X_{18} Source of credit. X_{18} = 1 if from money lenders and 0 otherwise and

U_1 = Error term

Result and discussion
Demographic and socio-economic characteristics of household heads

Social economic characteristics of the sampled households

The households included in the sample have varying socio-economic characteristics. The distribution of the sample based on the characteristics is shown in Table 1 below.

Table 1: Distribution of household heads based on selected socio-economic characteristics (N = 320)

Characteristics	Male (%)	Female (%)	Pooled
Age Distribution 21 - 30	38	39	77
31 - 40	52	85	137
41 – 50	53	25	78
51 – 60	21	7	28
Mean			44.43
Standard deviation			13.25
Household Size 1 - 3	43	40	83
4 - 6	43	49	92
7 - 9	51	44	95
>9	26	23	49
Mean			5.73
Standard deviation			3.31
Household educational status (yrs)			
Primary School	7	7	14
Secondary school	69	70	139
Specialised school	40	25	65
Tertiary Institution	48	54	102
Mean			2.8
Standard deviation			0.94
Primary livelihood Household Head			
Crop Farming	130	115	245
Livestock farming	10	16	26
Fish farming	2	4	6
Trading in manufactured goods	4	12	16
Engaged in Paid Employment	18	9	27
Mean			1.95
Standard deviation			1.54
Farm size (Hectares)			
.50-0.99	23	15	38
1.0-1.49	20	14	34
1.50-1.99	10	22	32
2.00-2.49	40	35	75
2.50-2.99	20	27	47
3.00-3.49	22	9	31
> 3.00	5	7	12
Mean			2.44
Standard deviation			1.75
Source of credit facilities			
Family and friends	58	71	129
Local Associations	80	78	158
Banks	26	7	33
Marital Status	40	36	76
Single	90	82	172
Married	15	15	30
Separated	12	18	30
Divorced	7	5	12
Widowed			
Household head membership			
No of association	68	63	131
1 - 2	45	52	97
3 - 4	28	22	50
5 - 6	23	19	42
7 - 8			
Active participation in Decision making Leader	70	41	111
Very Active	98	39	137
Somewhat Active	47	18	65
No participation	1	6	7

Source; Field Survey 2007

Table 2: Age Distribution of Household Heads (years)

Age	Male		Female		Pool	
	Freq	%	Freq	%	Freq	%
21-30	38	23.17	39	25.00	77	24.06
31-40	52	31.71	25	16.03	77	24.06
41-50	53	32.32	85	54.49	138	43.13
>50	21	12.80	7	4.48	28	8.75
Total	164	100	156	100	320	100
Mean	44.1		42.3		43.2	
SD	2.2		1.2		2.0	
Min	25		23		24	
Max	80		75		80	

Source; Field Survey 2007

Table 2 shows the age distribution of household heads in the study area. The mean age of household heads is estimated at 44.1 years for male household heads and 42.3 years for female household heads. The average age of the household heads for both male and female in the study area are below the national average age of 46 years. About 33 percent of the male household heads are headed by persons aged between 41 and 50 years while about 32 percent of the male household are between 31 and 40 years of age. Similarly, about 55 percent of the female household heads are between 41 and 50 years of age while only 25 percent of the female headed persons are between 31 and 40 years of age. More importantly, it is observed that only 23 percent of the male household heads are between 21 and 30 years while about 25 percent female house hold heads are between 21 and 30 years of age. About 13 percent of the male sampled household heads are aged 51 years and above while about 4 percent of the female headed households are aged 51 years and above. In essence, the age distributions showed that most of the respondents sampled (84 percent) are still economically active with just 16 percent in the retirement category

The age of the household head is expected to be negatively related to their involvement in social capital dimensions.

Table 3 shows the index of density of membership of both male and female household heads in the study area. The result reveals that about 31 percent of the male household heads belong to at least three associations while about 40 percent of the female household heads belong to at least three associations. Also it is discovered that about 29 percent of male household heads belong to at least six associations while 25 percent of female household heads belong to at least six associations. About 4 percent of the male respondents belong to about 8 different associations while about 2 percent of female household heads belong to about 8 different associations. Most of the associations the male household heads belong to are formal such as professional groups, farmers association, artisan, religion, cooperative societies, road transport workers, and ethnic groups while most of the associations of the female respondents are informal such as religion, ethnic or town associations, cooperative societies, local money lenders, rotating contributions and so on.

Table 3: Household Density of Membership Index

Density of membership (%)	Male		Female		Pooled	
	Freq	%	Freq	%	freq	%
1-2	51	31.10	44	28.20	95	29.69
3-4	50	30.49	62	39.74	112	35.00
5-6	47	28.66	39	25.00	86	26.88
7-8	10	6.10	8	5.13	18	5.63
>8	6	3.66	3	1.92	9	2.81
Total	164	100	156	100	320	100
Mean	30.4		30.4			
Min	5		10		5	
Max	85		76		85	

Source: Field survey 2007

Table 4.shows the different types of association the household heads belong to in the study area. The result indicates that about 48 percent of male household heads belong to cooperative societies while about 40 percent of female household heads belong to cooperative societies. About 25 percent of both sexes belong to farmers groups. About 28 percent of female household heads belong to religious groups while about 4 percent male respondents belong to religious groups. More importantly, about 22 percent of male respondents belong to professional associations while just 5 percent of female belong to professional associations. The respondents motives in joining associations are determined by the benefits being derived from the associations may be this is why majority of the respondents belong to cooperative and farmers groups.

Table 4: Households' Group and Network Index

Participation in Network	Male		Female		Pooled	
	Freq	%	Freq	%	freq	%
Ethnic/Religion	5	3.05	44	28.21	49	15.31
Professional Association	36	21.95	8	5.13	44	13.75
Farmers Group	40	24.40	39	25.00	79	24.67
Cooperative Society	77	46.95	62	39.74	139	43.44
Others	6	3.66	3	1.92	9	2.81
Total	164	100	156	100	320	100
Mean	73.2		57.8		68.43	

Source: Field survey 2007

Table 5 shows the household participation in decision making activities. The result indicates that only about 5 percent of male household heads are leaders while about 4 percent of female household heads are into leadership position of the associations. Furthermore, the result shows that about 24 percent of the male respondents are very active in decision making activities while about 14 percent of female respondents are active participators in decision making activities. More importantly, over 51 percent of male household heads are somewhat active in decision making while about 57 percent of female household heads are somewhat active in decision making. The decision making index of male household heads is 73.2 while that of female household heads is 57.8. The result shows that male household heads are more involved in decision making activities, hence the tendency to dominate their female counterparts.

Table 5; Households' Decision Making Index

Decision Making Index (%)	Male		Female		Pooled	
	Freq	%	Freq	%	Freq	%
Leader	8	4.88	6	3.85	14	4.38
Very Active	39	23.78	23	14.74	62	19.38
Somewhat Active	85	51.83	87	55.77	172	53.75
No Participation	32	19.51	40	25.64	72	22.50
Total	164	100	156	100	320	100
Mean	73.2		57.8			

Source: Field survey 2007

Summary Statistics of the Social Capital Dimensions.

Six dimensions of social capital and other variables were studied. These include Group and Networks, Trust and Solidarity, Collective Action and Cooperation, Information and Communication, Social Cohesion and Inclusion and Empowerment and Political Action. Table 6 presents the summary statistics for each of these dimensions. Under groups and networks, an average household of 5 individuals belongs to at least 3 associations and has 62 percent index participation. More importantly, the households have high trust and solidarity index 59 percent while collective action and cooperation index is 94 percent. Sharing of information and communication index among households is relatively moderate 54 percent while social cohesion and inclusion participation index is 57 percent but there seems to be a very low empowerment and political action involvement of about 44 percent. This implies that rural house hold participation in politics is below average. The various dimensions of social capital and Gender are further presented based on the specific characteristic of households presented in Table 6

Table 6: Social Capital Dimensions and Gender

Social Capital Dimension	No Variables	Male (%)	Female (%)	Total
Groups and Networks	25	66 (53.23)	58 (47.77)	124
Trust and Solidarity	15	62 (52.99)	55 (47.00)	117
Collective Action and Cooperation	8	100 (53.14)	88 (46.80)	188
Information and Communication	25	50 (46.30)	58 (53.70)	108
Social Cohesions and Inclusion	15	53 (46.49)	61 (53.50)	114
Empowerment and Political Action	35	46 (52.87)	41 (47.13)	87
Mean		**63 (51.22)**	**60 (48.78)**	123

Source: Field Survey 2007

Table 6 indicates that the female headed households have higher values of social capital in information and communication (58) and social cohesions and inclusion (61) than their male counterparts. The higher information and communication (53.70%) may be due to the fact that females naturally have the tendency to always gather information about location of new markets as well as introduction of new entrants and products into the market including current market prices of their products. Also, female headed households have higher social cohesion and inclusion (53.50%) to indicate their natural ability to join local associations purposely to enhance their households' welfare. Conversely, male headed households have higher social capital index in groups and networks, trust and solidarity, collective action and cooperation and empowerment and political action. The male dominance of groups and network may not be unconnected with the need to join various social groups and associations to boost their mean per capita expenditure while their dominance of collective action and cooperation may be due to their involvement in community based poverty reduction projects or communal activities. Male headed households are also more involved in empowerment and political action because of the need to enhance their economic and social status through political activities.

Social Capital Dimensions and Participation in decision making activities
The various social capital dimensions based on participation in decision making is presented in Table 7. From Table 7 it was revealed that social capital dimensions increase with the status of household members in local level associations because leaders participate most in decision making more than others. This may not be unconnected with social and other benefits derivable by the leaders.

Table 7: Social Capital Dimensions and Active Participation in Decision Making

Social Capital Dimension	Leader	Very Active	Somewhat Active	No Participation
Groups and Networks	145	101	70	4
Trust and Solidarity	156	128	27	9
Collective Action and Cooperation	111	137	65	7
Information and Communication	84	129	84	23
Social Cohesions and Inclusion	137	113	51	19
Empowerment and Political Action	201	71	20	28
Mean	**139**	113	53	15

Source: Field Survey 2007

Household Welfare and Social Capital: Disaggregating the Social Capital Index
Social capital has returns to the household that are similar in magnitude to those from human

capital and it provides little guidance as to which aspect of social capital produces this result. The aggregate index used in the previous section was based on three of those dimensions, which were assumed to interact with one another in a multiplicative way. This implies, for example, that heterogeneity or internal functioning may have different effects depending upon the number of associations of which the household is a member.

Table 8: Household Welfare and Social Capital : The Aggregate Model

Characteristics	Basic Model	Specification without Social Capital
Intercept	15.35 (23.11)	13.19 (14.12)
Social Capital Index	0.0052 (4.18)	-
Household Size	-0.0732 (9.16)	-0.0638 (7.16)
Educational Status Household Head	0.0152 (4.12)	0.0285 (5.41)
Female Head of Household	0.0418 (4.48)	-0.0058 (1.19)
Male Head of Household	0.00912 (0.95)	-0.0013 (0.71)
Age of Household Head	0.0417 (4.19)	0.0391 (4.01)
Age of Household Head Squared	-0.00126 (3.23)	-0.00273 (3.48)
Household Asset Score	0.0034 (3.61)	0.00916 (1.19)
R.squared	0.31	0.26
F-Statistics	32.7	28.11

Notes: 1. Dependent Variable = In (Income per capital)

2. t-statistics are in parentheses and are based on robust standard errors

Source; Field Survey 2007

However, it is also possible to consider that each social capital dimension acts independently, and that the effects are additive. The conceptual literature on social capital is not advanced to the stage that theoretical arguments can be put forth to select one approach over the other hence the use of additive model, in the model the aggregate social capital index with seven variables capturing the six dimensions of social capital (membership contributions are captured by two variablesdecision making and work contributions). Twelve variables were significant, these include groups and networks(3.19), trust and solidarity (3.51), collective action and cooperation (4.13), information and communication (2.41), social cohesion and inclusion (4.93), number of memberships (2.25), participation in decision making (5.14), household size (6.71) educational status of household head (4.17)age of household head (3.41), age of other household members (4.15) and household asset score (4.28)   The degree of active participation in decision making and the extent of payment of dues in kind are the most important aspects (Table 8). Households in the study area averagely belong to 3 associations. The coefficient of the membership variable

0.0017 p<0.001 indicates that an additional membership is associated with a higher household expenditure level. In the context of the model this is interpreted as the economic return to memberships in local associations.

Alluding to the possibility of reverse causation: high income households could have a higher demand for associational life, probably because they have more leisure (although the opportunity cost of their time is also higher). One can certainly argue that associational life has a consumption value and is not sought merely for its economic benefits. Clearly, this is related to the type of association: participating in church choir may have more consumption value than joining the farmers' cooperative. There is a close parallel in the interpretation of the coefficients of human and social capital variables. The former represent the return to years of investment in education through school attendance. In the case of social capital, the main input is also time, and the coefficient measures the returns to that time spent in developing networks, attending association meetings, etc. This time can indeed be spread over many years.

Table 8 suggests that the benefits from participating in internally heterogeneous associations are higher than from associations whose members are more alike. The reasons for this may have to do with the exchanges of knowledge and information that occur among members. Members from different backgrounds may learn more from each other because they have different knowledge to start with. A further analysis of heterogeneity (by including each dimension as a separate regressor in the model) supported this conclusion: the economic dimensions of heterogeneity (occupation, economic status and education) matter the most. In other words, associations where members differ in economic attributes yield more benefits to their members than associations where members differ primarily in demographic attributes. Location also matters: benefits are greater if the association brings together people from different neighbourhoods. Differences in location and economic characteristics indeed maximize the chance that association members have different knowledge and hence maximize the potential gain from exchange. Social capital dimensions relating to active participation in decision making and internal heterogeneity have positive effects on household welfare. This finding strengthens the case for viewing social capital as an input in the household's production function. This in turn opens up the case for investing in social capital, just as investments are made in human capital.

Conclusion
The magnitude of the social capital effect was found to be similar to that of human capital. The underlying structural equations treat social capital as an input, together with human and physical capital, in the household's production function. The effects of gender dimensions on social capital operate through (at least) three mechanisms: sharing of information among association members, reduction of opportunistic behaviour, and knowledge to be shared is larger and hence the potential benefit to members is higher. We found indeed that heterogeneity along dimensions such as education, occupation and economic status (which are likely to correspond to differing knowledge) confers the greatest benefits .Social capital reduces the probability of being poor and the returns to household investment in social capital are higher for the poor than for the population at large. This is especially the case for the number of memberships and households'

active participation in decision making. This underscores the potential pay-off to poor households from investing more time in creating social capital by participating actively in local associations. Social capital is hypothesized to have several long-term benefits, such as better access to credit and a resulting to better ability to smoothen out income fluctuations by borrowing and/or accumulating assets. Our empirical results confirm the validity of these propositions and highlight again that the internal heterogeneity of an association and its members' active participation in decision making are the key factors .

Among the six dimensions of social capital, the strongest contributions are from trust and solidarity, social cohesion and inclusion and collective action and cooperation. Similar to previous researches, the numbers of association membership and financial institutions have impact on the income of farmers and general households. Because trust was one of the most important aspects of social capital for the households, Nigerian governments may use regulations and economic incentives to encourage the change actor's behaviour to enhance trust. In the case of women, government may increase the monitoring and enforcement of implementing agreements and contracts among them and their customers. In the case of general households, traditional and communal activities may be regularly organised to create confidence through providing occasions for trust and commitment. Similarly, reciprocity may be enhanced through a policy that maintains and encourages cooperation among households (a policy to establish cooperative associations in which households can exchange labour, inputs and burrow credits to satisfy urgent needs for production activities). At the same time, through this cooperation, people may come to understand one another better thereby enhancing interpersonal trust and promoting even more cooperation.

The case study analysed also shows that Social capital has been a key instrument in undertaking social and productive projects, improving their living conditions and fighting the social exclusion of households in the study area. The households that engaged in social capital are more successful especially in the area of collective assets, obtaining external resources and the development of more highly paid activities. Without mincing words, Social Capital is a resource that enables those who possess it to obtain benefits that are unavailable to those who act individually or lack important connections. This does not mean that Social Capital is a sufficient condition for or the main factor in community development. It is a complex process involving several factors including Social Capital, a dynamic national economy and politics and favourable government policies and programmes. Social Capital is a necessary factor in the fight against rural poverty. Social Capital also helps to achieve specific, short-term objectives as well as broader, more sustainable objectives. Sustainable Projects are more difficult to accomplish since they imply a transformation of social relations that determine the distribution of benefits and opportunities in local areas. If the local power is rigid, non-democratic and controlled by agents opposed to poor groups, a high mass of social capital will be required to transform these structures. However, community social capital is fragile and may be weakened by adverse internal and external conditions. As a result, synergy must be established between Social Capital and government policy, whose task is to create institutions to facilitate the participation of the public in local level .associations.

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University Location And The Immediate Rural Economy Performance: An Assessment Of The Socio Economic Variables

By

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Abstract

The most dominant and economic features of rural Nigeria are poverty, unemployment, inequality and poor infrastructure among others. Past studies have highlighted that the transmission of these rural areas is the key to any meaningful programme of development and social change. Consequently, this study examined changes in income, physical growth, non-agricultural employment and state of infrastructures within the immediate rural communities of a University. Joseph Ayo Babalola University (JABU) Ikeji-Arakeji in Oriade Local Government Area was considered as a case study among other recently established universities in the south-west located in a remote area. Information was sourced from two sets of questionnaires administered on 68 respondents in the rural communities within 10km of the University. Results revealed that about 17%, 26%, 21% and 34% of the respondents in each of the communities earned between N500 and N50, 000 per annum before the university creation as against 19%, 26%, 21% and 37% of the respondents after the University started. The study also revealed that 17%, 28%, 20% and 34% were offered paid employment by JABU Management. This implies that the University has had effects on the social and economic well being of the rural communities. These are in terms of residents' increased earnings, numbers of houses built, provision of employment opportunities and inter-village roads.The study recommended that information centre that could create the awareness of opportunities in a privately owned university like JABU be sited in a rural community. Also, a more efficient and comprehensive data collection mechanism as a basis for design and evaluation of programmes for effective food production system should be installed.

Keywords: Socio-economic Impact, Income diversification, Infrastructural Development.

Introduction

The rural sector in Nigeria has come to be identified as the backward sector of the economy (Olajide *et al,* 1975). Its most distinguishing characteristics are poverty, the associated phenomena including mass illiteracy, malnutrition, ignorance and disease (Enabor, 1998). The rural area has been described as usually barren of modern social amenities. There are few or no hospital and schools, electricity and water supply are usually not available. The general atmosphere in the rural area is one of despondency or even hopelessness. The overall development policy had favoured industries located in urban areas, leaving basic rural problems unresolved. The influx of rural migrants seeking better jobs in urban areas has been greater than the numbers that could be absorbed. This has led to immense pressures on the infrastructures and social stability of urban areas (Udo,1975). Concurrently, the emphasis on urban development ignored the associated problems of under development in rural areas where the majority of the people in this country live.

Historically, institutions of higher education influence their host communities and immediate environment through activities like: programmes of advanced instruction which help to ensure that the area economies have sufficient numbers of trained professionals. Also, application of campus research initiatives to address local or regional needs and the development of collegiate public service programs to address specific community concerns and to help promote dialogue between the campus and the community (Hampton and Higham, 2005). Universities have been known for their impacts in the form of innovation ("Universities are engines of economic development") and technology transfer, enhancement of the quality of the local work force, improvements in the quality of life and public service (Caffrey and Isaacs 1971; Belfield, 2003; Ajadi, 2010). For example, the University of Georgia (UGA) with about 34,885 students has the single greatest economic impact: $2.2 billion on the Athens-area economy in the year 2009.

The study also reveals that the System's two regional universities are significant economic players in their host communities. Georgia Southern University had an impact of $526 million on the local economy and employment impact of 5,935 jobs, while Valdosta State University's economic impact was $340 million with 3,391 jobs. All of these activities form essential missions of institutions of higher learning, and are perceived by the public accordingly (Moretti, 2004). The work of Siegfrieda *et al* (2006) pointed out direct human capital effects of personnel of the University human capital on the local education level. As the result of this possible social benefits of education include the enhancement of productivity and greater civic responsibility. It is documented that spillover benefits occur if more highly educated workers enhance the productivity of other workers (Rizzo, 2004). Moretti (2004) finds that a percentage point increase of college graduates in a community's workforce increases wages of local high school dropouts by 1.9 percent, high school graduates by 1.6 percent, and other college graduates by 0.4 percent, for a weighted average effect of 1.3 percent. In addition, when a college or University hires a local resident, the position formerly held by the resident may open up additional opportunities for another local resident, and so on. A number of local residents may secure better jobs through such a "vacancy chain" (Chase, 1991). Positive externalities such as expanded entertainment, recreation, cultural, medical, shopping and dining opportunities may be created by the large community that results from the creation of a university.

Caffrey and Isaacs (1971) gave a Template for the measurement of economic impacts of schools on the environment. This was assessed by summing expenditures of the college community (students, faculty, staff and visitors) to reflect the level of multipliers effect of presence of

University system on the economic activity in a local economy (Caffrey and Isaacs, 1971). The multiplier effects include among others spending in the local community by faculty members, attracting foreign and local investment to the University and its environment, boosting of the economic activities by visitors, including alumni, who visit the campus for academic and/or athletic events. Universities with medical centers could also extend such facilities to local residents. In the light of the above discussion, the study therefore intend to measure the establishment of JABU on the environ and the people.

Preliminary investigation of the study areas revealed that inhabitants were of the opinion that the establishment of JABU will have impact on the immediate communities. They, however, claimed that there is no significant change in the income, there is no difference between the nature of the inter town roads before and after the establishment of the University, that JABU has not offered significant employment opportunities and that the new houses built after the University creation are independent of the university induced effect on the study area. The indigenes of Ikeji Arakeji described the situation of the town as pathetic and unbelievable. "The town that is rich and endowed with brilliant natives and made popular by the presence of the CAC does not have a befitting Police Station, Schools, Good Roads and Hospitals except glorified clinic or Health Centre" (The Nation, 2009). The questions asked by this study tilt on knowing the present level of income of the residents and physical growth of the community. Likewise, states of infrastructure and income diversification situation of the communities before and after the creation of JABU are of interest.

This paper reviews the roles assumed by JABU in Ikeji Arakeji and other surrounding communities. This is with a view of assessing how far the university has been able to fulfill the objective of fostering economic expansion and progress of the various communities around JABU. Such a comprehensive study will be useful in providing a sound framework for formulating policy guideline on the rural community-University cooperation as a means of alleviating rural poverty generally.

Research Methodology
The study area
The study was carried out in four (4) communities of Ikeji Arakeji, Ipetu Ijesha, Owena and Ikeji Ile, all of which are immediate surrounding towns and villages to the Joseph Ayo Babalola University. Ikeji Arakeji in Oriade Local Government Area of Osun State, Nigeria. With the help of GPRS, the communities were found to be within the distance of between 5 and 20 kilometers from the University. These towns/villages are more accessible to the research workers than all the other towns\villages in Oriade Local Government Area. The LGA covers about 120 kilometers of land mass with a population of about 80,249 (NPC, 2006) It is well blessed with numerous human settlements that are well connected with road networks. The vegetation of Oriade Local Government Area is mainly rainforest with scattered swamps, rivers, waterfall and living springs at Erin Ijesha. The soil is very fertile and encourages the cultivation of various types of food and industrial crops by the people in the area.

Sampling Method
The field work for the study was conducted between January 2010 and March 2010. Before embarking on the survey, a reconnaissance survey was carried out to estimate the number of households in the different towns/villages in the study areas. This was necessary in view of the lack of reliable population data on the villages and the fact that the sampling unit is the household. The households surveyed were those which have been in existence for at least three years before and after the establishment of the University.

Towns/villages were selected randomly. The selected towns are within the distance of between 5km and 20km. The selection of the villages was based on their distances to the University. Four distance classes were recognized, namely 5km or less, 6-10km, 11-15km and 16-20km, with the use of 20 percent (20%) sampling intensity the total number of households chosen for interview in each distance class was obtained for the study area (table 2). A sampling intensity of 20% was selected based on limited time and financial considerations. The head of the selected households were interviewed by means of well structured questionnaire. On the whole, the data for the analysis in this study were provided by 18 heads of households in Ikeji Arakeji, 14 heads of households in Ikeji Ile, 28 heads of households in Ipetu Ijesa and 8 heads of households in Owena (table 2).

Analytical Technique of the Study
Descriptive statistics of frequency and percentages were used to analyze all the data in this study. Social growth of the communities was assessed in terms of physical growth as regards the number of houses built and provision of interVillage roads. Also, the income level of the populace was determined through the estimation of the amount of non-agricultural employment people were involved among others. Popular models like RIMS II (Regional InputOutput Modeling System), IMPLAN and REMI were not used because they have been developed for government funded university systems where money flow from government to the communities and the university could be measured with a high degree of precision. However, the accuracy and reliability of this work is assured.

Result and Discussion
The Villagers Household Characteristics
The household characters investigated include the farmer's age, education, occupation, farming activities, Social status and the sex composition. Table 3 shows the age distribution of the communities (or heads of households). When all location are combined, 41% of the communities are 46 years and above in age while 17% of the communities are between the age of 25 and 45 years. This is indicative of the fact that the old ones have a young crop of farmers that can replace them when they can no longer farm. The active population can be of help in increasing farm output in the area. Table 4 shows the average age of the members of the community. The average ages of the member of the community are 54.00, 43.22, 44.96 and 47.73 years at Ipetu-Ijesha, Ikeji-Ile, Owena and Ikeji Arakeji respectively, when all the towns are combined, the average age of villagers is 47.00 years. If the young population could be adequately catered for, rural-urban drift is checked and food production in the area will be enhanced.

Income

The respondents' income as defined in this study is the average gross receipts from all sources over the periods 2003-2006 (before the establishment of the University) and 2006-2009 (after the establishment of the project). This was computed by summing up the gross annual income from the primary and secondary occupations and dividing by 4 (that is, number of each year in the period under consideration). This was done for each period without subtracting expenses on labour, fertilizers, insecticides, respondents household consumption in the case of farmers and trade purchases from trading receipts in order to estimate the income of the respondents engaged in petty trading. This is largely due to the fact that most respondents claimed that they could not remember a lot of expenditure details. It is for this reason that, the average gross annual income for each period under study was used.

Table 14 shows the source of income in the study areas before and after the establishment of the University. On the whole, 59% and 23% of the respondents depended on farming alone as their main source of income before and after the establishment of the University respectively. The frequency distribution of income before and after the establishment of the university is shown in Table 15. A greater proportion of the villager's income was between N2000 and N10,000 per month before and after the establishment of the University respectively. Table 16 shows the cumulative percentage of the respondents and income before and after the establishment of the University. On the whole, the poorest (10%) of the respondents controlled only 2.9% of the total income earned by the entire respondents. This means that half of the member of the rural community control just 18% and 30% of the total income earned before and after the establishment respectively.

Educational Background of the Rural Community

All the communities have primary and secondary schools (Table 10) without any higher or tertiary institution in the study area. Table 6 shows the educational background of the rural community. About 60%, 50%, 50%, and 95% of the members of the rural community Ipetu Ijesha, Owena and Ikeji ile and Ikeji Arakeji respectively had no formal education. For all the locations combined, 67% had no formal education while 33% had formal education. The corresponding figures for each of the four locations with respect to the villagers with formal education are Ipetu Ijesha(40%), Ikeji Ile(50%), Owena(50%) and Ikeji Arakeji(50%).

Occupation of the Member of the Rural Community

The resources of any community largely determine the main activities engaged in by the occupants of that community (Olayide, et al, 1975). Table 7 shows the primary (or chosen) occupation of the member of the rural community. About 90% of the respondents in Ipetu Ijesha indicated farming as their chosen occupation while 94%, 58% and 70% of the respondents at Ikeji Arakeji, Owena and Ikeji Ile respectively indicated farming as their primary occupation. For the study area, about 77% of the respondents have farming as their primary occupation. Other chosen occupation of the respondents in the study area include carpentry (5%), Food selling (7%), Tailoring (3%), Teaching (5%) and Fishing (3%). Table 8 shows the secondary occupation of the respondents in the study areas. The major occupation include Tailoring (17%),

Farming (13%), Power saw operator (15%), Contractor (4%), Hunting (29%), Pastoration (17%) and Fishing (18%).

Infrastructure Facilities

Infrastructure facilities play a prominent role in rural development. It is in realization of this importance that the Second National Development Plan (1970-1974) placed tremendous emphasis on the control dispersal of social overheads and infrastructure facilities. These have been defined to include transportation links (road), power and water supplies, health facilities and other community services. A careful looks at the Nigerians rural sector shows that these facilities are lacking as such tend to reduce productivity the attendant consequences of this are low income and rural migration.

Inter-Village Roads Management

Table 9 shows the condition of the inter-village roads before and after the establishment of the University, 9% of the respondents claimed that the inter-village roads were motorable all the year before the establishment of the University while 62% of the respondents claimed that the roads were seasonally motorable and 29% claimed that the roads were not motorable before the creation of the University. After the establishment of the University, 38% of the respondents claimed that the roads are motorable all the years while 52% claimed that the roads are seasonally motorable. 10% claimed that the roads were not motorable after the establishment of the University. What could be inferred from this is that the inter-village roads have not been improved by the establishment of the University.

Health Care Provision

The health facilities within the rural communities generally are poor. The implication of this is that in cases of major illness, the patients have to travel either to Ilesha or Akure which are about 40 0r 30 kilometer respectively from the study areas. Table 11 shows that dispensaries and maternity are the only health facilities in the area of study, there was no single hospital. Some respondents claimed that they do bring their sick people to the University Health Centre to receive treatment for a simple token.

Employment Creation

The problems of rural development are compounded by the ever growing rural population and the decline employment in the rural communities. Some of the problems according to (Eweka et al 1979) include those of school leavers who are not prepared by virtue of their training for the rural job market, the ever growing number of unemployed women and children and the growing apathy to labour, intensive primary production and the sub optimal energy to work arising from ageing and youthfulness of the rural labour force. Table 12 shows the number of the members of the rural community offered employment by the University since established. Out of the 37 respondents employed by the University, 28 (76%) were engaged as casual labourers while 9 (24%) were employed as semi-skilled workers. What could be inferred from this is that the University did provide some employment opportunities to the rural population.

Externalities *House Rentage by the Rural Communities*

The use to which the respondents who owned houses put them varied in all the study areas. Some of them rented out their houses while others did not. The reason why certain respondents did not rent out their houses was because available rooms could barely accommodate their large families. Also some of the respondents no longer receive rent from their tenants due to the assimilation and social cohesion, arising from long association.

Table 13 shows the average rent received from tenants in all the study areas. The amount charged per room per month varies from ?200 at Ipetu-Ijesha to N100 at Ikeji-Arakeji before the establishment of the University but rose to ?800.00 at Ipetu-Ijesha to ?500 at Ikeji-Arakeji after the University started.

Conclusion

The study has attempted to assess the influence of Joseph Ayo Babalola University presence on the immediate rural community while the socio-economic effects of the University on the output and living standard of the rural community was examined specifically. The average age of the respondents was 47 years. An active population this indicates. The study revealed that a high percentage of the respondents had no formal education, while 33% were literate. Also, 70% of the respondents had farming as their primary occupation. The source of income through farming alone was 50% before and 23% after the University was established.

The frequency distribution of income showed that most of the respondents (88%) fall within the income close of N3,000 to N10,000 per annum before the University creation and 76% fell within the range ?10,000 to ?40,000 after the University creation (Table 15). Some of the respondents (64%) were offered paid employment by the university. The chi-square value was 0.9039 which was significant at the 0.05% level. The inter-village roads were seasonally motorable after the establishment of the University. The chi-square of 16.510 was significant at 0.05% level. The University thus had some impact on the rural community with regards to roads. Barbing, shoe mending, hair dressing, tailoring, carpentry, food vending, and trading generally are the livelihoods that received boost in the community after the creation of the University.

Table 1: Distribution of Selected Household with the communities

Strata	Distance Class (km)	Town/Village	Estimated No of Household	Random Sampling(20%)
I.	8-10	Ipetu-Ijesha	140	28
II.	7-5	Ikeji-Ile	70	14
III.	4-2	Owena	40	8
IV.	1km or less	Ikeji-Arakeji	90	18
		TOTAL	340	68

Source: Computed From Survey Data

Table 1: Distribution of Selected Household with the communities

Age(years)	Ipetu-Ijesha No	Ipetu-Ijesha %	Ikeji-Ile No	Ikeji-Ile %	Owena No	Owena %	Ikeji-Arakeji No	Ikeji-Arakeji %	All Locations (Study Area) No	All Locations (Study Area) %
Btw 25-35	0	4.0	4	25.0	4	33.0	2	10.0	10	17.0
Btw 36-45	1	10.0	6	38.0	2	17.0	3	15.0	12	21.0
Btw 46-55	5	50.0	4	25.0	3	25.0	12	60.0	24	41.0
Btw56-65	3	30.0	1	6.0	2	17.0	2	10.0	8	14.0
66 & above	1	10.0	1	6.0	1	8.0	1	5.0	4	7.0
TOTAL	10	100.0	16	100.0	12	100.0	20	100.0	58	100.0

Source: Computed From Survey Data

Table 3: Average Age of the Household leads of the Rural Communities

Age (Years)	Ipetu Ijesha No	Age	Mid Total Point	Ikeji-Ile No	Age	Mid Total Age	Owena No	Age	Mid Total Age	Ikeji-Arakeji No	Age	Mid Total Age	All Locations No	Age	Mid Total
25-35	0	30.0	0.0	4	10	30.0	4	30.0	120.0	2	30.0	60.0	10	30.0	300.0
36-45	1	40.5	40.5	6	14	40.5	2	40.5	81.0	5	40.0	202.5	14	40.5	567.0
46-55	5	50.5	252.5	4	22	50.5	3	50.5	151.5	10	50.5	505.5	22	50.5	1111.0
56-65	3	60.5	185.5	1	8	60.5	2	60.5	121.0	2	60.5	121.0	8	60.5	484.0
66& Above	1	66.0	66.0	1	4	66.0	1	66.0	66.0	1	66.0	66.0	4	66.0	264.0
TOTAL	10	-	540.5	16	-	247.50	12	-	539.5	20	-	954.5	58	-	2726.0

$$Y= \frac{540.5Y}{10} \quad = \frac{691.5Y}{16} \quad = \frac{539.5Y}{12} \quad = \frac{954.58}{20} \quad Y= \frac{27\ 26.0}{58}$$

$$=54 \text{ years} \quad = 43.22 \text{ year} \quad 44.96 \text{ years} \quad 47.73 \text{ years} \quad 47.0 \text{ years}$$

Source: Computed from Survey Data.

Table 4: Family Size of the Villagers

Family Size	Ipetu-Ijesha No	%	Ikeji-Ile No	%	Owena No	%	Ikeji-Arakeji No	%	All Locations (Study Area) No	%
Children										
Male	30	24.0	28	25.0	31	26.0	31	26.0	120	25.0
Female	38	31.0	32	28.0	36	30.0	36	28.0	142	29.0
Dependants										
Male	10	8.0	5	4.0	6	5.0	7	6.0	29	6.0
Female	15	12.0	8	7.0	10	8.0	12	10.0	45	9.0
Heads of House Hold										
Male	10	8.0	14	12.0	11	9.0	14	11.0	49	10.0
Wives	21	17.0	27	24.0	30	24.0	21	17.0	99	21.0
TOTAL	124	100.0	114	100.0	124	100.0	121	100.0	483	100.0

Source: Computed from Survey Data.

Table 5: Education Background of the member of the rural Communities

Classification of Educational Background	Ipetu-Ijesha No	%	Ikeji-Ile No	%	Owena No	%	Ikeji-Arakeji No	%	All Locations (Study Area) No	%
No Formal Education	6	60.0	8	50.0	6	50.0	19.	95.0	39	67.0
Primary Education	3	30.0	6	38.0	5	42.0	1.	50.0	15	26.0
Secondary Education	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Tertiary Education	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Adult Education	1	10.0	2	12.0	1	8.0	0	0.0	4	7.0
TOTAL	10	100.0	16	100.0	20	100.0	20	100.0	58	100.0

Source: Computed from Survey Data

Table 6: Primary Occupation of the Rural Communities

Primary Occupation	Ipetu-Ijesha No	%	Ikeji-Ile No	%	Owena No	%	Ikeji-Arakeji No	%	All Locations (Study Area) No	%
Farming	9	90.0	15	94.0	7	58.0	14	70.0	44	77.0
Carpentry	0	0.0	0	0.0	1	8.0	2	10.0	3	5.0
Food Selling	1	10.0	0	0.0	2	17.0	1	5.0	4	7.0
Tailoring	0	0.0	1	6.0	0	0.0	1	5.0	2	3.0
Teaching	0	0.0	0	0.0	0	0.0	2	10.0	3	5.0
Fishing	0	0.0	0	0.0	2	17.0	0	0.0	2	3.0
TOTAL	10	100.0	16	100.0	12	100.0	20	100.0	58	100.0

Source: Computed from Survey Data.

Table 7: Secondary Occupation of the Members of the Rural Communities

Secondary Occupation	Ipetu-Ijesha No	%	Ikeji-Ile No	%	Owena No	%	Ikeji-Arakeji No	%	All Locations (Study Area) No	%
Timber Contractor	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Tailoring	1	20.0	1	20.0	1	20.0	1	11.0	4	17.0
Farming	0	0.0	0	0.0	1	20.0	2	22.0	3	13.0
Power Operator	0	0.0	1	20.0	1	20.0	1	11.0	3	13.0
Barbing	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Pool Agency	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Hunting	2	40.0	2	40.0	1	20.0	2	22.0	7	29.0
Fishing	1	20.0	0	0.0	1	20.0	0	0.0	2	8.0
Pastoralism	1	20.0	1	20.0	0	0.0	2	22.0	4	17.0
Contractor	0	0.0	0	0.0	0	0.0	1	11.0	1	4.0
TOTAL	5	100.0	5	100.0	5	100.0	9	100.0	24	100.0

Source: Computed from Survey Data.

Table 8: Condition of inter-Village Road Before and After the Establishment of the University

Conditions of Roads	Ipetu-Ijesha Before	After	Ikeji-Ile Before	After	Owena Before	After	Ikeji-Arakeji Before	After	All Locations (Study Area) Before NO	%	After NO	%
Motorable all year round	0	6	0	4	5	6	0	6	5	9.0	22	38.0
Seasoning motorable	8	4	10	12	3	4	15	10	36	62.0	30	52.0
Not motorable	2	0	6	0	4	2	5	4	17	29.0	6	10.0
TOTAL	10	10	16	16	12	12	20	20	58	100.0	58	100.0

Source: Computed from Survey Data.

Table 9: Education Facilities in the Study Areas

Educational Institutions	Ipetu-Ijesha	Ikeji-Ile	Owena	Ikeji-Arakeji	All Locations (Study Area)
NUMBER OF SCHOOLS					
Primary Schools	1	1	1	1	4
Secondary Schools	1	1	1	1	4
Tertiary Institutions	0	0	0	0	0
TOTAL	2	2	2	2	8

Source: Computed from Survey Data

Table 10: Health Facilities in the Study Areas

Health Facilities	Ipetu-Ijesha	Ikeji-Ile	Owena	Ikeji-Arakeji	All Locations (Study Area)
NUMBER OF HEALTH FACILITIES					
Dispensary	1	1	1	1	4
Maternity	1	1	1	1	4
Hospital	0	0	0	0	0
TOTAL	2	2	2	2	8

Source: Computed from Survey Data.

Table 11: Employment of staff by the University

Employment by the University	Ipetu-Ijesha No	%	Ikeji-Ile No	%	Owena No	%	Ikeji-Arakeji No	%	All Locations (Study Area) No	%
Yes	8	80.0	10	63.0	7	58.0	12	60.0	37	64.0
No	2	20.0	6	37.0	5	42.0	80	21.0	21	36.0
TOTAL	10	100.0	16	100.0	12	100.0	20	100.0	58	100.0

Source: Computed from Survey Data.

Table 12: Average Monthly Rents Received by Landlord

Location	RENT PER ROOM PER MONTH			
	Before: Average Rentage (N)	No of Tenants	Before: Average Rentage (N)	No of Tenants
Ipetu-Ijesha	200.00	3	800.00	6
Ikeji-Ile	50.00	9	400.00	15
Owena	200.00	5	1000.00	10
Ikeji-Arakeji	100.00	5	500.00	12

Table 13: Sources of income

Sources of Income	Ipetu-Ijesha Before	After	Ikeji-Ile Before	After	Owena Before	After	Ikeji-Arakeji Before	After	All Locations (Study Area) Before NO	%	After NO	%
Farming alone	4	1	10	3	5	3	15	6	34	59.0	13	23.0
Farming & Carpentry	0	0	0	0	1	1	0	0	1	2.0	1	2.0
Farming & Tailoring	2	1	2	1	1	2	2	4	7	12.0	8	14.0
Farming & Barbing	1	1	0	0	1	1	1	1	3	5.0	3	5.0
Farming & Contractor	0	0	0	0	0	0	0	0	0	0.0	0	0.0
Farming & Pastoralism	0	0	1	1	1	1	0	0	2	3.0	2	3.0
Farming & Hunting	3	2	1	1	2	1	2	2	8	14.0	6	10.0
Farming & Teaching	0	0	2	4	1	1	0	0	3	5.0	5	9.0
Farming & Employment	0	5	0	6	0	2	0	7	0	0.0	20.0	34.0
TOTAL	10	10	16	16	12	12	20	20	58	100.0	58	100.0

Source: Computed from Survey Data.

Table 14: Frequency Distribution of Income Before and After the Establishment of the University

Income Class	Ipetu-Ijesha Before	After	Ikeji-Ile Before	After	Owena Before	After	Ikeji-Arakeji Before	After	All Locations (Study Area) Before NO	%	After NO	%
0 – 500	2	0	6	1	2	1	2	1	12	21.0	3	4.0
501 – 10,000	4	2	2	1	3	2	3	1	12	21.0	6	8.0
10,001–15,000	4	2	2	2	1	2	4	3	11	19.0	9	12.0
15,001-20,000	0	4	2	3	2	4	4	2	8	14.0	13	19.0
20,000-25,000	0	0	3	7	2	1	3	2	8	14.0	10	14.0
25,001-30,000	0	0	1	2	0	1	1	8	2	3.0	11	15.0
30,001-35,000	0	2	0	0	0	0	0	2	0	0.0	4	5.0
35,001-40,000	0	4	0	0	1	2	2	1	3	5.0	7	9.0
40,000-50,00	0	0	0	0	1	1	0	4	1	2.0	5	7.0
50,001-55,000	0	0	0	2	0	1	1	2	1	2.0	5	7.0
55,001-60,000	0	0	0	0	0	0	0	0	0	0.0	0	0.0
TOTAL	10	14	16	18	12	15	20	26	58	100.0	73	100.0

Source: Computed from Survey Data.

Table 15: Cumulative Percentage of Villagers and Income Before and After the Establishment of the University

Cumulative Percentage of The rural community	Ipetu-Ijesha Cumulative % of Income		Ikeji-Ile Cumulative % of Income		Owena Cumulative % of Income		Ikeji-Arakeji Cumulative % of Income		All Locations (Study Area) Cumulative % of Income	
	Before	After	Before	After	Before	After	Before	After	Before	After
10	7.6	6.0	3.3	2.1	2.9	2.2	2.4	2.5	2.9	2.2
20	15.2	12.0	6.6	5.9	5.8	7.2	9.5	5.8	5.8	6.9
30	22.9	18.0	9.9	13.2	11.7	10.8	10.3	16.6	8.7	15.2
40	30.9	24.0	13.2	20.4	15.4	18.4	29.4	25.9	15.2	23.8
50	38.1	38.4	21.6	25.5	23.1	25.6	25.4	26.3	17.7	29.7
60	45.7	46.1	40.4	51.2	37.9	34.9	39.9	39.9	30.1	44.9
70	53.3	63.9	47.1	59.7	44.2	46.1	46.5	56.9	45.5	52.3
80	60.9	73.0	53.7	68.3	63.1	65.7	63.2	69.7	64.4	68.6
90	75.1	82.1	81.9	83.1	80.3	81.4	82.3	81.0	84.9	83.8
100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Computed from Survey Data.

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