GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 111 - 115
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 - 2903

ASSESSING THE EFFICACY OF SOME SELECTED HERBICIDES FOR WEED CONTROL IN UPLAND RICE PRODUCTION IN EDO STATE, NIGERIA.

B. O. OBADONI and S.U. REMISON

(Received 17 February, 2004; Revision Accepted 29 October 2005)

ABSTRACT.

Seven different herbicides (gramoxone, ronstar + propanil, propanil alone, risane, basagran, molinate and glyphosate) were assessed for their efficacy in weed control in rice and compared with hand weeding at 3 and 7 weeks after planting (WAP). Rice in plots treated with risane and basagran were significantly ($P < 0.05$) shorter whereas, those in plots treated with other herbicides did not significantly ($P > 0.05$) vary in height. Gramoxone controlled 80% of the weeds, while a tank mixture of ronstar and propanil, propanil alone and molinate effected a kill of (50-79%) of sprayed weeds. Glyphosate controlled 94.3% of the weeds. Risane and basagran were not effective; they controlled only 7 and 10% respectively of sprayed weeds. Injuries caused by herbicides were insignificant, except in gramonxone and tank mixture of ronstar and propanil, which significantly injured rice. Rice grain yield was largely dependent on the level of weed control except in glyphosate where yield was low despite high control efficiency. In terms of cost, gramonxne was the cheapest while propanil was the most expensive to procure and apply.

KEYWORDS: Herbicides, upland, rice, farms.

INTRODUCTION

Weed control is the major constraint and labour consuming activity in upland rice production in Edo State. Rice farmers in Edo State rely on hand weeding with hoes and cutlasses for controlling weeds. Most of them are not aware of the availability of chemical weed killers and the few who know cannot afford them due to cost. The stress on weeding with hoes and cutlasses limits holdings.

Organic herbicides came into agriculture at a time when a decreasing number of field workers, high cost of labour and soaring production cost made farmers receptive to labour-saving methods of weed control (Akobundu, 1987). Research in the Ivory Coast (Merlier, 1983), Nigeria (Akobundu, 1981), Senegal (Diallo, 1984) demonstrated that the pre-emergence application of oxadiazon at a rate of 1.0 to 1.5 kg a.i. ha^{-1} in rice suppressed weeds up to one month. The combination of pre-emergence thiobencarb and post-emergence propanil effectively controlled weeds in rice in Ghana (Carson, 1975), Nigeria (Akobundu, 1981), Ivory coast (Merlier, 1983) and Senegal (Diallo, 1984) when applied at the rates of 0.76 to 2.0 kg a.i. ha^{-1} and 1.73 to 2.2 kg a.i. ha^{-1} at 21 days after sowing rice.

Smith (1974) studied the response of rice to postemergence treatments of propanil applied at 6.7 or 9.0 kg a.i. ha^{-1} as single or split application to rice 15 –75 days after crop emergence. He reported that propanil applied at all times and rates at 15 to 55 days after crop emergence did not reduce grain yields, but 6.7 kg a.i. ha^{-1} applied 65 and 75 days after crop emergence injured rice plants; but seed viability and milling quality were not affected. Residues of DCA (3, 4 dichloroaniline) in grain and straw were highest from treatments applied 65 and 75 days after crop emergence; indicating that older plants were unable to effectively metabolize DCA . Khosro *et al.* (1989) evaluated fenoxaprop in combination with existing herbicides (propanil, thiobencarb or pendimethalin) for the control of grass weeds. Fenoxaprop at 0.17 kg a.i. ha^{-1} combined with the above herbicides controlled barnyardgrass *{Echinochnloa crus –galli*) and bearded sprangletop (*Leptochloa fasciculans*) in rice and performed as well as or better than standard treatments of propanil with thiobencarb or pendimethalin. Rice yielded well, and grain was of high quality

The tolerance of rice to acifluorfen and triclopyr applied alone or in mixtures with propanil was investigated by Smith (1988). He noted that acifluorfen applied alone and in mixtures with propanil reduced grain yield of rice by 7% when applied at the late- booting or heading growth stage. Earlier applications did not reduce rice yields. Triclopyr alone and in mixtures with propanil reduced rough grain yields of rice by 19% when applied at the late-booting growth stage. Both herbicides applied alone and in mixtures did not affect whole grain milling yield and germination of rice regardless of rate or growth stages of application.

Ayotade (1981) determined the effects of subtoxic levels (0, 0.07, 0.14, 0.28 and 0.56 kg a.i. ha^{-1}) of simazine on the nitrogen nutrition, yield and protein content of wetland rice (*Oryza sativa* L var 1R8 and MAS 2401). The results showed that simazine application at panicle primordial initiation stage significantly increased nitrogen uptake, percent protein in the grain and total protein yield of treated plants. It however significantly decreased grain yield mainly due to increased sterility.

In Edo State, Ekpoma is the nucleus of upland rice production. Farmers rely only on weeding with hoes and cutlasses due to ignorance, fear of herbicides injuring their crops and assumed high cost. The objectives of this study were to: a) assess the efficacy of some selected herbicides on the control of upland rice weeds; b) ascertain the level of injuries caused to the rice plants with application at the recommended rates and, (c) compare the cost of hand weeding with control of weeds using herbicides.

MATERIALS AND METHODS

Field studies were conducted in 1999 and 2000 at the Department of Botany Experimental Garden, Ambrose Alli University, Ekpoma. Ekpoma is situated between latitude 6° 43^{1}N and longitude 6° 08^{1}E. It has an average annual rainfall of 1,556 mm characterized by bi-modal peaks occurring in July and September with a short dry spell in August. Mean daily temperature throughout the period of study was 26 ± 2°C. The soil characteristics were: pH 5.6, percentage organic matter 1.8%, total nitrogen (N) 0.13%, available P (mg/kg) 7 35, exchangeable K (meg /100g of soil) 0.18, and cation exchange capacity (C.E.C) of 4.83.

The experimental design was a randomized complete block consisting of eight treatments replicated four times. Seven different herbicides (gramoxone, ronstar, propanil risane, basagran, molinate, glyphosate and ronstar tank mixed propanil) were screened for their efficacy in weed control in rice and compared with hand weeding at 3 and 7 weeks after planting (WAP). The rice was planted, five seeds per hole in plots measuring 5 m x 3 m at a spacing 25 cm x 25 cm on April

B. O. Obadoni, Department of Botany, Ambrose Alli University, Ekpoma, Edo State, Nigeria.
S.U. Remison, Department of Crop Science, Ambrose Alli University, Ekpoma, Edo State Nigeria.

15, each year using ITA 301 variety developed at International Institute of Tropical Agriculture (11TA) Ibadan, Nigeria.

Propanil was applied at 4.5 kg a.i. ha^{-1} at 3 WAP and at 54 days after sowing (DAS); gramoxone was applied post emergence at 3 WAP and 45 DAS at 0.56 kg a.i. ha^{-1} as directed spray between rows maintaining a very low nozzle height. This reduced swath, drift and concentrated the product on the target. Ronstar at 1.25 kg a.i. ha^{-1} was tank mixed with propanil at 2.15 kg a.i. ha^{-1} and applied post emergence at 3 WAP and 45 DAS. Also applied post emergence were risane and basagran at 3.5 kg a.i. ha^{-1} and 2.3 kg a.i. ha^{-1}, at 3 WAP and 50 DAS. Molinate was applied post emergent at 2.8 kg a.i ha^{-1} at 3 WAP and 54 DAS. Glyphosate, a non – selective and systemic herbicide was applied preplant at 3.0 kg a.i. ha^{-1}. All applications were made with lever- operated knapsack sprayer (LOK). Hand pulling of bigger weeds commenced at eight weeks after herbicide application, that is, at 11 WAP. Hand pulling of larger weeds was not factored into the cost because it was carried out in all plots including the hand weeded ones. A split and equal applications of 50 kg a.i. ha^{-1} of urea at 3 WAP and at booting was made.

Plant height was measured from the base to the tip of the uppermost spikelet at 100 DAS. Length of leaves was measured from the base to apex. Viability of progeny was tested through germination trials. In this case, twenty-four Petri dishes were lined with Whatman No 1 filter paper, moistened with water and twenty-five seeds from each treatment were planted in dish. Each treatment had three replicates. At ten days after sowing, germinated seeds from each treatment were counted, percentage germination calculated and data were subjected to analysis of variance. Visual ratings were taken for injury and weed control, the method developed by Smith and Khodayari (1985). For injury rating, if less than 10% of treated crops was killed, it was considered insignificant, a kill of 10 to 29% was slight; 30 to 69% moderate; while 70 to 100% was severe.. For weed control, a kill of less than 10% of sprayed weeds was considered poor; 10 to 49% deficient; 50 to 79%, fair and 80 to 100% good. A control level of less than 80% was considered unsatisfactory. In 1999, rice injury ratings were taken at 2 weeks after treatments. In 2000, injury ratings were not determined until 6 weeks after the treatments because in 1999, the rice recovered from most of the early injuries.

Cost benefit of using herbicides was compared to hand weeding. Weeding one hectare of rice farm was estimated to take 27 days working at 8 hours per day. Reward for labour during the time of study was ₦ 150 per day, hence it would cost approximately ₦4050 to weed one hectare of rice farm. Rice was harvested at 130 DAP, and air-dried to safe moisture content of 16%. Data obtained from all the parameters studied were subjected to analysis of variance.

RESULTS

Vegetative characters

The herbicides applied significantly ($P<05$) affected plant height. Rice in plots that were treated with gramoxone, ronstar tank mixed with propanil, propanil applied alone, molinate, glyphosate and hand weeded plots did not vary significantly ($P>05$) in height. Plots treated with risane and basagran had the shortest plants (Figs.1 a and 1b).

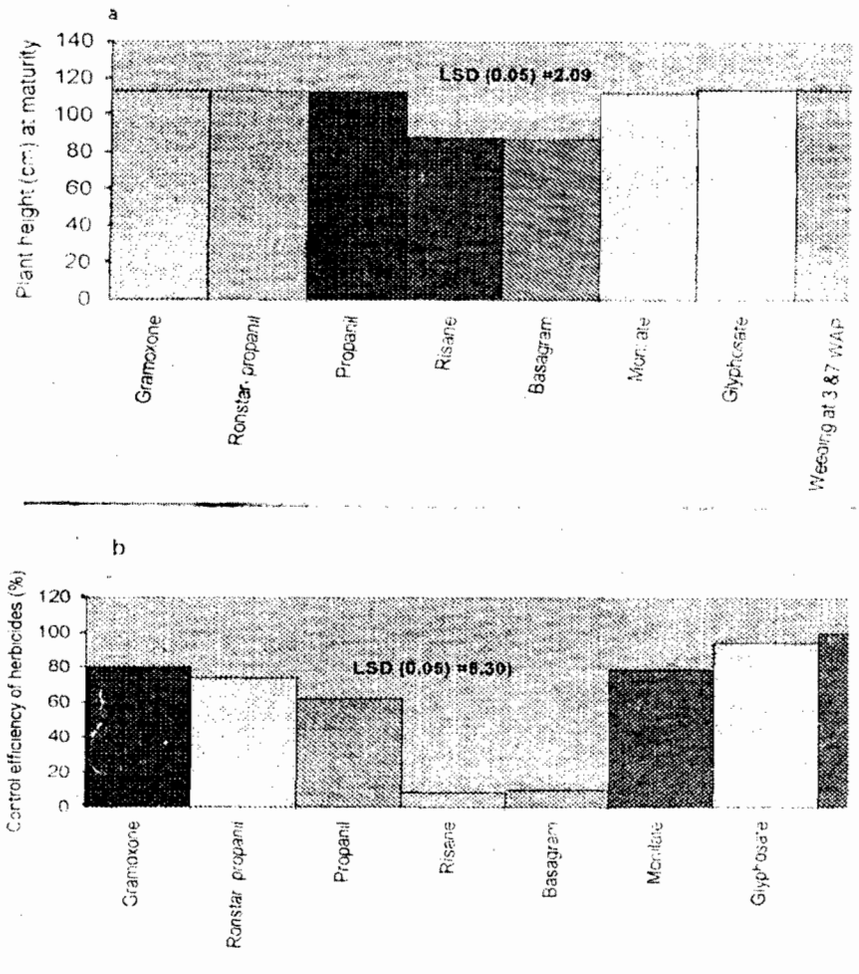

Fig. 1: Effects of different herbicides on (a) plant height and (b) control efficiency of the products averaged for 1999 and 2000

The herbicides varied greatly in their ability to control weeds. Gramoxone controlled 80% of the weeds, while tank mixture of ronstar and propanil alone, molinate were fairly (50-79%) effective. Glyphosate was the most effective; it effected a kill of 94.25% of treated weeds (Fig. 1b). Risane and basagran performed poorly, each controlling only 7 and 10% of sprayed weeds respectively. The hand weeded plots were regarded as control.

Phytotoxic injury at 6 WAP was significant ($P < 0.05$) for both years (Figs. 2a and 2b). Rice injury was higher at 2 than at 6 weeks after treatment (WAT). Injuries noticed were leaf bronzing, desiccation, chlorosis and inhibition of plant growth. Directed spray of gramoxone at 3 WAP and a tank mixture of ronstar and propanil significantly ($P < 0.05$) injured rice by 19 and 13% respectively at 6 WAT (Figs 2a and 2b). Injury caused by propanil applied alone was insignificant (4.5%). Preplant application of glyphoste did not injure rice while molinate caused an insignificant injury of 2%.

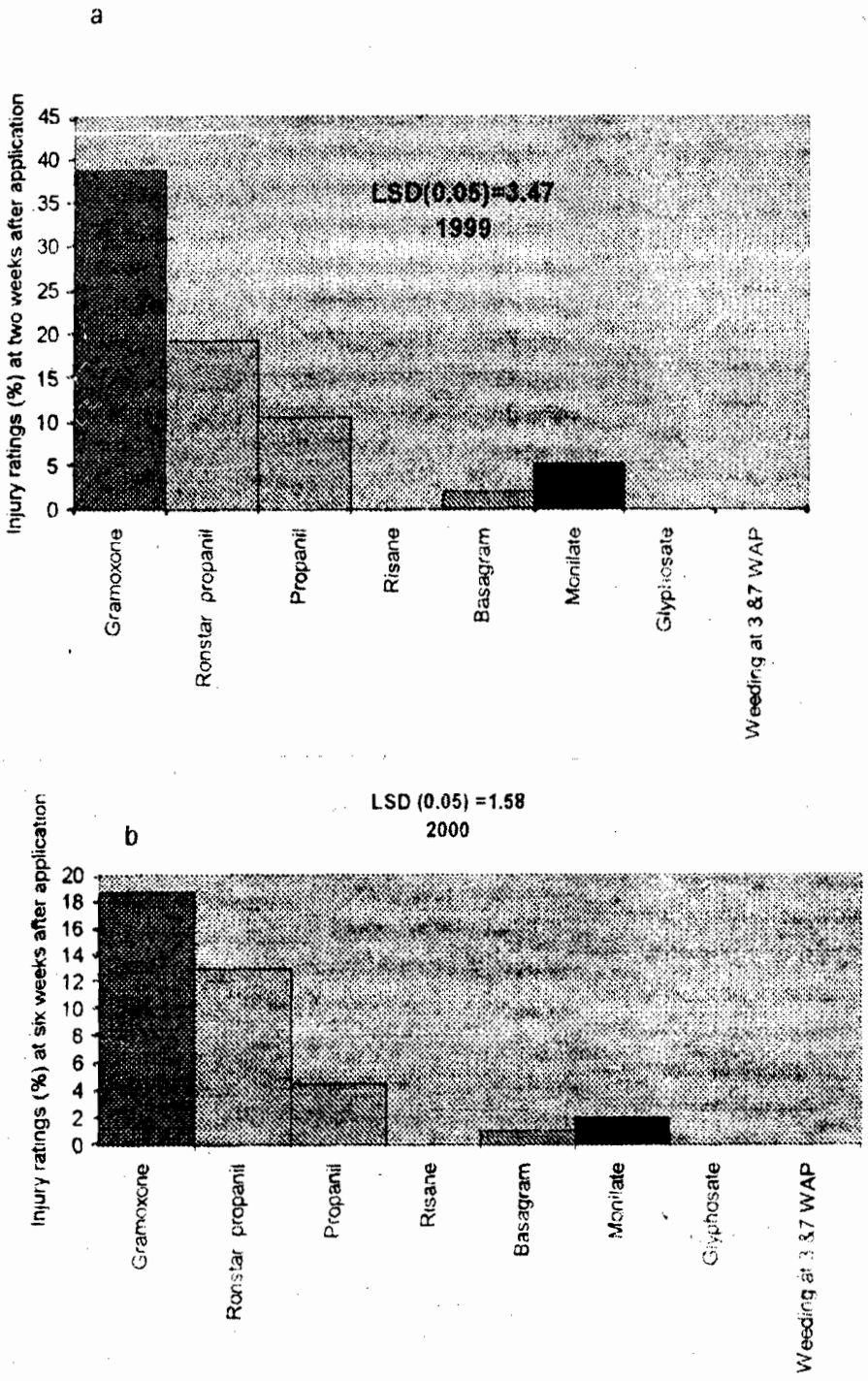

Fig. 2 A Comparison of injury ratings measured at (a) 2 weeks and (b) 6 weeks after application in 1999 and 2000 respectively.

Reproductive traits

Herbicide treatments did not affect germination of progeny. The herbicides significantly ($P< 0.05$) affected rice grain yield. Highest grain yield of 5181.50 kg ha^{-1} was recorded in hand weeded plots. Rice grain yield was 14.9% lower in plots treated with molinate compared to hand weeding. Rice grain yields from plots sprayed with gramoxone and ronstar tank mixed with propail did not significantly ($P > 0.05$) vary; while yield from propanil treated plots was 23.9% lower than the yield obtained from plots treated with gramoxone.

Glyphosate was the most effective herbicide but its high weed control efficiency did not translate to improved rice grain yield: only 3917.25 kg ha^{-1} was obtained compared to 4409.25 and 4120.50 kg ha^{-1} recorded from molinate and gramoxone treated plots respectively. Rice grain yields were lowest in plots sprayed with risane and basagran; they were 62.8 and 68.0% lower respectively compared to hand weeded plots. Generally, yields obtained from herbicide treated plots were significantly ($P\leq 0.05$) lower than yield from hand weeded plots (Table1).

Table1. Germination of progeny and yields as influenced by application of different herbicides averaged for two years, 1999-2000

Herbicides applied	Germination (%)		Yield kg ha^{-1}		Mean Yield kg ha^{-1}
	1999	2000	1999	2000	-
Gramoxone	93.50	92.00	4086	4154	4120.50
Ronstar + Propanil	92.25	91.25	3641.5	3666	3653.75
Propanil	93.50	94.50	3119.92	3153.58	3136.25
Risane	94.0	94.0	1654.89	1658.11	1656.50
Basagran	93.50	94.5	1937.75	1935.75	1936.75
Molinate	91.50	90.0	4489.75	4328.75	4409.25
Glyphosate	93.50	91.00	3864.92	3969.58	3917.25
Weeding at 3 & 7WAP	95.5	97.00	5086.63	5276.37	5181.50
LSD(0.05)	NS	NS	58	138	-

Cost benefit ratio of using herbicides

Data from the field studies indicated that gramoxone was the cheapest to apply requiring only ₦ 1960.00 ha^{-1} compared to hand weeding estimated at ₦4050.00 ha^{-1}. Although, glyphosate was very efficacious in the control of weeds, its procurement was 64% higher than hand weeding (Table 2).

Tables 2. Cost of applying some selected herbicides ha^{-1} compared with hand weeding averaged for two years (1999-2000).

☆Herbicides	Rate kg *ai* ha^{-1}	Litres ha^{-1}	Price/litre (₦)	Cost ha^{-1}(₦)
Gramoxone	0.56	2.8	700	1960
Ronstar + Propanil	1.25 +2.15	5.0+5.97	600+550	6283.50
Propanil	4.50	12..50	550.00	6875.00
Risane	3.5	10..90	300.00	3270.00
Basagran	2.30	4..80	450.00	2160.00
Molinate	2.80	5..50	520.00	2860.00
Glyphosate	3.0	8..30	800.00	6640.00
Weeding at 3 & 7WAP	-	-	-	4050.00

☆Prices as at 1999 and 2000 in Ekpoma, Edo State.

DISCUSSION

Except risane and basagran that poorly controlled weeds (7.5 and 10%, respectively) proper seedling growth and establishment were observed in plots treated with other herbicides. The improved rice growth observed in plots treated other herbicides was due to better use of available space, light and nutrients as a result of the weed-free environment (Fig. 1a). Gramoxone and glyphosate were non-selective, contact and systemic herbicides respectively, and not employed usually in weed control programme in rice. Since Ekpoma is a typical tropical environment with high species diversity, a broad-spectrum herbicide would be preferred.

Injuries caused by gramoxone was significant; it was caused by the drift of the product to non-target plants. If applied preplant no injury would be observed. Apart from gramoxone and glyphosate that were not usually used in the control of weeds in rice farms, data reported on injury and control efficiency in other herbicides were in conformity with the observations by Smith (1974,1981 and 1988) and Khosro *et al.* (1986).

Paddy yields reflected to a large extent, the levels of weed control (see Fig 1b and Table1). Low paddy yields in plots treated with risane and basagran suggested high weed competition due to poor weed control. The highest yield in hand weeded plots was as a result of better pulverization of the soil and hence improved percolation of water, incorporation and utilization of applied fertilizer. The results obtained suggested that herbicides that had the same efficiency of weed control, the grain yields from such treated plots would be similar assuming other factors are ideal. Previous research has shown that rice injury levels of 17% or less caused no loss of rice grain yield (Smith, 1968).

Hand weeding with a hoe was estimated at 27 days ha^{-1}. This figure was close to 31 days reported by Dadey (1973), De Detta *et al.* (1973) and Matsunaka (1975) depending on ecosystem and environmental conditions. Thomas and Joshua (1994) in the Savanna zone of West Africa reported that complete hand pulling of in-row weeds in upland rice required 89 days and was not profitable; selectively removing only the taller weeds reduced hand-weeding time to 37 days and increased yield by 11%.

Even though the application of some herbicides appeared to be cheaper than hand weeding, most rice farmers in Edo State still rely on hand weeding due to ignorance and reluctance to part with such monies to purchase herbicides. The cost of application per hectare would be higher than the estimates shown if acquisition of water and equipment were added. Other herbicides that would be considered too expensive to apply by the local rice farmers were ronstar tank

mixed with propanil and propanil applied alone (Table 2). Risane and basagran though cheap, performed very poorly in the trials and as such not recommended for use.

Such benefits from the use of herbicides over hand weeding had been reported by Angadi *et al.* (1993); but the results here are not in agreement with the findings of (Thomas and Joshua 1994) that the use of herbicides was not profitable in upland rice and only slightly profitable in rainfed lowland rice. The conclusion was that farmers should seek adequate information on the types of herbicides to procure to ensure efficacy and minimum cost.

ACKNOWLEDGEMENT.

We are grateful to our farm staff who assisted us in maintaining the crops in the fields especially scaring of birds at critical stages.

REFERENCES

Akobundu, O. I., 1981. Weed control in direct–seeded lowland rice under poor water control conditions. Weed Res 21 : 273 –278

Akobundu, O. I., 1987. Weed Science in the Tropics: Principles and Practices. John Wiley and Sons, New York.

Angadi, V. V., Babalad, H. B., Umapathy, P. N., Radder , G. O and Nadaf, S. K., 1993. Weed control in upland rice fields of Kamataka India. International Rice Research Newsletter 18(1) : 50-51.

Ayotade, K. A., 1981. Effect of simazine on nitrogen, yield and protein of wetland rice (*Oryza sativa*). Ife Journal of Agric. 3(1&2):8-15

Carson, A. G., 1975. Weed Competition and some promising herbicide combinations for its control in upland *rice (Oryza sativa) Ghana* J. Agric. Sci 8:223-230

Dadey, C. A., 1973. Plant Protection for the rice crop. *WARDA* Seminar on Plant Protection for the Rice Crop. May 21-29, Monrovia, Liberia.

De Datta, S. K., Bernasor, P. C. and Lacsina, R. Q . 1973. Weed control in flooded and upland rice in the tropics. WARDA Seminar on Plant Protection for the Rice Crop. May 21 –29, Monrovia, Liberia.

Diallo, S., 1984. Recherches in matiere du lutte contre les mauvaises herbs en Casamance. situation et reorientation. *In Actes de la reunion de bilan* orientation *desprogrammes riz de 'i ISRA* 28-29 Mar, Ziguinchor, Senegal.

Khosro, K., Nastasi, P. and Smith, R. J Jr., 1989. Fenoxaprop for grass control in dry seeded rice. Weed Technology 3: 131 –135

Khosro, K., Smith, R. J. Jr. and Tugwell, N. P., 1986. Interaction of propanil and selected herbicides on rice. Weed Sci 34: 800 –803

Matsunaka, S., 1975. Weed control and herbicides in rice culture. In Rice in Asia, Association of Japanese Agricultural Scientific Societies. University of Tokyo Press. pp 438-450.

Merlier, H., 1983. Weed Control in dryland rice in the Ivory Coast. In Weed Control in Rice. Proc. Conf. IRRI and IWSS,LOS Banos, Philippines. pp 139-146 31 Aug-Sept 4

Smith, R. J., 1968. Weed competition in rice. Weed Sci.16:252-255

Smith, R. J. Jr., 1974. Responses of rice to postemergence treatments of propanil. Weed Sci. 22:563 - 568

Smith, R. J. Jr., 1981. Control of red rice in water-seeded rice. Weed Sci. 29: 663 –666

Smith, R. J. Jr., 1988. Tolerance of rice to acifluorfen and triclopyr applied alone or in mixtures with propanil. Weed Sci. 36: 379 –383

Smith, R. J. Jr. and Khodayari, K., 1985. Herbicide treatments for control of weeds in dry–seeded rice (*Oryza sativa*) Weed Sci. 33: 686 –692.

Thomas, R. R. and Joshua, L. P., 1994. On-farm evaluation of low external input weed control technologies in direct-seeded rice in the Savanna Zone of West Africa. Agricultural Mechanization in Asia, Africa and Latin American 25 (4) : 65-67

[illegible]

[illegible]

[illegible]

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 117 - 121
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

PERFORMANCE OF TEN VARIETIES OF RICE (*Oriza sativa* L.) GROWN UNDER IRRIGATION DURING THE DRY SEASON IN BAUCHI, NIGERIA

A. GARBA And G.G.FUSHISON

(Received 14 November, 2006; Revision Accepted 6 February, 2007)

ABSTRACT

Investigation into the performance of ten rice varieties of rice grown under irrigation during the dry seasons of 2004/2005 and 2005/2006 in Bauchi, was carried out. Ten rice varieties; FARO 46, WITA 4, AIC 233, WAB 233, WAB 189 (FARO 54), FARO 44, Ex-China, NERICA 1 (FARO 55), WAB 450 and NERICA 7 were considered during the study. The experiment was laid out in a randomized complete block design with four replications. A significant ($P<0.05$) difference was observed among the varieties on plant height, number of leaves and tillers per plant. Variety FARO 44 produced significantly ($P<0.05$) higher number of tillers per plant than all the other varieties. Similarly, in yield and yield related characters, FARO 44 and WITA 4 had significantly higher number of spikes per hill, weight per spike, grain weight per hill and yield per hectare than all the other varieties considered.

KEYWORDS: Rice varieties, Irrigation, Dry season.

INTRODUCTION

In Nigeria, rice has been known to contribute about 14% of the total food requirement and its consumption has been rising in West Africa at a rate of 45% annually (Yoshida, 1978). However, the domestic production has not been enough to meet the demand of the crop.

With the first ban on importation of rice in the country in 1985; rice production has been increasing steadily from year to year. Currently Nigeria produce paddy rice of about 3.5 million tones, ranking first in the West African sub-region (Okocha, 2003). But even with this encouraging production in rice, the country's average yield is still very low of about 2 tons/ha and Nigeria still faces great deficit as current supply cannot meet the demand at homes. For the country to be successful in its bid to meeting the rice production and consumption demand of its citizens in the new millennium, the short term solution for bridging the gap between demand and supply of rice must be made by expanding the rice area through the use of improved varieties and better agronomic practices.

Above all, emphasis should be laid on availability of rice in Nigeria all year round, which will depend on how farmers can embark on irrigated rice production during the dry season. The potential yield of irrigated rice can be as high as 8 t/ha (Okocha 2002), which is far higher than all the other rice ecologies under rainfed condition. Therefore, irrigated rice production will supplement or increase with the quantity produced during the wet season which is below the quantity demanded presently in the country. Even though, dry season rice production is highly profitable it is not left without its own share of constraints which include lack of irrigation facilities limited appropriate technology etc. Until adequate and long lasting solutions to most of the problems of wet and dry season rice production are found, problem of self sufficiency in rice production generally will remain (Okocha, 2002).

To achieve these, high yielding varieties that can produce higher yields, resistant to diseases and photoperiod insensitive (Gomme, 1992) should be identified and improved upon. However, addressing some of these problems could be a first step for attaining self sufficiency in rice production in Nigeria. Based on the above, the research work was intended to investigate the possibilities of producing rice in dry season through the use of some promising varieties in Bauchi.

MATERIAL AND METHODS

Field experiments were conducted during the dry seasons of 2004/2005 and 2005/2006 at the Fadama Research Farm of Abubakar Tafawa Balewa University, Bauchi Nigeria. Bauchi is located in the Northern Guinea Savanna zone of Nigeria; 10°17"N and 9°49"E and it lies at 609.3m above sea level (Kowal and Knabe, 1972).

The materials used in this study were 10 varieties of rice which comprised of 4 adapted (FARO 46, Ex-China, WITA 4 and FARO 44) and 6 newly released varieties from West African Rice Development Authority (WARDA). These varieties are; NERICA 7, AIC 233, WAB 340, WAB 189 (FARO 54), WAB 450 and NERICA 1 (FARO 55). The ten varieties were laid out in a randomized completed block design with four replications. Plot size of $4.0m^2$ with 30cm path between plots and 1m path between replicates was used. The ten varieties were sown on the same day on the 23rd of December of 2004 and 2005.

The land was first ploughed and harrowed to obtain a fine tilth before sowing. Plots and blocks were made with water channels in between plots for easy irrigation. A spacing 20x20cm inter and intra row was use of all the varieties with 3-5 seeds planted per hill, following the recommendation of National Cereal Research Institute (2003) Badeggi Niger State. Before the beginning of the research, soil was first sampled and analyzed. The physicochemical properties of the soil at the experimental site are presented in Table 1. This formed the basis for the fertilizer application in the area. A compound fertilizer, NPK 20:10:10 was applied using broadcast method at the rate of 60kg N, 30kg P_2O_5 and 30kg K_2O per hectare at two weeks after emergence. At six and ten weeks after emergence, Urea fertilizer was split applied as top dress at the 10kg N per hectare at each application. The plots were kept free of weeds using manual means after Gramaxone was first applied as pre-emergent herbicide at the rate of 4 litres per hectare. Problem of rats and birds were observed during the research and method of scaring was employed to curtail the problem. Some of the varieties were also observed to be infected with blast, a disease cursed by *Pyriculania oryzae* and *Bentex T.* fungicide powder was used for the control at the of 900g per hectare. Eight hills were randomly tagged from four middle rows (net plot) of $1.2m^2$ for data collection. Parameters were taken at weekly intervals starting from 2 weeks after emergence until harvest.

A. Garba, Crop Production Programme, school of Agric. and Agricultural Tech., Abubakar Tafawa Balewa Univ., Bauchi. Nigeria
G.G. Fushison, Crop Production Programme, sch. of Agric. and Agricultural Tech., Abubakar Tafawa Balewa Univ., Bauchi. Nigeria

During the investigation, parameters such as plant height, number of leaves and tillers per plant, spikes per hill spikelets per spike, eyes per spike, eye and spike weight were all taken. Plant height was measured with the aid of a measuring tape from the base of the plant to the tip of the growing plumule. Numbers of tillers were counted excluding the main stem. Number of spikes per hill, spikelets per spike, eyes per spike, eye weight were all taken at harvest. Spike weight was measured with the aid of weighing balance (Mettler 2000) in the laboratory. During the period of study, water was supplied through furrow irrigation with the aid of a pumping machine from a nearby stream. During growth and development of the crop, water was supplied every 2 days in the mornings until it reaches field capacity (20 litres per plot) for the area. However, the frequency of irrigation was reduced towards the maturation period of the crop to ones a week.

The two year data collected were subjected to combined analysis of variance to study the effect of the treatments. The treatment means were then compared using the student Newman Keuls, (SNK) to test for the level of significance (MSTAT, 1996).

Table 1: Physico-chemical properties of the soils at the experimental site at the Fadama Farm of Abubakar Balewa University Bauchi, Nigeria

Section 1.01 Soil characteristics	**Experiment Site (Soil depth at 0-30cm)**
Section 1.02 Physical analysis	
Particle size distribution (gkg-1)	
Sand	120.02
Silt	230.40
Clay	640.58
Texture	Clay loam
Chemical analysis	
P^H water (1:1)	5.82
P^H $cacl_2$ (1:2)	5.31
Organic carbon (gkg^{-1})	1.80
Total nitrogen (gkg^{-1})	0.28
C:N	6.43
Available P ($mgkg^{-1}$)	6.78
CEC C mol (+) kg^{-1}	4.52
Exchangeable bases Cmol (+) kg^{-1}	
Ca	2.18
Mg	0.85
K	0.37
Na	0.03
BS (%)	75.86

RESULTS AND DISCUSSION

Significant ($P \leq 0.05$) difference was observed among the ten varieties throughout the study period (Table 2). FARO 46 was observed to be significantly ($P \leq 0.05$) taller (79.6cm) than all the other varieties. However, Ex-China and NERICA 1 were the shortest (40.6cm and 42.6cm respectively) among all the varieties studied. Based on general observations and literatures, plant height observed during this study was far shorter than the plant height of most of the varieties grown under the same ecology and during the dry season. According to the findings of Ayotade (1991), rice grown under irrigation can attain a height of between 110-140cm depending on the variety and the environmental conditions at the time. Even though varietal differences could be the major reason for the variation between the two researches, fundamentally, the environmental factors prevailing at the time of the study might have affected the growth and development of the crop rather negatively.

Number of tillers per plant (Table 3) shows that there was a significant ($P \leq 0.05$) difference among the ten varieties. Throughout the study period, WITA 4 and FARO 44 produced significantly ($P \leq 0.05$) higher number of tillers per plant (24 each) than all the other varieties. NERICA 1 however was the least in tiller number per plant (4). The variation in tillering potential among the varieties could be genetically controlled. Even though tiller production is controlled genetically by hereditary traits, environmental factors during the dry season might have influenced the tillering ability of some of the varieties like NERICA 1 which is known to tiller up to 11 per plant during the rainy season in Bauchi (WARDA, 2003).

Results obtained in this investigation indicated that rice yield and yield related characters (Table 4) differed significantly ($P \leq 0.05$) among the varieties. The effect of rice variety on number of spikes per hill, number of eyes per spike, weight per eye, weight per hill and grain yield per hectare, showed that all were significantly affected except number of spikelets per spike.

Number of spikes per hill varied significantly ($P \leq 0.05$) among the varieties studied. WITA 4 and FARO 44 produced significantly ($P \leq 0.05$) higher number of spikes per hill than all the other varieties. The differences observed among the varieties could be due to hereditary traits inherent within the different varieties investigated. Even though tillers are known to potentially produce spikes, it was observed in the present investigation that not all the tillers were able to produce spikes. This could be attributed to environmental factors which affected the crop prior to jointing stage, a critical stage of production in rice. Another reason to be advanced could be that, an environmental factor like temperature (Baker, 1988) or more may not have been at its optimum during the dry season, thereby affecting spike production in these varieties. The present study lends support to the report of Yoshida, (1978) that initiation of spikes in rice requires optimum temperature (critical temperature) of 15°C. This may not have been the same in the area at the time of the investigation. This might have affected some of the spikes not to be initiated. However, season and location of the two studies could be another reason for the variation in the two reports. As it was observed during the present investigation, there were other factors, such as insect pests and rodents which were responsible for the reduction on number of spikes produced.

Table:2 Effect of variety on plant height of rice from 2 WAS to 15 WAS grown under irrigation during the dry seasons of 2004/2005 and 2005/2006 at Bauchi, Nigeria.

	Plant height (cm)				
VARIETY	2 WAS	5 WAS	8 WAS	12 WAS	15 WAS
FARO 46	10.6d	20.9ab	37.3a	51.3ab	79.6a
WITA 4	9.3e	16.9bc	26.3bc	32.9cd	57.9c
AIC 233	11.9c	19.8ab	30.2ab	51.5ab	66.2b
WAB 340	11.9c	19.5ab	29.4ab	45.7c	57.8c
WAB 189 (FARO 54)	12.6b	21.1cb	34.6a	51.5ab	54.7c
FARO 44	8.1F	13.1cb	19.1cd	25.9de	40.6d
Ex-China	7.7F	11.5e	19.4cd	28.3cd	42.6d
NERICA 1 (FARO 55)	14.1a	27.7a	42.3a	58.2a	70.2b
WAB 450	9.9e	17.9ab	27.8bc	45.2c	56.2c
NERICA 7	11.6c	22.1ab	34.3a	55.5a	56.2c
S.E (±)	0.39	1.08	1.94	1.61	1.71
SNK (P≤ 0.05)	1.92	5.31	9.54	7.92	8.41

Means followed by common letters are not significantly different at 5% probability level (SNK).
WAS = Weeks After Sowing.

Table: 3 Effect of variety on number of tillers per plant of rice from 6 WAS to 18 WAS grown under irrigation during the dry seasons of 2004/2005 and 2005/2006 at Bauchi, Nigeria.

VARIETY	6 WAS	9 WAS	12 WAS	15 WAS	18 WAS
FARO 46	2bc	4b	8ab	13ab	13ab
WITA 4	5a	11a	19a	24a	24a
AIC 233	2bc	4b	6ab	8cb	9bc
WAB 340	2bc	4b	5ab	6d	7cb
WAB 189 (FARO 54)	2bc	5b	6ab	7b	7cd
FARO 44	4a	15a	21a	22a	24a
Ex-China	3ab	5b	11ab	14ab	14ab
NERICA 1 (FARO 55)	2bc	3b	4c	4d	4e
WAB 450	1cd	3b	4c	5d	6cd
NERICA 7	2bc	3b	4c	5d	6cd
S.E (±)	0.30	1.03	1.26	1.16	0.99
SNK (P≤ 0.05)	1.48	5.06	6.21	571	4.87

Means followed by common letters are not significantly different at 5% probability level (SNK).
WAS = Weeks After Sowing.

Table: 4 Effect of variety on yield and yield related characters of rice grown under irrigation during the dry seasons of 2004/2005 and 2005/2006 at Bauchi, Nigeria.

VARIETY	Number of Spikes/hill	Number of spikelets/spike	Number of eyes/spike	Weight/ eye (g)	Weight/ spike (g)	Weight/ hill (g)	GrainYield (Kg/ha)
FARO 46	13b	6a	44cd	0.0254b	1.11ab	14.86ab	37192ab
WITA 4	18a	9a	10a	0.0126F	1.37ah	23.93a	5982.2a
AIC 233	7bc	7a	79a	0.0184e	1.44ab	10.18ab	25145.5ab
WAB 340	6bc	8a	72a	0.0269a	1.70a	11.24ab	2809.6ab
WAB 189 (FARO 54)	5bc	7a	60ab	0.0223c	1.39ab	7.76a	1941.2bc
FARO 44	15a	8a	90a	0.0226c	2.27a	30.17a	7565.8a
Ex-China	14b	5a	60ab	0.0136F	0.88bc	12.25ab	3062.0ab
NERICA 1 (FARO 55)	4bc	6a	57bc	0.0202cd	1.16ab	4.42d	3605.8a
WAB 450	5bc	11a	92a	0.0195cd	1.77a	11.67ab	2296.5bc
NERICA 7	6bc	10a	97a	0.0112g	1.15ab	6.97ab	1743.1bc
SE (±)	0.76	6.68	6.68	0.0003	0.14	1.54	722.5
SNK (P≤ 0.05)	3.74	32.87	32.87	0.0013	0.69	7.58	3554.5

Means followed by common letters are not significantly different at 5% probability level (SNK).

Significant varietal effect on number of eyes per spike observed in this study showed WITA 4 producing significantly (P≤0.05) higher number of eyes per spike (104) than all the other varieties. FARO 46 however, had fewer number of eyes per spike (44) than the rest of the varieties. Differences in number of eyes per spike among the varieties could be due to environmental factors which could be detrimental to fertilization in some of the varieties. Adaptation and sensitivity to the environment could be another factor that might have militated against effective conversion of flower to eye set in these varieties. Environmental factors like temperature might have been at work during the entire time of flowering and eye set leading to flower abortion in these varieties (Coffer *et al.* 1996). During the investigation and particularly during flowering and eye setting periods, the temperature was generally high, which may be higher than the optimum temperature required by rice plants during eye formation. As was reported by Yoshida, (1978), rice requires optimum temperature of 30-33 ^{0}C at the

time of anthesis. However, its genetic factors inherent within the varieties coupled with level of adaptation of the varieties to the ecology of Bauchi, might have been another factor for consideration.

Significant (P≤0.05) difference was also observed among the varieties studied on weight per spike (Table 4). The result indicated that for all the varieties studied, FARO 44 was the heaviest in weight per spike (2.29g), while Ex-china was the least. This could basically be as a result of poor eye weight, which was due to infertility that was observed with some varieties during the investigation. This implies that the weight of spike is determined by eye weight. Invariably, the spike weight could be due to two fundamental characters; number and weight of eyes per spike.

Spike weight per hill (Table4) differed among the ten varieties, with WITA 4 producing heavier spike weight per hill (4.43g). Variation among the ten varieties may best be explained by the varietal characteristics as regard their adaptability to dry season and fluctuations in weather conditions. Even though some varieties had reasonable weight per hill which could be due to the fact that they were adaptable to the season and the ecology, production of higher spike weight per hill by WITA 4 could possibly be explained by the variety's high number of leaves and high number of tillers which enabled it to partition more photosynthates and nutrients used in the production of more spike weight per hill than the other varieties. This result corroborates the findings of Coffer and Hammer, (1996), who reported similar trend in rice production for more yield.

Grain yield varied significantly (P≤0.05) among the ten varieties (Table 4). FARO 44 and WITA 4 were the highest yielding varieties (7565.8 kg/ha and 5982.5 kg/ha respectively) when compared to the other varieties investigated (Table 4.). Variety's NERICA 7, WAB 189 and WAB 450 however, were significantly (P≤0.05) lower in grain yield with 1743.1, 1941.3 and 2296.5 kg/ha respectively. The performance of FARO 44 and WITA 4 in grain production per hectare may be due to their ability to produce more photosynthates which were utilized in the production of grains than the other varieties during anthesis and grain filling stages. This present report lends support to the work of Coffer and Hammer, (1996) who reported similar trend during anthesis and grain filling in rice. It could also be due to the genes that are inherent in the varieties vis-a-vis production of larger sized grains. The yield obtained from the present investigation agrees with that of Okocha,(2002) who reported that rice grown under irrigation can yield as high as 8 tones/ha. While the yield of NERICA 7, WAB 189 and WAB 450 that were significantly (P≤0.05) lower compared to other varieties, still agrees with the result of Singh *et al.* (1997), that rice grown under irrigation can have yield ranges from 2 to 4 tons/ha, depending on their sensitivity to different environments. The production of low yield in WAB 189 especially, that is known to produce higher yield of up to 5 t/ha during the rainy season (Edmond, 2006) could be due to the change in the season. WAB 189 has never been tried in the dry season in Bauchi. Therefore its ability to perform during this period remains a question. The variation in the two reports which supported both higher and lower yielding varieties in the present study may be as a result of varietal characteristics. Some of the varieties like AIC 233, WAB 340, WAB 189 (FARO 54) and NERICA 1 (FARO 55) are upland types while some of them like FARO 44 and WITA 4 are lowland types. Upland rice is less productive than lowland rice (WARDA, 2003) partly because it depends on nutrients that are dissolved in the soil moisture. When soil moisture is low, few nutrients are available, compared to the store house of the nutrients typically found in paddy waters for lowland rice (Singh *et al.* 1997). The yield of 2-4 tons/ha as obtained by Singh *et al.* (1997) could also be a result of geographical location of the research and also on the level of adaptation of these varieties.

Apart from what was observed in the present study, it was believed generally that so long as water which is the most important factor responsible for high yield in rice is kept at its best, higher yields could always be expected. However, environmental factors like temperature and sunshine hours (Fushison, 2006) might have also affected some of these varieties into not attaining to their full potentials in production.

Generally, all the varieties investigated on produced optimally. The reason could be that, apart from some limitations possibly from the environment like temperature, water through irrigation was sufficiently provided through out the growth and developmental stages of the crop. Similarly, adequate fertilization was provided for the crop. This may have also contributed to the appreciable yield observed during the study. The contribution of water and fertilizer application to rice has been supported by the report of Gomme, (1992), that the dry matter production after flowering directly correlated with yield under optimum conditions during dry season rice production. However during wet season, due to climatic constraints like low light and high night temperatures, the contribution of the reserved carbohydrates become substantial for grain filling and yield. An intriguing observation made during the study was the fact that the ten varieties used were all harvested at between 5-6 months after planting (December 23rd to June 6th) except Ex-China, NERICA 7 and FARO 44 that were harvested on the 14th, 14th and 17th of June respectively. This intriguing observation on the long duration to maturity noticed with all the varieties lend support to an earlier report by Gomme, (1992) that depending on the variety and climate, rice grains can be harvested in three to six months. The present finding also agrees with that of Yoshida, (1978) that temperature regimes greatly influence not only the growth pattern of the rice plant but also the growth duration as well. Based on this observation the higher grain yield produced by most varieties during the period might have also been due to the long time the varieties spent (about 6month) partitioning dry matter to grain production. On the other hand, it has well being established that respiration becomes low at low temperatures. The low respiration due to low night temperatures (Yoshida, 1978) during the grain development phases of rice may favor grain development and filling during the entire period.

CONCLUSION

Among all the varieties investigated, FARO 44 and WITA 4 were observed to perform better in grain yield than all the other varieties. From the yield obtained in the ten varieties, FARO 44 and WITA 4 seemed promising and can therefore be recommended for dry season rice production in Bauchi. Growing these varieties will go a long way in bridging the gap between the demand and consumption of rice in the country.

REFERENCES

Ayotade, K. A., 1991. Improvement of rice production in Nigeria between 1969 to 1989 and beyond. Paper presented at the Faculty of Agriculture, University of Ilorin, Kwara State, Nigeria. 35pp.

Baker, R. J., 1988. Differential Response to Environmental Stress. In: Wier, B. S; Eisen E. J., Goodman, M. M and Namgook G. (eds) Proceeding of the second International Conference on Quantitative Genetics Sinuer Associates Inc., Sunderland, Massachusetts, USA. p92 – 504.

Coffer, M. and Hammer G., 1996. **Plant adaptation and crop improvement**. International Rice Research Institutes (IRRI), Manila, Philippines. 636 pp.

Edmond, E.., 2006. **Effect of variety, fertilize type and date of fertilizer application on the growth and yield of rice at Bauchi, Nigeria.** Unpublished thesis of crop production programme, Abubakar Tafawa Balewa University, Bauchi, Nigeria. 48pp.

Fushison, G.G., 2006. Effect of environmental factors on tillering and yield of two rice varieties grown ur der irrigation during the dry season of Bauchi. Unpublished thesis, Abubakar Tafawa Balewa University, Bauchi Nigeria. 53pp.

Gomme, R., 1992. Current climate and population constraints in Agriculture. **In:** Kaiser and Drennen 1993, Cornell University, Ithaca (N.Y) Florida, United State of America p 67-86.

International Cereal Research Institute., 2003. Production technologies for lowland rice in Nigeria. NCRI, Badeggi, Niger State, Nigeria. 4pp.

Kowal, J. M. and Knabe, D. T., 1972. **An Agroclimatological Atlas of Northern States of Nigeria (with explanatory notes)**. Ahmadu Bello University Press Zaria, Nigeria. 11pp.

Mohammed, B., 2006. **Comparism between NERICA 1** (FARO 55) and an adapted rice variety (Ex-China) on yield and yield related characters in Bauchi, **Nigeria.** Unpublished Thesis, Abubakar Tafawa Balewa University, Bauchi Nigeria. 59pp.

M. Stat., 1996. M. Statistic soft wares for Student Newman's Kewls Test. Developed by Michigan State University, United State of America.

Okocha, P. I., 2002. Varietal improvement and rice production in Nigeria-past, present and future. Nigerian Journal of Agricultural Technology **10**: 6-17.

Singh, B. N., Fagade, S., Ukwungwu, M. N., William, C., Jagtap, S.S., Oladimeji, O., Effisue, A., and Okhidievbie, O., 1997. Rice growing environments and biophysical constraints in different agroecological zones of Nigeria. p35-44

WARDA., 2003. NERICA on the move. **In**: Coordinating NERICA's Potential and Dissemination. The Africa Rice Center, Abidjian, Cota-de-Lvoire 4pp.

Yoshida., 1978. Wetland characterization and classification for sustainable agricultural development. International Rice Research Institute (IRRI). Manila, Philippines 267pp.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 123 - 127
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 - 2903

RESPONSE OF ANNUAL WEED SPECIES TO ATRAZINE-BASED HERBICIDES IN MAIZE

J. O. MAKINDE

(Received 18 August, 2006; Revision Accepted 27 February, 2007)

ABSTRACT.

The response of weed species to preemergence applications of five rates (0.54, 0.81, 1.08, 1.34, and 1.61 kg/ha) of atrazine plus isoxaflutole (Atoll®) mixture was investigated during 2000 and 2001 cropping seasons. Primextra applied at 2.5 kg a.i./ha and atrazine plus Stomp applied at 1.25 + 0.83 kg a.i./ha were the checks in 2000 while 2.5 kg a.i./ha Atrazine SC (Soluble Concentrate) and 2.0 kg a.i./ha Atrazine WP (Wettable Powder) were also included as checks in 2001. Treatments were replicated four times in a randomized complete block design. Adequate level of weed control was exhibited in the weed densities of Atoll® treatments in all locations although these were comparable to weed densities in atrazine and its mixtures. Exceptions were found in Ilorin site in 2000. Weed biomass of herbicide treatments were similar in their respective sites. Most annual grasses and broadleaves encountered at the three sites were controlled except itchgrass in Ilorin. *Bracharia deflexa* population was reduced by 86 – 93% with Atoll treatments in 2000 at Ilorin. Atoll® treated plots reduced *Euphorbia heterophylla* population by 30 – 78% in Orin-Ekiti in 2000. While *E. heterophylla* declined in abundance by 56 – 92% in 0.54 and 0.81 kg a.i./ha, it was totally eliminated in 1.08 to 1.61 kg a.i./ha Atoll treatments in 2001.

KEYWORDS: Atoll, atrazine, isoxaflutole, maize, weed control, *Euphorbia heterophylla*

INTRODUCTION

Weed infestation is a major crop production constraint in southwestern Nigeria (Ayeni, 1991). The most important weeds of maize production are annual weeds and these often emerge with the crop. Weeds emerging with the crop are more competitive than those emerging later in the season (Bensch *et al.*, 2003). Therefore, their timely control is very essential in preventing early weed-crop competition, which often results in yield loss. Weed competition may cause reductions of 40 to 60% in maize grain yield (Lagoke *et al.*, 1981). The use of s-triazine herbicides, most especially atrazine and its formulated mixtures for weed control has been known for a few decades in maize production (Akobundu, 1987; Davelouis-McEnvoy and Valdez Marin, 1972; NACWC, 1994). Atrazine controls seedling grasses and broadleaves. However, environmental restriction on atrazine in several developed countries has led to increasing interest in isoxaflutole herbicide for weed control in maize.

Isoxaflutole {5-cyclopropyl-4-isoxazolyl [2-(methylsulfonyl)-4-(tifluoromethyl)-phenyl] methanone} is a systemic preemergence herbicide for broad-spectrum weed control in maize. It is a new herbicide of the isoxazole family. It is attractive because of its low use rates (Luscombe *et al.*, 1994; Vrabel *et al.*, 1995) and has the potential for usage in no-tillage corn to control weeds prior to planting and provide residual control of future emerging weeds (Vrabel *et al.*, 1996). Atoll® is a proprietary formulation of Rhône-Poulenc Agriculture Limited containing atrazine plus isoxaflutole. The objective of this research is to determine the response of annual weed species to atrazine plus isoxaflutole herbicide mixture in the forest (Orin-Ekiti), southern Guinea savanna (Ilorin) and derived savanna (Ibadan) ecologies of southwestern Nigeria.

MATERIALS AND METHODS

This study was conducted in the year 2000 and 2001 at Ilorin, Ibadan and Orin-Ekiti stations of the Institute of Agricultural Research and Training, Moor-Plantation. Land preparation entailed a disc plough and harrow. Formulated mixture of atrazine plus isoxaflutole (Atoll) was applied pre-emergence at five rates (0.54, 0.81, 1.08, 1.34, and 1.61 kg/ha). Atrazine plus metolachlor (Primextra) at 2.5 kg a.i./ha, and atrazine plus Stomp (pendimethalin) at 1.25+0.83 kg a.i./ha were included as checks. Atrazine SC (Soluble Concentrate) at 2.5 kg a.i./ha, Atrazine WP (Wettable Powder) at 2.0 kg a.i./ha were included only in 2001. There were eleven treatments with handweeded {at 3 and 6 weeks after sowing (WAS)} and weedy controls inclusive. Treatments were replicated four times in a randomized complete block design. Maize (variety, DMR-ESR-Y), was sown in 6 m x 5 m plots at a spacing of 90 cm x 40 cm. Seeds were sown on August 10 at Ilorin, September 25 at Ibadan, August 15 at Orin-Ekiti in 2000; and June 12 at Ilorin, July 16 at Ibadan, May 31 at Orin-Ekiti in 2001. Herbicides were applied with a CP 15 knap-sack sprayer calibrated to deliver 200 l/ha spray solution the same day seeds were sown.

Weed control treatments were assessed by weed density and weed biomass. Weeds were sampled in each plot at 6 WAS using a 50 cm x 50 cm quadrat. Weeds were identified by species for each treatment, counted, harvested and oven-dried at 80°C until a constant weight is obtained. Annual weed species collected were grouped into broadleaves and grasses and the percentages were calculated relative to the weedy check. The General Linear Model (GLM) procedure of Statistical Analysis System (SAS Institute, 1989) was used to conduct the Analysis of Variance (ANOVA) for the data. Duncan Multiple Range Test was used to separate differences between treatment means where ANOVA indicated the presence of such difference at 5% level of significance.

RESULTS AND DISCUSSION

Weed density and biomass were affected by herbicide treatments and year. The prevalent weeds at the three experimental sites are shown in Table 1. *Bracharia deflexa, Digitaria horizontalis, Commelina benghalensis, and Cyperus* spp. were common to all locations. Weed infestation varied considerably between years and locations. Weed densities of herbicide treatments were not significant at Ilorin site in 2000 (Table 2). Also, in 2001, weed densities of Atoll treatments at Ilorin site were not better than other herbicide treatments. Atoll treatments applied at 1.08 to 1.61 kg a.i./ha had comparable weed densities to handweeding at Ibadan site in 2000 (Table 2), while a better level of weed control was recorded in 0.81 to 1.61 kg a.i./ha Atoll treatments than the weedy check in 2001. Weed infestation at Orin-Ekiti site was significantly reduced ($p=0.05$) in 1.08 to 1.61 kg a.i./ha Atoll treatments when compared to 1.25 + 0.83 kg a.i./ha atrazine plus Stomp, 2.5 kg a.i./ha Primextra and the weedy check in 2000. Weed densities of all herbicide treatments were not

J. O. Makinde, Institute of Agricultural Research and Training, Moor-Plantation, Ibadan, Nigeria.

different in 2001 because the weed pressure was considerably reduced. Atrazine SC applied at 2.5 kg a.i./ha gave the lowest weed density in Orin-Ekiti and this was significantly different (p=0.05) from handweeding and weedy check.

There was no significant difference among the weed biomass of various herbicide treatments at Ilorin in 2000 (Table 3). Also in 2001, all Atoll treatments, atrazine plus Stomp and Primextra had no significant effect on total weed biomass in Ilorin. This is because while the population of annual broadleaves and grasses were reduced by the treatments, the perennial weeds encountered in this location remained uncontrolled. In Ibadan, 0.81 to 1.61 kg a.i./ha Atoll treatments had significantly lower (p=0.05) weed biomass than Primextra in 2000 (Table 3). All herbicide treatments and handweeding had significantly lower (p=0.05) weed biomass than the weedy check in Ibadan in 2001. At Orin-Ekiti, weed biomass of the herbicide treatments were not significantly different in 2000. Weed biomass of Atoll treatments were significantly lower than those of the weedy check while atrazine and its mixtures were not in 2001.

Control of broadleaf and grass species found in association with maize cultivation at the three sites were presented in Tables 4 to 6. Weed species at the three sites were mostly annuals. The Ilorin site, in 2000, had a total of 16 broadleaves and 9 grass species which were reduced by the herbicide treatments to 5 broadleaves and 5 grass species in 2001. The most prominent of the grass weeds were *Bracharia deflexa, Digitaria horizontalis and Rottboellia cochinchinensis* (itchgrass). These grasses except itchgrass were adequately controlled by the herbicides. Stomp contains pendimethalin which is a grass killer known to suppress itchgrass. This explains why in 2000 its mixture with atrazine gave an excellent weed control of 91%, a value that is much better than other herbicide treatments (Table 4). Most annual weeds that occurred in 2000 were controlled, hence, itchgrass increased in importance. This resulted in very poor control of grass weeds in 2001 with exceptions in atrazine plus pendimethalin mixture where weed control was 89% (Table 4).

Adequate weed control was achieved in Ibadan site in 2000 through 2001 where broadleaf and grass weed control were ≥72% and 62% respectively (Table 5). Sedge was not controlled in both years. The occurrence of *Oldenlanuia corymbosa* and *Bracharia deflexa* was restricted to the weedy checks in the two seasons. With the exception of the sedges, *Cyperus* spp. and *Panicum maximum* no other weed resisted control in this site. Concentrations of Atoll were as good as the herbicide formulations already in use in maize cultivation.

Total broadleaf control in 2000 was between 55 to 85% in Atoll treatments while no control was recorded in atrazine plus Stomp and Primextra in Orin-Ekiti site (Table 6). There was an improved broadleaf weed control which ranged from 58 to 93% in 2001. Contrary to the results obtained in 2000, atrazine alone or its tank mixes had 60 to 69% broadleaf weed control. Lingenfelter et al. (2002) have shown that isoxaflutole provided effective control of many common annual broadleaves such as pigweed species (*Amaranthus hybridus* and *A. retroflexus*), and common ragweed (*Ambrosia artemisifolia*). The control of these weed species improved at the higher use rate compared to the lower rates. Generally, poor control of grass weeds was observed in the Orin-Ekiti site. The control of broadleaf weeds increased as the concentration of Atoll increased. The high grass weed control, 82% in 2000 and 100% in 2001, observed in atrazine plus Stomp treatment in Orin-Ekiti resulted from the grass killer in the mixture. *Pennisetum purpureum* (elephant grass) was largely responsible for the very poor grass control in Primextra treatment. The herbicides applied could not control perennial weeds hence the poor performance where they occurred. *Euphorbia heterophylla* (milkweed) was the most abundant broadleaf in Orin-Ekiti. Earlier researches reported its resistance to the preemergence s-triazines and urea derivatives (Vidal *et al*, 1997; Garson and Vicente Lazo, 1996; Akinyemiju, 1992; Akobundu, 1987; Davelouis-McEnvoy and Valdez Marin, 1972) used for broadleaf weed control in maize production. In this study, *E. heterophylla* population was reduced by 30 – 78 % in Atoll treated plots in 2000. During 2001, the population was further reduced by 56 – 92% in 0.54 to 0.81 kg a.i./ha while it was eliminated from 1.08 to 1.61 kg a.i./ha Atoll treatments. *Ageratum conyzoides* constituted no menace in maize as all the herbicides used gave excellent control when compared to the density of 35 plants/ m^2 obtained in the weedy check.

Table 1: Predominant weed species of the experiment sites.

Weed species	Life cycle	Morpho-logical group	Family	Occurrence		
				Ilorin	Ibadan	Orin Ekiti
Ageratum conyzoides L.	A	B	Asteraceae	No	Yes	Yes
Bracharia deflexa (Schumach.) C. E. Hubbard	A	G	Poaceae	Yes	Yes	Yes
Cleome viscosa L.	A	B	Cleomaceae	Yes	No	No
Commelina benghalensis L.	A	-	Commelinaceae	Yes	Yes	Yes
Cyperus esculentus L.	P	S	Cyperaceae	No	Yes	Yes
Cyperus rotundus L.	P	S	Cyperaceae	Yes	Yes	No
Digitaria horizontalis Willd	A	G	Poaceae	Yes	Yes	Yes
Euphorbia heterophylla L.	A	B	Euphorbiaceae	No	No	Yes
Lactuca teraxacifolia (Willd.) Schum.	A	B	Asteraceae	No	No	Yes
Mariscus umbellatus Vahl.	P	S	Cyperaceae	No	No	Yes
Panicum maximum Jacq.	P	G	Poaceae	No	Yes	No
Pennisetum purpureum Schum.	P	G	Poaceae	No	Yes	Yes
Rottboellia cochinchinensis (Lour) Clayton	A	G	Poaceae	Yes	No	No

A= Annual P= Perennial B= Broadleaf G= Grass S= Sedge

Table 2. Effect of herbicide treatments on weed density 6 WAS.

Treatment (kg/ha)[a]	Ilorin		Ibadan		Orin-Ekiti	
	2000	2001	2000	2001	2000	2001
			no/m^2			
0.54 Atoll	19.8 b	8.8 bcd	27.8 ab	44.0 bc	28.0 ab	18.5 bc
0.81 Atoll	20.3 b	10.3 bcd	25.3 ab	8.0 bc	29.8 ab	14.3 bc
1.08 Atoll	16.8 b	16.3 ab	24.8 bc	5.0 c	18.8 b	12.3 bc
1.34 Atoll	14.3 b	13.8 abc	18.8 bc	11.0 c	13.8 b	10.5 bc
1.61 Atoll	13.5 b	7.3 cd	25.2 bc	8.0 c	22.5 b	11.0 bc
2.5 Atrazine SC	-	6.0 cd	-	18.0 bc	-	3.8 c
2.0 Atrazine WP	-	8.8 bcd	-	13.0 bc	-	10.3 bc
1.25+0.83 atrazine + Stomp	16.0 b	5.3 cd	22.5 bc	63.0 b	56.5 a	16.8 bc
2.5 Primextra	19.5 b	3.3 d	13.0 bc	18.0 bc	60.8 a	18.0 bc
Handweeded check	21.3 b	6.5 cd	11.8 c	12.0 bc	35.5 ab	24.8 ab
Weedy check	54.3 a	22.0 a	41.0 a	197.0 a	60.0 a	36.3 a

Means followed by the same letter within a column are not significantly different at 5% level using DMRT.
a – Atoll is a proprietary formulation of Rhône-Poulenc containing 37.5 g/l isoxaflutole and 500 g/l atrazine

Table 3. Effect of herbicide treatments on weed biomass 6 WAS.

Treatment (kg/ha)[a]	Ilorin		Ibadan		Orin-Ekiti	
	2000	2001	2000	2001	2000	2001
				no/m^2		
0.54 Atoll	40.25 ab	19.64	35.86 ab	8.78 b	71.90 a	4.86 c
0.81 Atoll	71.47 a	28.11	26.60 bc	4.11 b	17.97 bc	11.48 bc
1.08 Atoll	69.81 a	23.82	27.01 bc	1.96 b	57.87 ab	10.02 bc
1.34 Atoll	28.15 ab	10.58	28.50 bc	1.61 b	12.76 bc	11.00 bc
1.61 Atoll	60.27 a	11.20	28.01 bc	0.42 b	71.95 ab	7.64 bc
2.5 Atrazine SC	-	22.72	-	3.14 b	-	12.17 abc
2.0 Atrazine WP	-	20.58	-	3.49 b	-	17.30 abc
1.25+0.83 atrazine + Stomp	39.85 ab	12.08	31.01 bc	11.56 b	41.95 ab	12.58 abc
2.5 Primextra	76.31 a	26.34	70.12 a	2.36 b	63.94 ab	18.49 ab
Handweeded check	17.80 b	15.67	6.32 c	2.24 b	12.30 c	8.15 bc
Weedy check	63.04 a	24.28	52.93 ab	90.13 a	76.63 a	21.41 a
		NS				

Means followed by the same letter within a column are not significantly different at 5% level using DMRT.
NS = not significant
a – Atoll is a proprietary formulation of Rhône-Poulenc containing 37.5 g/l isoxaflutole and 500 g/l atrazine

Table 4: Effect of herbicide treatments on weed species 6 WAS in Ilorin.

Treatments kg a.i./ha	2000				2001			
	Broadleaf	Grass	*Bracharia deflexa*	*Digitaria horizontalis*	Broadleaf	Grass	*Bracharia deflexa*	*Digitaria horizontalis*
	% Control		no/m^2		% Control		no/m^2	
0.54 Atoll[a]	94	62	3	4	100	37	0	0
0.81 Atoll	100	69	0	0	100	29	0	0
1.08 Atoll	87	72	3	0	98	0	0	0
1.34 Atoll	95	56	2	0	100	29	0	1
1.16 Atoll	98	75	3	0	100	44	0	0
2.5 Atrazine SC	-	-	-	-	100	15	0	2
2.0 Atrazine WP	-	-	-	-	96	0	3	0
1.25+0.83 Atrazine + Stomp	100	91	0	1	98	89	0	0
2.5 Primextra	94	73	0	0	10	63	0	0
Handweeding	100	100	0	2	100	100	0	0
Weedy check	0	0	23	8	0	0	0	3

a – Atoll is a proprietary formulation of Rhône-Poulenc containing 37.5 g/

Table 5: Effect of herbicide treatments on weed species 6 WAS in Ibadan.

Treatments kg a.i./ha	2000				2001			
	Broadleaf	Grass	*Oldenlandia corymbosa*	*Bracharia deflexa*	Broadleaf	Grass	*Oldenllandia corymbosa*	*Bracharia deflexa*
	% Control		no/m^2		% Control		no/m^2	
0.54 Atoll[a]	97	72	0	0	79	86	0	0
0.81 Atoll	82	96	0	0	100	93	0	0
1.08 Atoll	97	93	0	0	98	100	0	0
1.34 Atoll	100	79	0	0	99	93	0	0
1.16 Atoll	100	93	0	0	99	100	0	0
2.5 Atrazine SC	-	-	-	-	98	86	0	0
2.0 Atrazine WP	-	-	-	-	100	86	0	0
1.25+0.83 Atrazine + Stomp	94	79	0	0	72	100	0	0
2.5 Primextra	100	62	0	0	96	100	0	0
Handweeding	100	100	0	0	100	100	0	0
Weedy check	0	0	6	4	0	0	25	2

a – Atoll is a proprietary formulation of Rhône-Poulenc containing 37.5 g/l isoxaflutole and 500 g/l atrazine

Table 6: Effect of herbicide treatments on weed species 6 WAS in Orin-Ekiti.

Treatments kg a.i./ha	2000				2001			
	Broadleaf	Grass	Milkweed	Goatweed	Broadleaf	Grass	Milkweed	Goatweed
	% Control		no/m^2		% Control		no/m^2	
0.54 Atoll[a]	59	23	40	0	58	33	28	0
0.81 Atoll	55	65	45	1	81	0	5	0
1.08 Atoll	80	47	21	0	92	0	0	0
1.34 Atoll	85	59	14	0	93	17	0	0
1.61 Atoll	72	47	29	0	92	83	0	0
2.5 Atrazine SC	-	-	-	-	69	50	17	0
2.0 Atrazine WP	-	-	-	-	68	17	13	0
1.25+0.83 Atrazine + Stomp	0	82	106	1	66	100	18	0
2.5 Primextra	0	6	104	3	60	0	27	0
Handweeding	100	100	0	0	100	100	0	0
Weedy check	0	0	65	35	0	0	63	27

a – Atoll is a proprietary formulation of Rhône-Poulenc containing 37.5 g/l isoxaflutole and 500 g/l atrazine

CONCLUSION

Atoll is as effective as the conventional herbicides already in use for annual weed control in maize. However, it has a major breakthrough in the control of *E. heterophylla* that has defied all chemical weed control in maize cultivation in southwestern Nigeria.

ACKNOWLEDGEMENTS

The author is grateful to the management of Aventis Crop Science Nigeria Limited for providing funds for this research.

REFERENCES

Akinyemiju, O. A., 1992. Weed control in maize with with acetochlor, alone and in combination with atrazine. Nigerian Journal of Weed Science 5: 53-62.

Akobundu, I. O., 1987. Weed Science in the tropics: principles and practices. John Wiley and Sons Limited. 526pp.

Bensch, C. N., Horak, M. J. and Peterson, D., 2003. Interference of redroot pigweed (*Amaranthus retroflexus*), palmer amaranth (*A. palmeri*), and common waterhemp (*A. rudis*) in soybean. Weed Sci. 51: 37-43.

Davelouis-McEnvoy, J. and Valdez Marin, L. A., 1972. Chemical weed control for maize in the Rimac and Canete Valleys. *Anales Cientificos* 10 (1 and 2): 28-32.

Garson, A. and Vicente Lazo, J., 1996. Phenological charaterization of populations of *Euphorbia heterophylla* L. and *Rottboellia exaltata* Lf., potentially resistant to S-triazines herbicides and urea derivatives. *Anales de Botanica Agricola* 3: 5-21.

Lingenfelter, D. D., Curran, W. S. and Handwerk, K., 2002. Isoxaflutole vs mesotrione: the battle of the bleachers. *Proc. NEWSS* 56: 24.

Luscombe, B. M., Vrabel, T. E., Paulsgrove, M. D., Cramp, S., Cain, P., Gamblin, A. and Millet, J. C., 1994. RPA201772: a new broad spectrum preemergence herbicide for corn. *Proc. North Cent.* Weed Sci. *Soc.* 49:57-58.

NACWC, 1994. National Advisory Committee on Weed Control. Weed control recommendations for Nigeria. Series No 3. 111pp.

SAS Institute Inc., SAS/STAT User's Guide, Version 6 Vol. 24th Edition. SAS Institute Inc., Cary, NC. 1989. 846 pp.

Vidal, R. A., Fleck, N., Oliveira, N., Strello, R., Guimaraes, F. B. and Silva, N., 1997. Increasing the number of mechanisms of action of herbicides for management of weed resistance. 1997 Brighton crop protection conference: weeds. Proceedings of International Conference, Brighton, UK, 17-20 November 1997. 1:363-368.

Vrabel, T. E., Jensen, J. O., Wrucke, M. A. and Hicks, C., 1995. EXP31130A: a new preemergent herbicide for corn. Proc. North Cent. Weed Sci. *Soc.* 50:24-25.

Vrabel, T. E., Striegel, W. L. and Lavoy, J. D., 1996. Efficacy of isoxaflutole as a burndown treatment in no-till corn. Proc. North Cent. Weed Sci. *Soc.* 51:67.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 129 - 131
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 - 2903

SOURCES OF FINANCE TO AGRICULTURAL SECTOR IN EDO SOUTH SENATORIAL DISTRICT OF EDO STATE, NIGERIA

K. O. ILAVBARHE AND J. AHMADU

(Received 11 February, 2005; Revision Accepted 21 March, 2007)

ABSTRACT

The study focused on sources of finance to the agricultural sector with particular reference to Edo South Senatorial District. Data were collected using well-structured questionnaires administered to one hundred (100) randomly selected farmers from the district. Simple descriptive statistics and t-test were used for data analysis. The result revealed that formal and informal financial institutions are the sources of fund available to farmers in the study area. The formal financial sources were found to be significantly more efficient as they contributed 69.13% of the total fund to the farmers while the informal financial sources contributed only 30.87%. However, a majority of the farmers (88%) patronized the informal sources and only few farmers (12%) patronized the formal sources. The reason adduced for this was the difficulties of getting loan from the formal sources. In view of this, it is suggested that the formal financial institutions should simplify their cumbersome method of loan disbursement.

KEYWORDS: Sources, problems, finance, agriculture and Edo South.

INTRODUCTION

Finance, according to Aniemeke and Gbanoba (1990), is defined as the money or sum of capital which any business organization may employ to acquire further wealth, raw materials, land, building, plants and machinery which may be needed for business operations. Agricultural finance, therefore, is usually defined as the economic study of the acquisition and use of capital in agriculture and agricultural credit refers specifically to the process of obtaining control over the use of money, goods and services in the present in exchange for a promise to repay at a future date (Adegeye and Dittoh, 1986).

Adegeye and Dittoh (1986) went further to say that agricultural finance can refer to the financing of agriculture at the national, state or at the farm level. At the national and state levels, agricultural finance is concerned with agriculture's contribution to and share of the national or state resources as well as the role of banks and other financial institutions in the financing of agriculture as a sector of the economy. At the farm level, agricultural finance refers to the financial management of the farm. Agricultural finance naturally leads to agricultural credit as governments obtain loans internally and externally to finance agricultural projects and farmers also obtain loans for the purpose of using them on their farms.

The role of finance in agricultural growth in particular and the global economic growth in general cannot be overemphasized. It is in line with its enormous role that the International Monetary and Financial Committee (IMFC) gave a strong support to International Monetary Fund (IMF) to help its members to develop sound financial sectors to protect against vulnerability and to mobilize financing for productive investment (Zile and Steinbuka, 2001). The finance or credit from this type of financial institution (IMF) to agricultural sector will stimulate its growth and development. It is in view of this that the government of Nigeria, at various times, established credit institutions to serve as formal financial resources to agricultural sector. These, Imoudu and Famoriyo (1996) pointed out to include Agricultural Credit Guarantee Scheme Fund(ACGSF), Nigerian Agricultural and Cooperative Bank (NACB), Commercial and Merchant Banks, Cooperative Societies and Agricultural Development Projects (ADPs). There are also other sources of finance to farmers, which Ijere (1986) referred to as informal financial institutions. They include personal savings, lending and gifts from relations, friends, moneylenders, merchants and pledging.

Despite the formal and informal sources of finance available to agricultural sector, small-scale farmers still lack adequate fund to finance their farming business. This may be due to the fact that the financial sources are often scarce, expensive, unreliable and most of the time their existence is not known. This work seeks to identify the sources and problems of finance to agricultural sector with reference to Edo South Senatorial District with a view to suggesting ways of enhancing more efficient agricultural finance.

Data were collected by the use of well structured questionnaire administered to one hundred (100) randomly sampled farmers from Edo South Senatorial District which comprises Oredo, Egor, Ikpoba-Okha, Ovia South West, Ovia North East, Uhunmwonde, and Orhionmwon Local Government Areas.

The data were analysed using simple descriptive statistics and t-test statistics to test the significant difference if any, between formal and informal sources of finance to farmers.

RESULTS AND DISCUSSION

Sources of Finance to Farmers

The available sources of finance to the respondents in the study area are shown in Table I

Table 1: Sources of Finance to Respondents

Source of fund	No. of respondents	Percentage (%)	Cumulative %
Personal Savings	55	55	55
Money Lenders	8	8	63
Relations	12	12	75
Friends	10	10	85
Traditional Credit Group	3	3	88
Co-operative	6	6	94
NACB	4	4	98
Commercial Banks	2	2	100
Total	100	100	100

Source: Field Survey, 2001.

K.O. Ilavbarhe, Dept. of Agricultural Economics and Extension Services, Faculty. of Agric. Univ. of Benin, Benin City, Nigeria
J. Ahmadu, Dept. of Agricultural Economics and Extension Services, Faculty. of Agric. Univ. of Benin, Benin City, Nigeria

The table shows that the highest percentage of the respondents (88%) depended on informal sources of finance with 55% solely relying on their personal savings. A total of 12% relied on borrowing from family relations; 10% from friends, 8% relied on borrowing from moneylenders and 3% used traditional credit group as their source of fund. The formal financial sources, on the other hand, recorded a total of only 12% respondents that patronized this source. Of this, 6%, 4% and 2% obtained their loans form Cooperatives, NACB and Commercial Banks respectively.

It is clearly indicative here that informal sources of finance played an over-riding role over the formal sources in the study area as a majority of respondents patronized the informal financial sources than the formal institutions. This is due to the ease of getting funds from the informal sources. This result agrees with the finding of Ada-Okungbowa and Aigoro (1996) on agricultural credit acquisition and use of small-scale farmers in Osun State that 91% of the respondents obtained their credit from informal financial sources while only 9% got theirs from the formal sources.

VOLUME OF FUND FROM THE VARIOUS FINANCIAL SOURCES

Table 2 shows the size of fund obtained by the respondents in the
Study area from the various available financial sources. It reveals that informal finance sources contributed on the average, a total of ₦16.750.00 representing 30.87% of the total fund to the respondents, while the formal financial sources contributed on the average, a total of ₦37, 500.00 representing 69.13% of the total fund.

It can be deduced here that the fund from the informal sources of finance which a majority of respondents relied on (Table 1) are grossly inadequate while the formal sources contributed reasonable and substantial amount which is more effective, but only to the few privileged respondent (Table 1). The reasons adduced for this is that cumbersome procedure, untimely disbursement of loan, demand for feasibility report and collateral security, coupled with farmers illiteracy constrained majority of the respondents from getting loans from the formal financial institutions. The institutions also are restrictive in the amount of loan given out to farmers due to the risky nature of agricultural business. As a result, the respondents resorted to the informal sources. The overall consequence is the depression in the agricultural sector. If this problem is not tackled, agriculture in Nigeria cannot grow beyond subsistence level.

Table 2: Size of Fund to Respondents by Various Sources

Source of fund	Size of fund ₦	mid size of fund ₦	Percentage (%) mid size	Cumulative % mid size
Personal Savings	1,000-5,000	3,000	5.53	5.53
Relations	200-2,000	1,250	2.30	7.83
Friends	1,000-2,000	1,500	2.76	10.59
Money Lenders	2,000-5,000	3,500	6.45	17.04
Traditional Credit Group	5,000-10,000	7,500	13.83	30.87
Cooperatives	10,000-15,000	12,500	23.04	53.91
NACB	10,000-25,000	17,500	32.26	86.17
Commercial Banks	5,000-10,000	7,500	13.83	100.00
Total		54,250	100.00	

Source: Field Survey, 2001

HYPOTHESIS TESTING

The formulated and tested hypothesis was that there was no significant difference between formal and informal sources of finance to agricultural sector.

The result from table 3 shows that the two sources of finance (formal and informal) differ significantly from each other ($P<0.05$).

Table 3: t-Test Analysis of Informal and Formal Sources of Finance to Agricultural Sector

No. of fund source	Size of fund ₦		Variance (6^2)		t-calculated	t-tab.
	Informal	Formal	Informal	Formal		
1	3,000	12,500				
2	1,250	17,500				
3	1,500	7,500				
4	3,500					
5	7,500					
Total	16,750	37,500				
Mean	3350	12500	6,300,000	2,500,000	6.324**	2.447

Source: Field Survey, 20001

***Financial Problems* Facing Farmers in the Study Area.**
The study revealed that many problems affect the farmers in their quest for fund.

Of the 12 respondents that obtained loan from the formal institutions (Table 4), a great deal of them (42%) complained of cumbersome procedures involved in loan acquisition. and 25% complained of inadequate loans. This might be due to inadequate fund by the institutions, restriction imposed on them by CBN, and risky nature of agricultural business which made them to be restrictive in the amount of loan to farmers. Other problems include untimely loan disbursement, high interest rate, and collateral security, with 17%, 8% and 8% respectively of percentages of respondents that complained. The current interest rate of 17% charged by NACB was considered to be high by the respondents.

Table 4: Problems Faced From Formal Sources of Fund

Category	No. of respondent	Percentage (%) respondent
Inadequate Loan	3	25
Cumbersome Procedures	5	42
Untimely Loan Disbursement	2	17
High Interest Rate	1	8
Collateral Security	1	8
Total	12	100

Source: Field Survey, 2001

Table 5: Problems Faced From Informal Sources of Fund

Category	No. of respondent	Percentage (%) respondent
Inadequate Fund	68	77
Exhobitant Interest Rate	15	17
Bad Treatment by Lender	5	6
Total	88	100

Source: Field Survey, 2001

Table 6: Why Loan was not obtained from Formal Financial Institutions

Reason	No. of respondent	Percentage respondent
Formal Institutions	Nil	Nil
Not Aware of Formal Institutions	Nil	Nil
Cumbersome Procedures	57	65
Collateral Security	20	23
Untimely Loan Disbursement	10	11
Inadequate Loan/High Interest Rate	1	1
Total	**88**	**100**

Source: Field Survey, 2001

In table 5 above, 77% of the 88 respondents that patronized the informal sources of fund complained of inadequate fund. The high percentage here shows the high intensity of low capital or fund available for use or to give as credit. 17% and 6% complained of exorbitant interest rate charged and bad treatment given by moneylenders respectively.

In table 6, respondents were questioned why they did not obtain loan from the formal sources. They all professed their awareness and the existence of the institutions as indicated by "Nil" in the table. But the reason for this, they attributed to the institutions' cumbersome loan procedures, demand for collateral security which most of them lack, untimely loan disbursement, and inadequate loan/high interest rate. The corresponding percentages of the complaint by respondents are 65%, 23%, 11% and 1% respectively.

CONCLUSION AND RECOMMENDATIONS

The finding revealed that formal and informal financial institutions are the available sources of fund to farmers in the study area. It was also found that most farmers patronized the informal sources of fund (which are inadequate and more expensive) than the formal sources due to the ease of getting fund and the difficulty of getting it from the latter. Therefore, it is suggested here that the formal financial institutions should simplify their cumbersome methods of loan disbursement and it should be timely and adequate. Farmers should avoid loan diversion and default in repayment The informal financial sources should be fashioned into improved lending institutions.

REFERENCES

Ada-Okungbowa, C. I. and Aigoro, S. K., 1996. "Agriculture Credit Acquisition and Use: A Case Study of Small Scale Farmers in Osun State, Nigeria". In: Applied Tropical Agriculture! An International Journal. Vol., (1): 38-43.

Adegeye, A.J. and Dittoh, J. S., 1986. Essentials of Agricultural Economics. Impact Publishers Nigeria Ltd., Ibadan. p.147.

Aniemeke, E. N. and Gbanoba, D. A., 1990. Essential of Business Economics for Tertiary Institution pp.143-146.

Ijere, M. O., 1986. New Perspective in Financing Nigeria Agriculture. 4th Dimension Publishing Co. Ltd., Ibadan pp. 37-47

Imoudu, P.B. and Famoriyo, O. A., 1986. "An Assessment of Approaches of Credit Availability in Nigerian Agriculture" Invited Paper Presented at the Third National Conference of Farm Management Association of Nigeria (FAMAM) held at ARMTI, Ilorin. August 24-27, 1986.

Zile, R. and Steinbuka, 1., 2001. International Monetary, and Financial Committee (IMFC) Meeting Endorses International Monetary Fund (IMF) Crisis Prevention Efforts. "In: Finance and Development. P.30. IMF Bulletin, June, 2001.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 133 - 137
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 - 2903

THE EFFECT OF QUARRYING ON SOIL AND VEGETATION IN AKAMKPA LOCAL GOVERNMET AREA OF CROSS RIVER STATE, NIGERIA

E. C. NZEGBULE and F. EKPO

(Received 12 January, 2007; Revision Accepted 27 March, 2007)

ABSTRACT

The impact of tailing waste from quarry operations on the soil and vegetation in Akamkpa Local Government Area, Cross River State were investigated. The selected sampling areas (0 km, 0.75 km and 2 km or control) were delineated based on the intensity of exposure to tailings and distance from the quarry Samples of the extracted material (chippings) was analyzed to ascertain the chemical composition. Samples of the soil (0-5cm), fodder species *Alchornea cordifolia* and *Aspilia africana*, edible fruit *Carica papaya* and *Mangifera indica* as well as root and tuber species *Manihot esculenta* and *Colocasia esculenta* were collected separately from each of the sampling area and analyzed for chemical characteristics. From the rock material, the concentrations of Cu, Pb, Zn, Fe, Cd, Ni, Cr and Mn in quarried materials (Chippings) were 9.28, 1.88, 10.64, 349.50, 2.06, 3.22, 1.12, and 2.44 (mg/kg) respectively. Quarry activities in Akamkpa affected the levels of Pb, Cu, Zn, Fe, Mn, Ni and Cd in the soil as these element had significantly higher concentrations in the soils collected from the immediate vicinity of the quarry (0 km). Also the concentrations of the metals in the plants leaves within the quarrying site were significantly higher ($P<0.01$) than that of the control (2 km). The concentrations of Zn, Cu and Ni in leaves of *Mangifera indica* collected from the farthest sampling position from the quarry were lower by 81%, 63.04% and 51.93% respectively than that collected from immediate vicinity of the quarry site. Quarry operation is causing increasing building of trace metals in the soils and vegetation in Akamkpa Local Government Area of Cross river State. Thus, the operations of the quarry industry need to be regulated to reduce the health risk the practice poses to the local populace.

KEYWORDS: Quarry, Soil and vegetation

INTRODUCTION

Quarrying as a land use method is concerned with the extraction of non-fuel minerals from rocks (Okere *et al* 2001). Gravels for building houses and other civil construction are obtained from quarrying of rocks of the earths crust. There is now a great demand for rocks especially limestone as an essential constituent of many building and construction processes. A variety of products from mining and crushed rocks form primary raw materials in many industrial applications (Ellen, 2000). Crushed rocks are used as aggregate in high ways or concretes construction, in bituminous mixture and rail road ballast (Wills, 1995). However, several wastes are generated during the processes of extraction and crushing of rocks. Environmental disturbance and contamination as a result of mining and mineral processing activities constitute the major threats to public health and environmental quality (Adepoju, 2002).

The severity of the environmental problem depends on the characteristics of the mineral being extracted, the method of mining, waste materials generated and site characteristics. The effects of such problems are manifest in the air, land, plants, and water around with mining activity. Tailing, a finishing ground particle of rock, are the most environmentally important component of the quarrying waste, released into the environment. Tailing generated from mining operations and weathering of rocks is among the major sources of trace metals introduced into the environment. The pollution of soils and water with trace metals through atmospheric deposition is well known (Kakulu 2003, Nriagu, 1990). Trace metals such as lead, Zinc, Cadmium, Copper, Manganese and iron from mining activities can also occur as natural biochemical cycles (Mattigod *et al*, 1983, Brown, 1979). Although some trace metals are essential in plants nutrition, plants growing in an environment with excessive accumulation of trace metals suffer toxicity effect and pose serious risk to human health when such plant based foodstuffs are consumed (Vausta *et al*, 1996, Alloway, 1990). Unfortunately extensive research aimed at understanding the effect of these heavy metals and their possible impacts on the environment in Akamkpa Local Government Area have not been done; also the important regulatory policies to minimize their environmental effects are not yet formulated.

MATERIALS AND METHODS

THE STUDY AREA:

The study area was at Akamkpa Local Government Area of Cross River State, Nigeria. The area lies between Latitude 6^0 50N and 07^0 30S. The maximum annual mean daily temperature of the area is between 29^0C and 34^0C. Akamkpa is characterized by the high rainforest vegetation. The two major seasons that prevail in the area are dry season (October-February) and rainy season with bimodal pattern (March- September). Short dry and windy periods of harmattan usually occur in the dry season. The mean annual rainfall is 2050mm. The soil in this area is clayey loam. Akamkpa has a population of about 95,000 people (NPC, 1991); and their main occupation is farming. The farmlands are owned by individuals according to the traditional tenure system and the major crops grown include cassava, maize, yam, okra and cocoyam.

Quarrying activities started in 1982 in Obot Netim Village in Akamkpa Local Government Area of Cross River State. Presently the companies that are carrying out quarrying in the area are: Crush Rock company, PRODECO (Property Development company) and HITECH company.

METHOD OF STUDY

During the dry season and prior to sample collections, 3 steel coated pans were kept for 48 hours at the 3 different distances in order to ascertain the amount of dust produced during the quarrying process that could settle in the pans to delineate the positions where the samples were to be collected,. The pans were kept at 0km, 0.75km and 2km away from the quarry site. This was done to determine the extent of spread of dust arising from the quarry operation and to establish the point of control. The contents of the pans were checked after the 48 hours and point without settlement of dust particles was used as the control.

Six different plant species of economic value were

E. C. Nzegbule, Dept. of Forestry and Environmental Mgt, Michael Okpara Univ. of Agric. Umudike, PMB 7267 Umuahia, Abia State, Nigeria
F. Ekpo, Akwa Ibom State College of Agriculture Obio Akpa, PMB 1001 Abak, Akwa Ibom State, Nigeria.

identified to be occurring commonly in the 3 sampling positions and were therefore selected as screening materials for he level of heavy metals. Leaf samples were collected from the 6 plant species (Table 1) in the 3 sampling locations using secautuer. The leaf samples were oven dried at 60^{0}C to a constant weight, milled, sieved and digested.

At each of the three sampling positions (0 km, 0.75 km, and 2 km), a 50g soil samples were collected randomly from a depih of 0-5cm using soil auger. The soil samples were collected on 4 replicate points at each sampling location. The soil samples were air dried for 4 days, screened, sieved and digested. The different types of samples were digested and extracted using 0.1% perchloric acid. The extracts were analyzed for Mn, Cu; Fe, Pb, Ni, Cr, Zn, and Cd using the Atomic Absorption Spectrophotometer (Unicam 919 model) at central research Laboratory, University of Uyo, Nigeria. Analysis of the crushed stones (Chippings) was done to support any inference that could be drawn on the accumulation of heavy metals in the area. Data collected were analyzed using the Analysis of variance (ANOVA) procedure (Steel and Torrie, 1980).

The least significant Difference (LSD) was used to compare means along rows

Table 1: Plant sample collected at the three different location of the quarrying site and their economic uses

Plant Species	Class of Species	Economic Importance
Manihot esculenta (cassava)	Arable Crop	- tubers used for making garri, foo-foo, starch, tapioca
Abelmochus esculentus (okra)	Arable Crop	- fruit used as soup condiment
Colocasia esculenta	Arable Crop	- corm used as food
Carica papaya (paw paw)	Cash crop	- fruits used as food, leaves as medicine, etc
Psidium guajava (guava)	Cash crop	- fruits used as food, leaves as medicine, etc
Mangifera indica (mango)	Cash crop	- fruits used as food, leaves as medicine, etc
Alchornea cordifolia	Fodder crop	- Feedstuff for livestock
Centrosema pubscens	Fodder crop	- Feedstuff for livestock
Pennisetum purperum	Fodder crop	- Feedstuff for livestock
Pteridium acquilinum	Fodder crop	- Feedstuff for livestock

RESULTS AND DISCUSSION

The rock substance on subjection to analyses contained various concentrations of different trace metals. The mean concentration of Cu, Pb, Zn, Fe, Cd, Ni, Cr and Mn in quarried materials (Chippings) were 9.28, 1.88, 10.64, 349.50, 2.06, 3.22, 1.12, and 2.44 (mg/kg) respectively. The concentration of Fe in the quarried materials was highest compared to other metals, while Cr had the least concentration (0.01mg/kg) in the same rock material. A similar study has shown that heavy metals can also occur as natural cycling from rocks but their various concentration depend on the type of parent material, age and formation (Mattigod *et al* 1983). The concentrations of Fe, Cu, Zn, Cd, Cr, Ni, Pb and Mn in the soils of the 3 sampling positions are shown in Table 2. The highest concentrations of almost all the heavy metals determined were recorded from the sampling position in the immediate vicinity of the quarry (0 km) except in the case of Cu. The concentrations of these heavy metals declined as distance from the quarry increases. Apart from the levels of Cu and Cr, other heavy metals had significantly higher level of their concentration in the immediate quarry vicinity than that occurring at the 0.75 km and 2 km sampling locations. The higher concentrations of heavy metals recorded in sampling position within the vicinity of the quarry could be a contribution from the tailing waste generated from the quarry which in itself contained high level of these metals. The soils from the other 2 locations farther away from the quarry had reduced heavy metal contents because the dispersal of the tailing wastes diminished in the area with increasing distance.

Table 2: The mean concentrations (mg/kg) of some heavy metals in the crushed rock (chippings)

Elements	Mean Concentration (mg/kg)
Copper	9.28±0.25
Lead	1.88±0.18
Zinc	10.34±1.27
Iron	349.50±2.34
Cadmium	2.02±0.05
Nickel	3.22±1.55
Chromium	1.12±0.02
Manganese	2.44±0.01

Also in all the economic plant species examined, higher concentrations of the metals (Mn Fe, Cu, Zn, Cd, Cr, Pb, Ni) were recorded from those growing within the immediate vicinity of the quarry (0 km) than those growing at 0.75 km or at 2 km away from the quarry. The enhanced concentrations of these trace metals is an indication that they were more available for absorption by the plants at the quarry site than other areas farther away. Among the 6 plant species sampled, *Manihot esculenta* and *Colocasia esculenta* which are tuber and root crops respectively had higher concentration of Pb, Mn and Fe in their leaves (Table 3). The mean concentration of Pb, Mn and Fe in *Colocasia esculenta* and *Manihot esculenta* declined significantly in the farthest sampling position from the quarry (2 km) (Table 4). The decline in concentrations of these metals as the distance from the quarry increases further shows that the quarrying operation is strongly associated with the build up of the trace metals in the plants. In most instances the concentration level of these metals in soil is less than that in plants. Many authors have indicated that the concentration of trace metals contained in plants may be higher than that of the soil on which they are growing due to biomagnifications and bioaccumulation (Ponyat and McDonnel, 1991). This also suggests the existance of other possible factors such as type of soil and plant species that affect nutrient absorption process which ultimately contribute in determining the level of heavy metals in plants (Egunjobi and Nwoko, 2002). The concentration of some of these metals reported in this study was well over the recommended level of 0.05mg/kg for vegetable species (FEPA, 1991).

This raises a lot of environmental concern because both man and livestock depend on these plant species for food, consequently they are inadvertently exposed to gradual accumulation of these heavy metals. In a related study, high Pb level was found in the blood sample of cattle reared near a lead smelter plant (Neuman and Dollhopt, 1992).

The concentrations of Zn, Cu and Ni were found to be higher among the fruit crops (*Carica papaya* and *Magifera indica*) than in other species sampled. The concentration of Zn, Cu and Ni in *Magifera indica* and *Carica papaya* were 21.36 and 23.25 for Zn, 21.50 and 18.95 for Cu; 26.08 and 24.95 (mg/kg) for Ni respectively. The percentage concentrations of Zn, Cu and Ni in leaves of *Magifera indica*

collected from the farthest sampling position from the quarry were lower by 81%, 63.04% and 51.93% respectively than that of plant leaves collected from immediate vicinity the quarry site. Also the leaves of *Carica papaya* occurring in the farthest sampling point had concentrations of Zn, Cu and Ni reduced by 75%, 48.92% and 59.77% when compared with stands of *C. papaya* occurring in the immediate vicinity of the quarry. The concentrations of these metals tend to decline as the distance from the quarry increases. Table 4 shows the concentrations of Cd and Cr in *Centrosema pubescens* and *Aspilia africana* as being higher than those other plant species evaluated in the immediate vicinity of the quarry (0 km). The values of Cd and Cr in these 2 plants decreased away from the immediate vicinity quarrying site. *Aspilia africana* consistently had higher concentrations of both Cd and Cr than other plant species in all the sampling position even at 2km distance from the immediate vicinity of the quarry. This shows that the capacity to absorb Cd and Cr is enhanced in this fodder species than the other type of plants. The significant concentration of these heavy metals in plant leaves at sampling position within the quarrying site indicates that the waste generated from the quarry is a major contributor of these metals to the vegetation and soil systems. The values obtained in this study were above the recommended range of 0.1-24mg/kg regarded as the maximum acceptable level for Cd in plant (Bowen, 1979). Cd levels greater than 5mg/kg had been reported as toxic to plants (Alloway 1995).

From the investigation no single plant species had highest concentrations in the entire heavy metals analyzed. This is attributable to their varying physiological differences and relative selectivity in rate of uptake of minerals. Also the metals are not equally available for absorption by plants, a factor dependent on the ionic form which the metals were occurring in the soil (Nwoboshi, 2000). Occurrence of heavy metals above the acceptable tolerance levels are particularly hazardous because of its uptake by plants, tendency to accumulate in food chain and its persistence once in the environment (Dudka and Adriano, 1997).

Although the present levels of some of these trace metals, for instance, iron and manganese pose no toxicity problem there is need to regulate and control the waste produced from quarrying activities in order to prevent the introduction of further excessive heavy metals into the existing food chain considering that the area is an agricultural zone.

Table 3: The mean concentrations (mg/kg) of some heavy metals in the soils at different sampling distances from the quarry

Sampling positions	Mn	Fe	Cu	Zn	Cd	Cr	Ni	Pb
0 km	28.75±3.85	950.25±2.85	92.24±7.26	21.13±4.26	8.25±1.24	1.45±0.82	3.25±2.84	32.25±2.17
0.75 km	17.92±4.28	520.35±3.75	94.26±3.27	16.25±1.29	3.28±0.29	1.05±2.74	2.98±0.45	14.27±2.08
2 km (control)	12.05±2.28	346.08±2.96	82.28±5.28	12.48±9.68	1.49±1.28	1.08±0.05	2.45±0.55	5.36±0.82

±: Standard error of mean

Table 4: The mean concentration (mg/kg) of heavy metals in plant leaves with respect to sampling distances from the quarry site

Plants	Pb			Mn			Fe		
	0 km	0.75 km	2 km	0 km	0.75 km	2 km	0 km	0.75 km	2 km
Alchornea cordifolia	7.50±3.48	5.50±0.65	2.00±0.47	42.25±1.10	36.07±2.56	12.25±1.16	30.00±0.05	13.28±1.58	12.19±0.40
Centrosema Pubescens	7.25±0.33	6.25±0.54	1.75±0.56	45.29±0.54	46.18±5.42	16.46±2.89	27.25±0.50	15.60±0.56	11.75±0.80
Aspilia Africana	6.25±0.25	5.25±2.87	1.25±0.92	33.25±2.29	28.06±1.19	15.58±3.45	25.09±1.17	14.28±0.65	10.25±0.86
Pterdium aquilium	7.00±2.86	4.75±0.28	27.6±0.08	46.85±6.75	38.0.9±7.85	20.18±4.94	23.48±0.80	18.24±0.50	8.25±0.02
Carica Papaya	8.26±0.38	5.57±0.48	2.75±0 59	60.28±5.50	29.18±4.21	18.16±0.11	42.28±1.45	35.20±1.40	28.29±0.54
Magifera indica	6.35±2.77	4.28±0.44	1.57±0.75	53.19±3.05	31.14±2.42	14.51±2.59	23.75±1.75	16.90±1.75	9.50±0.25
Psidium Guajava	7.60±2.34	3.86±0.95	2.25±0.48	38.71±4.05	26.57±5.55	21.00±0.16	28.17±0.49	20.38±0.84	11.45±0.18
Manihot esculenta	9.25±0.47	4.55±0.89	2.25±0.44	69.07±1.58	32.05±1.89	14.25±1.50	55.28±1.15	29.65±3.90	12.68±0.49
Abelmoscus esculenta	8.57±086	5.68±0.58	2.75±0.46	47.08±1.71	22.50±2.85	10.61±0.19	39.33±3.38	14.75±2.69	10.75±1.05
Colocasia esculenta	9.75±0.84	3.85±0.40	2.75±074	70.25±2.93	36.76±3.70	14.75±2.55	56.50±4.55	19.75±1.15	12.00±3.28

Table 4 (contd): The mean concentrations (mg/kg) of some heavy metals in plant leaves at different sampling distances from the quarry.

Plants	Zn			Cu			Ni		
	0 km	0.75 km	2 km	0 km	0.75 km	2 km	0 km	0.75 km	2 km
A. cordifolia	8.29±2.55	7.25±0.58	2.80±0.60	16.05±1.05	12.75±2.38	8.45±0.15	12.55±0.56	7.98±0.22	5.05±0.27
C. Pubescens	12.50±1.29	5.29±0.30	1.50±0.56	14.28±2.58	10.28±0.48	5.34±0.08	17.25±0.52	14.28±0.60	12.05±0.92
A. Africana	12.75±1.19	4.75±0.18	3.25±1.28	10.75±1.26	7.14±2.20	6.35±0.57	16.00±0.05	8.88±0.40	4.50±0.22
P. aquilium	10.50±0.85	3.05±0.04	1.27±0.75	11.78±2.31	8.25±0.12	7.28±1.73	13.45±0.99	9.45±0.56	5.68±0.04
C. papaya	23.25±1.11	4.29±1.56	2.25±0.15	18.95±3.21	5.22±0.85	3.50±0.80	24.93±0.56	8.56±0.58	6.28±0.59
M. indica	21.36±1.11	4.29±1.56	2.25±0.15	21.50±3.56	9.25±0.11	4.75±1.06	26.08±0.58	10.50±0.29	8.25±0.75
P. guajava	11.68±1.05	5.28±0.18	1.75±0.06	9.69±1.83	6.75±1.96	5.49±0.57	13.75±0.36	6.85±0.46	2.47±0.56
M. esculenta	12.50±1.21	5.58±1.11	1.25±0.18	10.00±0.02	7.82±0.48	5.00±0.58	10.25±1.06	8.60±1.50	4.28±0.09
A . esculenta	9.27±1.15	3.25±0.05	1.25±0.16	12.08±1.18	7.00±0.03	5.25±2.24	12.55±0.55	7.68±1.85	4.75±0.48
C. esculenta	11.50±0.18	5.65±1.06	3.65±0.25	7.75±0.65	4.25±1.19	4.20±2.20	14.56±1.29	10.25±2.25	6.94±1.53

Table 4 (contd): The mean concentrations (mg/kg) of some heavy metals in plant leaves at different sampling distances from the quarry.

Plants	Cd			Cr		
	0km	0.75km	2km	0km	0.75km	2km
A.. cordifolia	10.50± 1.28	5.28±0.26	2.75±0.56	6.50±1.28	4.00±0.38	2.28±1.18
C. pubescens	12.25±0.60	5.25±0.20	2.10±0.59	12.00± 0.50	3.80±1.84	2.00±1.25
A.. Africana	12.17±0.17	6.26±0.50	3.78±0.59	18.05±1.20	7.50±0.50	5.50±1.70
P. aquilium	8.55±0.48	4.75±1.57	1.57±0.38	9.25±0.85	4.68±0.90	2.28±0.68
C. papaya	10.75±2.34	4.55±1.23	2.26±1.18	8.75±1.33	5.08±1.09	3.05±0.01
M. indica	8.38±1.56	3.25±0.55	1.25±1.14	9.05±0.33	5.52±0.06	3.25±1.14
P. guajava	10.87±1.05	4.55±0.25	1.56±0.25	8.50±0.54	4.95±1.85	2.05±1.56
M. esculenta	11.25±1.05	5.85±1.29	2.25±0.06	9.25±0.80	6.28±0.50	3.75±0.95
A. esculenta	8.25±1.29	3.06±0.90	1.59±0.95	7.50±1.17	3.75±0.65	2.75±1.18
C. esculenta	10.50±1.75	5.36±0.58	2.38±1.58	6.75±1.12	4.28±1.84	3.04±1.10

± Standard error of mean

REFERENCES

Adepoju, S. O., 2002. Effects of alluvial Gold Extraction on Water Soil Acidity and Organic matter at Igun Nigeria J. Engineering (1) 30-33.

Alloway, B. J., 1990. Heavy metals in soils. Blaki (Publ). Glasgow. U. K. P324.

Alloway, B. J., 1995. Heavy metals in soils 2nd (ed). Black and San (Publ.) Glasgow Pp. 278.

Bowen, H. J., 1979. Environmental Chemistry of the Elements Academic Press London Pp91-120.

Brown R., 1979. Lead in the home garden and urban soil environment Regents of the University of Minnesota. http;/ WWW. Extension. Umu. Edu/distribution/horticulture/DG 2543. html.

Dudka, so and Adriano, C., 1997. Environmental impact of metal, mining and processing. A Review J. Environ Quality; 26:590-602.

Ellen, O. V., 2000. U. S. Environmental protection Agency, Office of Compliance, profile of metal mining industry Washington, O. C. U. S. EPA Report No. EPA 310-12-95-008.

Egunjobi, P. and Nwoko, J., 2002. Differential accumulation of lead on selected edible vegetables associated with road side gardening in Nigeria. Trop. J. Applied Sc. 2 (1): 29-35.

FEPA., 1991. National Guidelines and Standards for industrial Effluents, Gaseous Emission and Hazardous Waste Management in Nigeria Pp 59-66.

Kakulu, S. E., 2003 Trace metals in Soils and Vegetation from Some Tin Mining Area in Nigeria. Global J. of Pure an Applied Sc. 9 (3):331-337.

Mattigod, S. V. Page, A. and Lyle, E., 1983. Assessment of Metal Pollution in Soils. In: I. Thronton (ed). Applied Environmental Geochemistry. Academic press New York P. 488.

Neuman, I. and Dollhopt, 1992. Lead levels in blood from cattle residing near a Pb smelter. J. Environ. Quality 21 (2): 181-185.

Nwoboshi, L. C., 2000. The nutrient factor in sustainable forestry. Ibadan University Press. Pp303

Nriagu, J. O., 1990. Global metal Poilution. Poisoning the Biosphere. Environment. 32:7-23.

NPC., 1991, Population Census of Cross River State. In census 1991; National Summary. National Population Commission (NPC), Abuja, Nigeria.

Okere, U. J., Ugwu, T. O., Ufot, U. O. and Akamigbo, F., 2001. Management of Wet Land Soils for Sustainable Agriculture and Environment. Proceedings of the 27th Annual Conference of the Soil Science Society of Nigeria. PP 291-294.

Ponyat, R. V. and MCDonnel, M. Y., 1991. Heavy metal accumulation of forest Soil along an urban, rural gradient, in south Eastern New York. Air: soil pollution and U.S. water 23 (56): 797-807.

Steel, R. G. and Torrie, J. H., 1980. Principles and Procedures of Statistics. A Biometrical Approach and Edition Mcgraw-hill Book Company N.G. Pp 63.

Vousta, D., Grimanies, A. and Samara, C., 1996. Trace elements in vegetables grown in an industrial Area in relation to soil and air particulate matter. J. Environ. Pollut. 94(3) 325-335.

Wills, M. C., 1995. Studies of copper and zinc forms in some polish and Egyptian soils: part II Distribution of some copper and zinc in soils profiles. Polish J. Soil. Sci. II (I) 34-41

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 139 - 144
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

THE USE OF DIAMETER DISTIBUTIONS FOR DETERMINING OPTIMUM HOLDING LENGTH FOR *GMELINA ARBOREA* PLANTATIONS IN A NIGERIAN LOWLAND RAINFOREST

S. AJAYI., O. OLAJIDE, and I. B. ADINYA

(Received 25 Jahuary, 2007; Revision Accepted 9 March, 2007)

ABSTRACT

Weibull Parameter models using Forest stand attributes as predictor variables were applied to partition Diameter at breast height (Dbh) into size classes (Small -< 40 cm dbh, Medium - 40–80 cm dbh and Large - > 80 cm dbh) so as to ascertain the produce /size categories of Gmelina arborea in Ukpon River Forest Reserve, Cross River State, Nigeria. The diameter distributions were projected for three management periods (5, 10 and 15 years) to determine the optimal holding length for the Gmelina plantations. An optimal holding length of 10 years was determined for the plantation when 70.6% of surviving trees (329 trees/ha) will be of timber size as against the current 1.8%. Implications of deviating from the optimal holding length were highlighted

KEYWORDS: Optimum holding length, Diameter distributions, Dbh, Ukpon River Forest Reserve

INTRODUCTION

In Nigeria, large investments in *Gmelina_arborea* plantations have been made particularly to provide raw materials for pulp and paper mills (Ajayi *et al.*, 2004). The species is now being utilized for timber production as a result of failure of the mills to utilize them. These plantations have outgrown their planned maximum volume production rotation of 8 years (Akachukwu 1981; Evans, 1992). Global concern for the sustainable management of these plantations has been expressed so as to achieve many things people expect of them (ITTO, 2001; 2003). Furthermore, silvicultural management has been limited; leaving stands untended. Natural and man- made agencies such as diseases, wind and fire have superimposed their effects on the variations caused by sites, climate and management. Omoluabi *et al*, (1990) estimated the area of established plantations by 1990 to be 213,730 hectares. Of this area, *Gmelina arborea* plantations cover 83,377 hectares (41.8% of the total). Atte (1994) estimated about 10,000 ha of such plantations in Cross River State. *Gmelina arborea* plantations at Edondon in Ukpon River Forest Reserve have age range of 19 – 33 years. These plantations are currently managed for timber production. The fuel wood needs of surrounding beneficiary landlord communities are also considered in the management objective.

Clutter *et al.*, (1983) noted that if the existing stand on a particular site differs from the optimum continuing series stand, a decision problem exists. How long should the existing stand be left before it is harvested and the first stand of the continuing series established? How long should *Gmelina arborea* plantations at Edondon be left before harvesting? The Government of Cross River state wants to determine the optimum length of time to hold her *Gmelina arborea* plantations to obtain at least 300 trees of timber size (>80 cm dbh or 2.5 m girth) per hectare and steadily provide poles and fuel wood from trees of lower dbh classes. Rotation length is an important tool for forest management. It determines the tree's age; hence it largely determines the size, quantity and quality of the timber and profitability. Rotation age also affects the regulation possibilities and thereby the age distribution of the forest. Any of these factors can be the main determinant of length (Leuschner, 1984; Evans, 1992). The distribution of volume by size classes as well as the overall volume is needed as input to many forest management decisions. One widely applied technique for even-aged stands is a 'diameter distribution' modeling procedure. Diameter distribution have been found very satisfactory for describing the relative frequencies by diameter at breast height (dbh) class in unthinned stands where the underlying dbh distribution is within the range of shapes that the mathematical function can approximate. To date, diameter distribution methods have been used to quantify forest yields (Osho, 1989; Sokpon and Biaou, 2002; Ajayi, 2005).

The main objective of this study is to apply diameter distribution – based models to determine the optimum holding length for *Gmelina arborea* plantations in Ukpon River Forest Reserve, Cross River State, Nigeria. Choosing the correct rotation age for the plantations will help to obtain maximum wood volume and money yield.

STUDY AREA

The *Gmelina arborea* plantations at Edondon are sited within Ukpon River Forest Reserve, Cross River State. The Ukpon River Forest Reserve has a total area of 12,950 hectares and managed by the Cross River State Forestry Commission. The plantation occupies about 3,757 hectares of the Forest Reserve. The Reserve falls along latitude 5.86° N and longitude 8.46° E (Forest Resource Study – CRS, 1990)

The mean annual rainfall range from 12.1 mm in January to 378 mm in August. The rain is fairly distributed throughout the months of April to October. Mean annual temperature range from 27.6° C in August to 33.1° C in February. Strong winds usually accompany the onset of dry season, which is caused by hot and dry North East wind. The mean relative humidity range from 71% in February to 90% in August (Ajayi, 2005).

The Ukpon River Forest reserves lies within the lowland rainforest with fresh water swamp at the fringes of Ukpon River and Derived Savannah north of the reserve. The structure and physiognomy of the forest is stratified with highly heterogeneous floristic composition. Recognizable tree species within the reserve includes *Ricinodendron spp., Terminalia spp., Triplochiton scleroxylon , Sterculia spp., Pterygota spp., Khaya spp. Milicia excelsa, Garcinia spp., Chrisophyllum spp., Alstonia spp., Ceiba pentandra and Pterocarpus spp.*

The main rock types are granite gneisses and quart schist with gravels and occasional rock outcrops in some areas. The soil is derived from the Eze Aku formation of precambrian series. Edondon soils are classified as Cambisol of Acid Crystalline rock (Ogar, 1994).

S. Ajayi, Dept. of Forestry and Wildlife Resources Mgt, Cross River Univ. of Tech., P.M.B 102,Obubra, Cross River State, Nigeria
O. Olajide, Department of Forestry and Wildlife, University of Uyo, Uyo, Nigeria
I. B. Adinya, Dept. of Agricultural Econs and Extension, Cross River Univ. of Tech. P.M.B 102,Obubra, Cross River State, Nigeria

The topography varies from undulating land on the south and southwestern parts of the plantation to rugged and hilly land on the North and Northeastern part of the Forest reserve. Many seasonal streams that flow northward and empty their waters into Ukpon River dissect the plantation. The access roads within the plantation are poorly developed and the existing routes are not maintained

The principal occupation of the communities around the Forest Reserve is farming. Major crops of interest are cassava (*Manihot spp.*), yams (*Discorea spp.*) cocoyams (*Cocos nucifea*) and plantains/banana (*Musa spp.*). Other crops generally seen in common production are maize (*Zea mays*), eggplants (*Solanum melongina*), okra (*Abelmoschus esculentus*), pepper (*Pipper gueneense*) and melon (*Cucumeropsis manii*). Majority of the populace from the landlord communities depend on the *Gmelina arborea* plantation for their fuel-wood supply.

METHODS

Data collection

Forest reserve maps were used to locate the boundaries of the plantations in the field. To allow for comparison of difference in growth performance of one stand and the other, the age series were grouped into seven age classes – 20, 22, 24, 26, 28, 30 and 32 years and each treated as a compartment - Table 1 (Okojie 1981). The compartments were coded using alphabets (A to G) and their sizes in Hectares indicated (Table 1).

Table 1: Age grouping of Unthinned *gmelina arborea* Plantation in Ukpon River Forest Reserve

YEAR OF ESTABLISHMENT	GROUP YEAR/COMPT.	AREA (HA)	AGE (YRS)
1971 – 1972	1972 (G)	440	32
1973 – 1974	1974 (F)	1266	30
1975 – 1976	1976 (E)	1044	28
1977 – 1979	1978 (D)	212	26
1980 – 1981	1980 (C)	257	24
1982 – 1983	1982 (B)	10	22
1984 – 1985	1984 (A)	21	20
TOTAL	3250		

Stand Attributes and Weibull Parameter Models

Stand attributes models developed for the same plantation (Ajayi, 2005) were used to describe and project Surviving number of trees per hectare (N), Basal area per hectare (BA) and Site index (S) for 5, 10 and 15 years hence (Equations 1 - 4).

$N = 1854.250 - 35.768\ A$ ..... (1)

where,

N = Surviving number of trees per hectare (N/Ha)

A = age of stand (Yrs)

$BA = -755.362 + 1.712AHd + .940A^2 + 52.391Hd$ .. (2)

where,

BA = basal area per hectare (m^2/Ha)

A = age of stand (Yrs)

Hd = Average height of dominant and co-dominant trees.

$Log\ S = Log\ Hd + 6.776\ (A^{-1} - A_i^{-1})$ ..... (3)

and in all cases, $Log\ Hd = 1.735 - 6.776\ A^{-1}$ ..... (4)

where,

S = Site index (m)

Hd = Average height of dominant and co-dominant trees

A = age of stand

A_i = Index age (25 years)

The projections were fitted into Weibull parameter equations developed for the plantations (Ajayi, 2005) to estimate α, β and λ for the three management periods.

The Weibull parameter equations are:

$\alpha = -42.090 + 670\ S + 3.259\text{-}02\ N$ ..... (5)

$Log\ \beta = .307 + 4.581E - 02\ A$ ..... (6)

$Log\ \lambda = 2.041 - 27.769A^{-1} - 5.37E\text{-}03\ BA$ ..... (7)

where,

A = age of stand

S = site index (m)

N = number of trees per hectare (N/ha)

BA = basal area per hectare (m^2/ha)

α, β and λ = Weibull parameters

Number of trees/ha by Size /Dbh classes

The parameters were then fitted into the Weibull cumulative function and the probabilities for three produce/Dbh classes calculated. The categories are:

Size Category	Produce	Dbh(cm)
Small	Fuel wood, fence poles Pulpwood	< 40
Medium	Pulpwood/poles Match splint	40 – 80
Large	Sawn timber and veneer	> 80

The probability of the population in each size category was given as follows:

For **Small** category (< 40 cm Dbh),

$$P(x<40) = 1 - \exp\left[-\left[\frac{40-\alpha}{\beta}\right]^{\lambda}\right] \quad \ldots (8)$$

For **Medium** category (40 – 80 m Dbh),

$$P(40<x<80) = \exp\left[-\left[\frac{40-\alpha}{\beta}\right]^{\lambda}\right] - \exp\left[-\left[\frac{80-\alpha}{\beta}\right]^{\lambda}\right] \quad \ldots (9)$$

For Large category (> 80 cm),

$$P(x>80) = 1 - \left[P(x<40) + P(40<x<80)\right] \quad \ldots (10)$$

where,

α, β and λ are Weibull parameters

The probability for each size class was multiplied by the projected total number of trees per hectare in each compartment and by management periods to determine the frequency for that size class.

The total number of trees per size class in a management period was calculated from:

$$N_{S_j,Y_k} = \Sigma N_{i\,(S_j,Y_k)}\, A_i \quad \ldots\ldots (11)$$

where,

N_{S_j,Y_k} = total number of trees in *j*th size class and *k*th years hence

$N_{i\,(S_j,Y_k)}$ = frequency of trees per hectare in compartment *i*, *j*th size-class and *k*th years hence (N/ha).

A_i = hectares in compartment i

RESULTS

Number of trees/ha by size categories

Table 2 shows the proportion of various size classes in *Gmelina arborea* plantations at Edondon. Of the 825 trees per hectare predicted for the plantation 393 trees/ha (47.7%) and 417 trees/ha (50.5%) fall into the small and medium categories respectively. A small proportion of 15 trees/ha representing 1.8% have attained timber size.

Table 2: predicted number of trees by size categories for *gmelina arborea* plantations at edondon (N/HA)

COMPT.	AGE	STAND SIZE	STEMS/ HA	SMALL < 40CM		MEDIUM 40 – 80CM		LARGE > 80CM		COMPT TOTAL STEM
				STEMS/ HA	TOTAL STEMS IN COMPT	STEMS/ HA	TOTAL STEMS IN COMPT.	STEMS/ HA	TOTAL STEMS IN COMPT.	
	(YRS)	(HA)	NN/HA							
AA	20	21	1,125	958	20,118	167	3,507	0	0	23,625
BB	22	10	1,070	892	8,920	178	1,780	0	0	10,700
CC	24	257	1,010	790	203,030	220	56,540	0	0	259,570
DD	26	212	929	609	129,108	318	67,416	2	424	196,948
EE	28	1,044	850	453	472,932	393	410,292	4	4,176	887,400
FF	30	1,266	786	294	372,204	477	603,882	15	18,990	995,076
GG	32	440	700	163	71,720	481	211,640	56	24,640	308,000
TOTAL		3,250			1,278,032		1,355,057		48,230	2,681,319
PROPORTION (%)					47.7		50.5		1.8	100
MEAN NO. OF STEMS/HA					393		417		15	825

Source: Equations 8 - 10;

α = - 42.090 + 670 S + 3.259-02 N;

Log β = .307 + 4.581E - 02 A; and

Log λ = 2.041 - 27.769A^{-1} - 5.37E-03 BA

Projections of stand attributes and diameter distributions

Table 3 shows the projections for age, surviving number of trees per hectare, basal area per hectare and site index for 5, 10 and 15 years hence.

TABLE 3: PROJECTED STAND ATTRIBUTES FOR *GMELINA ARBOREA* PLANTATIONS AT EDONDON

COPT	PREENT AGE (YRS)	SIZE (HA)	YEARS HENCE											
			5				10				15			
			A (YRS)	N (N/HA)	BA M^2/HA	S (M)	A (YRS)	N (N/HA)	BA M^2/HA	S (M)	A (YRS)	N (N/HA)	BA M^2/HA	S (M)
A	20	21	25	960	110.28	29	30	781	123.93	29	35	602	134.20	29
B	22	10	27	886	227.87	29	32	710	127.37	29	37	531	141.24	29
C	24	257	29	817	122.19	29	34	638	131.58	29	39	459	150.91	29
D	26	12	31	745	125.61	29	36	568	137.41	29	41	388	163.83	29
E	28	1044	33	674	129.30	29	38	495	145.68	29	43	316	180.61	29
F	30	1266	35	604	134.20	29	40	424	156.88	29	45	245	201.37	29
G	32	440	37	531	141.24	29	42	352	171.65	29	47	173	226.81	29

Source: $N = 1854.250 - 35.768 A$;
$BA = -755.362 + 1.712AHd + .940A^2 + 52.391Hd$;
$\text{Log } S = \text{Log } Hd + 6.776 (A^{-1} - A_i^{-1})$;
$A_i = 25$ years and ;
$\text{Log } Hd = 1.735 - 6.776 A^{-1}$

These projections are very paramount to the determination of future Diameter distributions for *Gmelina arborea* plantations at Edondon. Table 4 shows the Weibull parameter estimates for projecting the diameter distribution (by size categories) for three different management periods hence (5, 10 and 15 years)

Table 5 is a summary of the projected diameter distributions for the three management periods by Dbh size-classes.

Table 4: Weibull Parameters projection for *gmelina arborea* plantations at Edondon

YEARS HENCE	PRO- JECTED AGE (YRS)	WEIBULL PARAMETERS			COMPT. SIZE (HA)
		α	β	λ	
5	25	8.6264	28.3302	2.1777	21
	27	6.2147	34.9840	2.3964	10
	29	3.9660	43.2006	2.6747	257
	31	1.6195	53.3470	2.9000	212
	33	0	65.8764	3.2000	1044
	35	0	81.3456	3.3647	1266
	37	0	115.3187	3.4043	440
10	30	2.7928	48.0065	2.8177	21
	32	0.4789	59.2816	3.0849	10
	34	0	73.2048	3.2937	257
	36	0	90.3982	3.4021	212
	38	0	111.6298	3.3724	1044
	40	0	137.8479	3.1937	1266
	42	0	170.2236	2.8752	440
15	35	0	81.3486	3.3643	21
	37	0	100.4546	3.4041	10
	39	0	124.0481	3.3005	257
	41	0	153.1828	3.0472	212
	43	0	189.1603	2.6626	1044
	45	0	233.5877	2.2006	1266
	47	0	288.4496	1.7069	440

Source: $\alpha = -42.090 + 670 S + 3.259\text{-}02 N$
$\text{Log } \beta = .307 + 4.581E - 02 A$
$\text{Log } \lambda = 2.041 - 27.769A^{-1} - 5.37E\text{-}03 BA$
$N = 1854.250 - 35.768 A$
$BA = -755.362 + 1.712AHd + .940A^2 + 52.391Hd$
$\text{Log } S = \text{Log } Hd + 6.776 (A^{-1} - A_i^{-1})$
$\text{Log } Hd = 1.735 - 6.776 A^{-1}$

Table 5: Projected number of trees by size categories for *gmelina arborea* Plantations at Edondon

YEARS HENCE	PLANTATION SIZE (HA)	SMALL < 40CM			MEDIUM 40 – 80CM			LARGE > 80CM			TOTAL STEMS /HA (N/HA)	TOTAL ANNUAL ALLOWABLE CUT
		STEMS /HA (N/HA)	PROPORTION (%)	ANNUAL ALLOWABLE CUT	STEMS /HA (N/HA)	PROPORTION (%)	ANNUAL ALLOWABLE CUT	STEMS /HA	PROPORTION (%)	ANNUAL ALLOWABLE CUT		
5	3250	113	17.5	73,601	350	54.3	227,481	182	28.2	118,190	645	419,272
10	3250	19	4.1	6,226	118	25.3	38,483	329	70.6	106,902	466	151,611
15	3250	6	2.2	645	19	6.8	6,177	253	91.0	54,851	278	61,673

The projections from table 5 show that *Gmelina arborea* plantations at Edondon will have a stocking of 645 trees/ha in the next 5 years. The composition will be 113 trees/ha (17.5%), 350 trees/ha (54.3%) and 182 trees/ha (28.2%) for small medium and large size categories respectively. A 10-year management period hence will produce a stocking of 466 trees per hectare with 19 trees/ha (4.1%), 118 trees/ha (25.3%) and 329 trees/ha (70.6%) for small, medium and large size categories respectively. If the plantations are to be held for 15 years, a stocking of 278 trees/ha is anticipated and this will be made up of 6 trees/ha (2.2%), 19 trees/ha (6.8%) and 253 trees/ha (91.0%) for small, medium and large size categories respectively.

DISCUSSION

Size categories and management options

The statistics indicate that currently, *Gmelina arborea* plantations at Edondon are mainly composed of trees of small and medium dimensions. The number of trees/ha in each size-class can be multiplied by the unit price on the tariff table to determine the money yield per hectare. This will help the Cross River State government to decide which size category to emphasize or concentrate management effort depending on demand and money yield for a particular produce category. For instance, there is a general drop in demand for small logs in Cross River State. There is also low demand for trees of medium size (poles) as most projects requiring wooden poles in the past tend to favor concrete poles now. It is a wise decision to allow a proportion of the small logs and pole sized trees to grow to timber size before harvesting. Sawn wood from Gmelina is highly valued for its unique properties. It lends itself to good finishing when used for furniture and internal decorations (Lauridsen and Kjaer, 2002)

Holding length for Gmelina plantations at Edondon

Of the three projected management periods, 10 years tend to favor the objective of producing a minimum of 300 trees per hectare with dbh above 80cm (timber size category. The ten-year length is appropriate as it provides the wood needs of all stakeholders, which include fuel wood for landlord communities, money for the government, wood for industries and the protection of the environment (Atte, 1994) as a result of sustainable removal of different sizes over the length. Managing the plantation for a shorter period of say 5 years for instance, will produce only a small proportion of 28% in the timber size category. The 5-year length can only be considered if the State government decides to set up paper mills that will demand pulpwood. Extending rotation length to 15 years will produce less number of trees in the timber size category than 10 years (253 trees/ha) and leave little for other size categories.

CONCLUSIONS

It is concluded that rotation lenghth determination is a useful tool for forest management. When the desired number of stems by size category is specified as part of management objective of a plantation, Weibull distribution can be applied to correctly determine the optimum holding length for maximum wood yield and profitability.

ACKNOWLEDGEMENT

This research work was supported by the International Foundation for Science (IFS) Stockholm, Sweden, through a grant to Dr. Samuel Ajayi (D/3839 – 1).

REFERENCES

Ajayi, S., Ogar, N. E. and Anyaorah, C. N., 2004 A Mathematical Programming Approach to Sustainable Management of *Gmelina arborea* (Roxb Plantations in a Nigerian rain forest. International Journal of Education, Vol. 2 Nos.1&2. Development Universal Consortia, Ikot Ekpene, Nigeria.

Ajayi, S., 2005. Growth and Yield Models for Sustainable production of *Gmelina arborea* (Roxb) from Ukpon River Forest Reserve, Cross River State, Nigeria. Ph.D Thesis, Dept, of Forest Resources Management University of Ibadan, Ibadan, Nigeria. 197 pp

Akachukwu, A. E., 1981. Estimation of volume and weight growth in *Gmelina arborea* with X-ray densitometry. In forest site and productivity. Netherlands pp 153 – 59.

Atte, O. D., 1994. Land and Forests of cross River State: A participatory Approach of Rural People's Perception and preferences. A Proposal. Cross River State Forest department, Calabar, Nigeria.

Clutter, J. L., Fortson, J. C., Piennar, L. V., Brister, G. H. and Bailey, R. L., 1983. Timber Management: A quantitative Approach. John Wiley & Sons Inc. N. Y. 333pp.

Evans, J., 1992. Plantation Forestry in the Tropics. 2nd ed. Oxford Univ. Press. 403pp.

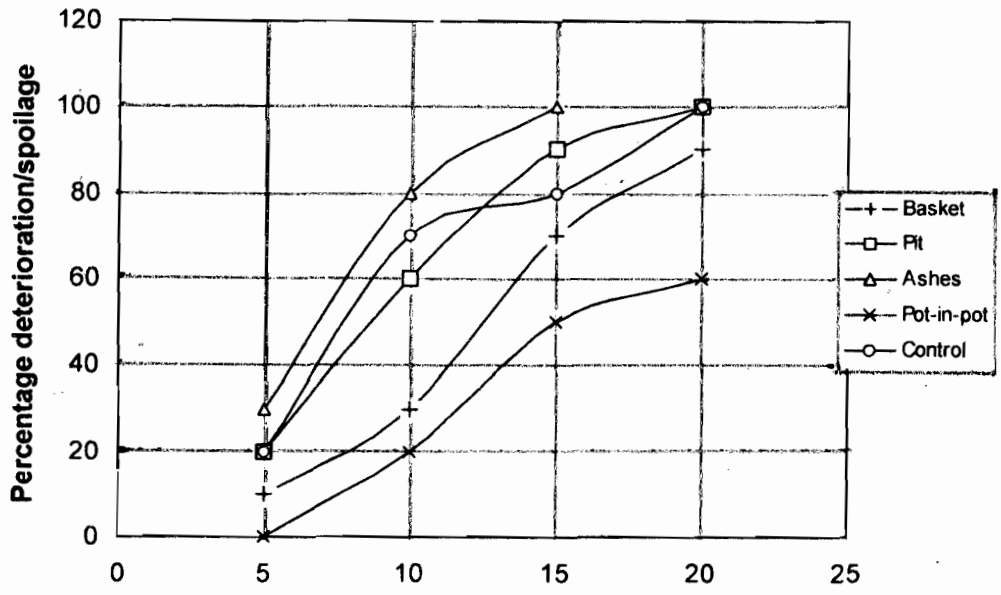

Figure 1: Deteriotion/spoilage of fresh Mango fruits stored using different starage methods

CONCLUSION

This experiment yielded some tangible results. From the results obtained, it was observed that the efficiency of the four methods of storage viz basket, control, pit and ashes storage methods were very low compared to that of the pot-in-pot method of storing mango fruits which has high efficiency. These findings have shown that the pot-in-pot method of storing mango fruits can sustain viable fruits up to 20 days and beyond.

Pot-in-pot storage method is considered the best among the methods used and so is recommended for short-term storage and should be carried out properly especially in the rural areas where the use of conventional cool storage is a problem due to poverty and lack of electricity.

REFERENCES

Abba, M. B., 2001. Fresh Food without a Refrigerator, Awake of 8 June 2001 page 29. By Watchtower Bible and tract Society of New York.

Anthony, Y., Ezedima, F. O. C. and Onazi, O. C., 1986. Introduction to Tropical Agriculture. Longman group, UK Ltd. Page 97-99.

Arinle, E. A., 1989. Traditional Grain Structure in Nigeria. Symposium proceeding at the National Seminar on Grain Storage, Abuja.

Babatola et al., 2002. Comparative efficiency of some storage methods for leaf vegetables, Nigerian Journal of Horticultural Science Vol. 6 pp. 25 – 29.

Currah, L. and Proctor, F. J., 1990. Onion in Tropical Regions. Natural Resources Institute, Bulletins No. 35 Central avenue, United Kingdom, pages 20-24.

Gibbon, D. and Pain, A., 1985. Crops of the dryer Regions of the Tropics. By Longman Group Limited, Uk.

Gaman, P. M. and Sherrington, K. B., 1981. The Science of food. Second edition published by press Ltd., Oxford, New York Toronto.

Hildreth, E. M., 1959. Elementary Science of Food. Page 169, MILLS AND BOON LTD. 17-19 Foley street, London.

Odey, S. O., Manuwa, S. I. and Ogar E. A., 2005. Sustenance of weight of vegetables during storage using locally constructed evaporative cooler. Proceedings of the 2nd Annual conference of the Nigerian Society of Indigenous Knowledge and Development (NSIKAD, 2005).

Sebrell, W. H. and Haggerty, J. J., 1967. Food and Nutrition, published by Time Life Books, New York.

Wadia, R. A., 1986. Effect of temperature and relative humidity on post harvest diseases of certain fruits and vegetables. Horticultural Abstarct. 39(4) 568 – 573.

Williams, C .N. and Chew, W. Y., 1980. Trees and Field Crops of the Wetter Regions of the Tropics, By Longman Group UK. Limited.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 149 - 152
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

ECONOMIC EFFECTS OF BEE POLLINATION ON MAIZE YIELD IN FURO, FUFORE LOCAL GOVERNMENT AREA, ADAMAWA STATE, NIGERIA

M. R. JA'AFAR-FURO

(Received 8 May, 2006; Revision Accepted 12 March, 2007)

ABSTRACT

The economic effects of bee pollination on maize yield in Furo, Fufore local government area, Adamawa state, Nigeria, were determined. Data were obtained from two (2) experimental farm plots (A and B) of two (2) hectares each for two (2) cropping seasons (2003 and 2004). The mean yields of the two (2) years for the farm plots were used for the gross margin analysis. Results showed that the bee-pollinated maize farm plots yielded 21.23% higher than the maize farm plots pollinated from other sources. This gave a gross margin of ₦197,095.00 and ₦121,120.00 for bee-pollinated maize farm plot and maize farm plot pollinated from other sources respectively. It was concluded that bees enhance pollination in maize and by extension increase the yield of the crop. The government and private institutions should therefore, incorporate the use of bees in their extension programmes as a strategy of improving the farmers' crop yield in the country.

KEYWORDS: Bee, Farm, Maize, Plot, Pollination.

INTRODUCTION

The dwindling aspect of crops yield in the sub-saharan Africa is creating great concern in the minds of both agricultural scientists and the farmers in general. Of the various efforts made towards addressing this problem in Nigeria for instance, the use of inorganic fertilizers which mainly composed of Nitrogen, Phosphorus and Potassium, improvement of seeds variety and farm equipment have been on the increase in the recent past.

Inspite of these efforts, noted Odigbo and Onwualu (1994), the imbalance between the food demand and the actual production continued to widen. Okon (2002) observed that the high thermal conductivity for inorganic fertilizers could be detrimental to the seedling emergence and /or their growth rate which consequently lead to low yield of crops unlike the reverse experienced with the use of organic manure. In his attempt to find reasons for poor performance in the agricultural sector in the developing world, Rossett (2002) reported the inability of the local authorities to tailor agricultural technologies that are in conformity with the small-scale farmers' variable but unique circumstances, in terms of local climate, biodiversity, resources among others, as the main reason for low productivity. Whereas studies like Robinson *et al.* (1989), Hoff and Phillips (1990) and Lasalle and Gauld (1992) all effectively appraised the value of bee pollination in the United States and Australia in the developed world, the aspect of improvement in pollination of crops has not been properly documented in this part of the globe.

Be that as it may, the fact still remains that 90 million of the Nigeria's population live in rural areas. Of this number, over 70 percent live below poverty line. Many of these rural poor are subsistent farmers (Eni and Ugoani, 2003). The search for solutions towards improving their productivity must therefore, continue. This experimental study is an addition to the various efforts of the successive governments of Nigeria in increasing the food production by the teeming farmers who reside in the rural areas. It is hoped that other communities of similar economies would benefit from this attempt.

MATERIALS AND METHODS

The experiment was carried out in two (2) different farm plots (A and B) of two (2) hectares each situated about five (5) kilometers apart in Furo area of Daware district, Fufore local government area of Adamawa state, Nigeria. The virgin camisoles (soil) farm plots (A and B) in the *Fadama* (lowland) were cleared, ploughed and harrowed using a tractor. Plantings using TZB (white variety) maize variety were effected in February of the two (2) production seasons (2003 and 2004). Water pumps were used to irrigate the lands at the interval of three (3) days in the evenings in the period under consideration. Urea and NPK (Nitrogen, Phosphorus, Potassium) fertilizers in the ratio 46% (urea) and 15:15:15% (NPK) and quantity of 150Kg and 200Kg respectively, as first and second applications were made on each farm plot and for each season. In addition to above, four (4) 27-bar Kenya top-bar colonized (*Apis mellifera*) beehives of 96cm (length) x 56cm (Top width) x 26cm (height) x 21cm (base width) were placed at different locations in farm plots A and B for the period of three (3) weeks with the aim of facilitating pollination in 2003 and 2004, respectively. In other words, the beehives were used in plot A in 2003, whereas the plot (A) was allowed to be pollinated from other sources in 2004. Similarly, plot B was pollinated from other sources in 2003 and arranged to be pollinated by bees in 2004. Two (2) security personnel were employed to guard against vandals (one in each farm plot). The harvests of two (2) farm plots were effected in the first week of May of every cropping season. The means of both farm plots were obtained for the analysis.

M. R. Ja'Afar-furo, Department of Agriculture and Natural Resources Fufore Local Government Area, Adamawa State, Nigeria.

RESULTS

Table 1: The gross margin of a bee-pollinated maize farm plot in Furo, Fufore local Government, Adamawa state, Nigeria.

Criterion	Qty	Unit Cost (₦)	Total (₦)
A) Revenue			
Threshed maize	97.5(100Kg bag)	3750	365625 (92.51)
Corn stock	148 (bale)	200	29600 (7.49)
Gross Revenue (GR)	-	-	395225 (100)
B) Variable Cost			
Clearing of farm plot	-	-	2500 (1.26)
Ploughing	-	-	6500 (3.28)
Harrowing	-	-	3800 (1.92)
Planting	-	-	3000 (1.51)
First weeding	-	-	12000 (6.06)
Second weeding	-	-	9000 (4.54)
Third weeding	-	-	7900 (3.99)
Harvesting	-	-	8200 (4.14)
Threshing and bagging	97.5 bags	200/bag	19500 (9.84)
Gathering of corn stock	148 bales	20/bale	2960 (1.49)
* Transportation			
Bags of maize	97.5 bags	100/bag	9750 (4.92)
Farm materials	-	-	8940 (4.51)
* Fertilizers			
Urea	300Kg	1980/50kg bag	11880 (6.01)
NPK	400Kg	1950/50kg bag	15600 (7.87)
SSP	400Kg	1460/50kg bag	11680 (5.90)
* Treated seeds			
TZB (white variety)	20Kg	1000/1kg	20000 (10.09)
Hire of water pump	30days	300/day	9000 (4.54)
Empty 100Kg bags	98'	40/bag	3920 (1.98)
Ground rent	2 hectares	10000/hectare	20000 (10.09)
Security man	3months	4000/month	12000 (6.06)
Total Variable Cost (TVC)	-	-	**198130 (100)**
C) Gross margin (GM) (GM = GR – TVC)	-	-	**197095**

Note: Values in parentheses show percentage of gross revenue and total variable cost, respectively.
Naira (₦) 140: US$1
Source: Field survey (2003 and 2004)

Table 2: The gross margin of a maize farm plot pollinated from other sources in Furo, Fufore local Government, Adamawa state, Nigeria.

Criterion	Qty	Unit Cost (₦)	Total (₦)
A) Revenue			
Threshed maize	76.8 (100Kg bag)	3750	288000 (92.43)
Corn stock	118 (bale)	200	23600 (7.57)
Gross Revenue (GR)	-	-	311600(100)
B) Variable Cost			
Clearing of farm plot	-	-	2500 (1.31)
Ploughing	-	-	6500 (3.41)
Harrowing	-	-	3800 (1.99)
Planting	-	-	3000 (1.57)
First weeding	-	-	12000 (6.30)
Second weeding	-	-	9000 (4.72)
Third weeding	-	-	7900 (4.15)
Harvesting	-	-	8200 (4.30)
Threshing and bagging	76.8 bags	200/bag	15360 (8.06)
Gathering of corn stock	118 bales	20/bale	2360 (1.24)
* Transportation			
Bags of maize	76.8 bags	100/bag	7680 (4.03)
Farm materials	-	-	8940 (4.69)
* Fertilizers			
Urea	300Kg	1980/50kg bag	11880 (6.24)
NPK	400Kg	1950/50kg bag	15600 (8.19)
SSP	400Kg	1460/50kg bag	11680 (6.13)
* Treated seeds			
TZB (white variety)	20Kg	1000/1kg	20000 (10.49)
Hire of water pump	30days	300/day	9000 (4.72)
Empty 100Kg bags	77	40/bag	3080 (1.62)
Ground rent	2 hectares	10000/hectare	20000 (10.49)
Security man	3months	4000/month	12000 (6.30)
Total Variable Cost (TVC)	-	-	**190480 (100)**
C) Gross margin (GM) (GM = GR – TVC)	-	-	**121120**

Note: Values in parentheses show percentage of gross revenue and total variable cost, respectively.
Naira (₦) 140: US$1
Source: Field survey (2003 and 2004)

DISCUSSION

Although *Zea mays* is generally regarded as being *anemorphilous* (successful pollination relies on wind dispersal of pollen), maize pollen is also collected by bees (Emberlin *et al*,1999). Earlier studies, which also showed the evidence that maize pollen is collected by bees, are available from experimental results and monitoring (Percival, 1947, 1955; Nowakowski and Morse, 1982; Vaissiere and Vinson, 1994). Of the pollen types that were discovered by Mourizio (1951) to be extremely important to bees, *Z. mays* was amongst the pollens that were found to stimulate the development of brood food glands, ovaries and also prolong the life span. Farooq *et al.* (2004) emphasized on the use of honeybees by the farmers in the Hindu Kush Himalayas in promoting their mountain agriculture through pollination of their field crops (maize inclusive), fruits and vegetables.

All these studies strongly suggest that honeybees could be effectively utilized to facilitate pollination in *Z.mays*. However, many farmers have poorly understood this aspect. This study is therefore, an attempt to evaluate the economic benefits or otherwise of honeybees on the yield of maize as the major stable crop in the state.

The results in Table 1 indicate the gross margin of bee-pollinated maize farm plot. Gross revenue of ₦395225 was realized from the two production periods. The total variable costs, which formed the inputs procurement costs, was ₦198130. Thereby bringing the gross margin of this maize farm plot to a sum of ₦197095. Table 2 shows the gross margin of maize farm plot pollinated from other sources. Similarly, positive gross revenue of ₦311600 was obtained from the two cropping seasons. While the total variable cost was ₦190480, a sum of ₦121120 was recorded as the gross margin for the period under consideration.

Comparatively, it could be observed from the two tables (1 and 2) that the bee-pollinated maize farm plot (Table 1) yielded 20.7 bags of threshed maize higher than the maize farm plot pollinated from other sources (Table 2), accounting for about 21.23% of the total yield. This gives equivalent farm revenue of ₦77625 higher in Table 1. Also, a sum of ₦75975 higher was recorded for the bee-pollinated maize farm plot (Table 1) in terms of gross margin.

The implication of the above results is that although *Z. maiys* (maize) is being regarded as *anemophilous*, honeybees can also enhance the pollination of this popular crop and by extension increase the yield, of which in this study, by not less than 21%.

CONCLUSION AND POLICY IMPLICATION

The results of comparative analysis of this study had shown that inspite of the fact that maize has been mainly considered as *anemophilous* crop, honeybees (*A. mellifera*) can improve the yield of *Z. mays* immensely.

It is therefore, recommended that the government should include the use of honeybees in their extension packages as measure of enhancing the crop production of the small-scale farmers who form the bulk of food producers in the country.

ACKNOWLEDGEMENTS

I am grateful to both the Adamawa state local government services commission, Yola, Nigeria and the authorities of the Fufore local government area, Adamawa state, Nigeria for financing this study.

REFERENCES

Emberlin, J., Adam-Groom, B. and Tidmarsh, J., 1999. A report on the dispersal of maize pollen. Commissioned by Soil Association based on evidence available from publications and internet sites. 27pp.

Eni, H. and Ugoani, A., 2004. Yielding Gains Gradually. Special feature.Tell Magazine No.1. January 5, Nigeria. P23

Farooq, A., Partap, U., Joshi, S. R. and Gurung, M. B., 2004. Indigenous honeybees: Allies for mountain farmers. In: Campen, E.V. (ed) Magazine on Low External Input and Sustainable Agriculture: 20(4):12-13

Hoof, F.L. and Phillips, J. K., 1990. Honey Background for 1990 farm Legislation, Washington D.C., U.S. Department.

Lasalle, J. and Gauld, D., 1992. eds. Hymenoptera and Biodiversity. C.A.B. International, Wallinford. 348pp.

Maurizio, A., 1951. Untersuchungen uber den Einfluss der Pollenernahrung und Brutpflege auf die lebensdauer und den physiologischen Zustand der Bienen. Report of the 14th International Beekeeping Congress. Leamington Spa. P320.

Nowakowski, J. and Morse, R., 1982. The behaviour of honeybees in sweet corn field in New York State. America Bee Journal. 13:16.

Odigbo, E. U. and Onwualu, A. P., 1994. Mechanization of Agriculture in Nigeria: A critical Appraisal. Journal of Agricultural Technology. 2:2-3.

Okon (2002) In: Maunde, F.A. and Sajo, A. A., 2004. Effects of Fertilization on maize yield at Sangere, Girei Local Government, Adamawa State. Journal of League of Researchers in Nigeria: 4(2):38-46.

Percival, M.S., 1949. Pollen Collection by *Apis mellifera*. New Phyto. 46:142-165

Percival, M.S., 1955. The Presentation of Pollen in certain angiosperms and its collection by *Apis mellifera*. New Phyto. 54:353-368.

Robinson, W.S., Nowogrodzki, R. and Morse, R. A., 1989. The Value of honeybees as Pollinators of U.S. Crops. American Bee Journal. 129:411-487

Rossett, P., 2002. Genetically Engineered crops-Will they feed the hungry and reduce Poverty? In: Nielsen, F. (ed.) Low External Input and Sustainable Agriculture. 17 (4):4-7

Vaissiere, B. and Vinson, S. B., 1994. Pollen Morphology and its effects on Pollen collection by honeybees, *Apis mellifera L. (Hymenoptera: Apidae)*, with special reference to upland cotton, *Gossypium hirsutum L. (Malvacaece)*. *Grana*. 33:128-138

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 153 - 157
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

AN ASSESSMENT OF SOURCES AND UTILIZATION OF CREDIT BY SMALL SCALE FARMERS IN BENIN METROPOLIS OF EDO STATE, NIGERIA

K. O. ILAVBARHE

(Received 11 February, 2005; Revision Accepted 19 March, 2007)

ABSTRACT

This study focused on the sources and uses of credit by small scale farmers in Benin metropolis of Edo state. Data were collected by the use of a well structured questionnaire administered to sixty (60) respondents randomly selected from the study area. Data were analyzed using simple descriptive statistics, chi-square and Z-test. Findings revealed that the formal credit sources contributed 30.64 percent of the total credit to only 12 farmers while the informal sources contributed 69.36 percent to 48 farmers. The commercial banks, though loan out the highest amount of credit per person (₦30, 000), was the least patronized. "Esusu" on the other hand was the most patronized of the credit sources. Local merchants contributed lowest amount of credit per person (N5, 500). The performance of the credit sources was found to be significant ($P<0.05$). Furthermore, the effect of credit on expenditure on variable inputs, adoption of innovations and farmers' income was not significant. This may be due to inadequate credit amount, high cost of credit and loan diversion. It is recommended that banks and credit providers should give loans that are adequate in amount to avoid diversion.

KEYWORDS; Assessment, Sources, Utilization, Credit Small Scale Farmers, Benin Metropolis

INTRODUCTION

Before the advent of the oil boom, Nigeria's economy was essentially agrarian. Agriculture was the country's major source of foreign exchange earnings, However, this perceived glory of the agricultural sector faded away in the 1960s, giving way to petroleum. The aggregate Gross Domestic Product (GDP) was estimated to have recorded an annual growth in real terms of about 10 percent in 1980 – 1990 compared with the average of 3.2 percent since 1992. In addition, agricultural sector's share of the GDP at 1984 constant factor cost seemed to have stagnated at 21 percent (CBN, 1999).

The oil sector attracted government attention while the agricultural sector suffered severe neglect especially in terms of budgetary allocation and financial support in the form of credit. Owing to lack of agricultural credit to the small scale farmers who are at the centre of the Nigerian agriculture, financing new innovation is hampered, hence the stunted growth of the agricultural sector. Miller's (1977) assertion is pertinent that agricultural development in low income countries is severely constrained by lack of credit. It is appreciable to note that the number of loans guaranteed by Agricultural Credit Guarantee Scheme Funds (ACGSF) in 1999 stood at 12,859 loans, representing a decline of 1778 loans or 12 percent when compared with the 1998 figures. In Edo State, the number of loans guaranteed stood at 138 and 96 in 1998 and 1999 respectively, indicating a decline of 30 percent (ACGSF, 1999).

This lack of credit thus, stunts agricultural growth and development as farmers lack the wherewithal to adopt improved agricultural practices which are very expensive. Unless adequate credit is injected into the agricultural sector to enhance rapid and continual use of growth promoting inputs, the attainment of self sufficiency in food and fibers production in Nigeria will continue to be a mirage.

In an attempt to keep body and soul together, the farmer must have to patronize the different sources of credit irrespective of cost and reliability. The question now is, which of these sources of credit is most effective in terms cost and availability? Is the credit obtained channelled into proper usage and what is the effect of the credit on the farmers? To provide answers to these questions, it is proper to assess the various sources of credit and their patronage by small scale farmers.

Credit is a device for facilitating the temporary transfer of purchasing power from one individual or organization to another (Oyatoye, 1981). It represents liquidity or a generalized command over resources (Pisckke *et al*, 1983). In the views of Abott and Makeham (1990), credit is an access to capital for which repayment will be made at a later date. Through credit, people are enabled to use capital when they need it and at a price (interest) paid to mobilize such loans.

Agricultural credit, which this study is concerned with, is the process of obtaining control over the use of money, goods and services in the present in exchange for a promise to repay at a future date and the proceeds invested in agricultural enterprises (Adegeye and Dittoh, 1985). A lender forgoes the use of his money or its equivalent in the present by extending a loan to a borrower who promises to repay on terms specified in the loan agreement. Imoudu and Famoriyo (1986) referred to credit as the acquisition of funds at a cost for a specified period. At the end of the contract period, the control ceases and the funds revert to the initial owner.

Credit therefore is a critical factor in agricultural development. For most governments in developing economies, the channelling of institutional finance to agriculture has increasingly become an important policy instrument for expanding output particularly of the rural poor (Agu, 1998). Noting the role of credit in agricultural development, Ijere (1998) echoed that credit is a moving factor that energizes other factors of production and makes latent potential and under utilized capacities functional thereby acting as a catalyst that propel the engine of growth. In agricultural development, credit provides several attractive features, one of which is that it offers fast relief for complex situations and difficult problems confronting farmers (Pisckke *et al*, 1983). It provides the basis for increased production efficiency through specialization of functions, thus bringing together in a more productive union the 'skilled' farm manager with small financial base and those who have substantial resources but lack know – how in farm management (Oyatoye, 1981). Furthermore, the provision of credit facilitates and accelerates the necessary investment and hence the adoption of new technologies or innovations (Famoriyo and Nwagbo, 1981, Williams, 1984, and Upton, 1997), This is not unconnected with its ability to break the vicious cycle of poverty of the rural and subsistent farmers thereby increasing their income and capital formation status (Adegeye and Dittoh, 1985). The provision of credit in isolation of new technology may have little impact in transforming the agricultural sector. This statement is in line with Rogers (1999) assertion that research and technology are the vehicles on

K.O. Ilavbarhe, Dept. of Agricultural Econs. and Extension Services, Fac. of Agric. Univ. of Benin, Benin City, Nigeria

which agricultural development can move forward.

According to Makeham and Malcolm (1986), credit can be used to increase both farm production and wealth, adding that there are two broad groups of farmers; those that started with their own fund only to discover that internally generated fund can not keep pace with the required expansion and development, and those who need credit to start the business of farming. To this end, credit must increase earnings from the farmers resources and this increase must exceed the full cost of borrowing to avert loan default.

Two broad sources of credit are available to the farmers. These include formal and the informal credit institutions (Imoudu and Famoriyo, 1986; Ijere, 1986; and Upton, 1997, Alufohai and Ilavbarhe, 2000 and Ilavbarhe and Ahmadu, 2001). The formal institutions are the banks, special government agricultural lending corporations and cooperative credit unions. while the informal sources are friends and relatives, merchants, money lenders and the rotatory credit associations commonly referred to as 'esusu. Studies have shown that the formal credit institutions are deficient in their ability to meet the credit needs of farmers hence farmers still resort to the informal sources despite the high cost and unreliability associated with this source. An assessment of these credit sources will help to put to shape a number of vital issues.

METHODOLOGY

Data for this study were collected through the use of well structured questionnaire administered to sixty (60) respondents selected at random from the study area. The data generated were subjected to descriptive statistical analysis by the use of mean, percentages, frequencies and tables. The significance of the analysis was tested with chi-square whose formula is expressed as;

$$\chi^2 = \frac{(O-E)^2}{E}$$

Where χ^2 = chi-square

O = observed value

E = expected value which was calculated by multiplying the probability (P) that the credit extension from the nine (9) credit sources used are equal ($P=\frac{1}{9}$) by the total percentage sample space.

To assess the effect of credit on the farmers and their output, Z – test statistics was used. Through the test, it will be established if there are significant difference between the respondents' expenditure on variable inputs, innovations and income before and after credit utilization. Z – test is given as

$$Z = \frac{\bar{X}_a - \bar{X}_B}{\frac{S_A + S_B}{\sqrt{n_A}\sqrt{n_B}}}$$

Where $\bar{X}_A$ and $\bar{X}_B$ = mean of samples A and B respectively S_A and S_B = standard deviation of A and B respectively n_A and n_B = number of observations in sample A and B respectively A and B = after and before credit respectively.

RESULTS AND DISCUSSION

Assessment of Sources of Agricultural Credit

Table 1: Farm Credit by Sources

Sources of Credit	Frequency	Percentage (%)	Amount Borrowed (₦)	Percentage of total Amount Borrowed	Average amount per Person ₦
Family/Relations	16	17.78	127,200.00	12.26	7,950.00
Friends	18	20.00	146,500.00	14.12	8,138.89
'Esusu' (Thrift)	30	33.33	298,000.00	28.72	9,933.33
Business Partners	7	7.78	72,000.00	6.94	10,285.71
Local Merchants	2	2.22	11,000.00	1.06	5,500.00
Money Lenders	5	5.56	65,000.00	6.26	13,000.00
Commercial Banks	1	1.11	30,000.00	2.89	30,000.00
Co-operatives	8	8.89	208,000.00	20.04	26,000.00
NACB	3	3.33	80,000.00	7.71	26,666.67
Total	90*	100.00	1,037,700.00	100.00	11,530.00

*Multiple Responses

Source: Field Survey, 2004

Multiple responses as regards credit acquisition from the various credit sources is indicative of the inadequacy of credit from any one source. Some of the respondents had to rely on two or more credit sources to manageably cater for some of their financial needs.

Out of a total credit of One million, thirty seven thousand and seven hundred Naira only (₦1, 037,700.00) obtained by the respondents, the formal credit institutions contributed Three hundred and eighteen thousand Naira only (₦318, 000.00), about 13.33 percent to 12 (13.33 percent) of the respondents while the remaining Seven hundred and nineteen thousand, seven hundred Naira (₦719, 700.00), about 86.67 percent was contributed by the informal sources to 78 (86.67 percent) of the respondents. This suggests the unwillingness of the formal credit institutions in extending loans to the agricultural sector. Adegeye and Dittoh (1985) made similar observation when they lamented the continual patronage of the informal credit sources by farmers owing to the negative attitude of the formal credit institutions towards agricultural sector.

The commercial banks, NACB and the Co-operatives which are the formal financial institutions contributed 1.11 percent, 3.33 percent and 8.89 percent of the total amount of credit to 1.67 percent, 5 percent and 13.33 percent of the respondents respectively. The respective average credit amount per person is ₦30, 000.00, ₦26, 666.67 and ₦26, 000.00 respectively from the commercial banks, NACB and the Cooperatives.

Commercial banks are leading in this neglect of the agricultural sector as evident in their granting of loan to only one respondent. Although they contributed the highest average amount of loan per person, the target was grossly inadequate, meaning that the core problem is unwillingness which is far from lack of funds. This can be attributed to the biological nature of agriculture and the associated risks involved which could include crop failure among others. Commercial banks therefore, prefer to lend to the industrial

and service sectors where returns are surer with fewer risks, (Asika and Nwachukwu, 1988; Balogun, 1986; and Balogun and Out, 1991 and Milanovic, 2003). Next to commercial banks in average amount of loan per person is the NACB. Coverage was also very low. The reasons for this are the cumbersome procedures involved in obtaining loans, inadequate collateral security by farmers, inadequate funding of the bank by the promoters, and past experience of loan default. These corroborate the findings of Ilavbarhe and Ahmadu (2002). The co-operatives are however a better avenue for channelling credit to small scale farmers as the number of respondents who borrow from this source are more and the total amount given out is higher than any of the formal sources even though the average amount per person is low. The reason for this is that they have limited sources of fund and have to ration among members. Cumbersome procedures and untimely disbursement of loan are minimized. Interest rates are low. Their constraint, however, is inadequate fund to meet the financial demand of members.

The informal credit institutions, on the other hand, include family, relations, friends, 'esusu' (thrift), local merchants, and money lenders having 12.26 percent, 14.12 percent, 28.72 percent, 6.94 percent, 1.06 percent, and 6.26 percent as the respective proportions of the total amount of credit obtained by 26.67 percent, 30.0 percent, 50.0 percent, 11.67 percent, 3.33 percent, and 8.33 percent of the respondents respectively. Similarly, the average amounts of credit per person are ₦7,950.00, ₦8,138.89, ₦9,933.33, ₦10,285.71, ₦5,500.00 and ₦13.000.00 respectively from these sources.

The percentage coverage is low except thrift (esusu) which has about 50 percent. Local merchants come last with respect to the amount of credit per person, suggesting a very low level of funding. On a general note, these findings show that 'esusu' is the major source of credit to the respondents though the average credit per person is still low. Its ease of accessibility is the reason for its high patronage. This source therefore needs to be encouraged to effectively shoulder the financial needs of the farmers.

Comparison of credit sources: chi-square analysis

The formulated and tested hypothesis is that there is no significant difference between the various sources of credit available to respondents in the study area in terms of number of credit and amount given out (Ho)

Table 2:Chi-Square Analysis of the Difference between the various Credit Sources

Source of credit	Observed percentage of credit beneficiaries	Expected percentage of credit beneficiaries	χ^2 of credit beneficiaries	Observed percentage of total amount of credit	Expected percentage of total amount of credit	χ^2 of total amount of credit
Family/Relations	26.67	16.67	5.99	12.26	11.11	0.12
Friends	30.00	16.67	10.66	14.12	11.11	0.82
Thrift (esusu)	50.00	16.67	66.64	28.72	11.11	27.91
Local Merchants	3.33	16.67	10.68	1.06	11.11	9.09
Money Lenders	8.33	16.67	4.17	6.26	11.11	2.12
Commercial Banks	1.67	16.67	13.50	2.89	11.11	6.08
NACB	5.00	16.67	8.17	7.71	11.11	6.04
Co-operatives	13.33	16.67	0.67	20.04	11.11	7.18
Total			122.41*			55.92*

Source; Computed from Table 1

χ^2 (0.05, 8) = 15.51 * Significant at 5%

The result of the chi – square analysis shows that the various sources of agricultural credit are significantly different from each other at 5percent level (P<0.05). This is in terms of percentage number of respondents reached and the percentage amount of credit extended. This is evident in the higher values of the chi – square calculated (122.41 and 55.92) for percentage respondents and percentage of total credit amount extended respectively as compared with the tabulated value of 15.15. Thus, the null hypothesis is accepted.

Access to Commercial Bank Credit

Table 3: Factors that Affect Farmers' Access to Commercial Bank Credit.

Response	Frequencies	Percentage
Unaware	11	18.33
Illiterate	7	11.67
High Interest Rates	9	15.00
Fear of Indebtedness	8	13.33
Banks Unwillingness to Lend to Agric.	14	23.33
No Collaterals	6	10.00
Cumbersome Procedures	3	5.00
Fear of being monitored	2	3.33
Total	60	100.00

Source: Field Survey, 2004

Ranking by respondents of the factors that affect their access to commercial banks' credit in order of intensity as revealed in table 3 shows that unwillingness of the commercial banks to lend to the agricultural sector has the highest percentage of 23.33 percent, followed by unawareness on the part of the farmers with 18.33 percent and the least is the fear of being monitored with 3.33 percent. This furtner confirms the result in table 1 where the banks extended credit to only one respondent in the study area. It is therefore deduced here that the attitude of most commercial banks towards credit extension to the agricultural sector makes it impossible for them to advertise their products to the public. Illiteracy in

addition to unawareness to new technology is a function of the level of education of the average small scale farmers in Nigeria.

Other factors such as high interest rates, fear of indebtedness, lack of collaterals, cumbersome procedure and fear of being monitored are not unconnected with the high risks involved the agricultural sector. Different commercial banks charge varying interest rates based on their perceived risk. This is in conformity with the assertion of Allison – Oguru and Daba Ibifubara Bob – Manuel (2000) that different commercial banks charged different interest rates depending on how favourably disposed they are towards lending for agricultural purposes. The risks (crops/animals failure due to vagaries of weather, price fluctuations) further compound these fears of loan default.

Utilization of Credit

Response by respondents on the utilization of farm credit (table 4) shows that 76.67 percent expended proceeds of the credit obtained on farm labour. This could be due to the high cost of labour as a result of competing demand for unskilled labour by the other sectors of the economy and also, because most of the respondents are part time farmers or take farming as secondary occupation. Labour is the most demanding input on the farm hence its high financial requirement. Followed closely are seeds and seedlings or planting materials which accounted for about 70 percent. This also suggests that respondents must have used improved seeds/seedling as these are usually expensive. Rent is still a serious problem in the study area as it ranks third in the farmers' use of credit.

Table 4; Utilization of Farm Credit by Respondents

Item on which Credit was Expended	Frequency	Percentage
Labour	46	76.67
Seeds/Seedlings	42	70.00
Foundation Stock (livestock)	7	11.67
Rent	18	30.00
Feeds	7	11.67
Medication	9	15.00
Agrochemicals	16	26.67
Hospital Bills	5	8.33
School Fees	6	10.00
Trading	4	6.67
Others (Farm Building, Transportation, Equipment, etc)	11	18.33

Source; Field Survey, 2004
Note; Multiple Responses.

Other uses to which credit were put include foundation stock, feeds, medication, agrochemicals, and others (farm building, transportation and equipments) accounting for 11.67, 15.00, 23.33, 3.33, and 18.33 percent respectively. Some respondents diverted part of their credit proceeds to non farm uses. These uses are hospital bills, school fees and trading. These may not be treated as serious diversion because they help in the physical wellbeing of the farmer and funds are not available to provide them, they greatly affect the productivity of the farmer. As observed by Adegeye and Dittoh, (1985), the farm is a social, political and economic entity and hence credit is required for other purposes as is the case of health and trading which though not directly related to farm production, indirectly influence it. School fees also influence farm production but in the long run as parents of educated and well placed children in the other sector of the economy are likely to be more endowed financially to fund their production activities.

Assessment of Credit Performance

The null hypothesis (Ho) formulated and tested here is that there is no significant difference between the mean expenditure on variable inputs/innovations adopted, mean income of farmers before and after credit usage. The result of the Z- analysis (table 5) reveals the Z- calculated values of expenditure on variable inputs/innovations and farmers' income to be 0.53 and 0.42 respectively but they are not all significant at 5 percent level. The null hypothesis is, thus, accepted in both cases; meaning that the impact of credit on the respondents and their production is negligible.

Table 5; Results of the Z- test Analysis of Credit Performance

Parameters for Assessment	Mean Value		Standard Deviation		Z- Calculated	Z- Tabulated
	Before Credit	After Credit	Before Credit	After Credit		
Expenditure on Variable Inputs/Innovations	28895.56	43319.39	87510.53	12195.50	0.5337*	1.9600
Farmers' Income	229934.65	351845.63	956192.18	1318975.88	0.4151*	1.9600

Source: Computed from Field Data, 2004
Not Significant at 5%

Reasons for the non significant performance of credit are numerous. It is obvious from the results that the amount of credit obtained by the respondents were too small to induce any meaningful change in production and income. It could also be attributed to loan diversion to non farm uses and high expenditure on land rent. Besides, credit is only one of the numerous factors that account for the differences in production and income between a borrower and non borrower. Those other factors include: differences in technology, irrigation, weather, price uncertainty, differences in product and input prices and differences in household financial constraints.

CONCLUSION AND RECOMMENDATIONS

The study has revealed that the various sources of agricultural credit available to farmers in the study area are significantly different from each other in their performances and the contribution of agricultural credit to production was enormous. However, the credit impact with respect to expenditure on variable inputs/innovations adopted and

farmers' income was insignificant. This was as a result of insufficient credit which hampers the scope of operations of beneficiaries, high cost of land, loan diversion and other factors that influence credit utilization.

As a result of the foregoing, it is recommended that government, wealthy individuals in the society and private organizations should urgently come to the aid of farmers in the study area by providing them with adequate credit. These should be channelled through cooperative societies or 'esusu'. Government should make land available to practising farmers and farmers should be more serious with the use of proceeds of loans.

REFERENCES:

Abott, J. C. and Makeham, J. P., 1990. Agricultural Economics and Marketing in the Tropics (2nd edition), Longman, London Pg. 170

Adegeye, A. J. and Dittoh, J. S., 1985. Essentials of Agricultural Economics, Ibadan, Impact Publishers Nig. Ltd. Pg147-162

Agu, C. C., 1998. Loan Management in Agriculture", In Ijere, M. O. and A. Okorie) (eds) Readings in Agricultural Finance. Lagos. Longman Pg. 119

Allison – Oguru, E. A. and Bob – Manuel, D. I., 2000. Effect of Economic Liberalization on the Flow of Commercial Banks' Credit to Farmers in Rivers State, Nigeria", Tropicultura 18(3), Pg 152-157.

Alufohai, G. O. and Ilavbarhe, K. O., 2000. Women Cooperative Societies and Access to Productive Resources in Three Local Government Area of Edo State: Journal of Agriculture, Forestry and Fisheries. (1) 46-51

Asika, N. M. and Nwachukwu, R. O., 1988. The Role of Nigerian Commercial Banks in Agricultural Financing' Nigeria Journal of Business Administration 1(2) Pg 10-15.

Balogun, E. D., 1986. "Sources of Finance to Agriculture" A Paper Presented at the Allied Bank National Workshop on Nigerian Agriculture, Conference Centre University of Ibadan, Ibadan.

Balogun, E. D. and Out, M. F., 1991. Credit Policies and Agricultural Development in Nigeria, Central Bank of Nigeria Economic and Financial Review No 29.

Famoriyo, M. O. and Nwagbo, E. C., 1991. Problems of Agriculture and Agricultural Finance in Nigeria" Proceedings of a Seminar Organized by Central Bank of Nigeria on Agricultural Credit and Finance in Nigeria Held at Ibadan, April 27 – 30, 1981.

Ijere, M. O., 1998. Agricultural Credit and Economic Development" In Ijere, M. O.and A. Okorie (eds) Readings in Agricultural Finance, Lagos. Longman.

Ilavbarhe, K. O. and Ahmadu, J., 2001. "Performance of Nigerian Agricultural and Cooperative Bank (NACB) Loan Scheme in Financing Small Scale Agricultural Production: A Case Study of Ika North L.G.A. of Delta State. Knowledge Review: A Multidisciplinary Journal, 4(1) Pg 47-51

Imoudu, P. B. and Famoriyo, O. A., 1986. An Assessment of Approaches to Credit Availability in Nigeria Agriculture" Invited Paper Presented at the 3rd National Conference of Farm Management Association of Nigeria (FAMAN) held at ARMTI, Ilorin, August 24 – 27, 1986.

Makeham, J. P. and Malcolm, L. R., 1986. The Economics of Tropical Farm Management. London, Cambridge University Press. Pg 146-153.

Milanovic, B., 2003. Two Faces of Globalization; Against Globalization as We Know It World Development 31(4) 667-683

Miller, L. F., 1977. Agricultural Credit Finance in Africa. New York The Rockefeller Foundation, Pg 64-67, 724.

Oyatoye, E. T. O., 1981. "Financing Small Farmers: A Change of Strategy". A Paper Presented at Central Bank Of Nigeria Seminar on Agricultural Finance in Nigeria held in Ibadan, April 27-30, 1981.

Pischke, J. D. V., Dale, W. A. and Gordon, D., 1983. Editorial Comments on "Changing Perceptions of Rural Financial Markets" In Pischke, J. D. V., W. A. Dale and D. Gordon (eds) Rural Financial Markets in Developing Countries, Washington: EDI, World Bank.

Rogers, B. A., 1999. Agricultural Policy in Nigeria http://nigeriaworld.com/feature/article/agripolicy.htm

Upton, M., 1997. The Economics of Tropical Farming Systems Cambridge Low Price Edition Pg 141-164

Williams, A., 1984. Policies, Planning and Financing of the Nigerian Agricultural Sector" A Paper Presented at a Symposium Organized by Societe Generale Bank (Nig.) Ltd. Held in Lagos, October, 25 – 26 1984.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 159 - 161
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

FACTORS AFFECTING THE GROSS MARGINS OF BROILER ENTERPRISES IN CALABAR MUNICIPALITY, CROSS RIVER STATE, NIGERIA.

D. I. AGOM., A. ESSIEN., S. O. AKPET, and G. EDAME
(Received 14 March, 2007; Revision Accepted 8 May, 2007)

ABSTRACT

A survey was conducted to determine the factors that affect the gross margins of some broiler farms in Calabar Municipality of Cross River State using regression analysis. Six independent variables (X_1-X_6) were fitted into the regression equation to determine gross margin which is the dependent variable (Y). These independent variables were cost of feed (X_1), day old chicks (X_2), labour (X_3), drugs and vaccines (X_4), water (X_5) and other costs (X_6). The linear functional form was selected as the lead equation on the basis of the strength of the coefficient of determination (R^2), significance levels of variables and the signs of the coefficients. The linear function had an R^2 value of 65.7% implying that 65.7% of the variation in gross margin was explained by the included variables in the equation. The F value of 5.75 was significant at 1% implying that the overall equation had significance. The coefficients were all negative except other costs (X_6), meaning that they were all negatively correlated to the gross margin. This implies that the more the amounts expended on these variables, the smaller the gross margin. However, only cost of feeds, labour and other costs were significant at 1%, 5% and 5% respectively. There is therefore the need to keep the amounts expended on all these variables low, particularly cost of feeds which was significant at 1%, implying a very strong influence on gross margin. This can be achieved by looking for cheaper alternatives such as cassava to supply carbohydrates instead of maize, in a way that would not compromise standards and quality.

KEY WORDS: Gross margin, Broiler enterprise, regression, input variables, coefficients.

INTRODUCTION

Animal protein deficiency, which has become the hallmark of most developing economies can be confronted head on and surmounted if there is a major policy thrust on the part of governments of developing Countries to encourage poultry production. The reason is simple. Birds are prolific, with a short gestation period and Generation Interval, they have the benefit of high numbers and can be ready for the table in a matter of weeks. Broilers for instance can be ready for the table these days in as short as six weeks (Oluyemi and Roberts, 2000). Poultry enjoys wide acceptance among adherents of different religious sects across the nations of the earth (Enyenihi, *et al*, 2003).

A lot of research has been carried out and many are on going, on how to improve poultry production. Specialised breeds like meat breeds, layers and dual purpose birds have been developed over the years through breeding and selection. Animal nutritionists have been concerned with how to reduce anti- nutritional factors in feed ingredients, meeting the nutritional requirements and enhancing the efficiency of feed use of poultry birds. Those involved in Poultry Housing and equipment have also been working round the clock to increase efficiency. There have also been great breakthroughs in the storage of poultry products and value addition.

In spite of all these advances in poultry production and on-going research efforts, there is the need to ask the question, 'how profitable is the poultry enterprise in a depressed economy like Nigeria's?' The need therefore arises to focus on the different variables that affect the Gross margins of Broiler enterprises. According to Abiola (2003), Broiler production is characterized by fast returns on investment, low land requirement as well as adaptability to small, part-time and large commercial production. The projected profit per broiler is N150:00.A hundred kilograms of poultry droppings in Calabar goes for a N100:00.Maggots from poultry droppings have also been shown to have a great potential as a source of protein in poultry nutrition with a biological value close to fish meal and superior to ground nut cake and soyabean (Abiola, 2003). Even hydrolised feather meal can replace soyabean in poultry rations though it is low in sulphur-containing amino acids and lysine (Adejumo and Ladokun, 2005).

The ban on the importation of frozen chicken by the Nigerian Federal Government (even though poorly supervised), and the growth of the fast foods industry portends a great future for broiler production in Nigeria. However, the cost of producing poultry meat has increased steadily over the years. A ton of maize as at November 2004 was N39, 000:00 in Ibadan in Southwestern Nigeria (a region that can be conveniently described as the mitochondria of commercial poultry production in Nigeria), but as at May 2005, a ton of maize in Ibadan sold for N64, 000:00, representing a 73.45% increase over the November 2004 price. This high cost of maize, which was occasioned in 2004, by drought in northern Nigeria where most of the nation's maize is produced, also caught up with other energy sources like millet, sorghum and guinea corn. The new export value of cassava has further exacerbated the scarcity of grains, causing the Nigerian Federal government in the month of July, 2005, to release grains from the National Strategic Food Reserve (NSFR) to cushion the effect of the high prices of foodstuffs. But the Government has had to be very cautious to check against smugglers catching in on this (The Guardian, July 29th, 2005). This trend occurs annually as most production in Nigeria is rain fed. Since nutrition gulps more than 80% of the total cost of running any poultry enterprise, any effort or government policy that reduces the cost of feed inputs, would increase gross margin.

Gross margin according to Say (1987) is one of the most useful indicators pointing to the viability of any enterprise. It is simply the difference between Total revenue (TR) and Total Variable Cost (TVC) (Upton, 1996). Ekpeyong (1995) opined that feed represents 64.96% of Total Variable Cost (TVC) while Ekpeyong (2002) observed that feed cost represented just 54.25% of TVC. Several other factors affect Gross margin of any Broiler enterprise. The age of the birds at marketing, for instance if birds are marketed between 8-12 weeks when the feed conversion efficiency of the birds must have dropped, this would obviously have a negative effect on Gross margin; Cost of day-old chicks, government policies and high cost of other inputs also take their own toll on gross

D. I. Agom, Department of Agricultural Economics and Extension, University of Calabar, Calabar. Cross River State. Nigeria
A. Essien, Department of Agricultural Economics, Cross River University of Tech., Obubra Campus. Cross River State, Nigeria
S. O. Akpet, Department of Agricultural Economics, Cross River University of Tech., Obubra Campus. Cross River State, Nigeria.
G. Edame, Institute of Public Policy and Administration, University of Calabar, Calabar. Cross River State. Nigeria

margin (Gillespie 1992; Obioha 1992). As at 1983, Nigeria was acclaimed to be the 13th leading producer of poultry and poultry products in the world, but this is no longer the case today, 22years after, due partly to high cost of inputs and the fact that over the years Nigeria has progressively slided lower and lower on the poverty and production ladder.

The objective of this paper therefore, is to crystallize the factors that affect the Gross margins of Broiler farms in Calabar municipality with the ultimate goal of influencing policies concerning this sector of Agriculture. Findings that arise here from would be useful, not only to current broiler farmers, but also to prospective investors in this sector.

METHODOLOGY

The study was conducted in Calabar Municipality of Cross River State, located between latitude 4° 55'N and 5°55'N and longitude 8° 20'E and 8° 25'E. It is bordered in the north and west by Odukpani local government area, on the east by Akpabuyo local government area, and on the south by Calabar South local government area. The people are mostly Civil servants and speak the Qua and Efik languages. The population of the local government Area as at year 2000 was put at 176,213 (CRSG, 2004).

Data for the study came from both primary and secondary sources. The primary data were obtained from 25 broiler farms purposively sampled for the purpose of this study. This small number of respondents is due to the fact that we have very few poultry farmers in the study area. The names of the respondent farms and farmers were obtained from commercial suppliers of day old chicks as well as from their acquaintances. The selected farmers were interviewed using a set of structured questionnaire. The collected data were subjected to budgetary analysis as well as ordinary least squares (OLS) regression techniques using three functional forms (linear, exponential and double log) (Koutsoyiannis, 1977; Marriot, 1974).

The gross margins were obtained using:

GM=TR-TVC ... ... (1)

Where:

GM=Gross Margin

TR=Total Revenue

TVC=Total Variable Cost

The Total revenue (TR) in this study was given as the gross income accruing to broiler farms as a result of sales of matured birds, poultry droppings and empty bags of feeds.

The regression analysis was carried out to determine the factors affecting Gross margins. This is given implicitly as:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6)$ ... ... (2)

Where

Y=Gross margin of farm in Naira

X_1=Value of feed used by farm in Naira

X_2=Value of day-old chicks purchased by farm in Naira

X_3=Value of labour used on farm in Naira

X_4=Value of drugs and vaccines used by farms in Naira

X_5=Value of water used by farm in Naira

X_6=Value of other costs incurred by farm in Naira.

RESULTS AND DISCUSSION

The regression analysis revealed that 65.7% of the variation in Gross Margins of broiler farms in Calabar Municipality is jointly explained by Feeds (X_1), cost of day-old chicks (X_2), value of Labour (X_3), value of drugs and vaccines (X_4), value of water (X_5) and other costs (X_6).

The F-value of 5.750 was significant at 1%, indicating that the included variables were significant in jointly determining the Gross margin. The coefficient of feed was significant at 1%, with a negative sign, implying that the more the funds expended on feeds, the lower the gross margin. The matter is even more serious with the glaring reality that nutrition gulps more than 80% of the total cost of running any poultry enterprise (Oluyemi and Roberts, 2000). The coefficient of Labour was also significant (at 5%) with a negative sign. Table 1 shows the Variables that affect Gross Margin in Calabar Municipality using different functional forms.

Table 1: Coefficients of factors influencing the gross margins of Broiler enterprises in Calabar

Functional Form	Constant	X_1	X_2	X_3	X_4	X_5	X_6	R^2	$\bar{R}^2$	F
Linear	-3495.84 (-1.603)	-5.995** (-2.718)	-0.638 (-0.268)	-10.536* (-2.544)	-4.041 (-1.246)	-1.918 (-0.106)	5.014* (2.546)	0.657	0.543	5.750
Exponential	9.278 (29.573)	-8.497E-05 (-2.718)	4.149E-05 (1.217)	-9.664E--05 (-1.626)	-9.859E-05 (-2.119)	-2.764E-04 (1.0653)	5.965E-05 (2.114)	0.659	0.539	5.483
Double-log	-14.450 (-0.778)	-63.397[a]	5.363 (0.741)	0.772 (0.448)	0.514 (0.422)	0.635 (0.813)	-3.804 (0.622)	0.884	0.302	1.520

Figures in parenthesis are the t-values

** Significant at 1%

* Significant at 5%

X_1=Value of Feed (₦)

X_2=Value of day old chicks (₦)

X_3=Value of labour (₦)

X_4=Value of Drugs and Vaccines (₦)

X_5=Value of Water (₦)

X_6=Value of other costs (₦)

The Linear functional form was selected as the Lead equation on the strength of its R^2, the significance levels of most of the variables and the signs of the coefficients. The result of the analysis is presented in the equation below:

$Y = -34945.84 - 5.995X_1^{**} - 0.638X_2 - 10.536X_3^{*} - 4.04X_4 - 1.918X_5 + 5.014X_6^{*}$ ...(3)

(-1.603) (-2.718) (-0.268) (-2.544) (-1.246) (-0.106) (2.546)

R^2=0.657

$\bar{R}^2$=0.543

F=5.750

Figures in parenthesis are t-values

** Indicates that the variable is significant at 1%

* indicates that the variable is significant at 5%

All variables are as earlier defined

The R^2 value of 0.657 indicates that 65.7% of the variation in gross margins of broiler enterprises in Calabar municipality are jointly explained by the included variables namely; costs of feeds (X_1), day old chicks (X_2), Labour (X_3), drugs and vaccines (X_4), water (X_5) and other costs (X_6). The coefficients of feed and labour were negative (the more the amount expended on them, the lower the gross margin). Sourcing for cheaper alternatives to these variables would impact positively on the Gross Margins. These negative correlations between the dependent variable (Gross margin) and these independent variables (feed and labour cost, cost of drugs and vaccines, day old chicks and water) could also translate to inefficiency in the use of these resources.

CONCLUSION AND RECOMMENDATIONS

Feeds, chicks, labour, water and vaccines all affect Gross margin. The negative relationship these have with gross margin implies inefficiency in the use of these inputs. An arrangement for cheaper but no less effective alternatives to all these inputs should be sought. Efficient use of these inputs would also positively impact on Gross margins.

Investors should be encouraged to establish hatcheries to service the eastern axis of Nigeria to bring down the cost of day old chicks and total cost of production; this will also improve on the gross margin of the enterprise.

Establishment of feed mills and encouraging large scale cultivation of maize in Nigeria will go a long way in assuaging the high cost of poultry feeds which constitutes the main cost item in all broiler enterprises.

One of the ways to increase the Gross margins of farmers in Calabar Municipality and the entire Nation, is for several investors to plough their resources into setting up feed mills and looking for cheaper alternatives for feed ingredients like, maize. The fact that most of the feed ingredients come from the northern States also increases feed costs; the level of production of some of these feed ingredients could also be increased in the Southeastern .States. Another way of increasing the GM of broiler farmers is to set up more hatcheries in the Southeastern region, as is the case with the Southwestern part of Nigeria, which has come to be accepted as the hub of poultry production in Nigeria. The fact that hatcheries are many in South Western Nigeria brings about competition between the hatcheries, invariably keeping the prices of day old chicks low. The Southeast could also benefit from this competition and enjoy low prices, lower total cost and higher gross margins.

REFERENCES

Abiola, S. S., 2003. Employment creation opportunities in the agro-allied sub-sector: The case of poultry farming" Bullion, Vol 27(1): 11-14.

Adejumo, D. O. and Ladokun, A.O., 2005. Nutritional evaluation of feather meal as a protein source in Broiler Diets. Proceedings of the first Nigeria International Poultry Summit (NIPS) held at The Temperance Hotel,Ota,Ogun State, from February 20-25,2005.pg 95-98.

Business Guardian., 2005. Government begins public sale of Grains. The Guardian, Friday 29th July 2005, p.25.

C R S G., 2004. Cross River State Development Programme Book for Year 2000-2004.

Ekpeyong, E. E., 2002. An economic study of Broiler production in Calabar municipality. Unpublished B.Sc Project in the Department of Agric. Economics and Extension, University of Calabar, Nigeria.

Ekpeyong, U. U., 1995. An economic study of Broiler production in Calabar municipality. Unpublished B.Sc Project in the Department of Agric Economics and Extension, University of Calabar, Nigeria.

Enyenihi, E. A., Agom, D. I. and Odok, G. N., 2003. The imperative of democratization on Nigeria's poultry industry A paper presented at the 37th annual conference of Agricultural Society of Nigeria (ASN), Calabar, November 16th – 20th. Pp 15 – 16.

Gillespie, J. R., 1992. Modern livestock and poultry production Fourth edition, University press, London

Koutsoyiannis, A., 1977. Theory of Econometrics 2nd ed. Macmillan press, London.

Marriott, F. H. C., 1974. The interpretation of multiple observations. Academy press, London

Obioha, F. C., 1992. A guide to poultry production in the tropics. Acena publishers ltd. Nigeria

Oluyemi, J. A. and Roberts, F. A., 2000. Poultry production in warm wet climates. Spectrum books Limited, Ibadan pg 147-168.

Say, R. R., 1987. Manual of Poultry production in the tropics. English Edition. C.A.B. International, p 103.

Upton, M., 1996. Economics of tropical farming systems Oxford University press, London.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 163 - 169
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

ASSESSMENT OF THE DETERMINANTS AND IMPLICATIONS OF AGRICULTURAL PRICE VARIABILITY FOR FOOD SECURITY IN NIGERIA

A. E. OBAYELU and O. L. BALOGUN

(Received 22 December, 2006; Revision Accepted 15 March 2007)

ABSTRACT

This paper examines the determinants of variability of market prices of agricultural products in Nigeria with a view to identifying variation that exist in the prices of some agricultural commodities and their effects on food security. Information was gathered through the use of secondary data from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics. Data obtained were analyzed using descriptive statistics such as percentage, price relatives as well as measure of Central tendency and dispersion like the Means Standard Deviation and Coefficient of Variation (CV). The results of the analysis showed that, relative to the price of manufacture goods, agricultural products prices exhibits great variation from one area to other and one period to other over the past half century and are expected to continue. The price variation from the study was found to be as a result of several factors ranging from variation in the quality of the product, transaction cost, speculative activities of the middle-men, variability of yields, and government policy to climatic factors. Because of the importance of agricultural products pricing, Nigeria can only achieve and sustain self-sufficiency in production of food through marketing policy that keeps the price of agricultural products attractive to farmers in comparison with prices of other products.

KEYWORDS: Determinants, price variability, agricultural products, food security and Nigeria

INTRODUCTION

The primary focus of the Nigerian government at all levels, is to ensure food security by achieving self-sufficiency across a broad range of agricultural commodities. This can be achieved when all the citizens can be assured of adequate supply of food at all time. The price of food is therefore crucial to food access in the country. While the poorest wealth groups are most reliant on market purchases, the better off groups stock food from their harvest. It is clear that agricultural production is typically a risky business with farmers facing a variety of price, yield, and resources risks which make their income unstable from year to year. As a result of this, the pricing systems for agricultural products are diverse and very significant in explaining the quantity of food crops that will be produced as well as that of export crops. Prior to 1986 in Nigeria, Commodity Boards were established with the role of reducing the chain of intermediaries in the purchase of produce and hence, help to increase the price payable to producers. The Boards were charged with fixing product prices and purchasing of agricultural products from farmers. These Boards were however dissolved given room for free market forces to play a prominent role in price determination of agricultural products. This problem of prices facing Nigerian farmers therefore merits research attention to stabilize agricultural producer prices. Taussig (1918) discounted the precision of short run-equilibrium prices and suggested that the variability in agricultural products price impede products flow. He stressed that even on a single day, there is no one price rigidity settled by the equilibrium of supply and demand. With the wavering doings of human being and uncertainties about the supply and the conditions of consumption and demand, differences of opinion are likely and prices are not mathematically certain but statement of tendencies.

Evidence has shown that the long-term prices of agricultural commodities after adjusting for inflation has been declining for more than 150 years as compared with prices of other products like the manufacture and oil. Variability of price especially with the international markets is becoming more competitive as a result of globalization, market liberalization and privatization of parastatal organizations. Gilbert and Janter (2000) therefore opined that market liberalization is the major change that affects many markets for tropical agricultural commodities over the past decade. Many internal markets particularly in Africa were regulated by the marketing board mechanisms with the aim at reducing the variability of farm prices. In certain instance, these schemes enjoyed a measure of success, particular where the macroeconomic environment was one of stable exchange rates but more usually they were used as taxation instrument. They also absorbed resources through rent extraction and regarded response to secular declines in prices. Often the organizations ended up as being insolvent and partly through donor pressure, they have been either abolished or stripped of their powers at the same time, all the limited number of economically interventionist international commodity agreement, which had the objectives of smoothing international price variability have either collapsed or seen their economic change lapse.

One of the effects of price variation is that, government unforeseen variations in export prices can complicate budgetary planning and can jeopardize the attainment of debt targets. This is a problem for the highly indebted poor countries like Nigeria, which was highly dependent on agricultural exports before the oil boom of 70s, but because her oil export can no longer solve all her problems, therefore, there is an urgent need to increase agricultural production to boost export. Price variability increases cash flow variability for exporter and reduces the collateral value of inventories, both factors work to increase borrowing costs, small holder farmers, often with poor access to efficient saving instruments cope with revenue variability through crop diversification with the consequence that they largely forgo the potential benefits obtainable through specialization (International Task Force on Commodity Risk Management in Developing Countries,1999).

The Preoccupation of this paper in line with Duncan (1997) recommendation on the need for research study of price variability is to find out the determinants of variation of agricultural products price in Nigeria and the effects of this on the Nigeria food security. This has been a kind of research work which the World Bank has long recognized as important for rural households and, government. This study is therefore an important requirement for an improved food security in Nigeria. This study follows an extensive review of policies and programmes of previous and present governments that aimed at enhancing food production and poverty reduction among the households in Nigeria which has yielded little or no result. The authors believe that, price variability is one of the factors that can lead to the decline in agricultural productivity thereby leading to hunger, poverty and malnutrition and food insecurity. Specifically the study looks at

A. E. Obayelu, Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria
O. L. Balogun, Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria

i. The relative importance of agricultural price in the context of agricultural production
ii. Determine the magnitude of change in price to changes in agricultural output supply
iii. Provide information that could guide policy makers in designing policy strategy to expand agricultural products through moderate prices rather than concentrating on oil pricing if truly they want the country to be food secured with reduction in poverty level.

The rest part of the paper goes thus: Section two presents theoretical framework and section three contain data and methodology. Section four presents empirical results and interpretation, while section five offers some policy recommendations and conclusion.

Brief Review of Literature

Price is one of the four major variables a marketing manager control. It is the perceived or qualitatively calculated worth of a product or goods to buyers and sellers and is often set by the seller which may be farmers, wholesalers or retailers. The buyers either negotiate or refuse to pay that price or in certain instance accept it without question. To some extent price is not static element of transaction but a dynamic one. There exist many empirical studies on the effects of price or exchange rate on trade in literature (Schuh 1974, Okuneye 1985, Ihimodu 1993, Ogiogion 1993, Osuntogun et al 1997, Obadan 1994, Adubi and Okunmadewa 1999). But most of the efforts have concentrated on the price and export effects in a static setting ignoring the determinant of price variability with only little emphasis on price fluctuation of agricultural products. Agricultural pricing is the most difficult of price determination (others are consumer pricing and industrial pricing) due to a number of reasons, among which are: Seasonality and unpredictable nature of production, the attendant high risks, long cycles of production and government involvement leaving little or no latitudes for the farmers

In agricultural product pricing system adequate and conducive price arrangement is an important complement of the total agricultural activities of a community (Muktar, 2002). According to Muktar, unless farmer can have the market and the right price to sell his produce he will be depressed and be driven out of production. One of the problems price has brought to Nigeria is unfavorable terms of trade for rubber and palm oil which started from the mid-1980s when the country had recourse to import competing grains to augment domestic supplies (Balogun, 2000). Balogun stressed further that, the poor performance of agricultural production for export in Nigeria is mostly due to the persistent decline in World Commodity Price (shocks), poor management of public resources and inappropriate incentives and technological constraints. Price variability and long run price decline have also been found as major characteristics of many of the tropical primary agricultural commodity markets (Panos et al 2002). The main cause of low commodity prices of agricultural products according to Panos et al (2002) is oversupply. In addition, Olukosi and Isitor (1990) opine that, there exist a persistent pattern of price behaviour such as seasonal patterns of change, yearly variation, trend and cycles in the prices of agricultural products in Nigeria. Variation in prices observed overtimes could be as a result of complex mixture of changes associated with seasonal, cycles, trend and irregular or random factors. Because of the market seasonal pattern of change, they concluded that prices of storable products such as cereal and leguminous grains are depressed to the lowest level at harvest time and then rise as the season progresses, reaching a peak just before the next harvest season. This was supported by Michael (2004) in his studies on the Nigeria oil seeds and product. Taussig (1918) believes that we can have short price fluctuations arising from several causes such as accurate response to changes in supply and demand, overreaction due to incomplete knowledge of the nature of the participation in price making and incompatibility of the pricing mechanism with the current nature of the industry. Therefore in judging the need for price flexibility we should identify the causes of variations in prices emanating from the present system.

The Nigeria government in effort to achieve stabilization of seasonal prices of the agricultural products has therefore established various marketing organizations for agricultural price regulation and support (table 1).

Table 1: Summary of the Historical Trends in the Development of Produce Marketing in Nigeria.

Date/ Period	Agency	Remarks
Pre-Colonial	Private/ Traditional system of trading involving local agencies as well as foreign businessmen	Bartering and other forms of trading
Pre-World War II	Some level of organized trading Involving colonial agencies in various commodities including crops and livestock products like skins, leather, etc, mainly aimed at feeding the metropolitan industries of the colonial countries	Increases activities especially with the advent of rail lines to different parts of the country
1939-1945	Business organized private marketing-UAC, John Holt, CFAO, PZ etc	Prominence of and the rise of indigenous businessmen in agricultural commodity marketing.
1947	Establishment of West African produce control Board	Initial indication of active and increased government control of commodity marketing.
1949-1953	First Extra Commodity Boards established, establishment of Nigerian produce marketing company (NPMC)	NPMC responsible for overseas trade of agricultural commodities and acted as sole agent for the regional marketing Boards
1954-1976	Era of the Regional marketing Boards Eastern Northern Western and Mid-Western	When they operated they took care not only of the marketing but also their Development in term of research and Extension
1977-1986	Second Government Commodity Boards The NPMC and the states marketing Boards were abolished in 1977 and in their place 7 commodity Board were put in place. Namely: Cocoa, Cotton, Grains, Groundnut, Palm Produce, Rubber and Root/tuber	Following the creation of more states in 1976, there was the problem of proliferation of the state marketing boards among others. So FGN decided to create these boards
1987-2001	This is a blank period as far as organized government assisted/controlled farm produce marketing is concerned as technically no organized body took over from those abolished commodity boards of 1986	Middlemen foreigners have literally taken over this trade with the bad consequence for the poor farmers and country
2001 to date	3 multi-commodity development/marketing companies for Arable crops, Tree crops and livestock.	To handle marketing and other services

Source: Muktar, M. (Debt management office-Abuja) 2002 personal communication.

DATA SOURCE AND METHODOLOGY

The data set for this paper consist of time series data for producer prices and agricultural commodities output, spanning 1970 through 2003 except in places where data are limited due to unavailability of national value. The variables under consideration are obtained from the National Bureau of Statistics (formerly called Federal Office of Statistics), Central Bank of Nigeria Annual Reports and Statement of Account, Food and Agriculture Organization (FAO) production yearly book and Federal Ministry of Agriculture, Abuja.

The methods of data analysis used are: Descriptive analysis (percentages and price relative) and measure of dispersion (Variance, Standard Deviation, Coefficient of Variation). The standard deviation has the advantage of reflecting variability among all years in the period and is less sensitive to outliers.

$$\text{Variance } (\delta^2) = \frac{(Y_1 Y_m)^2 + (Y_2 Y_m)^2 \ldots + (Y_n Y_m)^2}{N} \quad \text{-------1}$$

$$\text{Standard Deviation } (\delta) = \sqrt{\frac{(Y_1 Y_m)^2 + (Y_2 Y_m)^2 \ldots + (Y_n Y_m)^2}{N}} \quad \text{---2}$$

Where N = the number of years in the period
(Y_1, Y_2 .....Y_n = annual prices in year 1 through
Y_M = average annual price, over the period.
Coefficient of Variation is a relative measure of variation. It describes the magnitude sample values and the variation within them. This is the ratio of the standard deviation to the mean

$$\text{Coefficient of Variation (CV)} = \frac{\text{Standard Deviation}}{\text{Means}} \text{ X 100 ----3}$$

Distributions with CV < 100 are considered low-variance, while those with CV > 100 are considered high-variance
Price relatives sometimes called simple index number gives an indication of how much the price of selected commodities in a given year have changed over that of the base year.

$$P = \frac{P_1}{P_0} \text{ x 100} \quad \text{----------4}$$

where
P = Price relative
P_1 = price in a given year,
P_0 = price in the base year

RESULTS AND DISCUSSION

This paper relied on the available data for this study with the results of the analysis presented in tables 2, 3, and 4. Table 2a shows that a significance difference exist in the prices of agricultural produce between one state to another and among different products when compared to price of petroleum products and manufacture goods which have slight price variation across states in terms of pump prices as well as same manufactured products. For instance, using 10 selected states over a period of 10 years (1988-97), the price variance across states of gari, yam, maize (shelled) sorghum, millet, rice, cowpea (white) and ground nut per ton were ₦ 3989, ₦ 5031.9, ₦ 5510.9, ₦2486.8, ₦ 3624, ₦ 2247.5, ₦ 5777.2 and 5510.8 respectively. Price of gari was highest in Akwa Ibom, followed by Cross River, Niger and Lagos State respectively. The observed regional variations in prices, to a great extent accounted for changes in output, regional specialization, taste, transport costs and marketing margins. The highest price in Akwa Ibom and Cross River was as a result of high demand when compared with supply in these areas. The activities of oil companies in the states being among the oil producing states negatively affect the areas of land that could be used for agriculture, hence the supply of staple food is expected to be hampered. This was suggested for the high prices of staples in the two states relative to other states in the country. Also, the ever increasing population of the area because of inflow of people coming from other states to partake in oil exploration activities has resulted in demand to exceed supply and as a result high prices of agricultural commodities. In this zone, gari is believe to be one of the major food consumed by the greatest percentage of the population. In general, table 2b indicates that prices of staples increased more during reform relative to other period. A possible explanation was however as a result of the effects of increase in supplies from the domestic sources. For instance, the purpose of reforms in market is to correct distortions and structural imbalance which is expected to enhance the effectiveness of price factors.

Variation in prices of some industrial products exists from one state to another or from one period to other due to technological improvement of such products besides transportation or transaction cost. Variation in agricultural products from one state to another or from one period to another as shown in tables 2a and 2b are however not due to the above reasons only but other reasons ranging from climatic to human factors.

Table 2a: Average variation in the Rural Market Prices of Some Domestic Staple Crops across States in Nigeria (1988-1997) in ₦ per ton.

State	Gari	Yam	Maize (Shelled)	Sorghum	Millet	Rice	Cowpea (White)	G/N (Shelled
Lagos	11374.5	18225.1	11042.5	11836.4	15076.2	17046.4	18538.4	18412.0
Benue	8378.2	9385.6	7174.3	7770.0	8405.3	20808.7	9199.0	8782.0
Ondo	7645.8	19924	6115.9	9482.6	17262.4	1726.4	17040.6	13067.5
Cross River	18071.3	8907.2	8430.7	13378.8	13410.2	161693.8	1945.9	25190.7
Ogun	8339.4	7737.8	7827.4	7479.6	7156.0	19871.9	18585.0	16745.0
Edo	6533.4	8965.2	8289.3	12932.3	13432.5	19061.1	17794.5	26885.0
Plateau	7884.1	6510.3	5822.4	5893.4	6414.8	14742.0	13826.3	16816.7
Niger	12363.3	2436.4	6838.4	7525.8	8571.5	22346.0	21131.4	22817.3
Adamawa	10193.6	7252.1	7142.9	7728.7	7026.6	18642.2	217621.1	1415.5
Akwa Ibom	18191.1	11565.2	12641.5	11062	11108.4	16056.9	911169.2	2230.78
Average	10897.47	10090.89	8132.53	9508.96	10786.39	31199.54	124685.14	15236.25
Variance	15,912,121	25,320,018	4,197,991	6,184,174	13,133,376	5,051,256	33,376,040	30,365,610
S.D	3989	5031.9	2048.9	2486.8	3624.0	2247.5	5777.2	5510.8
C.V	36.60	49.87	25.19	26.15	33.59	7.20	4.63	36.17

Note: SD = Standard deviation, CV = Coefficient of Variation, G/N = groundnut
Source: Computed from CBN Annual Report and Statement of Accounts of various issues

Table 2b: Average growth rates in prices of Staples in Different Nigeria Markets, 1980- 2000

Crops	period	Lagos (Sruth - West)	Cross Rivers(South-South)	Plateau(North-Central)	National
Garri	1980-85 (pre-reform era)	-7.40	7.43	1.11	-4.49
	1986-1993(Reform era)	21.50	16.53	18.41	10.09
	1994-2000(post reform era)	19.33	6.34	7.25	-0.05
Rice	1980-85 (pre-reform era)	3.98	2.03	4.79	5.54
	1986-1993(Reform era)	5.75	1.92	0.13	-1.97
	1994-2000(post reform era	10.26	-3.22	3.67	-1.90
Yam	1980-85 (pre-reform era)	-2.47	0.29	-6.91	-4.92
	1986-1993(Reform era	22.27	25.19	16.17	3.09
	1994-2000(post reform era	-8.14	-1.75	13.20	4.22
Beans	1980-85 (pre-reform era	4.81	7.61	8.51	5.02
	1986-1993(Reform era	1.17	-1.70	-1.26	0.21
	1994-2000(post reform era	-1.90	3.85	3.31	3.21
Millet	1980-85 (pre-reform era	-6.86	1.35	3.53	1.35
	1986-1993(Reform era)	10.77	13.69	3.44	5.82
	1994-2000(post reform e6.40ra)	2.73	4.42	5.62	-7.15
Maize	1980-85 (pre-reform era	-0.18	-3.94	7.10	0.77
	1986-1993(Reform era	7.43	8.54	8.48	5.05
	1994-2000(post reform era)	6.40	-4.03	4.32	

Source: computed from CBN Annual Reports (Various issues)

Magnitude of changes in Agricultural Products Price to changes in Output Supply

From table 3a, the average change in the price of cash crops was generally negative except for palm kernel and ground nut in 1970 to 1985 (pre SAP era). This was higher between 1986 and 1993 (SAP era) and has since then fluctuating. Producers price of cocoa palm kernel, rubber, cotton and ground nut between 1970-2003 varies by ₦46267.30, ₦10318.0, ₦33, 334.9 and ₦18642.60 respectively while level of output changed by 65.1 tons, 284.9 tons, 122.8tons, 93.4tons and 6604.6 tons of the respective crops stated as above. Groundnut has the highest variation when compared with other crops .Table 3b also shows that changes in domestic prices of major staples and cash crops in Nigeria was moderate in 1980 to 1985 despite the declined in the World prices of this commodities. It was also positive and even higher during 1986 to 1988. This observed trend can be explained by the depreciation of the Nigeria naira.

However, table 4 gives an indication of how much prices and output of the selected agricultural commodities in a given year has changed over that of the base year. The table indicates that the nominal price and output of cocoa between 1975 -79 were ₦1030.0 and 179.6 tons respectively. Calculating the price and output relative gave 129 and 73 respectively, which indicates that the price of the commodity between these periods was 129% higher than its price in the base year (1970-74) and the output has fallen by 30% when compared to the base year.

The result of the analysis as indicated in the table further shows variation in both prices and output of the agricultural product from year to year. There was 17.6% increase in price of ground nut between years 2000 – 2002; 2.8% increase between years 2002-2003 with a fall in output of about 70% within the same periods. This might be due to a drastic fall of about 14.8% in price. Also, there was about 10.6% increase in price of cocoa between the same periods with about 69.8% increase in its output.

Table 3a: Prices and Outputs of Major Agricultural Export Commodities, 1970 – 2003 (Amount in ₦ and Output in tons)

Year	Outputs					Producers prices				
	Co	P.K	R	C	G/N	Co	P.K	R	C	G/N
1970-74	797.0	120.2	N.A	132.0	79.0	246.4	286.6	65.6	291	1427.2
1975-79	1030.0	150.0	365.0	330.0	290.0	179.6	287	58.8	242.4	556.6
1980	1300.0	180.0	420.0	300.0	420.0	153	279	45	77	674
1981	1300.0	200.0	485.0	400.0	450.0	174	294	60	48	530
1982	1300.0	200.0	485.0	465.0	450.0	156	310	50	38	458
1983	1400.0	230.0	700.0	520.0	450.0	140	179	45	12	196
1984	1500.0	400.0	750.0	560.0	650.0	140	340	58	108	591
1985	1500.0	400.0	1200.0	700.0	1750.0	1609	360	226	114	621
1986	1600.0	400.0	1000.0	850.0	1000.0	148	727	190	100	896
1987	3500.0	850.0	1000.0	1000.0	2075.0	100	824	180	195	687
1988	7500.0	100.0	1500.0	4000.0	2250.0	253	545	211	194	1016
1989	10100.0	1800.0	2000.0	2433.0	6421.0	256	939	132	187	1017
1990	8500.0	2000.0	1395.0	2600.0	4320.0	244	1190	147	276	1166
1991	10158.0	2525.0	5300.0	4163.0	4752.0	268	1203	215	309	1361
1992	12845.0	5693.0	12520.0	3778.0	6843.0	292	1321	320	346	1297
1993	25278.0	10567.0	24091.0	N.A	12958.0	306	491	225	192	1416
1994	61180.0	143730.0	34400.0	45000.0	13500.0	323	503	230	218	1453
1995	73402.0	31730.0	34775.0	45000.0	20067.0	203	543	225	301	1579
1996	80222.0	22185.0	51197.0	45232.0	24125.0	323	548	245	309	2078
1997	89687.0	16554.0	56722.0	35833.0	17797.0	345	550	250	349	2101
1998	79600.0	21000.0	61833.0	32953.0	21509.0	165	572	255	351	2271
1999	85766.0	19129.0	57892.0	40208.0	2809.0	170	600	265	351	2307
2000	90000.0	20000.0	59400.0	35000.0	44110.0	170	629	275	353	2390
2001	100944.0	233500.0	69800.0	33204.0	69362.0	171	6206	278	358	2401
2002	130670.0	23500.0	65667.0	33868.0	81592.0	172	2645	284	379	2375
2003	150943.3	24322.5	113898.6	3253.2	83855.0	173.2	672.1	-	400.6	506.0
Average	39689.3	9341.8	27570.6	17521.5	17275.9	214.4	525.1	239.2	153.4	1220.7
Variance	214066214	106461124	111121558	347546535	605135400	4238	81168	15080	8724	43,620,71
S.D	46267.29	10318.0	33334.9	18642.6	24599.5	65.1	284.9	122.8	93.4	6604.6
CV	116.57	110.45	120.91	106.40	142.39	30.36	54.26	51.34	60.89	54.11

Note
Co = Cocoa P.K = Palm Kernel CV = Coefficient of Variation
C = Cotton G/N = Ground nut S.D = Standard deviation
n.a = not available R = Rubber (Dry lump)

Sources: (1) Computed from data published by the National Bureau of Statistics (formerly called FOS), CBN Annual Reports and Statement of Accounts (Various issues) and International Financial statistics FAO production year Book.
(ii) Federal Department of Rural Development Agricultural Monitoring Evaluation Unit (2003): Bulletin on Agricultural Commodities Market Prices.

Table 3b Real price changes in selected Nigeria Agricultural commodities

	1980-82	1983-85	1986-1988	1989-1991	1992-1994	1995-1997	1998-2000
Cocoa							
A	4.00	4.77	66.41	-2.65	59.85	12.75	0.12
B	-20.09	8.60	-11.77	-9.45	5.24	4.94	-19.43
Cotton							
A	-10.73	2.85	62.31	26.38	28.29	43.02	-46.72
B	-15.15	-0.76	-0.77	6.96	1.42	-1.34	-6.74
Palm kernel							
A	5.27	23.10	30.54	29.57	59.28	4.71	6.30
B	-22.98	6.16	-0.76	-8.59	13.69	1.25	-12.45
Groundnut							
A	12.57	12.26	44.90	30.70	25.51	9.21	30.26
B	-20.08	-6.75	10.85	9.33	-8.65	1.15	-5.27
Rubber							
A	17.83	7.44	23.10	42.07	62.34	16.67	1.54
B	-24.21	-2.67	5.19	-0.81	0.90	3.02	-0.05
Palm oil							
A	10.85	10.62	33.44	26.58	112.95	-23.68	9.56
B	-13.50	3.94	-4.54	-8.48	14.84	1.03	-18.91
Rice							
A	5.0	27.82	14.82	99.46	-41.51	23.51	0.84
B	-15.01	1.41	3.89	-0.92	3.67	0.64	-6.13
Sorghum							
A	28.35	18.81	15.08	33.99	14.23	42.56	8.37
B	-8.67	-1.68	-1.51	2.18	-0.40	1.80	-7.32

Note: "A" represent changes in domestic price; "B" represent change in the World price
Source: computed by the authors

Table 4: Price and Output Relatives of the Major Agricultural Commodities Shown in table 3a above

Year	Producer Prices					Output				
	Co	P.K	R	C	G/N	CO	P.K	R	C	G/N
1970-74	100	100		100	100	100	100	100	100	100
1975-79	129	125	100	250	367	73	100	90	83	39
1980	163	150	115	227	532	62	97	69	26	47
1981	163	166	133	303	570	71	103	91	16	37
1982	163	166	133	352	570	63	108	76	13	32
1983	176	191	192	386	570	57	97	90	4	28
1984	188	333	205	424	570	57	119	88	37	41
1985	188	333	205	530	823	65	126	345	39	44
1986	201	333	329	644	2215	60	254	290	34	53
1987	439	707	274	750	1266	41	288	274	67	48
1988	941	832	422	3030	2627	103	190	322	67	71
1989	1267	1498	548	1843	2848	104	328	201	64	71
1990	1066	1664	382	1980	8128	99	415	224	95	82
1991	1275	2101	1452	3154	5468	109	420	328	106	95
1992	1599	4735	3430	2862	6015	119	461	488	119	91
1993	3172	8791	6600	-	8662	134	171	343	66	99
1994	7676	11956	9425	34091	16403	131	176	351	75	102
1995	9210	26398	9527	34091	17089	82	189	389	86	111
1996	10065	18457	14224	34267	25401	131	191	373	103	146
1997	11253	13772	15540	27146	30538	132	192	381	106	147
1998	9987	17471	16941	24964	22528	140	200	389	120	159
1999	10761	15914	15861	30461	27227	67	209	404	121	162
2000	11292	16639	16274	26515	55835	60	219	419	121	162
2001	12665	19450	19123	25154	87800	60	216	424	123	168
2002	16395	19551	26210	25658	103281	70	225	433	130	166
2003	18939	20235	31205	24282	106146	70	235	-	138	35

Source: Computed by the authors from table 4a above

CONCLUSION AND RECOMMENDATIONS

The study revealed that regional variation in prices of agricultural products exist in Nigeria and this is one of the factors leading to decline in agricultural productivity which eventually leads to hunger, poverty, malnutrition and food insecurity. Lower agricultural product prices result in abandonment of traditional occupation owing to a wide differences in prices.

The variation in prices was found to be beyond technological improvement attributable to manufacture products. The major determining factor was found to be the problem of transporting agricultural commodities from the producing areas to the consumers, while others include, middlemen speculative activities, difference in other transaction cost, climatic factor, uneven distribution of human population, Government policies, variation in input cost, limitation in shelf life of the products, changes in demand and supply, weaknesses in the currency of the destination countries if the products are exportable, yields variation from one season to other or location to other, quality of such products, pressure by other competitive products pricing policy that are of close substitute

One can therefore conclude that unlike other products, price variability will continue to exist in agricultural commodities in as much as the above factors remain. Variation can only be reduced when the Nigerian government go into production and make her reserves a stronger one in order to be able to stabilize agricultural products to some extent and achieve its objectives of self-sufficiency and food security. Other recommendations are:

i. Government intervention on agricultural price stabilization should be at counterbalancing only the extreme points of price variability not attempting to smooth out price fluctuations within too narrow a range. Since the latter requires frequent and often distortion interventions on the market and also potentially very costly

ii. Other mechanisms such as crop insurance scheme, forward and futures market could be explored before putting in place fully fledged price stabilization schemes.

iii. Stabilization schemes should be administratively simple and transparent.

iv. Government should carefully weigh the costs of schemes that require the public sector to perform such activities as procuring storing and distributing stocks so that, it will not be like the abolished marketing boards of 1977-1986. They should examine whether those functions could be better contracted out to the private sector.

REFERENCES

Adubi A. A. and Okunmadewa F., 1999. Price Exchange rate volatility and Nigeria's Agricultural trade flows: A dynamic analysis. AERC Research Paper 87. African Economic Research Consortium. Nairobi, Kenya

Balogun, E. D., 2000. Resuscitating Agricultural Production for export. CBN Publication

Central Bank of Nigeria (various issues): Annual Reports and Statements of Accounts.

Duncan, R. C., 1997. World Food Markets into the 21st Century. Commodity Risk Management Policies. Australian. Journal of Agriculture and Resource economics 41(3) 429-443.

Federal Department of Rural Development Agricultural Monitoring Evaluation Unit., 2003. Bulletin on Agricultural Commodities Market Prices.

Gilbert, C. and Janter, W., 2000. Commodity Production and Marketing in a Competitive World. A Paper Presented at a Joint CFC-UNCTAD Panel Discussion in Bangkok. January.

International Task Force on Commodity Risk Management in Developing Countries (1999). Annual report

Ihinmodu, I. I., 1993. The SAP and Nigeria's Agricultu.al Development Monograph Series No 2, NCEMA, Ibadan, Nigeria.

Michael, D., 2004. Nigeria oil Seeds and Products. Soybean Situation Reports.

Muktar, M., 2002. Commodity market in Nigeria. Debt Management Office, Abuja. Personal Communication.

National Bureau of Statistics (formerly referred to as Federal Office of Statistics)(various issues): Abstracts of Statistics

Obadan, M. I., 1994. Real Exchange Rate in Nigeria. Preliminary Study. Monograph Series. No 6, NCEMA, Ibadan, Nigeria.

Ogiogion, G. O., 1993. The benaviour of Foreign Exchange rates in Nigeria. Determinants and Market Efficiency Final Report African Economic Consortium Nairobi, Kenya

Okuneye, P. A., 1985. Nigerian Agriculture on the Run refuses to move. University of Agriculture, Abeokuta Inaugural lecture series No 236p.

Olukosi, J. O and Isitor, S. U., 1990. Introduction to Agricultural Marketing and prices: Principles and Applications. Living Books series. G.U Publications, Abuja, Nigeria.

Osuntogun, C. A., Edordu, C. C. and Oramah B. O., 1997. Potentials of Diversifying Nigeria's non-oil Exports to Non-traditional Markets. A publication of African Economic Research Consortium, Nairobi Kenya. January, 1997

Panos, V. I., Donald, F. L. and Anderson, J. R., 2002. Agricultural Markets and Risks: Management of the latter, not the former. No 2793, Policy Research Working Paper Series from the World Bank, Washington D. C.

Schuh, G. E., 1974. The Exchange rate and U.S. Agriculture "American Journal of Agricultural Economics 56:1-3

Taussig, F. W., 1918. Principles of Economics. The Macmillan Co. New York, Vol.1, 2nd Edition Rev.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 171 - 176
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

EVALUATION OF DIRECTIVE AND NON-DIRECTIVE APPROACHES TO COMMUNITY DEVELOPMENT: A CASE STUDY OF RURAL COMMUNITY DEVELOPMENT PROJECTS IN ISOKO NORTH LOCAL GOVERNMENT AREA OF DELTA STATE, NIGERIA.

B. O. OVWIGHO

(Received 24 May, 2006; Revision Accepted 3 April, 2007)

ABSTRACT

The study was necessitated by the yawning gap between the development of urban and rural areas in Nigeria in spite of the continual government investment in rural development. The specific objectives were to: collate the completed and uncompleted rural community development projects in the study area between 1994 and 2005; investigate the relationship between approaches and level of completion of projects, evaluate factors which enhance sustainability of rural community development projects; and classify specific projects into directive and non- directive approaches. Primary and secondary sources of information were used. Data were collected by the use of interview schedule. Data were analysed by the use of simple percentages mean and Chi square test. Fourteen projects were completed and 27 uncompleted. It was found that a statistically significant relationship exists between approaches and completion of rural community development projects (X^2 = 8.65, p< 0.05). Factors which influenced sustainability of rural community development projects were presence of political office holders ($\bar{x}$ = 3.69), consultation with local people ($\bar{x}$ = 3.46), community participation ($\bar{x}$ = 3.29), projects based on felt needs($\bar{x}$ =3.20), ability to maintain projects ($\bar{x}$ =3.32), donation of social and capital intensive projects ($\bar{x}$ =3.03), and democracy ($\bar{x}$ =2.75). The ranking conducted by the respondents showed that the type of projects to be embarked upon determines the approach or strategy to be adopted in its implementation. Any approach to be adopted in project implementation must be subjected to theoretical and empirical analysis with reference to the intended beneficiaries.

KEY WORDS: Evaluation, Directive approach, Non-directive approach, Rural Community development, Projects, Isoko North Local Government

INTRODUCTION

Background of the Study

The development of the rural communities should remain a primary concern to persons who are interested in the welfare as well as social and economic emancipation of man from forces of under-development. In recent years, individuals, corporate organizations, governments and non-governmental organizations have adopted various approaches or strategies aimed at making life comfortable for the rural dwellers. The approaches which have been adopted include Top- bottom Approach, Bottom-up Approach, Animation Rurale, Integrated Rural Development, Participatory Rural Appraisal, Participatory Rural Appraisal and Planning, Farming Systems Research and Extension, Self- help Approach, Matching Grant, Beneficiary Assessment, Citizen Participation, Sectoral Development, Community Driven Development (CDD), and Directive and Non – directive approaches.

The differences in approaches to rural community development are based on ideological postures of policy makers and interventionists (Ladele, 2005; and Essang, 1981). From the above understanding coupled with practical and theoretical deductions, the various approaches or strategies to community development could be classified into the directive and non - directive approaches (Table 1). Table 1 shows that more strategies or approaches come under the non-directive approach. As noted earlier the differences in

Table 1: Two – way classification of approaches to rural community development

Directive Approaches	Non-directive Approaches
Top – bottom	Bottom – up
Sectoral development	Animation Rurale
Integrated Rural development	Participatory Rural Appraisal
Conventional	(PRA)
	Participatory Rural Appraisal and Planning
	Farming System Research and Extension
	Self- help
	Matching Grant
	Beneficiary Assessment
	Citizen Participation
	Rapid Rural Appraisal
	Focus Group Discussion
	Community Driven Development
	Participatory Technology development

Sources: Ayanwu, C.N (1992). Community Development: The Nigerian Perspective
Igbokwe, E.M and Enwere, N.J. (2001). Participatory Rural Appraisal in Development Research

B. O. Ovwigho, Department of Agricultural Economics and Extension, Delta State University, Asaba Campus, Asaba Nigeria

the names of approaches could be attributed to ideological differences coupled with the desire to associate the approaches to an individual, group or organisations. Ayanwu (1992) described the directive and non - directive approaches. He stated that the directive approach encapsulates those approaches by which governments or donor agencies provide what is needed for the implementation of programme. He remarked that the problem with this approach was that the people's involvement in the planning and execution of the programme was minimal. On the other hand, he explained that the non-directive approach encompass those approaches which allows the people to decide for themselves the extent of their needs, the degree of their willingness to do something to meet their needs, and how best they could organise, plan and act to carry out their project successfully. He further averred that the approach was built on three emotional pre-conditions. First, the people themselves must be dissatisfied with things as they are in order to be able to agree on their needs. Second, they must realise that their need was likely to remain unsatisfied unless they do something about it. Third, they must ensure that they have sufficient resources to achieve the satisfaction of their need.

According to Farrington and Martin (1987), Scoones and Thompson (1994), and CTA (2003) the conventional system of research and development has been criticised for following a linear process of technology transfer. In response to this criticism new approaches have been developed over the past 25 years starting with farming system research and evolving into the farmer participatory approaches.

Freudenberger (1994) stated that the Rapid Rural Appraisal involves a quick use of several data collection methods to gather practical information on development issues in local communities. These might include interviewing key informants reviewing secondary data sources, mapping exercises and conducting semi-structured interviews with groups and individuals Igbokwe and Enwere (2001) described the Participatory Rural Appraisal (PRA) as a family of approaches and methods which enable local people to share, enhance and analyse their knowledge of life and conditions, to plan and act. The use of PRA enables local people to undertake the appraisal, analysis and action as well as monitoring and evaluation of their problems. They maintained that Focus Group Discussions help to produce qualitative data that provide insight into attitudes, perceptions, feelings, and manner of thinking and opinions of participants on issues like products, services or opportunities, problems and constraints. Ladele (2005) stated that the community Driven Development was geared towards community participation and improving social capital.

Statement of the Problem.

The Nigerian governments at all levels have committed much human and material resources into development of the rural areas yet a yawning gap still exists between the urban and rural areas in terms of availability of social and economic amenities. Canagarajah *et al.* (1997) noted that development efforts in Nigeria were tilted in favour of urban areas (Table 2). Idode (1989) cited the work of Olatunbosun, which indicted both the colonial and independent governments of Nigeria for neglecting the majority who lived in the rural areas. He found that while social amenties and services were provided by the government in the urban areas, the rural communities were asked to fend for themselves.

Many reasons could be adduced for the slow pace of rural development in Nigeria. The reasons range from political, social, economic, institutional to ideological. The ideological reasons responsible for the slow pace of rural development appear to be related to every other reasons for the slow pace of rural development in Nigeria hence the need for this study which deals with the evaluation of the directive and non-directive approaches to community development.

Objectives of the Study

The general objective of the study is to evaluate the effects of the directive and non- directive approaches on sustainable rural community development in Isoko South Local Government Area of Delta State, Nigeria. The specific objectives are to:

1. Collate the completed and uncompleted rural community development projects between 1994 and 2005.
2. Examine the relationship between completion of rural community development projects and approaches adopted.
3. Identify the factors which enhance sustainability of rural community development projects.
4. Classify specific projects into directive and non-directive approaches.

Hypothesis: One null hypothesis was tested.
Ho: There is no significant relationship between approaches and completion of rural community development projects.

Table 2. Incidence of poverty in Nigeria, 1985 – 1992 (values in percent)

	National		Urban		Rural	
Extreme Poor (N198)	1985	1992	1985	1992	1985	1992
Number of Poor (Millions)	10.1	13.9	1.5	4.3	8.6	9.6
Poverty Incidence	12.0	13.6	4.9	10.9	16.1	15.4
Poverty depth	4.2	8.5	0.9	6.1	4.2	8.0
All Poor (N395)						
Number of Poor (Millions)	36.1	34.7	9.7	11.9	26.4	22.8
Poverty Incidence	43.0	34.1	31.7	30.4	49.5	36.4
Poverty depth	15.7	14.7	9.1	12.0	18.9	16.1

Sources: Canagarajah *et. al.* (1997).Evolution of Poverty and Welfare in Nigeria,1985-92

METHODS

Sampling Procedure and Sample size.

Purposive and stratified simple random sampling procedures were used in selecting the respondents. The snow-ball sampling technique was randomly used to select two key informants made up of a youth and an elder from each of the forty six (46) rural towns and villages in the Local Government Area. The community Development Officer attached to the Local Government Area Council was also interviewed. Thus the sample size was made up of ninety three (93) respondents

Method of Data Collection

Data were collected from both primary and secondary sources. Observation and questionnaires/interview schedule were used to elicit information from respondents. The interview schedule and questionnaires were used to elicit information from illiterate and literate respondents respectively. Primary sources of information were derived from document presented to the researcher by the community development officer attached to the Local Government Area.

Method of Data Analysis

Data were analysed by the use of simple percentages, mean and Chi square test. A factor with a mean score of 2.50 and above was selected as a valid factor, which

enhances the sustainability of rural community development project. A project with a mean rank value below 3.00 was classified either under the directive or non-directive approach. The project ranks ranged between 1 and 5. One(1) being the highest and five (5) being the lowest.

RESULTS AND DISCUSSIONS

Completed and Uncompleted Rural Community Development Projects

The projects embarked upon in the study area by governments and non-governmental organisations, level of completion and approaches were collated (Table 3) Table 3 shows that out of the 41 projects implemented during the period, 14 were completed and 27 uncompleted. A total of sixteen (16) and 25 of the projects were implemented by the use of self-help / matching grant approaches and full government sponsorship respectively. Ayanwu (1992), Idode (1989), and Ekong (2003) stated that self-help is a community development strategy in which the local people write to pursue projects on which they have collectively agreed. Self – help efforts demand the participation of all members of the community. They maintained that, the principle of self-help highlights community development as a movement of the people. Ayanwu (1992) remarked that in the case of the directive approaches to rural community development the government or an outside agency involved in the programme sets in to provide what is needed for its implementation. He observed that the people's involvement in the planning and execution of the programme was minimal. Essang (1981) remarked that in most developing countries the commonest approach to rural development was the building of infra-structure. These include physical infrastructure and institutions such as roads, communication networks, irrigation, storage facilities, market facilities, research, and extension institutions as well as Schools and Universities.

Table 3. List of completed and uncompleted rural community development projects

S/No	Name of projects	Location	State of Completion	Approach
1	Town Hall	Akiewhe-Owhe	Completed	SH
2	Town Hall	Edhomoko-Owhe	Uncompleted	SH
3	Town Hall	Bethel	Uncompleted	SH/M
4	Town Hall	Ofagbe	Uncompleted	Govt. S
5	Town Hall	Oghenerurie-Iyede	Uncompleted	Govt. S
6	Town Hall	Ofagbe-Emevor	Completed	SH
7	Town Hall	Oghiewe-Emevor	Uncompleted	Govt. S.
8	Town Hall	Otibio-Owhe	Uncompleted	Govt. S.
9	Town Hall	Erovie-Ozoro	Uncompleted	SH/M.
10	Town Hall	Urude-Ozoro	Uncompleted	Govt. S.
11	Town Hall	Uruto-Ozoro	Uncompleted	SH
12	Extension of Electricity	Okpe – Isoko	Uncompleted	Govt S
13	Extension of Electricity to Grammar School.	Ekugbo-Iyede	Uncompleted	SH/M.
14	Extension of Electricity	Oghenerurie-Iyede	Uncompleted	Govt S
15	Building of Classroom Blocks (Emewa Primary School).	Emevor	Uncompleted	Govt. S
16	Building of 4 classroom Blocks (Odio Primary School).	Emevor	Uncompleted	Govt. S
17	Principal Quarters (Ekuigbo-Iyede Grammar School)	Ekuigbo-Iyede	Uncompleted	Govt. S
18	Building of 6 classrooms and Headmaster office Blocks	Iwhride-Iyede	Uncompleted	Govt. S
19	Building of Post Office	Ellu	Uncompleted	Govt. S
20	Building of Post Office	Otor-Iyede	Uncompleted	Govt. S
21	Building of 60 Beds Hospital	Oghara-Iyede	Uncompleted	Govt. S
22	Building of Health Centre	Otor – Owhe	Completed	SH/M
23	Mini Water Scheme	Itebiege	Uncompleted	SH/M
24	Water Scheme Project	Igeh	Uncompleted	Govt. S
25	Street roads construction	Etevie-Ozoro	Uncompleted	Govt. S
26	8 Kilometre earth road	Etevie-Ozoro	Uncompleted	Govt. S
27	Street roads construction	Ulli – Iyede	Uncompleted	Govt. S
28	Construction of 60 open Market stalls	Emevor	Uncompleted	Govt. S
29	Construction of 50 open market stalls	Ofagbe-Emevor	Uncompleted	Govt. S
30	Construction of 60 open market stalls and 60 lock up stalls.	Otor-Iyede	Uncompleted	Govt. S
31	Extension of Electricity	Oyede	Completed	SH
32	Provision of Portable water	Aradhe	Completed	SH
33	Construction of 40 open market stalls	Ulli-Iyede	Completed	SH
34	Extension of electricity	Ulli – Iyede	Completed	Govt. S
35	Building of classrooms and Headmaster Office Blocks	Ulli- Iyede	Completed	Govt. S
36	Town Hall	Aradhe	Completed	SH
37	Town Hall	Owhelogbo	Completed	SH
38	Water project	Canaan	Completed	SH
39	Building of Post Office	Owhelogbo	Completed	Govt. S
40	Building of Health Centre	Owhelogbo	Completed	Govt. S
41	Town Hall	Otibio	Completed	SH

Source: Field Data (2006) and Document from Community Development Department, Isoko North Local Government Council Ozoro.

NB: SH/M = Self –Help/ matching grant.
SH = Self help
Govt.S = Government Sponsored

Relationship Between Approaches and Completion of Rural community Development Projects

The approaches adopted in the implementation of the community development projects were elicited from the respondents (see Table 3). The self-help / matching grant, and government sponsored projects were classified under the non-directive and directive approaches respectively. The results were subjected to Chi square test (Table 4).

The results of the Chi square test contained in Table 4 shows that there was a significant relationship between

approaches and completion of the rural development projects. More projects were observed to be completed under the non-directive approaches. Idode (1989) adduced three reasons for the success of projects carried out by the use of self-help movement. First, the development ventures were an expression of the people's preferences as to which projects they want to spend their money and energies on. Second, the people derive special satisfaction from projects which they plan and execute through communal labour. Third, the high rate of embezzlement of public funds which usually characterise the failure of local governments in Nigeria is avoided under the self-help movement. Similarly, Ayanwu (1992) averred that the whole idea of the principle of self-help was based on the premise that when people are given the opportunity to work out their own problems, they will find solutions with lasting effects.

Table 4. 2 X 2 Contingency Table showing approaches and state of completion of projects.

Approaches	Completed	Uncompleted	Total
Directive (Government Sponsored)	4 (7.54)	21 (16.46)	25
Non-directive (Self-help/Matching Grant)	10 (5.46)	6 (10.54)	16
Total	14	27	41

($X^2 = 8.65$; $p < 0.05$).
Source: Field data (2006)

N.B:
Parenthesis – Expected Frequencies.

Sustainability of Community development Projects

Some factors which could enhance sustainable community development projects were rated on a four – point rating scale (Table 5).

The mean scores in Table 5 shows that political office holders (3.69). Consultation with local people (3.46), community participation (3.29), felt needs(3.20), ability to maintain projects (3.32), social and capital intensive projects (3.03) and democracy (2.75) are factors which help to make projects sustainable. Ayichi (1995) remarked that local people should be involved at all stages of projects intended for their benefits in varying degrees. He recommended that they should be involved in problems identification, research design, execution, evaluation and validation. Shokunbi (1998) observed that the penchant of government and non-governmental organisations not to consult with local people before embarking on projects in the rural areas was responsible for projects failure in Nigeria. Ekong (2003) and Ayanwu (1992) discovered that the felt needs of the people must form the starting point for planning a programme of community development. They averred that many unsuccessful community development programmes were based on presumed 'real' rather than the actual 'felt' needs of the people.

Table 5. Some factors influencing the sustainability of community development projects

S/no	Item	SA	A	D	SD	x	Remarks
		4	3	2	1		
1	Projects based on felt-need succeed more	45	30	10	8	3.20	Valid
2	Projects donated by multi-national companies succeed more	11	9	40	33	2.00	Not valid
3	Projects implemented by local people with matching grant from donors succeed more	15	11	39	28	2.14	Valid
4	Capital intensive projects like educational institutions by donors agencies and governments succeed more	40	26	17	10	3.03	Valid
5	Consultation with local people make projects to succeed.	53	32	6	2	3.46	Valid
6	Ability to maintain projects is essential to the overall success	49	30	9	5	3.32	Valid
7	Projects can thrive better under atmosphere of peaceful co-existence	16	13	24	40	2.05	Valid
8	Participation of community members at all levels facilitate sustainability of projects	49	28	10	6	3.29	Valid
9	Democracy facilitates sustainability of community development projects	30	19	35	9	2.75	Valid
10	Political office holders help to sustain community development projects						

Source: Field data (2006)

Classification of Projects into Directive and Non-directive. Approaches

Eleven (11) projects were ranked between 1 and 5 by the respondents in order of suitability for directive and non-directive approaches. The ranks were summed up and projects with total mean ranks below 3.00 were classified suitable for either the directive or non – directive approach (Tables 6 and 7)

Table 6 shows that electricity with mean rank value (1.02), hospitals / health care center (1.37), roads (1.38), educational institutions (2.40), Pipe borne water (2.46) and post office (2.48) were suitable for implementation using the directive approach. In Table 7 the respondents suggested that agricultural extension services / introduction of new technologies (2.00), cottage industries (2.23) farm produce storage equipment (2.24), market stalls (2.28) and town halls (2.98) should be implemented by the use of non-directive approach. By these ranking procedures, projects which were considered suitable for directive approach invariably became unsuitable for implementation under non- directive approach and vice versa. This corroborates the fact that the type of project or programme determines the approache(s) to be adopted in its implementation.Batten (1965) posited that some forms of development could be planned and implemented without the common people being consulted. He further affirmed that certain development initiatives could only take place if the people agree with them, want them and are willing to implement them by themselves.

Table 6: Ranking of 11 projects in order of suitability for directive approach

S/No	Projects	No. of Respondents Per Rank					Total Ranks	Mean Value	Remarks
		1	2	3	4	5			
1	Electricity projects	87	4	2	-	-	95	1.02	Suitable
2	Hospitals/Health Centres	73	10	6	4	-	127	1.37	√
3	Roads	76	7	2	8	-	128	1.38	√
4	Educational Institutions	14	45	21	9	4	223	2.40	√
5	Pipe-borne water	11	48	19	10	5	229	2.46	√
6	Post Offices	32	20	15	16	10	231	2.48	√
7	Cottage Industries	18	22	15	18	20	279	3.00	Not Suitable
8	Agricultural Extension services/ introduction of new technologies.	13	21	14	20	25	302	3.25	√
9	Farm Produce Storage Equipment	9	19	16	19	30	321	3.45	√
10	Market stalls	15	8	10	31	29	330	3.55	√
11	Town Halls	8	10	12	28	35	351	3.7	√

Source: Field data (2006)

Table 7. Ranking of 11 projects in order of suitability for non-directive approach

S/No	Projects	No. of Respondents per rank					Total Ranks	Mean Values	Remarks
		1	2	3	4	5			
1	Agricultural Extension Services/ Introduction of new tecnologies	49	17	12	8	7	186	2.00	Suitable
2	Cottage Industries	35	26	17	6	9	207	2.23	√
3	Farm Produce storage Equipment	25	42	11	9	6	208	2.24	√
4	Market stalls	18	47	15	10	3	212	2.28	√
5	Town Halls	17	16	22	28	10	277	2.98	√
6	Post Offices	14	10	24	31	14	300	3.23	Not suitable
7	Roads	10	15	20	30	18	310	3.33	√
8	Hospital / Health Centres	3	8	30	29	23	340	3.66	√
9	Pipe borne water	5	9	21	24	34	352	3.78	√
10	Educational Institutions	4	7	15	41	26	357	3.84	√
11	Electricity projects	7	2	3	39	42	386	4.15	√

Source: Field data (2006)

CONCLUSION AND RECOMMENDATION

Various approaches have been adopted for the implementation of rural community development projects. There was a statistically significant relationship between approaches and completion of rural community development projects. The type of project to be implemented should determine, the approach to be adopted. Experts and policy makers should not adopt a project implementation approach because it merely represents something new. Community development approach must be subjected to theoretical and empirical analysis before being adopted for implementation of a given project.

REFERENCES

Ayanwu, C. N., 1992. Community Development :The Nigeria Perspective. Ibadan. Grabestner Educational Publishers, pp. 62 –111

Ayichi, D., 1995. Agricultural Technology Transfer for Sustainable development in Nigeria. In: Eboh, E.C., Okoye C. U., and Ayichi, D. (eds). Rural Development in Nigeria: Concepts, Processes and Prospects. Enugu : Auto – Century Publishing Company Ltd, pp. 126 –133.

Batten, T. R., 1965. The Human Factor in Community Work. London: Oxford University Press, p.13

Canagarajah, S., Ngwafor, J and Thomas, S., 1997. Evolution of Poverty and welfare in Nigeria: 1985 – 92. Washington D. C.World Bank Policy Research Working Paper 1715

CTA., 2003. Agricultural Extension: End of the Line. *Spore*. No 108, p. 8

Ekong, E. E., 2003. An Introduction to Rural Sociology. Uyo: Dove Educational Publishers, pp 309 – 328.

Essang, S. M., 1981. Stimulating Economic Progress In Rural Economies. In: Olayide, S. O., Ogunfowora, O., Essang, S. M, and Idachaba, F S. (eds). Elements of Rural Economics. Ibadan: University Publishing House, p. 321

Farrington, J and Martin, A., 1987. Farmer Participatory Research: A Review of Concepts and Recent Practices Occassional Paper No. 9 London: Overseas Development Institute.

Freudenberger, K. S., 1994. Tree and land Tenure. Rapid Appraisal Tools. Rome: FAO

Idode, J. B., 1989. Rural Development and Bureaucracy in Nigeria. Ikeja: Longman Nigeria Limited, pp. 1, 17,142 –161

Igbokwe, E. M., and Enwere, N. J., 2001. Participatory Rural Appraisal in Development Research. Lagos: New Generation Books,77p

Ladele, A. A., 2005. Rural Development Process and Practice. In: Adedoyin, S.F. (ed). Agricultural

Extension in Nigeria. Ilorin: Agricultural Extension Society of Nigeria. pp. 139 – 143

Scones, I. and Thompson, J., 1994. (eds). Beyond Farmer First: . Rural People's Knowledge, Agricultural Research and Extension Practice. London: Intermediate Technology Publication. pp 1 – 2

Shokunbi, L., 1998. New Approach to Sustainable Rural Development. The Guardian. Lagos: Guardian Newspapers Ltd., June 26, 1998.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 177 - 182
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

UNLOCKING THE PROFIT POTENTIALS OF INNOVATIONS. A CASE STUDY OF THE IITA PLANTAIN AND BANANA HYBRIDS.

B.O. FATUROTI., G. N. EMAH., B. I. ISIFE., A. TENKOUANO., T. A ADENIJI., and J. LEMCHI

(Received 21 July, 2006; Revision Accepted 20 December, 2006)

ABSTRACT

Plantain and banana hybrid varieties that are resistant to black Sigatoka disease (a leave disease reported to have caused between 30-50% yield loss in plantain across the world) were disseminated by IITA plantain improvement programme in three southern states of Nigeria. This study was designed to determine the profit potentials of these disseminated technologies. Ninety farmers from fifteen villages spread across the three states were sampled and percentages applied for data analysis. It was revealed that the main disseminated technology (plantain hybrid) was fairly adopted in the three states: Bayelsa 46%, Akwa-Ibom 38% and Rivers 36%. The hybrids were disseminated in a package that was established to have influenced high adoption rates in the components that had high profit values. Such components include sucker production in which 45% of the respondents recorded more economic returns (money) than even fruit sales, post harvest utilization was also revealed as a main source of income in the disseminated technology as potential waste from wind damage and over ripening were turned into products such as flour (which 93% of the respondents have adopted) and fruit juice respectively. The respondents as a result of the technology recorded a high profit margin of N37, 063 extra income per hectare. The regression analysis revealed that only two variables, plantain and banana constraints identification and number of innovation adopted had predictive values for the IITA hybrids adoption (R= 0.87). It was concluded that agricultural technology dissemination should be approached in a total way with motivational factors to cater for glut that may result from massive production, adoption and yield increases as well as ways to ensure steady and continuous innovation spread through organized seed/planting material production.

KEYWORDS: Black Sigatoka, profit potentials, motivation factors and adoption.

INTRODUCTION

Plantain and banana are among the most important staple food crops in humid forest zone of West and Central Africa. Improved socio-economic conditions in the recent past have suddenly increased the use of the crop as a staple food in urban and rural communities, in spite of the soaring prices occasioned by short supply, poor and inefficient production systems. In West and Central Africa, banana and plantain are an important part of the fight against poverty. This is due to the crops contribution to food security, employment, diversification of income sources in rural and urban areas, and contribution to the gross national product (GNP) (Nkendah and Akyeampong, 2003).

Bananas are mostly eaten raw as a dessert fruit, because in the ripe state they are sweet and easily digested. Plantains are generally much starchier and can be eaten ripe or unripe. They are usually boiled, fried or roasted (Robinson, 1996).

Plantain production is relatively efficient, given the limited resources available in traditional production systems. Plantain grows well in areas of heavy rainfall, 1250 – 3000mm per annum (KariKari, 1972), or 100mm per month (Swennen, 1990) where winds do not prevail, and rains are evenly distributed. Plantain can tolerate different types of soils but because of its shallow root system, it does best in well-drained soil rich in organic matter.

Important threat to plantain & banana production in Africa includes black Sigatoka disease, weevils and nematode attack as well as low propagation rate (planting materials) and its perishability. These constraints propelled researches aimed at counteracting the limitations. IITA plantain and banana hybrids offered farmers the opportunity of bumper harvest as they are not only resistant to these diseases and pests but they also combine high yielding and flexibility of processing into many home and industrial products. Eleven varieties were deployed to the farming system in the southern states of Nigeria plantain growing belt. The varieties were: PITA 14, PITA17, PITA 26, BITA3, FHIA17, FHIA18, FHIA20, FHIA23, FHIA25, CRBP39 and Agbagba (Landrace check). Agronomic practices and maintenance were the same for all the varieties and they had similar but slightly different physiological characteristics. These hybrids produce suckers profusely which allows for rapid multiplication and the fruits though many are shorter than the landrace. Infact, this was the initial concern of disseminators. The technology dissemination was not limited to hybrids plantlets dissemination. Other packages such as sucker multiplication (macro propagation techniques), post harvest utilization techniques ensures a turning of waste to wealth as all the plant parts as well as all stages of maturity and ripening even over ripening can be converted to one cash spinning and nutritious products or the other (Adeniji et al, 2004).

Cochrane (1979) stated that a key issue in the economics of innovation and adoption is to understand the impact of technology change on prices and, in particular, the well being of the population overtime. When a supply increasing innovation is adopted to a significant degree, it will lead to reduction in output prices, especially in agricultural commodity with low elasticity of demand. Thus, Cochrane (1979) argues that the real gainers from technology change and innovation in agriculture are likely to be consumers, who pay less for their food bill.

This paper therefore sets out to unlock the profit potentials and impact of the IITA plantain and banana hybrids in three states of the southern Nigeria.

MATERIALS AND METHODS

The study covered Akwa-Ibom, Bayelsa and Rivers, which are located in the Niger Delta area of Nigeria, where plantain and banana is regarded as a major traditional food crop. Five villages were purposefully selected from each of the states with particular bias to the Agricultural Development programme (ADP) operating zones in these states. These five villages in the pilot project had five farmers one per village,

B. O. Faturoti, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.
G. N. Emah, Rivers State University of Science and Technology, P.M.B. 5080, Nkpolu, Port Harcourt, Nigeria.
B. I. Isife, Rivers State University of Science and Technology, P.M.B. 5080, Nkpolu, Port Harcourt, Nigeria.
A. Tenkouano, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.
T. A Adeniji, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.
J. Lemchi, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.

thereafter random selection was done to select five farmers per each village plus the original one pilot farmer to whom the innovations were initially disseminated in the state. Thus six farmers were interviewed in each of the selected villages making up a total 30 respondents per state and 90 in all.

Data were collected in two phases. The first one being the data from researchers and extension agency to provide background for the innovations developed and disseminated to farmers, while their prospects for adoption were being studied. The second phase was basically the individual farmer's field survey and interview.

These data revealed that fourteen Plantain and banana-based technologies were developed and disseminated through the extension outfits for farmers' adoption in the study area. These included disease resistant hybrids; PITA 14, PITA17, PITA 26, BITA3, FHIA17, FHIA18, FHIA20, FHIA23, FHIA25, CRBP39 and Agbagba (Landrace check), selection of planting materials, selection of land (soil), cropping system (intercropping method), weed control methods and rapid sucker multiplication techniques as well as fertilizer usage and post-harvest processing techniques. Farmer's data was gathered through interview schedule and structured questionnaire. Adoption was defined as the acceptance and sustained use of the technology over a time period. Since this technology was disseminated in 2001, its adoption index was then calculated by dividing the number of innovations practiced by number of innovations disseminated, multiplied by 100. The data was analyzed using SPSS for windows version 10 (1999). for frequency counts and percentages as well as correlation and regression analysis, which revealed the predictive variables for adoption.

RESULTS AND DISCUSSION

The respondents' revealed four sources of planting materials. Gift source accounted for 11.8%, old-field 43.5%, purchase sources 42.4% while research and extension sources accounted for only 2.4%. This suggests that plantain-farming experience played a major role in its spread and innovation testing as farmers still relied heavily on their old-fields for planting materials. Another implication of this finding is that, apart from fruits sales in plantain production, sucker sales possessed the potentials to generate income especially in Bayelsa where 80% of the planting materials were purchased (Fig1). Of the 90 farmers interviewed 45% made more money from sucker sales than from fruits, a result of attraction to the hybrids by other members of the communities who have seen the obvious advantage of the hybrids, and felt motivated to pay the pilot farmers for the hybrid suckers from plantain and banana stock supplied free by IITA to the pilot

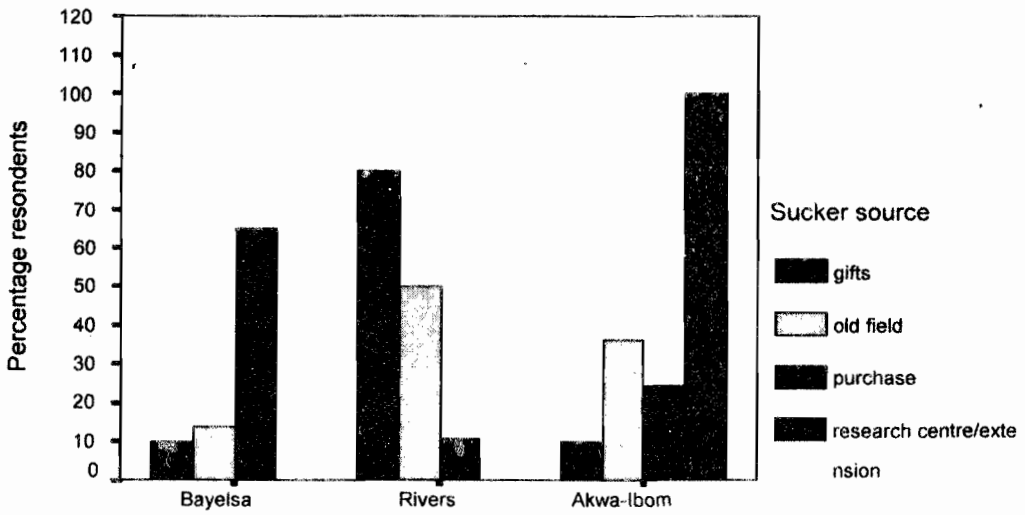

Fig. 1: Sources of planting materials by state.

The frequency of respondents as related to type of plantain and banana variety grown showed that 34.1% of the respondents grew only local variety, 2.4% cultivated only the hybrids varieties while 63.5% of the respondents cultivated both improved and local. Fewer respondents grew hybrids/landrace in combination, in Bayelsa (46.67%) while Rivers (80%) and Akwa-Ibom (64%) had overwhelming number of respondents growing hybrids and landrace in combination. This mixture of hybrids and landrace materials inter planting is an adoption of the concept of varietal mixture trial by IITA (inter planting hybrids with landrace in orderly arrangement) to the pilot project farmers, wherein the hybrids served as a bio-pesticide to slow down *black sigatoka* symptoms and improved the yield of the hybrids. This showed that the respondents preferred to plant the new hybrids in association with their own varieties while looking out for comparative advantage in the innovation. This is in agreement with Rogers and Shoemaker (1971).

Post harvest processing innovation adoption results (table1), revealed that 69.4% of the respondents had post-harvest processing awareness, while only 12.9% of the respondents adopted the innovation. Though adoption of this variable is evolving, 93% of the respondents processed their products into flour. Price sample of this product showed a price of N450 ($3) for 0.5kg package (table2). Other products are yet to be adopted at considerable level but the obvious value added to the plantain and banana hybrids had brought about adoption and extra income to the respondents as attested to by 15% of them (6% in Akwa-Ibom, 7% in Bayelsa and 2% in Rivers) (fig 2). The rather low adoption rate of post-harvest processing of plantain may be traced to the complexity of the innovation and the capital outlay needed to adopt it. This is in agreement with the report of Lehvall and Wahblin (1973) explained that communicability of an innovation and its degree of complexity affects adoption.

Table 1: Post-harvest processing awareness / adoption level

Post harvest awareness level	Frequency	Percentage	Post harvest adoption level	Frequency	Percentage
Aware	59	69.4	Adopted	11	12.9
Not Aware	26	30.6	Not adopted	74	87.1
Total	85	100	Total	85	100

Source: Field survey 2004.

Table 2: Post-harvest product and pricing regime.

Products	Respondents frequency	Respondents %	Average product price
Flour	79	93.03	N450 / 0.5kg pack
Juice	5	5.8	N100 / 50cl
Cake	1	1.17	N100 / 100g pack
TOTAL	85	100	

Source: Field survey 2004.

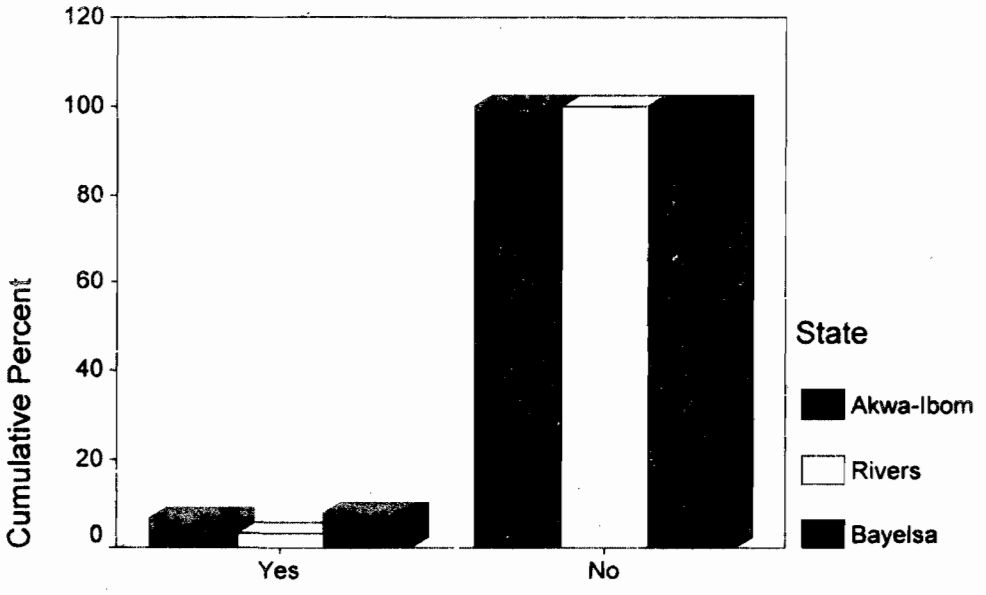

Fig.2: Respondents with outstanding income from plantain processing

Source: Field survey 2004.

Various sources of awareness were identified, the highest source of the innovations' awareness in Bayelsa was extension agents (33%) while the lowest was field day (7%), the number of field days to popularize the innovations in Bayelsa and Rivers State were extremely low. Rivers had the highest source of awareness from fellow farmers (63%) and the lowest source from field day (3%). Akwa-Ibom had the combination of ADP, farmers and field day as the highest source of awareness (32%) and fellow farmers (8%). On the whole, the major source of awareness of innovation from the respondents in the three states was farmer – farmer source which accounted for 30.3% source of awareness, followed by extension agent's source (20%), then field day (7.1%) and research staff (7.1 %) awareness. The least source of awareness was from Radio (1.2%), (Fig 3). On this basis it is recommended that dissemination efforts should target established and liberal farmers from whom diffusion could then be achieved. This is in agreement with the ideal of Training and visit (T&V) as proposed by Benor and Baxter (1984), which recommended the use of contact farmers to demonstrate and spread innovations.

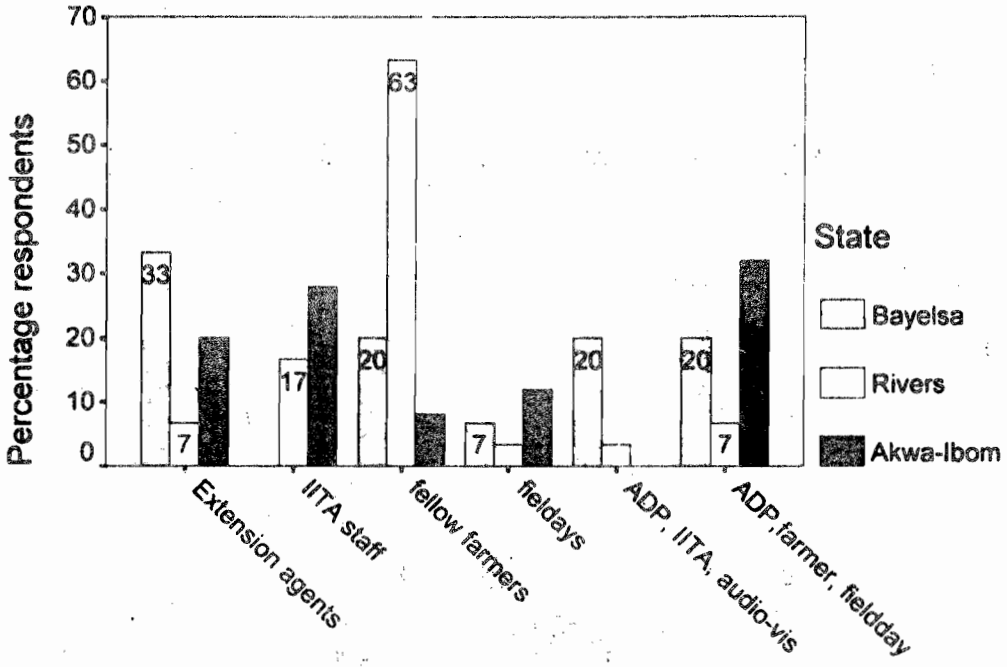

Fig. 3: Sources of Awareness by State

Technology dissemination of the type in this study demands constant and guided visits to induce and sustain adoption. From table 3, data revealed that 48.2% of the respondents confirmed a no visit/ occasional visits by extension agents, while only 17.6% of the respondents had fortnight visitation from extension agents. The worst farmer-extension contact was recorded in Rivers with 66.7% respondents having no contact with extension agents (table3), from the result, it could be said that there is a weak relationship between extension agents and the respondents (farmers), and this could have negative consequences on adoption. Adesina et al (1995) elaborated on the consequence in Africa. Extension is expected to assist in answering farmers' questions and remove constraints encountered by farmers in climbing the adoption ladder. Where these extension roles are absent or low, a low adoption rate should also be expected especially with complex innovations. This might have partly accounted for low adoption of post harvest processing innovation, herbicide innovation, debudding innovation ,and hot water treatment innovation in this package.

Table 3. Frequency of Extension Visits

Class	Time of Visit	Combined Frequency	Combined Percent	Bayelsa Percent	Rivers Percent	Akwa-Ibom Percent
1	Fortnightly	15	17.6	0.00	6.67	52.0
2	Monthly	18	21.2	50.0	6.66	8.0
3	Quarterly	11	13	0.00	16.67	20.0
4	No visit	33	38.8	30.0	66.67	16.0
5	Occasionally	8	9.4	20.0	3.33	4.0
	Total	85	100	100.0	100.0	100

Source: Field survey 2004

Figure 4, revealed that the highest income class range was ₦10, 000 - ₦50, 000 by 33.3% of the respondents, 26.2% of the respondents made between ₦1- ₦10,'000, while ₦11, 000 - ₦20, 000 and ₦21, 000 - ₦30, 000 income classes were 11.9% each of the respondents respectively. The respondents in the income bracket of ₦51, 000 - ₦80, 000 and ₦81, 000 - ₦400, 000 accounted for 7.1% of the respondents each. An often overlooked potential of seed market in agriculture accounted for a major breakthrough in the study, as sucker sales generated significant income for the respondents. Infact 45% of the respondents had formed a cottage industry from sucker production

These extra income as a result of the IITA Plantain hybrids technology adoption, when viewed with the area of respondents' farmland used for plantain showed 92.9% respondents having 0.1-3.5hectares planted to plantain, which generated enormous monetary reward (Fig 4). The total amount of extra income realized by the respondents as a result of the innovation was ₦1, 823,500 while the total area planted to plantain by the respondents was 49.2 hectares, this translates to ₦37,063 extra, income from the technology per hectare.

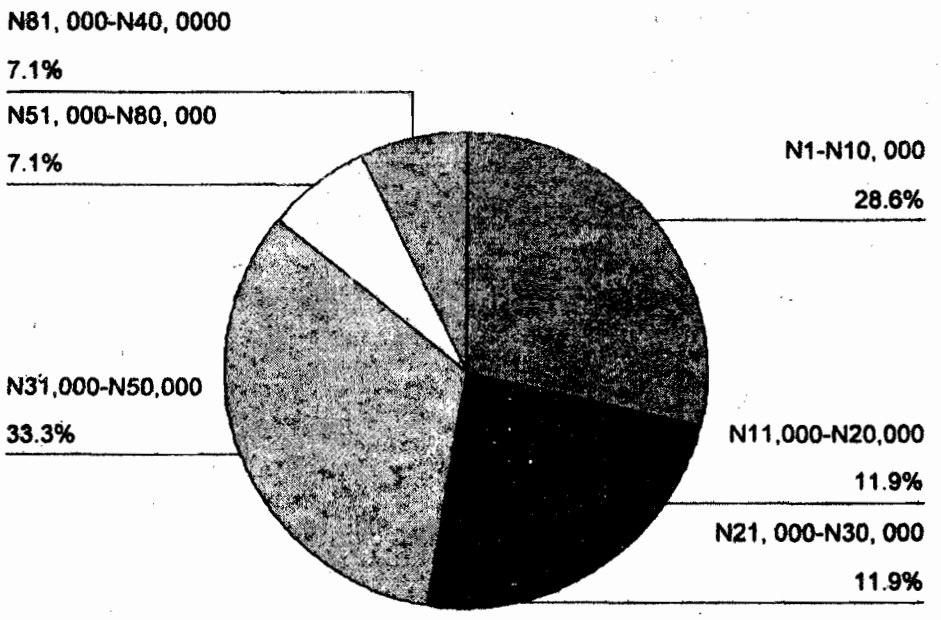

Fig.4: Profit as a result of technology.

Source: Field survey 2004.

The rate of adoption of the new hybrids disseminated in the states was slightly different from state to state. Bayelsa state had the highest rate of 46% followed by Akwa-Ibom State (38%) and Rivers State (36%) fig 5. The organized major plantain and banana market situated in Bayelsa state and the high enthusiasm generated by the project farmers in the state may have accounted for better adoption rate in the state.

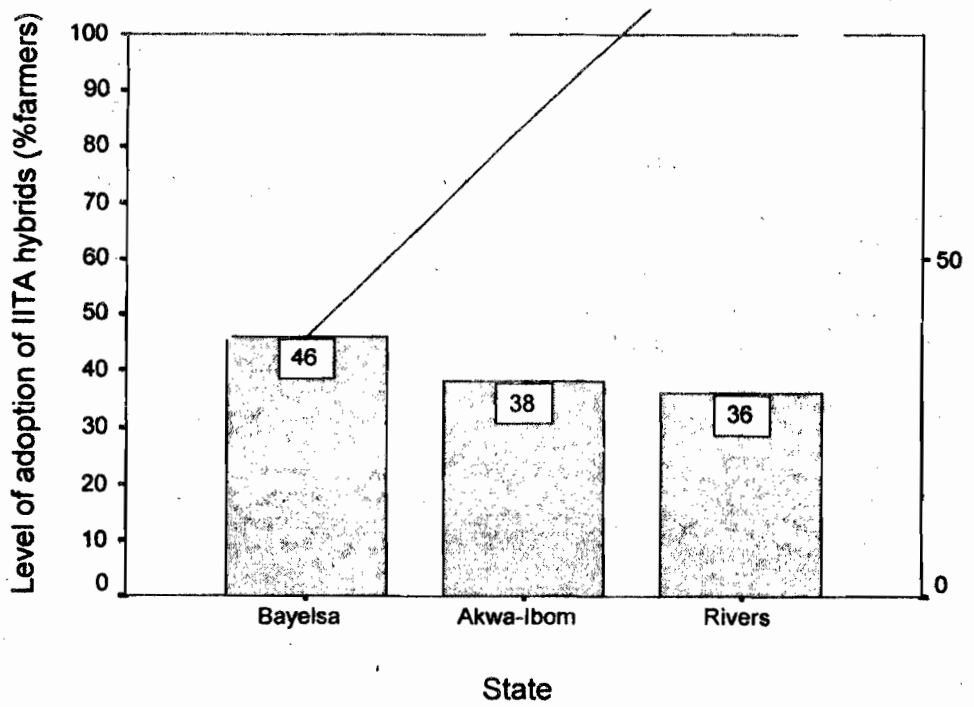

Fig. 5: Adoption level of IITA plantain and banana hybrids.

Correlation analysis revealed some variables with positive significant relationship with the new hybrids adoption. The variables were, age of farmer (X_1), marital status (X_2), size of household (X_3), plantain and banana production constraints identification (X_4), interviewer (X_5), frequency of extension visits (X_6), experience since innovation awareness (X_7), yield/income increase (X_8), market distance (X_9) and number of innovation adopted (X_{10}). These variables were subjected to regression analysis to ascertain their predictive effects on adoption.

The regression analysis revealed that, the variables pooled together explained 75% of the new hybrids adoption (r = 0.87). The linear regression model used was Y = a + bx, where;

Y = new varieties adoption (Dependent variable)
a = constants
b = regression coefficient and
x = independent variables (X_1, X_2, X_3, X_4 ,X_5, X_6, X_7, X_8, X_9, X_{10})

Substituting the models therefore.

New hybrid adoption = $1.034 - 0.0184 X_1 + 0.0017 X_2 - 0.0050 X_3 + 0.0009 X_4 - 0.0035 X_5 + 0.0071 X_6 - 0.013 X_7 - 0.0041 X_8 + 0.032 X_9 + 0.500 X_{10}$.

($P < 0.01$; SE = 0.088; r = 0.87, $r^2 = 0.754$)

This regression analysis explained that 75% of the new hybrids adoption was attributed to these ten variables, but only three of the variables had statistical significant association with the adoption of new hybrids. The significant variables were age of farmers, constraints identification and number of innovation adopted. The contribution of farmers' age on adoption of new hybrids, which is significant but negative, revealed that younger farmers had a higher propensity to adopt new innovations as they are more daring and can easily seek for help. In the same vein the influence of plantain and banana constraints identification on adoption could be explained in that interventions were tailored to constraints identified during the exploratory/baseline survey conducted before the dissemination. The respondents also seemed to have been endeared to the disseminators, as the innovations were perceived to target their jointly identified problems during the exploratory survey. The innovations must have been seen as evolving from their needs for interventions to declining yield and disease prevalence. In the same vein the influence of the number of innovations adopted may be as a result of the facts that the innovations were disseminated in a package that had fourteen sub-innovations with implications for yield increase. The chances of adoption of the main innovation (new hybrids varieties) increased with the adoption of more innovations in the package most of which are culturally and visibly profitable to the farmers as they addressed both increased productivity and post harvest storage loss.

CONCLUSION

This study concluded that originators/disseminators of innovations should package innovations with obvious motivational factors that present flexibility for users. Since innovations are primarily meant to improve the lots of the end users, the potentials for economic gains when made obvious will no doubt encourage adoption. Exploratory survey of the end users to gather their perceived problems and resources made at the beginning of the study as well as regular contacts of originators with the end users (farmers) are necessary precursors of adoption as revealed by this study. Since originators of innovation (research) are not the traditional disseminators, national agricultural systems saddled with these roles need to be strengthened and should also live up to expectation.

REFERENCES

Adeniji, T. A., Tenkouano, A., Faturoti, B. O and Sanni, L.O., 2004. Potentials of plantain and banana (Musa spp.) fruit in the production of a non-alcoholic beverage "Musamalt". In: (G.O. Adegoke, L.O. Sanni, K.O. Falade and P.I. Uzo-Peters, eds.). Proceedings of the 28th Annual Conference and Annual General Meeting, Nigerian Institute of Food Science and Technology, University of Ibadan, Ibadan, Oyo State, Nigeria, 12-14 October, 2004.

Adesina, A. A and Baidu-Forson, J., 1995. Farmers' perception and adoption of new agricultural technology: evidence from analysis in Burkina Faso and Guinea, West Africa. Agricultural Economics. 13(1): 1-9.

Benor, D and Cleaver, K., 1989. Training and visit system of agricultural extension. Interpaks exchange, 6(2), 1-3.

Cochrane, W. W., 1979. The development of America Agriculture. A Historical analysis. (University of Minnesota press, Minneapolis).

Lehvall, Per and Clas Wahblin., 1973. A study of some assumptions underlying innovation diffusion functions, Swedish Journal of Economics 75 (December), Pp362-377.

KariKari, S.K., 1972. Plantain growing in Ghana. World crops 24, Pp22-24.

Kislev, Y and Schori-Bachrach, N., 1973. The process of an innovation cycle, American Journal of Agricultural Economics 55(1), 28-37.

Nkendah, R., Akyeampong, E., 2003. Socioeconomic data on the plantain commodity chain in West and Central Africa, InfoMusa, Vol 12, No 1, International Network for the Improvement of Banana and Plantain, pp. 8-13

Rogers, E.M and F.F. Shoemaker (1971) Communication of innovations. A cross-cultural approach (New York) Free press of Glucoe.

Robinson, J. C., 1996. Bananas and Plantains, CABI Publishing, CAB International, Oxon, UK.

SPSS., 1999. SPSS for windows release 10.0.1. Standard version. SPSS Inc.

Swennen, R., 1990. Plantain cultivation under West African conditions: A reference manual. International Institute of Tropical Agriculture.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 183 - 186
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

PALM OIL MARKETING EFFICIENCY IN IKOM LOCAL GOVERNMENT AREA CROSS RIVER STATE

V. E. ENYA and M. O. ONIAH

(Received 25 July, 2006; Revision Accepted 7 March, 2007)

ABSTRACT

This paper examines the efficiency of marketing palm oil in Ikom Local Government Area of Cross River State. Data were collected on prices of palm oil, and cost of marketing activities, such as transportation, market union levies, storage, ticket, haulage and market sanitation fees. Gross margin, marketing share, and efficiency index were used to analyze the data. The result showed that palm oil efficiency was highest in Ekukunela and lowest in Edor. The study also revealed that retailers were more efficient in the performance of their marketing functions than the wholesalers.

KEYWORDS: Palm oil, Marketing, Efficiency

INTRODUCTION

Palm oil is one of the most important oil as it is consumed by almost all the worlds' population, (Ngoody, 1989, Bouis, 1994). It is very rich in fat, Vitamin A and minerals such as calcium and sodium needed for good bone development and health. It is used for domestic cooking and for the manufacturing of soap, detergents, cream, margarine, pharmaceutical products and many other general uses. In most rural communities in Nigeria, it is used as fuel for lighting and as a medicinal product. As a cash crop, palm oil is one of the major contributors to the national non oil foreign earnings of Nigeria as its oil accounted for 90% of national total exports during the 1961-1965 period (Udom, 1987). With the discovery of crude oil, Nigeria began to produce less than half of what it used to produce and that pattern continued, until it could no longer meet even its domestic demand. Palm oil had constituted 63% of Nigerias' total production of vegetable oil between 1984 and 1986. In 1986 palm oil importation accounted for 83.6% of the 308,896 tones of animal and vegetable oil imported in to the country (Udom, 1991). This action flooded the market with palm oil, lowered its price and discouraged producers from further production. This situation led the federal government to ban the importation of palm oil in 1986. Palm oil production output rose from 860tones in 2000 to 1025.8 tones in 2004 representing 16.2% increase (CBN, 2004).

Marketing involves finding out what customers want and helping to set up the production and marketing system that meets their demand so as to maximize income (FAO, in Koppel, 1995). Price of palm oil serves as an incentive to producers and consumers. The price of palm oil must not only be acceptable by consumers but must at the same time answer the question of profitability of producers and marketers. Marketing cost constitutes the highest proportion of price determinant of liquid agricultural product like palm oil (Olofonkunbi, 1982, Strauss and Thomas, 1988).

In Nigeria there has continued to exist the problem of price and sales volume fluctuation over the years as a result of marketing inefficiencies. Marketing inefficiencies are clearly evidenced through low marketing margins, low profits and high marketing cost. Marketing inefficiencies can seriously retard progress even in the most pragmatic production plan. Marketing efficiency describes how well products are marketed to maximize profit. A marketing mechanism capable of tackling the supply-demand, distribution and pricing problems of our domestic product will likely improve marketing efficiency (Idris, 1999). Consequently this study is intended to analyze the efficiency of palm oil marketing in Ikom so as to derive some policy implications.

METHODOLOGY

The study covered five major markets in Ikom Local Government Area of Cross River State of Nigeria. These are four Corners, Edor, Akparabong, Okuni and Ekukunela. These markets were randomly selected to obtain data for the purpose of this study. The study was carried out between August and November 2005 and involved ninety respondents who were selected from five selected markets. Six producers, six wholesalers, and six retailers, totaling eighteen respondents from each market were also selected. A well structured questionnaire was administered to all the respondents. The data collected included producers' price, retail price, wholesale price, market and sanitation levies, cost of transportation and rented shop, haulage, market tickets and market union fees.

Method of Data Analysis

Marketing efficiency is influenced and determined by marketing margin, profit and marketing cost as well as market shares. Marketing margin is the difference between purchase price and price of resale (Abbott and makeham 1980). It is not a good indicator of efficiency. It consists of marketing cost and profit. The various marketing cost involved in this study include transportation cost, cost of rented shop, market levy, market sanitation levy, haulage, market tickets and market union fees. Marketing margin was calculated using procedures developed by Olufokunbi (1982).

TMM=Rp – Pp 1
MMR = TMM – MMW 2
MMW = Wp – Pp 3
Where,
TMM is the total marketing margin
MMR is the retail marketing margin
MMW is the wholesale marketing margin
Rp is the retail price
Pp = producers' price
Wp = wholesalers price
TP = TMM –TMC 4
Where,
TP = Total profit
TMM = Total marketing margin
TMC = Total marketing cost (transport cost, haulage, cost of rented shop,
union dues, tickets, market, sanitation fee etc)
TMEI = Tp/TMC 5

Where,
TMEI is the Total marketing efficiency index
Tp is Total profit

V. E. Enya, Dept. of Agricultural Econs. /Extension, Cross River Univ. of Technology, Obubra Campus, Cross River State. Nigeria
M. O. Oniah, Dept. of Agricultural Econs./Extension, Cross River Univ. of Technology, Obubra Campus, Cross River State, Nigeria

TMC is total marketing cost

The marketing efficiency index was used to determine the efficiency of the various palm oil marketing institutions and places. It shows how much profit accrues to every ₦1 invested in marketing 20 litres of palm oil.

The marketers' share is also used to assess the sustainability and strength of various marketing segments in the market. It showed the value of various market Segments as a percentage of its retail price. It is the marketers' share of the consumer's expenditure. It is calculated as follows,

PS = Pp/Rp*100.....6

Where,
PS is producers' share.
Pp is producers price
Rp is retail price.

The producers share reveals the proportion of the consumers expenditure that bypassed the retailer and went directly to the producer. Because majority of the palm oil producers were small scale producers they sold not only to wholesalers, but also directly to the final consumers.

WS = MMW/Rp*100.....7

Where,
WS is wholesalers share
MMW is wholesale marketing margin
Rp is retail price.

Rs = Mmr/Rp*100.....8

Where,
Rs is retailers share.
MMR is retail marketing share.
RP is retail price.

WP = MMW-WMC.....9
Where,
WP is wholesale profit
MMW is wholesale marketing margin.
WMC is wholesale marketing cost.
WMEI = Wp/WMC.....10
Where,
WMEI is wholesale marketing efficiency index.
WP is wholesale profit.
WMC is wholesale marketing cost.
REP = MMR-RC.....11
Where,
REP is retail profit.
MMR is retail marketing margin.
RC is retail cost.
RMEI = REP/RC.....12
Where,
RMEI is retail marketing efficiency index.
REP is retail profit.
RC is retail cost.
TC = PC + TMC.....13

Where,
TC is total cost.
PC is production cost.
TMC is total marketing cost.

RESULT AND DISCUSSION

The result in table 1 indicated an average total marketing margin of ₦1140, average production cost of ₦1200, average total marketing cost of ₦230, average total profit of ₦910, average producers marketing share of 64.15% and an average total marketing efficiency index of 4.0 from the five markets studied. The producers' market share was highest in Edor and Okuni markets having the same ratio but lowest in the Fourcorner market. The high producers' marketing shares in all the markets is due to the fact that most palm oil producers are small scale producers who sell not only to wholesalers and retailers but also directly to final consumers. Marketing efficiency was highest in the Four corner market and lowest in Edor market. The average efficiency index for the five markets was 4.0.

The result showed that for every ₦1 spent on palm oil marketing activities an average profit of ₦4 was realized.

Table 1: Total marketing efficiency index per 20 liters of palm oil.

Markets	Producer price (pp) ₦	Retail price (Rp) ₦	Producer market share (Ps) %	Total marketing margin (Tmm) ₦	Production Cost (Pc) ₦	Total Marketing Cost (Tmc) ₦	Total cost (Tc) ₦	Total Profit (TMP) ₦	Total Marketing efficiency index (TMEI) ₦
Four corners	2200	3600	61.1	1400	1150	255	1405	1145	4.49
Ekukunela	2100	3300	63.63	1200	1250	220	1470	980	4.50
Edor	2000	3000	66.70	1000	1200	230	1430	770	3.35
Okuni	2000	3000	66.70	1000	1015	225	1240	780	3.50
Akparabong	1900	3000	63.33	1100	960	220	1180	880	4.0
Average	2040	3180	64.15	1140	1200	230	1430	910	4.0

Note: Transportation cost is part of the total marketing cost.
Sources: Computed from 2004 survey data using the equation specified in methodology.

In table 2, the result showed that the average wholesalers marketing margin, average wholesalers market share and average wholesalers marketing efficiency index of palm oil for the five markets were ₦120, 3.8% and 0.33 respectively. Wholesalers marketing efficiency index was highest in Edor and lowest in Ekukunela markets. The average wholesalers efficiency index 0.33 indicated that if wholesalers marketing cost alone was used to realize the profit, then every N1 spent on wholesales marketing activities yielded N0.33 per 20 litres container of palm oil on the average.

Table 2: Wholesalers marketing efficiency per 20 liters of Palm oil

Markets	Producers price (Pp) ₦	Wholesale price (Wp) ₦	Wholesale marketing Share (Ws) %	Wholesale marketing margin (Mmw) ₦	Wholesale marketing cost (Wmc) ₦	Wholesale Profit (Wp) ₦	Wholesale efficiency index (WMEI)
Four corners	2200	2350	4.2	150	105	45	0.43
Ekukunela	2100	2200	3.0	100	75	25	0.04
Edor	2000	2150	5.0	150	100	50	0.5
Okuni	2000	2100	3.3	100	90	10	0.11
Akparabong	1900	2000	3.3	100	80	20	0.25
Average	2040	2160	3.8	120	90	30	0.33

Sources: Computed from 2004 survey data using the equations specified in the methodology.

The result in table 3 showed an average retail marketing margin of N1020, and average retail market share of 32.1%, and an average retail marketing efficiency index of 6.29. The result indicated that retail market share and retail marketing efficiency was highest in Fourcorners and lowest in Edor markets. The average retail marketing efficiency index of 6.29 indicated that if retail marketing cost alone was used to realize the profit, then every N1 spent on retail marketing activities yielded an average profit of N6.29 per 20 litres of palm oil. From the result, if a retailer was able to sell a 20 litres container of palm oil in a day, a wholesaler must sell up to 6.29/0.33 which is 19 gallons in a day to be able to realize N6.29 profit which the retailers realized for selling a gallon of palm oil.

Table 3: Retailers marketing efficiency index per 20 litres of palm oil

Markets	Total Marketing margin (Tmm) ₦	Wholesale marketing margin (Mmw) ₦	Retailers marketing margin (NMR) %	Retailers Share (Rs) ₦	Retail cost (Rc) ₦	Retail Profit (Rep) ₦	Retailers marketing efficiency index (RMEI)
Four corners	1400	150	1250	34.7	150	1100	7.33
Ekukunela	1200	100	1100	33.3	145	955	6.59
Edor	1000	150	850	28.3	130	720	5.54
Okuni	1000	100	900	30.0	135	765	5.67
Akparabong	1900	100	1000	33.3	140	860	6.14
Average	1140	120	1020	32.1	140	880	6.29

Sources: Computed from 2004 survey data using the equation specified in the methodology.

RECOMMENDATION

There is need to reduce the marketing cost associated with palm oil marketing. Such reduction of cost could improve marketing efficiency of palm oil. This could be achieved by direct government involvement in the provision of adequate and functional marketing facilities and infrastructures including good road network. Parasitic intermediaries (tickets, haulage and other unnecessary market fee collectors) in the marketing channels of palm oil that do not add value or utility to the marketed product should be removed to reduce the high cost of marketing palm oil. If this is done marketing efficiency of palm oil will improve. Removal and dismantling of all barriers to free trade, such as market union and spectators can go long way in curbing the perturbation of palm oil prices and the unreasonably high prices arising from high marketing cost. Also the marketing system needs to be reorganized to effectively and efficiently perform the productive function of palm oil marketing.

CONCLUSION

The major focus of this study was to analyze Palm oil marketing efficiency in Ikom Local Government Area of Cross River State. Marketing margins, marketing cost, profit, marketing shares and marketing efficiencies of various marketing institutions (wholesalers and retailers) and five market places (Fourcorners, Ekukunela, Edor, Okuni and Akparabong) were determined and compared. Producers market share was highest in Edor and Okuni markets and lowest in the Fourcorner market. Marketing efficiency index was highest in the Fourcorners market and lowest in Edor market. The average efficiency index for the five markets was 4.0. Wholesalers marketing efficiency index was highest in Edor and lowest in Ekukunela markets, while retail marketing efficiency index was highest in Fourcorners and lowest in Edor markets. Retailers achieved higher profit and had higher marketing efficiency than wholesalers of palm oil. However wholesalers profit can equate retailers profit if wholesalers are able to sell 19 gallons (380 litres) of palm oil for every one gallon (20 litres) a retailer sells. Generally marketing efficiency of palm oil is low in the study area on the average. It is on these bases that the above recommendations were made.

REFERENCES

Abott, J.C. and Makeham, J.P., 1980. Agricultural Economics and Marketing in the Tropics. Longman Group Ltd, London.

Bouis, H. E., 1994. "The Effect of Income on the Demand for food in the poor Countries: are Our Data Bases Giving Us Reliable Estimates". Journal of Development Economics. Vol.44. No. Pg. 15.

CBN., 2004. Annual Report and Statement of Account

Ngoody, F. W., 1989. "Vegetable Marketing in South Eastern Nigeria" Nigerian journal of agricultural production. Vol. 15, No.1 Pg. 41.

Idris, M., 1992. "Commodity exchange operation". In Chikwendu, D.O. marketing of Agricultural product: concepts and strategies for Next century. Farm management Association of Nigeria proceedings 1999, pp. 120.

Koppell, C., 1995. Marketing information system for NTFPS community. Forestry field manual (6), Food and Agriculture Organization Rome.

Olufokunbi, B., 1982. An econometric analysis of demand for beef in Ile-Ife Nigerian journal of agricultural economics, volume 1, number 1, pp25-39.

Strauss, J and Thomas, D., 1998. Health, nutrition and economic development. Journal of economic literature vol. 36. No.2 pp766-817.

Udom, D. S., 1991. Prospect of Nigeria attaining self-sufficiency in palm oil Production. Nigerian agricultural journal, 26(19) 3-19.

Udom, D. S., 1987. Towards stabilizing palm oil price in Nigeria. Nigerian journal of palms and oil seeds. Vol. 8. no. 8. pp50-55.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 187 - 189
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

EFFECTS OF PHOSPHORUS RATES ON THE GROWTH AND YIELD OF *MUCUNA FLAGELLIPES* (VOGEL EX HOOK) IN OBUBRA CROSS RIVER STATE, NIGERIA

O. A. AGBA., J. E. ASEIGBU.,C. P. E. OMALIKO and M. A. AKEH
(Received 3 April, 2006; Revision Accepted 8 November, 2006)

ABSTRACT

Two field experiments were conducted during the 2004 and 2005 cropping seasons at the teaching and research farm of the Department of Agronomy, Obubra Campus, Cross River University of Technology to study the effects of phosphorus on the growth and yield of *Mucuna flagellipes* (Vogel ex Hook). The experiment comprised nine treatments of single super phosphate (0-18-0) fertilizer rates at 0kg/ha, 15kg/ha, 20kg/ha, 25kg/ha 30kg/ha, 35kg/ha, 40kg/ha, 45kg/ha and 50kg/ha, laid out in a Randomized Complete Block Design (RCBD) with three replications. Results showed that the application of phosphorus significantly improved the growth and yield of *Mucuna flagellipes*. The successive increases in phosphorus rate produced an increase in vegetative growth measured as the number of leaves and branches per plant, and plant height. Phosphorus at 40 kg/ha and 45kg/ha produced significantly higher pods and seed weight per plot and per hectare than the lower rates. The highest seed weight of 3.85 t/ha and 3.90 t/ha were obtained from the plots that had 45kg/ha of phosphorus fertilizer in both 2004 and 2005 cropping seasons.

KEYWORDS: Mucuna flagellipes, Phosphorus, growth, yield

INTRODUCTION

Mucuna flagellipes (Vogel ex Hook) is a legume that belongs to the sub-family papilionoideae and has been described as a climbing perennial herb with compound trifoliate leaves (Anonymous 1979).

Mucuna flagellipes is one of the less known legumes but rich in edible oils, fats, protein and minerals (Odedele 1983, Okoro 1998, Eyiuche 1988).

The seeds are used in soup preparation where it serves as a condiment and soup thickener. In pharmaceutical industry, the gum is used as a binder in formulation of ephedrine hydrochloric tablet (Okoro 1998 and Eyiuche 1988). Despite the high economic importance of *Mucuna flagellipes*, it is grown only at a sub-subsistence level. There is paucity of literature on the growth of the crop in a commercial quantity.

Phosphorus is an essential plant nutrient, which promotes growth and yield of most legumes. Literatures show that the application of phosphorus increases the growth and yield of legumes (Omueti, 1995, Sharma 1996, and Singh 1994). Generally, literature on the use of phosphorus in the cultivation of *Mucuna flagellipes* in Obubra is lacking.

The objectives of this study were to evaluate the effects of phosphorus on the vegetative growth of *Mucuna flagellipes* and determine the rate of phosphorus fertilizer that will give optimum yield of *Mucuna flagellipes* in Obubra agro-ecological zone.

MATERIALS AND METHODS

Two field experiments were conducted in the Teaching and Research Farm of the Department of Agronomy, Obubra Campus, Cross River University of Technology, Cross River State during the 2004/2005 cropping seasons.

The experimental site was cleared, ploughed and ridged on 10th April, 2004. The filed was marked out into three blocks. Each block was further divided into nine plots of 3 x 2 metres which were separated by 0.5 meters. Mature seeds of *Mucuna flagellipes* were collected from Ikom market and planted on 20th April, 2004. The planting distance was 0.7 x 0.8 metres within and between the rows respectively.

Treatments comprised nine levels of phosphorus (single super phosphate, 0-18-0) at the rates of 0, 15, 20, 25, 30, 35, 40, 45 and 50 kg/ha, laid out in Randomized complete Block Design (RCBD). The method of application was by localized placement by ringing at 4 weeks after planting.

Data were collected on the following parameters; average number of leaves, branches per plant, plant height (cm) at 6, and 12 weeks after planting, number of pods per plant, pod and seed weight (kg) per plot and hectare respectively. This trial was repeated during the 2005 cropping season.

All data collected were subjected to statistical analysis using Analysis of variance (ANOVA) procedure as outlined by Steel and Torrie (1980)

RESULTS AND DISCUSSION

The result of this investigation showed that the application of phosphorus significantly improved the growth and yield of *Mucuna flagellipes* (Table 1). All cases of phosphorus treatment produced better growth than where phosphorus was not applied. *Mucuna flagellipes* vegetative growth recorded as number of leaves and branches per plant increased with successive increases in phosphorus rate at 6 weeks after plant.

The application of 40kg/ha or 45kg/ha of phosphorus did not produced any significant difference in the growth of the crop as indicated by the number of leaves, branches, plant height, and vine diameter at 6 or 12 weeks after planting. However, phosphorus rate of 50 kg/ha produced the highest vegetative growth parameters recorded in both 2004 and 2005 cropping seasons. This result support the findings of Kumar and Pillar (1998) that reported increases in the vegetative growth of cowpea as a result of phosphorus application.

The used of phosphorus significantly enhanced the yield of *Mucuna flagellipes* (Table 2). Incremental application of phosphorus produced more number of pods per plant than where phosphorus was not applied.

On the average, pod and seed yield increased with the increases in the phosphorus rate but not beyond the rate of 45 kg/ha. Phosphorus at 45 kg/ha produced significantly higher pods and seed weight per plot and per hectare than the lower rates. The highest seed weight of 3.85 and 3.90 t/ha

O. A. Agba, Department of Agronomy, Cross River University of Technology Obubra, Cross River State. Nigeria
J. E. Aseigbu. Department of Crop Sciences, University of Nigeria, Nsukka Nigeria.
C. P. E. Omaliko, Federal Ministry of Science and Technology, Abuja, Nigeria
M. A. Akeh, Department of Biological Sciences, Cross River University of Technology, Calabar, Cross River State, Nigeria

were obtained with the use of 45 kg/ha of phosphorus fertilizer in both 2004/2005 cropping seasons. Cromer *et al.* (1992) obtained a significant increase in cowpea yield due to phosphorus fertilization.

Table 1: Effects of phosphorus on the growth of *Mucuna flagellipes* during 2004 and 2005 cropping seasons.

	2004 Growth parameters.				2005 Growth parameters			
Treat Phosphorus Rate (kg/ha)	No of Leaves per plant	No of branches per plant	Plant Height (CM)	Vine Diameter (mm)	No of Leaves per plant	No of branches per plant	Plant Height (CM)	Vine Diameter (mm)
Vegetative Growth Parameters at 6 weeks after planting								
0	6	2.0	42.5	1.4	6	2.0	43.5	1.3
15	9	3.2	65.7	1.1	8	3.1	65.8	2.1
20	11	4.3	82.3	2.8	11	4.4	83.2	2.7
25	12	5.1	91.3	3.2	13	5.1	92.3	3.3
30	14	6.3	99.9	3.9	14	6.0	97.6	3.8
35	17	6.5	110.3	4.5	17	6.3	111.2	4.7
40	18	7.1	112.1	6.9	19	7.1	113.1	7.2
45	18	7.1	121.6	6.9	19	7.1	125.4	7.2
50	19	8.3	134.2	8.3	20	9.2	134.4	9.1
LSD (P=0.05)	0.3	0.11	16.3	0.02	0.7	0.11	15.2	0.03
Vegetative Growth parameters at 12 weeks after planting								
0	15	4.5	100.3	8.7	14	4.6	101.6	7.9
15	20	6.3	121.5	13.1	19	6.2	121.5	13.2
20	23	7.2	128.3	16.8	24	7.1	128.9	16.5
25	25	7.5	134.7	19.9	26	7.1	135.2	19.8
30	28	8.2	149.8	22.3	29	8.3	150.8	21.5
35	33	10.3	158.3	25.4	33	10.5	159.2	26.3
40	34	13.1	173.2	30.6	35	13.4	171.5	29.5
45	34	13.2	184.6	32.3	35	13.4	183.4	32.6
50	41	15.3	197.3	34.7	42	16.1	196.3	34.5
LSD (P=0.05)	1.5	1.2	17.1	3.5	2.1	0.2	18.7	1.8

Table 2. Effects of phosphorus on the yield of Mucuna flagellipes during 2004 and 2005 Cropping seasons.

	2004 yield attributes					2005 yield attributes				
Treats phosphorus Rate (kg/ha)	No of pods per plant	Pod weight per plant (g)	Seed weight per plant (g)	Seed weight per plot (kg)	Seed weight per hectare (ton/ha)	No of pods per plant	Pod weight per plant (g)	Seed weight per plant (g)	Seed weight per plot (kg)	Seed weight per hectare (ton/ha)
0	11.1	68.2	38.5	0.53	0.88	12.1	69.5	47.2	0.15	0.85
15	15.2	157.3	68.7	0.84	1.40	14.8	148.9	69.1	0.85	1.42
20	17.3	185.5	84.3	1.03	1.72	17.3	187.4	82.3	1.04	1.73
25	18.5	218.7	99.5	1.14	1.90	18.2	212.6	97.6	1.13	1.88
30	21.4	243.4	107.4	1.23	2.05	21.5	241.5	105.5	1.31	2.18
35	24.3	261.6	115.3	1.44	2.40	23.1	260.2	113.8	1.45	2.42
40	27.2	289.3	120.6	1.78	2.97	27.1	278.4	121.3	1.76	2.93
45	32.5	317.7	131.6	2.31	3.85	33.1	301.5	130.5	2.34	3.90
50	35.7	341.5	158.4	2.10	3.50	36.2	333.7	149.5	2.12	3.53
LSD (P=0.05)	1.3	15.4	5.6	0.11	0.21	1.2	18.1	14.7	0.02	0.24

CONCLUSION AND RECOMMENDATION

The application of phosphorus at 45kg/ha promote the growth and seed yield of *Mucuna flagellipes*. Based on the results of this investigation, *Mucuna flagellipes* should be cultivated with the application of 45kg/ha of phosphorus (single super phosphate) for optimum growth and seed yield under Obubra agro-ecological zone of Cross River State.

REFERENCES

Anonymous., 1979. Tropical legumes: Resources for the future. Report on an Adhoc panel of the Advisory committee on Technological innovation. National Academy of Science Washington D.C 214 P.

Cromer, R. N., Kriedemann, P. E. and Stewart, L., 1993. Leaf growth and photosynthetic response to nitrogen and phosphorus in cowpea. Crop Science. 36: 127-1276.

Eyicuhe, P. I., 1988. Comparative evaluation of *Mucuna flagellipes*_gum and other binders on dissolution of ascorbic acid and ephedrine hydrochloric tablets. B. Pharm Thesis University of Nigeria, Nsukka.58 P.

Kumar, R. M. and Pillai P. B., 1979. Effect of phosphorus on symbiotic fixation of nitrogen by leguminous Crops. Junior Indian Soc. Soil Science. 16 (2): 111-114.

Odedele, J. O., 1983. Physiochemical properties of *Mucuna flagellipes*. B. Sc. Thesis. Department of FST. University of Nigeria , Nsukka. 56 P.

Okoro, B. J., 1998. Proximate analysis of seeds and growth evaluation of *Mucuna flagellipes* under four phosphorus fertilizer rates in field plots. B. Agric Thesis Department of Crop Science. University of Nigeria, Nsukka 48p.

Omueti, J. O., 1995. The effects of phosphorus fertilizer on the protein and the essential components of the ash of legumes. West Africa Journal. Bio. Applied Chem. 13 (1): 14-19.

Sharma. B. S., 1996. Effects of soil phosphorus on yield of Soybean. Exptal. Agric. 21 (2). 34-39.

Sing, G. S., 1994. Effects of phosphate on the growth of cowpea in sandy loan soils. Soil Science 16 (4): 151-154.

Steel, R. G. D. and Torrie, J. H., 1980. Principles and procedures of statistics: A Bio metrical Approach second Edition. McGraw Hill Inc. New York 633 P.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 191 - 194
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

COMPARISON OF COTTON SEED CAKE AND POULTRY LITTER AS PROTEIN SOURCES IN THE DIETS OF GROWING WADARA CATTLE FED BASAL DIET OF SORGHUM STOVER IN SEMI ARID REGION OF NIGERIA

B. IMAM, A. A. NJIDDA and A. KIBON

(Received 9 May, 2007; Revision Accepted 6 July, 2007)

ABSTRACT

An experiment was conducted to compare the effect of feeding poultry litter and cotton seed cake on dry matter intake (DMI), dry matter digestibility (DMD), live weight gain and economic analysis of wadara cattle. Nine wadara cattle (males) aged two and a half years with a mean live weight of 187.4± 0.67kg were randomly allotted to three treatment groups. The treatments compared were: T_0 (Control) received Sorghum Stover ad-libitum + wheat offal's at 2.5kg/animal/day; T_1 received sorghum stover ad-libitum + wheat offals at 1kg/animal/day + 1.5kg/animal/day of poultry litter and T_2 received sorghum stover + wheat offals at 1kg/animal/day + 1.5kg/animal/day of cotton seed cake. All animals were housed and fed individually in pens with concrete floor. The DMI were 3.62kg, 4.75kg and 4.86 for T_0, T_1 and T_2 respectively. Supplementing sorghum stover with poultry litter and cotton seed cake significantly ($P<0.05$) increased DMI. The DMD were 66.7, 68.6, and 68.5% for T_0, T_1 and T_2 respectively. Live weight gains were significantly different among treatment groups with T_0, T_1 and T_2 having 15.00, 18.34, and 33.33kg live weight gain. Supplementing sorghum stover with poultry litter or cotton seed cake resulted in an economic return. T_1 and T_2 recorded return of ₦7472.43 and ₦13555.8 while T_0 had ₦6031.17.

KEY WORDS: Cotton seed cake, poultry litter, sorghum stover and supplement

INTRODUCTION

Borno state is a traditionally livestock rearing area of Nigeria and is also quantitatively the most important cereal crop producing area. This area covers guinea and sudan savanna and the sahelian region. It has a mean annual rainfall of 300 – 900mm (Thambyapillay, 1983), which falls from late May to early October. It is characterized by high ambient temperature ranging from 30 to 40 degrees centigrade and relative humidity of 13 – 42.5% (Ijere and Daura, 2000).

Most of the Nigeria's estimated 9.3million cattle are located in the northern state (Scarr, 1986), the region is the largest and the most important pastoral zones in Nigeria. Nigerian livestock resources (RIM, 1992) estimates that Borno state has about 2,726,999 heads of cattle, and experience a dry season of at least 5 – 6months during which animals consuming poor quality feeds lose weight (Scarr, 1986).

As feeds represent the greatest cost in livestock production, its availability is affected by seasonal variation in feed quantity and quality in this area and this causes fluctuations in animal productivity. Ray and Deleeuw (1974) listed three sources of feeds for ruminant livestock in Northern Nigeria and these include crop residues, pastures and browse plant. Adebowale (1985) reported that there is abundant farm wastes such as stover and straws during the dry season. It is estimated that 1.7, 4.4 and 5.9million hectres of maize, millet and sorghum respectively are under cultivation annually in Nigeria (Egharevba, 1979); Anon., 1981). Others include rice, wheat etc. The importance of these crop residues as fodder is well recognized by local herdsmen. It is estimated that 40% of the dry season grazing time is spent by local cattle on crop residues (Powell, 1983)

Despite the availability of these crop residues in large quantities and their potentials as substantial feed resources, they are poorly utilized due to protein limitation for feeding livestock during the long dry season (Fomunyam and Mbomi, 1987). Mosi and Butterworth (1985) indicated that nitrogen content of most of the cereal crop residues is less than 1%.

Efforts to improve intake and utilization of these poor quality crop residues by animals have been through treatment (Sundstol, 1981) and supplementation with protein sources (Kellaway and Leibholz, 1983). Treatment of crop residues with chemicals like alkali and urea, biologically by treating with enzymes or inoculants have been shown to be beneficial, but some of these chemicals and inoculants are expensive, corrosive or uneasy to handle and may even not be available to the local herdsmen. Supplementation with conventional concentrate feeds rich in protein on the other hand have not been economically feasible due to its high cost, non or marginal returns after usage, demand for use by the increasing human population and feeding non ruminant livestock. To this effect, there is often need to explore the potentials of alternative sources of supplementary feeds rich in nitrogen, inexpensive and available that will improve the nutritive value of the poor quality crop residues for feeding ruminant livestock. Poultry litter, which is cheap and available, is a good source of protein for improving utilization of these available crop residues by ruminant livestock. Poultry litter is usually rich in nitrogen, averaging 28% crude protein, half of which is a true protein and the remaining part is mostly uric acid and ammonia (Bhattacharya and Taylor, 1975). Uric acid is slowly broken down in the rumen resulting in a more efficient utilization of nitrogen with minimal risk of toxicity (Oltjen *et al.*, 1968).

The objective of the study is therefore to compare the effects of feeding cotton seed cake and poultry litter as protein supplement on dry matter intake, dry matter digestibility and live weight change of wadara cattle.

MATERIALS AND METHODS

Animals and Treatment

Nine wadara cattle aged 2-3 years with a mean live weight of 186 ±2.61kg were used for the study. A randomized complete block design was used for the experiment. The animals were randomly allocated to three treatments with three animals per treatment. The treatments compared are:

T_0 (Control)	Sorghum stover (ad-libitum) Wheat offals at 2.5kg/animal/day
T_1	Sorghum stover (ad-libitum) Wheat offal at 1kg/animal/day Poultry litter 1.5kg/animal/day

B. Imam, Ministry of Animal and Fishery Development, Damaturu, Yobe State – Nigeria.
A. A. Njidda, Department of Agricultural Science and Technology, Ramat Polytechnic P.M.B 1070, Maiduguri – Nigeria
A. Kibon, Department of Animal Science, University of Maiduguri, P. M. B. 1069, Maiduguri – Nigeria

T_2 Sorghum stover (ad-libitum)
Wheat offal at 1kg/animal/day
Cotton seed cake 1.5kg/animal/day

Experimental Procedure

All animals were dewormed with albendazole bolus (Vermittan bolus) and housed in individual pens with free access to water and mineral licks. The study comprised of 14 days of feed adaptation period and 7 days measurement period. Feed offered twice daily at 8:00hrs and 16.00hrs.

The animals were fitted with canvas bag around its rear end to collect feacal samples and total urine voided were recorded from each animal using measuring cylinders and sampled for chemical analysis. Sample of feed offered were taken daily during the measurement period for chemical analysis. Body weights of the animals were also measured at weekly intervals. Dry matter digestibility was determined at three weeks intervals using the formula given below:

$$\% \text{ Apparent digestibility} = \frac{\text{dry matter intake} - \text{faecal dry matter}}{\text{Dry matter intake}}$$

Chemical Analysis

Samples of the feeds and faeces were collected and bulked separately during the experimental period, sub-samples taken and was analyzed in triplicate for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), nitrogen free extract (NFE) and ash according to AOAC (2002)

Statistical Analysis

The data obtained from the trial were analyzed using analysis of variance procedure in complete randomized block design (Steel and Torrie, 1980) to detect differences between treatment means.

RESULTS ABND DISCUSSION

Proximate Composition of Experimental Diets

The result of the chemical composition of the experimental diets is shown in Table 1. The poultry litter used in this study had a crude protein (CP) content of 18% on dry matter basis which is less than 29% CP dry matter (DM) basis analyzed for cotton seed cake. The 18% crude protein (CP) of poultry litter is within the range of 17.7% reported by Odhuba *et al.* (1986b) and 14-30% reported by Bhattachary and Taylor (1975) but lower than 28.5% reported by Jamrich and Farakas (1977). The variation in the crude protein content reported may be attributed to the composition of the feeds used or fed to the birds, frequency of removal and the concentration of dropping in the litter, the type of litter used and the density of birds in the poultry house. The cotton seed cake (CSC) had 29% CP is slightly higher than the 26.0% reported by Ehoche and Roffler (1982), but lower than the 41% reported by Allen (1982). The differences in value may be attributed to the quality of the supplement, as time taken under storage before supplementation and the technique employed in processing affects the quality of the product. This involved decortications to make the product palatable for animal consumption. The value of ether extract range from 1.50 – 14.00% with the highest value 14% in CSC. The higher value is due to the high oil content in the CSC. Mineral content range from 5.00 – 15.00% with poultry litter (PL) having the highest value (15%) and lowest in sorghum stover though there was no significant difference between the ash content of CSC and PL. The ash content of the PL is higher than the 14% and 12.7% reported by Allen (1982) and Odhuba *et al* (1986). This variation may be due to the routine supplementation with mineral sources in intensive poultry production. Different category of birds receives different types of feeds with variation in feed composition and equally this may affect the composition of litter to be used for ruminant feeding. The 19% crude fibre (CF) in poultry litter is higher than 13% in cotton seed cake. The higher CF content in PL may be attributed to the wood shaving based litter used in this study. Sorghum stover, which formed the basal diet, was more fibrous. Skerman and Riveros (1990) reported that the CF content ranges from 22-25% in young plants and from 30-40% in mature plants and is particularly high in tough fibrous grasses. The value of the CF is also similar to the value (41.1%) reported by Ehoche and Roffler (1982). The nitrogen free extract (NFE) was also highest (37.00%) in T_o and lowest (29.00%) in T_1.

Table 1: Chemical composition of experimental diets

Ingredients (%)	TREATMENTS		
	T_o (SS)	T_1 (PL)	T_2 (CSC)
Dry matter (DM)	92.10	91.20	93.00
Crude Protein (CP)	18.00	29.00	4.00
Crude Fibre (CF)	19.00	13.00	44.00
Ash	15.00	6.00	5.00
Ether Extract (EE)	7.60	14.00	1.50
Nitrogen Free Extract (NFE)	32.50	29.20	37.80

SS = Sorghum Stover; PL = Poultry Litter; CSC = Cotton Seed Cake

Feed Intake and Digestibility

The result of the feed intake and dry matter digestibility is shown in Table 2. The intake of stover was not significantly different ($P>0.05$), this therefore, showed that supplementing the stover with poultry litter (PL) and cotton seed cake (CSC) signified the increase in total dry matter intake (DMI). Substitution of stover was observed following supplementation with PL and CSC. The result also showed that supplementation with PL and CSC increases the DMI of the experimental animals significantly ($P<0.05$). Thus the DMI were significantly higher for the supplemented group compared to the control animals (T_o). DMI of T_2 is higher compared to animals on T_1. Lower intake observed in T_1 may be attributed to the depression of intake caused by the poultry litter. This is also evidenced from the lower stover intake in the treatment group. The result is consistent with the work of Adu and Lakpini (1983), Trung *et al.*, (1984) though the results is in contrast to the findings of Njidda *et al.* (2007) who observed higher DMI of sheep when fed PL during the wet season. The level given in this study is higher than the 25% reported by these researchers. Lower intake due to poor palatability of poultry had also been reported by Tinnimit *et al.* (1975). Though the DMI was significantly ($P<0.05$) increased by PL supplementation, this increase is not highly reflected in weight gain of the animals in the treatment group. In T_2, the supplement was highly relished by the animals due to its palatability with a consequence of substitution as observed from the lower intake of sorghum stover. Increase in DMI and palatability due to CSC supplementation had been supported by the report of Alhassan *et al.*, (1986) and Formunyam and Mboni (1987). Preston and Leng (1987) also reported that a limit of 20% supplementation with oil seed cakes prevent depression. Higher than 20% offered in the study consequently resulted to reduction in the intake of basal diet.

The result of the dry matter digestibility (DMD) is shown in Table 2. There is no significant difference ($P>0.05$) in DMD due to either PL or CSC supplementation, though the DMD tend to increase in supplemented groups than the control groups. The DMD was increased by approximately 2% in supplemented groups. The presence of sorghum stover in the rumen for a longer time as evidenced from the crude fibre content, and as fibrous diets are often low in nitrogen with the result that fermentation or extent of microbial proliferation is limited by the rumen concentration of ammonia, the supplemented PL stimulated the rumen microbes to digest the feed materials ingested. It aided in the supply of needed ammonia through the breakdown of uric acid which is ultimately utilized by the rumen microbes for digestion. The apparent digestibility of T_1 is higher than the reports of Orskov (1986) and Odhuba *et al.* (1989) but within the range reported by Olayiwole and Olurunju (1986). The higher digestibility coefficient may be due to the higher quantity of PL supplemented to the animals in this study, the type of ration fed to the animals and the type and specie of animals used in the study may also serve as a factor to bring difference in digestibility coefficient. The difference obtained with the result of Olayiwole and Olurunji (1986) was due to the presence of

molasses, which serve as an energy source and the pre-treatment before supplementation with PL. The high coefficient of digestibility encountered in CSC supplementation is evidenced from the high content of CP. It helped in stimulating the rumen microbes to degrade the materials ingested. This is supported by Ehoche and Roffler (1982), they indicated a digestion of sizeable portion (55%) of CSC in the rumen and favourably stimulated the rumen microbes to degrade the ingested fibrous materials. It supplied the needed nitrogen to the microorganism for efficient digestion.

Table 2: Mean dry matter intake and dry matter digestibility of wadara cattle fed sorghum stover supplemented with poultry litteer or cotton seed cake

	Treatments			
Ingredients (%)	T_o	T_1	T_2	SEM
Stover intake (kg)	2.71	2.45	2.56	0.12^{NS}
Total dry matter intake (kg)	3.62	4.75	4.86	0.12*
Dry matter digestibility (%)	66.73	68.69	68.50	2.08^{NS}

a, b and c = means with different superscripts within the same now are significantly different (P<0.05) ; *=Significant (P<0.05)
SED = standard error of difference between two means

Live Weight Change

The result of the live weight change is shown in Table 3. There is a significant effect (P<0.05) on live weight gain and daily live weight gain due to supplementation with PL or CSC when compared to the control group (T_o). Higher live weight gain observed in T_2 was possibly due to the supply of rumen undergradable protein which by-pass the rumen degradation and ultimately digested in the small intestine. This is supported by Ehoche and Roffler (1982). They reported that an estimated 45% of the CSC protein escaped the ruminal degradation. Kellaway and Leibholz (1983) had proven the low rumen degradability of CSC into the small intestine. This work is in line with the work of Delgardo *et al* (1979). They reported a two-two-fold increase in live weight after supplementation with (50% by weight) oil seed cake compared to (100% by weight) poultry litter. The data indicated that poultry litter is not a good source of by-pass protein. The lower live weight gain observed in T_1 was possibly due to the very low quantity of by-pass protein as evidenced from its chemical characteristic. Bhattachanya and Taylor (1975) had reported that half the quantity of crude protein in PL is true protein and the remaining part is mostly uric acid and ammonia. This quantity is low to support maximum growth. Preston and Leng (1987) reported that high growth ratio cannot be supported and the products of fermentative degradation and that by-pass protein supplements are essential to take advantage of the volatile fatty acids energy absorbed. Simialrly, Verner (1984) reported that the supply of amino acid to the animal might be too low to support maximum growth if only non-protein nitrogen (NPN) is given as the nitrogen supplement. Trung *et al* (1984) also reported a poor gain in live weight when PL was given at high levels.

Table 3: mean live weight and live weight change of wadara cattle fed sorghum stover supplemented with poultry litter or cotton seed cake

	treatments			
Ingredients (%)	T_o	T_1	T_2	SEM
Initial weight (kg)	187.33	187.61	187.42	-
Final weight (kg)	200.33^c	205.00^b	220.66^a	3.07*
Live weight gain (kg)	15.00^c	18.34^b	33.33^a	1.33*
Daily live weight gain (kg)	0.24^c	0.29^b	0.53^a	0.02*

a, b and c = means with different superscripts within the same now are significantly different (P<0.05) ; *=Significant (P<0.05)
SED = standard error of difference between two means

Economic Analysis

The result of the economic analysis is shown in Table 4. The result shows that supplementing sorghum stover with poultry litter and cotton seed cake had a higher economic return than the unsupplemented group. The main essence of supplementation is to increase the live weight of the animal so as to have higher economic return after sales that will support the cost of inputs incurred. Feed cost was higher in T_1 and T_2. This is evidenced from the higher level of more costly cottonseed cake supplemented to the animals in the treatment group. Profit after sales was higher in T_2 than in T_1 with the least in T_o. The higher return was due to the higher live weight gain of the animals in T_2 followed by T_1 and T_o. The result reveals that the economic return of the supplemented groups is higher compared to unsupplemented group with the margin being higher in T_2 despite is highest feed cost.

Table 4: Economic analysis of wadara cattle-fed sorghum stover alone supplemented with poultry litter or cotton seed cake

	TREATMENTS			
Ingredients (%)	T_o	T_1	T_2	SEM
Initial weight (kg)	187.33	186.66	187.33	-
Final weight (kg)	200.33^c	205.00^b	220.66^a	3.07*
Live weight gain (kg)	15.00^c	18.34^b	33.33^a	1.33*
Price/kg beef (₦)	450	450	450	
Price/gain (₦)	6,750	8,253	14,998.5	-
Feed cost (₦)	6031.17	780.57	1,442.7	
Return margin (₦)	6,031.17	7,472.93	13,555.8	

a, b and c = means with different superscripts within the same now are significantly different (P<0.05) ; *=Significant (P<0.05)
SED = standard error of difference between two means

CONCLUSION

From the result it can be concluded that supplementing sorghum stover with PL and CSC is of immense importance if proper rationing and strategic feeding have been employed in ruminant production. The result also showed that supplementing sorghum stover with poultry litter increased DMI, DMD with lower live weight gain of the animals in T_2. Supplementation with CSC increase DMI and live weight gain of the animals in T_2, DMD was also high. Higher economic return of almost a two-fold was seen in CSC supplementation as compared to that of PL. If itemized, the cost of input was high with CSC due to the cost of the supplement, and higher economic gain due to the higher live weight gain of the animals.

REFERENCES

Adebowale, E. A., 1985. Non-conventional feed resources in Nigeria. NIFOJ 1, 2, 3. Pp. 181

Adu, I. F. and Lakpini, C. A. M., 1983. The utilization of dried poultry waste as protein supplement for growing Yankasa sheep. J. Anim. Prod. Res. 3 (1): 49-56.

Alhassan, W. S., Ehoche, O. W. and Adu, I. F., 1986. Influence of graded levels of cotton seed cake supplementation on the nutritive value of cereal straw by sheep and goats. J Anim. Prod. 6 91): 39-54.

Allen, R. D., 1982. Feedstuff Analysis Table Feedstuffs. Minneapolis. Pp. 25-31 (cited by Preston and Leng, 1987).

Anon., 1981. IAR cropping scheme meeting report. Inst. for Agric. Res. Ahmadu Bello University Samaru, Zaria, Nigeria.

AOAC., 2002. Official Methods of Analysis of official Analytical Chemists (W. Horwtz ed.) 17th Edition, Association of Analytical Chemists, Washington D.C.

Bhattachanya, A. N. and Taylor, J. C., 1975. Recycling of animal waste as a feedstuff. A Review. J. Anim. Sci. 41: 1438 – 1457.

Delgardo, A., Eliab, A., Veitia, A. L. and Garcia, A., 1979. The use of pasture for beef production. A poultry litter/sunflower cake meal rations in the supplementation of bulb grazing pangola grass during the dry season. Cuban J. Agric. Sci. 13: 265-272.

Egharevba, P. N., 1979. Trends and constraints in millet production. Nat. Accelera. Food prod. Prog. Workshop, Zaria, Nigeria.

Ehoche, O. W. and Roffler, R. E., 1982. The proportion of supplemental protein escaping degradation in the rumen of cattle. J. Anim. Prod. Res. 2 (1): 11-29

Fomunyam, R. T. and Mboni, S. E., 1987. Teprosia spp and cotton seed cake supplementation of rice and maize stalks fed to sheep and goats in the dry season. Proc. Of the fourth annual workshop held at the Institute of Animal Research, Bamenda, Cameroun, 20-27th October 1987. P. 143.

Ijere, J. A. and Daura, M. M., 2000. "Borno State" In: Mamman, A. B., Oyebanji, J. O. and Peters, S. W. (eds). Nigeria: A People United, A Future Assured. Volume 2. Gabumo Publishers, Calabar.

Jambrich, J. and Farakas, J.,1977. Kanferensia ozuziet karani potravinars kych odpadov. (Conference on utilization of food industry refuse). Bratislava pp. 11-21.

Kellaway, R. C. and Leibholz, J., 1983. Effect of nitrogen supplements on intake and utilization of low quality forages. World Anim. Rev. 48: 33-37.

Mosi, A. K. and Butterworth, M. H., 1985. The intake and digestibility by sheep of oat straw and maize stover fed with different levels of rough meal. Anim. Feed Sci. and Tech. (In press).

Njidda, A. A., Kibon, A. and Ngoshe, A. A., 2007. Effect of cotton seed cake and dry poultry litter supplementation on performance and growth rate of grazing sheep in the sub-sahelian zone of Borno state. J. Appl. Sci. 10 (1): 6763 – 6773.

Odhuba, E. K., Magadi, J. P. and Sanda, I. A.,1986b. Poultry waste in cattle rations. I. Utilization of broiler litter as a source of nitrogen in semi-intensive feed lot rations. E. Afri. Agric. J. 52: 16-21.

Olayiwole, M. B. and Olurunju, S. A., 1986. Feedlot performance of yearling steers previously maintained on different crop residues/supplement regimes. In: Utilization of agricultural by-product as animal feed in Africa. D.A. Little and A. N. Said (eds). Proc. Of a workshop held at Balantyre, Malawi September 1986. pp. 77-80.

Oltijen, R. R., Slyter, L. L. Kozak, A. S. and William, E. E., 1968. Evaluation of urea, biuret, urea phosphatre and uric acids as non-protein nitrogen sources for cattle. J. Nutri. 94: 193-202

Orskov, E. R., 1986. Strategies for rural development with emphasis on livestock production, resources utilization and F.A.D. assistance. In; Utilization of agriculture by-products as livestock feed in Africa. D.A. Little and A. N. Said (eds). Proc. Of Workshop held at Balantyre, Malawi September 1986. Pp. 154-164.

Powell, J. M., 1983. ILCA's research on crop-livestock interactions in the sub-humid zone of Nigeria. Seminar on collaborative research in Agriculture (ACIAR), Zaria, Nigeria.

Preston, T. R. and Leng, R. A., 1987. Matching ruminant production system with available resources in the tropics and sub-tropics. Penambul Books, Armidale. P.108.

Ray, J. G. T and Deleeuw, P. M., 1974. The importance of crop residue as fodder. Res. Analysis in katsina Province Nigeria. Samaru Research Bulletin: 139.

RIMS., 1992. Resources Inventory and Management Limited. Nigerian Livestock Resources. Executive summary and Atlas (11) National Synthesis State Reports (iV) reports and commercially managed livestock survey reports, pp. 1-1612.

Scarr, M. J., 1986. The optimal use of agro-industrial by-products crops residues in Nigeria. In: Utilization of agricultural by-product as livestock feed in Africa. D.A. Little and A. N. Said (eds). Proc. Of a workshop held at Malawi, September, 1986, Pp. 157.

Skerman, P. J. and Riveros, F., 1990. Tropical grasses, plant production and protection series 23, Rome: FAO.

Steel, R. G. and Torriem, J. H., 1980. Principles and procedure of statistics. McGraw-Hill, New York, pp. 132-219.

Sundstol, F., 1981. Methods for treatment of low quality roughages. In; Utilization of low quality roughages in Africa. Proc. Workshop, Amisha, Tanzania. AUN-Agric. Dev. Report. AUS, Norway.

Thambyapillay, G. G. R., 1983. The Paleo-hydro-climatology of Lake Chad. Annals of Borno. 1: 105-145.

Tinnimit, P., Yu, Y., McQuffey, K. and Thomas, J. W., 1975. Dried animal waste as a protein supplement for sheep. J. Anim. Sci. 35: 431-435.

Trung, L. T., Abenir, E. E., Palo, L. P., Matias, J. H., Riversa, C. C. and Capanid, R. R., 1984. Lancaeus lencocephal and other supplementary value of ipid ipid or dried poultry manure to rice straw for dairy heifers. Phil. Agric. 67 (4): 379-390.

Verner, F. K., 1984 Straw in practical rations for cattle. In: straw and other Fibrous by-products as feed. F. Sundstol and E. Owen (eds) Felsevier, Amsterdam. Pp. 443.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 195 - 200
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

PROFITABILITY ANALYSIS OF BROILER PRODUCTION IN OYIBO LOCAL GOVERNMENT AREA OF RIVERS STATE, NIGERIA.

M. O. IRONKWE and F.O. AJAYI

(Received 31 May, 2007; Revision Accepted 16 July, 2007)

ABSTRACT

The aim of the study was to analyze the profitability of broiler production in five communities in Oyibo Local Government Area of Rivers State, Nigeria. These communities include Oyibo East, Oyibo West, Afam, Owaza and Amaeka a sample size of 20 poultry farmers were randomly selected from each study area giving a total of 100 farmers for the study. Data were collected through a structured interview schedule and questionnaire. They were analyzed by descriptive statistics, gross margin and return to management analysis. The study concluded that broiler production as part of a poultry investment or as a whole business venture is profitable. The results revealed that the investment after six months yielded a net profit of 100% (₦ 2, 000,000). The net profit had a positive value because the birds grew to heavy weights over a short period of time attracting high prices in return. These are clear indications that broiler production is a viable venture. The constraints that militate against broiler production are high cost of breeding stock (day old broiler chicks), high cost of feed, disease out break, unavailability and high cost of drugs and veterinary personnel, lack of capital and poor housing and equipment. Investment in broiler production is therefore recommended as this will boost quick animal protein production and improved nutritional status of many Nigerians. It will also provide economic empowerment and poverty reduction in the economy.

KEY WORDS: Broiler production, Profitability, constraints, Rivers State

INTRODUCTION

One of the major developmental challenges facing most developing countries is their inability to adequately feed their ever-increasing population with the right proportion of animal protein, (Effiong 2005). The nutritional status of many Nigerian is therefore characterized by low animal protein and high calorie intake. Most animal proteins are delicious but not easily affordable. Animal proteins sources include livestock, poultry meat, fish, egg, beef, milk, port, bacon etc. the three most popular are fish, beef and poultry egg and meat. The level of poultry productivity is not commensurate with the level of poultry technologies being generated by Nigerian poultry production research (Eekeren, et al., 1995, Aparataku et al., 1998).

Broilers are rapid growing meat birds which have been confirmed by such research reports as seen in the work of Olomu and Offiong (1980b) Doughlas and Harms (1981), Hullan and Proud foot (1981), Christmas et al, (1982). This implies that more protein and income can be derived from increased broiler production and consumption. The development of the poultry industry has also been described as the fastest means of bridging the protein deficiency gap prevailing in the country. Most African diets (Including Nigeria) are deficient in animal protein which results in poor and stunted growth as well as increase in spread of disease and consequently death (Apantaku et al., 1998).

The consumption level of protein in Nigeria according to F.A.O. 1990 is 3.5g/kg/ day which is far below the recommended level of 6.5g/kg/day.

Poultry production needs improvement in its method of production so as to increase the supply of livestock/poultry product supply. For investment in any venture, the investor must be convinced that it is a profitable one by carrying out an economic analysis of the project. The economic aspect of project preparation and analysis require a determination of the likelihood that a proposed project will contribute significantly to the development of the total economy and that its returns will be great enough to justify using the scare resources that is available. This analysis therefore can convince producers to invest their limited resources in broiler production using intensive technique.

This profitability study will create awareness that investment in broiler will pay off better than alternative poultry projects like layers, turkeys, ducks productions. Poultry production is popular in every parts of Nigeria. There are no taboos restricting its production. Broiler is a part of poultry production that is lucrative in the sense that the birds are ready for market weight at about eight weeks of age. And if well fed and diseases free condition maintained, their weights per kilogram compared to the cost of production offsets the high cost incurred in keeping them intensively. Okorie (2000) reported that although there has been an increase in broiler production, the industry is usually affected by high cost of say old chicks, high cost of feeds, high cost of unavailability of drugs and veterinary personals. Ekpeyong (1992) reported that broiler production was directly affected by prices of input and output.

Adegeye (1997) emphasized that subsistence oriented production especially among small scale farmers, poorly developed inputs and product markets, non policy implementation low investment in broiler enterprises, weakened extension services, poor utilization of superior varieties of live stock species, drudgery are some of the manifestations of these constraints which influence efficiency use of resource.

This review was therefore embarked upon to determine an average capital requirement for broiler production and the possible profit that can accrue from it. The data from this study was collected and analyzed to determine the profitability or otherwise of investment on these farms for a six months cash flow production period.

METHODOLOGY

The study was carried out in five autonomous communities namely Oyibo East, Oyibo West, Afam, Owaza and Amaeke in Oyibo local Government area of Rivers State. The State lies between latitude 6^0 and 8^0 South and longitude 9^0 and 6^0 West and situated in Southern boundary of the humid zone. Mean annual rainfall in the area is 330mm, lasting from March to October. Mean daily temperature during the wet season is 24^{oc} with mean relative of humidity of 96 %. The dry season lasts from November to February with mean daily temperature ranging from 24 - 32^{oc} and mean relative humidity of 25-40% (Meteriology department, Rivers State Ministry of Information). The study areas were preferentially selected because of their high involvement in farming practices.

M. O. Ironkwe, Department of Animal Science and Fisheries, University of Port Harcourt, P.M.B 5323, Choba, River State, Nigeria.
F. O. Ajayi, Department of Animal Science, Rivers State University of Science and Technology, Port Harcourt, River State, Nigeria

Data collection

Twenty farmers from each community that has broiler units in their poultry farms were randomly selected; they have farm size ranging from 200-2000 broilers. The sample size is small because it is not every poultry farmer that had broiler section. The study lasted from June to December 2006. Structured questionnaire and oral interview were used to collect data on socio-economic changes such as age parity of farmers, family size and level of education, ,marital status etc Data were collected on production and marketing variables which included cost and returns. Data were also collected on the constraints of broiler production.

Analytical Techniques

The tools of analysis used in the study include:- Simple descriptive statistics such as means, ranges and percentages used to report the socio-economic characteristics of the respondents and the reasons why they embark on broiler production The farm budgeting model was used to analyze the profitability of broiler production. The budgetary method emphasized the cost and returns of the broiler rearing unit. The level of profit and profitability index were estimated using gross margin and return to management. The profitability index were estimated using gross margin and return to management. The profitability index (PI) is the Net farm income (NFI) per unit of Gross Revenue (GR)

Therefore, PI = NFI/GR

The equation for obtaining the Net farm income can be stated in the following manner:

NFI = TR – (TVC + TFC). (Farm budgeting Model).

Where;

NFI = Net Farm Income in Naira

TR = Total Revenue in Naira

TVC = Total Variable Costs in Naira

TFC = Total Fixed costs in Naira

Net farm Income signifies the difference between total returns in Naira for the farm and total expenses of production in Naira.

The total Revenue is defined as the total money value of all broiler produced whether sold, consumed or in stock. Total fixed costs are those costs incurred which do not vary when output changes and therefore have no influence on production decisions. Total variable cost is the cost of variable input such as feeds, labour and drugs used in production. They change directly with the level of production. Gross margin is the difference between Total Revenue and Total variable costs.

The following profitability measures were calculated:

(i) Rate of Returns on investment: RRI (%) = NFI/TC x 100
Where TC = Total cost
Hence, TC = TFC + TVC

(ii) Rate of returns on fixed costs (%) = $\frac{TR - TVC}{TFC} \times 100\%$

(iii) Rate of Returns on variable costs (%) = $\frac{TR - TFC}{TVC} \times 100\%$

(iv) Capital Turnover (CTO) = TR/TC

A five point numerical rating scale with 1 representing the lowest and 5 the highest values on the scale, was used to determine the constraints associated with broiler production in the study area. A score of 5 represents very high constraints while 1 represents very low constraints.

Against each constraint area, respondents were expected to circle number between 1 and 5 including the constraint area in broiler rearing.

The total scores of respondents for the number of constraint areas were expressed in:

(i) Weighed Average $Xw = \frac{5(N_1) + {}^{4}(N_2 + {}^{3}(N_3) + {}^{2}(N_4) + (N_5)}{5}$

Where; Xw = weighed average

$N_2 + N_5$ = Rating scale

F = Frequency of respondents = 100

(ii) The mean score of respondents was set at 3.00 that is

$\frac{x = 5 + 4 + 3 + 2 + 1}{5} = 3$

RESULTS AND DISCUSSION

Personal and Socio Economic Characteristics of Broiler Farmers.

The result in Table 1 showed that the respondents 80% were males while the remaining 20% were females. This implies that broiler production in the area was dominated by men. All the producers interviewed are married men and women. The model age range of broiler producers was 30 – 50 years. About 70% of the broiler farmers in the study areas were 45 years and below. This implies that most of the broiler farmers were middle aged. Most (70%) of the respondents were illiterates while only 30% of the respondents had formal education. This showed that most of the respondents had great potentials for broiler farming once some of these farmers could adopt new innovations that could promote and boost broiler farming in the study area as it has the necessary prospects. About 80% of the broiler producers were part-time farmers, while the rest 20% were full-time farmers and fishermen. Hence Poultry (broiler) was essentially a part-time activity, with respondents major occupation ranging from crop farming, fishing, trading artisanship to civil service job. Commercial broiler production therefore is popular but not practiced by many in Rivers State because of interest and focus on oil businesses that is predominant in the South-South zone.

The average size of broiler farm in the study area as represented by the annual total value of four hundred thousand naira (₦400, 000) only, this appears to be big for commercially oriented part-time or full-time venture. This is still encouraging since most of the poultry farmers have other units like layers and cockerels.

Table: 1:- Percentage distribution of selected personal and socio-economic characteristics of broiler producers.

Characteristics Sex	Number of Respondents	% Distribution
Male	15	75
Female	5	25
Total	20	100
Marital Status		
Married	18	90
Single	2	10
Total	20	100
Age (years)		
25	4	20
22 – 32	6	30
31 – 43	7	35
44 – 50	3	15
Total	20	100
Mean age 38 years		
Level of Education		
No formal education	4	20
Primary education	8	40
Secondary education	5	25
Tertiary education	2	15
Total	20	100
Broiler keeping as only occupation		
Yes	2	10
No	18	90
Total	20	100
Broiler keeping experience years		
6 – 10	8	40
11 – 15	8	40
16 – 20	4	20
Total	20	100
Type of broiler		
Anak broiler	15	75
Cobb broiler	25	25
Total	20	100

Survey: - Field Survey 2006

Analysis in Table 1 revealed that majority (75%) of the respondents are males with less (25%) females in the business. This could be due to the fact that poultry business is risky and women are generally not good risk takers. Some women also join their husbands and make it a family venture as a lot of tedious operations are involved.

According to this table, most of the respondents (90%) are married. This shows that broiler keeping is a responsible business through which farmers make enough money to maintain their families. Mostly middle aged (30%) people are involved in broiler keeping. This involves people who combine it with other trades or some are into it as a means of making a living in the absence of white collar job.

Most broiler farmers according to this research (40%) had formal education. This has enabled them to accept farm extension and veterinary experts which improved their outputs. This has enlightened them to join poultry farmers associations through which they can now obtain loans to expand their operations. The mean broiler keeping experience is about ten years, implying that it is not a new verdure in the study area. The most popular broiler kept in the area is anak broiler (kept by 57% of farmers.) while the least is the cob. The choice of breed is dependent on the one that was first introduced in the area which has appeared to be resistant to disease attack in the area. There are different reasons why people embark on only enterprise including broiler and poultry in general.

Table 2: Distribution on the basis of their reasons for keeping broiler in addition to other poultry.

Main reasons for keeping broiler	Frequency	Percentage
Emergency cash	4	20
Consumption	2	10
Employment	2	10
Cash and consumption	5	25
Employment and cash	7	35
Total	20	100

Field: Survey 2006

Analysis is Table 2 revealed that the primary reason for keeping broiler as part of a poultry farm given by 35% of the respondents was for both employment and cash while 25% of the respondents raised broilers mainly for cash and consumption as away of meeting the protein needs of their households. About 20% of the respondents kept broiler serves as "savings account" for their keepers. Since they are stoked and targeted for sale at specific periods like during festivities. They come up to market weights of 1. 8- 2.5kg within 8- 10 weeks of age: Withdrawals in the form of sales are made from these saving accounts to attain to household needs. Thus the commercial poultry industry is largely based on broiler production. Other reasons advanced by keepers accounted for 10% SAR it as a source of valuable meat (delicacy) during festivities. Another 10% also represented educated class that could not find white collar jobs and decided to employ themselves, practices what they studied in order to earn money and boost animal protein production.

Table 3: Cost and Profitability Analysis

Item	Value(₦)	Percentage of total cost
Gross Revenue (GR)	4,00000	
Broilers sold twice a year 2,000 broilers at ₦2,000.00 each	4,000,000.00	
Broilers unsold for the year 2,000 broilers at ₦2,000.00 each (at first half of the year)	4,000,000.00	
Variable costs		
Labour	100,000.00	5
Feed/Feeding	800,000.00	40
Repairs and maintenance	200,000.00	10
Drugs/Veterinary services	100,000.00	5
Total variable cost	1,200,000.00	60
Fixed cost		
Purchase of land Plus building	300,000.00	15
Breeding stock	400,000.00	20
Drinkers, feeder and equipment	100,000.00	5
Total fixed cost	800,000.00	45
Gross Margin		
Total cost	2,000,000.00	

Net farm income (Return management) 2000000 Profitability Index (NFI/GR)

Rate of Returns on fixed cost (%) = NFI/TC x $\frac{100}{1}$

= $\frac{2000000}{2000000}$ x 100 =100

Rate of Return on fixed costs

% = $\frac{TR - TVC \times 100}{TFC}$

$\frac{4000000 - 1200000 \times 100}{800000}$

$\frac{2800000 \times 100}{800000}$

= 350%

Rate of Return on variable costs

(%) = TR – TFC

$\frac{400000 - 800,000 \times 100}{1200000}$

$\frac{3200000 \times 100}{1200000 \quad 1}$

= 267%

= TR = 4000000

TC = 2000000

= 2.0

Table 3 shows the annual cost and returns that accrued to an average broiler farmer in Oyibo area of Rivers State. The total revenue per poultry farmer that invested on 2000 broilers was found to realize four million naira (₦ 4, 000,000) while the total cost incurred per farmer was two million naira (₦2,000, 000) every six months. Cost of breeding stock amounted to four hundred thousand naira (₦ 400, 000) which represents 20% of the total cost of production. Cost of feeding eight hundred thousand naira (₦ 800, 000) constituted the highest share of the cost, amounting to 40%. This supports the claims by (18) that cost of feed is the largest single variable cost in general animal production. Cost of labour one hundred thousand naira (₦100, 000) constituted about 5% of the total cost while purchasing of land / building and maintenance, purchasing of drugs / veterinary services accounted for 20%, 10% and 5% respectively of the total cost of production. Other items such as feeders, drinkers, shovels, head pans, brooms cutlasses water, woods shaving etc contributed negligible percentage to total cost of production. Table 3 reveals that fixed cost takes only about 40% of the annual investment in poultry production, whereas variable costs accounts for the remaining 60%.

The farmers generate revenue through the sale of the animals at different times. Income generated by the enterprise was ploughed back into the business.

At the end of the production period (Six months) the broiler farmer in the study area sold 2000 broiler at ₦ 2, 000 each. This is done two times within one year. During the production period, the average farmer had invested a total of ₦ 2000000 out of which ₦ 1200000 and ₦ 800,000 were variable costs and fixed costs respectively. The net farm income (NFI) which represents the return to management and labors accounted for ₦ 2000000, hence a return to investment of about 100%. However, this net income was sufficient to keep a broiler farmer fully occupied; he can use it to maintain other units of his poultry farm. Hence the need to increase the level of broiler production to alleviate poverty and boost animal protein production and consumption.

The profitability index (PI) was 0.100, indicating that for every naira earned as revenue, about 100 kobo returned to the farmer as net income. With a CTO of 2.0 and PI of 100, improvement in broiler productions is likely to increase (Gross Revenue) of ₦ 2, 000000 every six months resulted in a net income (return to managements) of ₦ 2,000000 per farmer every six months.

This indicates the profitability of broiler production as a part time or full-time venture in Oyibo local government area of River State.

The rate of return on fixed cost was estimated at 350%. Hence on every six months basis, generated ₦ 3.50 while the rate of return on naira cost incurred on variable assets, generated ₦ 2.67. This implies that to maximize profit accruing from broiler production, there has to be effort directed at increasing the efficiency or optimal use of all variable inputs for example maintaining healthy environment will minimize ill health of the birds and money spent on drugs and veterinary services will also be reduced. Feeding good quality feed under healthy environment will make the birds to come to market weight (2.5kg) in less than twelve weeks. All these will bring about increased revenue from broiler production in the area.

Constraints to Broiler Production:

Analysis in Table 4 revealed some constraint area in broiler production such as acquiring parent stock, high cost of feed, disease outbreak, lack of capital, Poor housing, unavailability and high cost of drugs and inaccessibility to veterinary services and management skill.

The constraint on disease may be partly due to poor management practices done by inexperience and non experts. There is also the problem of lack of good foundation stock as a result of the fact that some respondents acquired their stock from inheritance. Hence the common cases of in-breading depression within the herd.

Table 4: Distribution of respondents by their constraint areas in broiler production

Constraint areas	Very Constraint	High Constraints	Moderate Constraints	Low Constraints	Very Low Constraints	Constraint Area raw score	Mean score (xs) Rank
High cost of feeds	10	6	4	3	2	250	5.00 1st
Stock procurement	8	7	5	3	2	240	4.80 2nd
High cost drugs	9	6	5	3	2	230	4.60 3rd
Inaccessibility of veterinary							
Services	9	9	5	2	2	222	4.40 4th
Disease outbreak	7	4	3	4	2	210	4.20 5th
Lack of capital	10	9	6	2	3	198	3.95 6th
Poor housing	5	8	5	2	4	180	2.60 7th
Lack of management	5	8	4	3	3	180	2.60 8th

CONCLUSION AND APPLICATION

Despite the above mentioned constraints that confronts farmers in Oyibo, broiler production in the study areas have proved to be profitable. The study therefore concludes that adequate funding to livestock farmers with much emphasis on poultry (broiler in particular) will bridge the wide gap that exists in animal protein production and consumption which will therefore make enough meat available for the general populace. Also Government can support through the provision of loans to existing, farmers, funding Universities of agriculture and Faculties of Agriculture in Universities existing in their areas of operation, as this will encourage them to research and come up with new funding in livestock/poultry production.

REFERENCES

Apantaku S. O., Omotayo, A.M and A.B Oyesola 1998. Poultry Farmers willingness to Participate in Nigerian Agricultural Insurance scheme in Ogun State, Nigeria (Eds.) Oduguwa, O.O Fanimo, A. O and Oshinini, O. A proceedings of the silver Anniversary Conference, Nigeria Society for Animal production. Gateway Hotel, Abeokuta 21 – 26 March, 1998, 542.

Adegeye, A. J., 1997. Risks and uncertainties in Nigerian Agriculture and the need for insurance, paper presented at the workshop on risk management and administration of insurance in Nigeria. Dept of AGE, University of Ibadan.

Christmas, R. D., Douglas, C. R., Kalch, L. W. and Harms, R. H., 1982. Response of Broilers chickens to Dietary Energy and Lysine levels in Warm Environment. Poultry Science, 61:2103 – 2106

Douglas, C. R and Harms, R. H., 1982. Virginiamycin and Broiler Performance. Poultry Science, 61: 1885 – 1890

Eekeren, W., Maasa, A., Saatkamp, H. and M. Versehuur., 1995. Small Scale Poultry Production in the tropics. Wageningen; Agromisa. Appl. Agric Vol 2: 31-35.

Effiong, E. O., 2005. Efficiency of Production in selected Livestock Enterprises in Akwa Ibom State, Nigeria. Unpublished Ph.D Thesis, Department of Agric. Economics Michael Okpara University of Agriculture, Umudike.

Ekpeyong, U.U., 1992. An economic study of Broiler production in Calabar Municipality Unpublished B. Agric. Dissertation. Department of Agricultural Economics and Extension. University of Calabar, Nigeria.

F.A O., 1990. Strategies for Sustainable Animal Agriculture in Developing countries. Rome. Pp. 20 – 25.

Hullan, H. W. and Proud Foot, I. G., 1981. Effect of Previous Diet on feed intake and Body Weight Gain of Broilers and leghorn chicks. Poultry Science, 60:172 – 178.

Okorie, N. M., 2000. Input-output Relationship in Commercial Egg Production in Calabar, Cross Rivers State. M. Sc thesis, Nigeria Department of Agricultural Economics and Extension University of Calabar, Nigeria

Olomu, J. M and Offiong, S. A., 1980. The Effect of different peotein and energy levels and time of change from starter to finisher ration on the performance of Broiler chickens in the tropics J. Agric. Science; (Camb.) 97: 629 – 632.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 201 - 205
COPYRIGHT© BACHUDO SCIENCE CO LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

EFFECTS OF CROPPING PATTERNS ON THE CONTROL OF *PODAGRICA* SPP. (COLEOPTERA: CHRYSOMELIDAE) ON OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH)

B. I. AHMED, I. ONU, N. VONCIR, and M. ALIYU

(Received 18 April, 2006; Revision Accepted 19 December, 2007)

ABSTRACT

Two years field experiments were conducted at the Teaching and Research Farm of Abubakar Tafawa Balewa University, Bauchi, Nigeria (Latitude 10° 17N and Longitude 9°49E) with a view to determining effect of intercropping okra with groundnut, cowpea and cotton and on reducing the population of *Podagrica* spp. on okra plant. Results of the experiments indicated that manipulations of cropping pattern using cotton, groundnut and cowpea as intercrop with okra not only reduced the population of *Podagrica* spp. on okra but also increased crop performances as well as improved fruit yield. The findings of these investigations strongly recommend the intercropping of okra with groundnut, cowpea or cotton for protection of the plant against *Podagrica* spp.

KEYWORDS: *Podagrica* spp., Cropping Patterns, Population and Okra

INTRODUCTION

In Nigeria, cropping pattern is generally is generally defined as the simultaneous cultivation of different crop species in close association on the same piece of land. The main objective of practice is to reduce the population of insect pests attacking crops in a particular field (Kumar, 1984). It is a common traditional practice among the farmers of Northern Nigeria (Udom, 1995). The Northern Guinea Ecological Zone in which, Bauchi State of Nigeria lies (latitude 10° 17N and longitude 9° 49E) supports a high density of settled population. However, the total food production is lower than the requirement (Norman, 1971). This is mainly due to poor yield resulting from frequent crop failures as a result of activities of insects pests, diseases and some other unfavorable growing conditions like drought that is commonly encountered in this part of the country. It is important to note that up till toady the demand of the Nigerian small scale farmers for standard method of managing insect pest population through the various cropping arrangements still remain largely unsatisfactory. This has already resulted into the present production trend of low quality okra that is even far below the requirement of the average Nigerian. This is as a result of the roles played by insect pests in limiting crop production especially in the tropics where man is always in competition with them for available natural resources (Ahmed, 2000). Food and Agriculture Organization of United Nation (1997) reported that the estimated annual losses due to insect pests alone stand at between 15-20% and 18-20% during production and storage, respectively. Such losses are even higher in developing countries, for example in Nigeria, the Federal Department of Agriculture in 1995 reported that about 60% of the total food and fibres currently being produced are lost to insect pests. These figures clearly show how insect pests are devastating our crops both in the field and storage. From the foregoing it is evident that much need to be done on intercropping especially on the aspect of entomology and hence the need to carry out more trials.

It was in the light of the above and coupled with the seriousness of damage caused by *Podagrica* spp, on okra as well as the hazards involved in the use of agro-chemicals particularly in Bauchi State of Nigeria, that it was considered desirable to carry out a study to determine the effect of cropping patterns on the control of *Podagrica* spp. on okra.

MATERIALS AND METHODS

Field experiments were conducted in randomized complete block design for two consecutive farming seasons (1998 and 1999). Both in the 1998 and 1999 trials, the land was first cleared, ploughed and harrowed twice before planting. Nigerian kwando short local and Indian long white variety of okra were intercropped with some selected varieties of groundnut (s-dakar), cowpea (kananado) and cotton (S1-cotton) during the trial. The two varieties of okra were independently planted on different plots of land to serve as control. The plot size was 6 x 4.2m² and was separated from each other by a distance of 1m on all the sides and 2m between replication. A total of eight treatments were used during the experiments and each was replicated three times. Both in the 1998 and 1999 trials, the land was first cleared, ploughed and harrowed twice before planting. Additionally, the seeds of both Nigerian kwando short local and Indian long white varieties were soaked in water for 24 hours before they were taken to the field for sowing. This was done in order to promote germination (Tindall, 1986). Sowing of seeds for the three different crops (cotton, cowpea and ground nut) and the two varieties of okra was done at a distance of 60cm between rows and 30cm within rows, which gave rise to a population of 84 plants per plot while cotton, groundnut and cowpea were intercropped with varieties of okra in a ratio of 1:1 per plot. All the agronomic practices for raising good vegetable crops (weeding, sanitation and fertilizer application) were strictly followed.

Damage caused to okra plant by *Podagrica* spp. was assessed by counting the number of damaged and undamaged leaves as well as measuring the height of okra both at vegetative and fruiting growth stages. The observations were done at an interval of 20, 30, 40, 50, 60, 70, and 80 days after planting. For the purpose of damage assessment, five plants from the two middle rows of each of the plot were randomly selected and tagged for recording observation on number of leaves per plant. Heights of the tagged plant were recorded at vegetative and flowering/ fruiting growth stages of the plants using a meter rule. Similarly, assessment of population of *Podagrica* spp. was made on five randomly selected plants from each of the 24 plots. Numbers of Podagrica spp. on both the upper and lower surfaces of the leaves of sampled plants was recorded. The counting was done early in the morning or late in evening (when the beetles

B. I. Ahmed, Crop Production Programme, School of Agriculture, Abubakar Tafawa Balewa University, Bauchi, Nigeria
I. Onu, Department of Crop Protection, Faculty of Agriculture, Ahmadu Bello University, Zaria, Nigeria
N. Voncir, Crop Production Programme, School of Agriculture, Abubakar Tafawa Balewa University, Bauchi, Nigeria
M. Aliyu, Crop Production Programme, School of Agriculture, Abubakar Tafawa Balewa University, Bauchi, Nigeria

were less active) at an interval of 20, 30, 40, 50, 60, 70, and 80 days after planting as recommended by Rao and Willey (1989). Harvesting of fresh fruit started when they were due and continues until when senescence set in and no more fruits were produced on them. For fruit yield, fresh fruits from the plants were picked once a week and the cumulative weight of harvested fruits were determined at the end of the crop's life. Additionally, number of fruits per plants was also recorded. Data obtained were subjected to the analysis of variance (ANOVA). Least significant difference (LSD) was used to differentiate between and among the treatment means (Steel and Torie, 1981).

RESULTS AND DISCUSSIONS

Effects of cropping two okra types along with cotton, groundnut and cowpea on leaf formation during the wet seasons of 1989 and 1999 are presented in Table 1. In the two years of trials, intercropping had significantly influenced leaves formation in okra. The number of leaves in okra intercrop mixtures was found to be higher than in the okra sole crop treatments throughout the period of observation. The number of leaves in the okra plant in the intercropped plots was consistently higher when compared with those from okra plants sole cropped plots. Highest number of 39.48 numbers of leaves per plants was recorded in Indian long white variety/cowpea mixtures. Iremerin (1988) had earlier reported that leaves being site of photosynthesis contribute immensely to the performance of okra plant. The result of this finding is also in line with the finding of Jodhan (1979) who reported that cropping arrangements in okra plant has serious effects on the number of leaves and can greatly affect the yield. In a similar study with cowpea, Raheja (1977) had indicated that higher numbers of cowpea leaves is likely to be obtained when intercropped with sorghum. Reasons on why number of okra leaves was consistently high on okra intercrop may be attributed to the low population densities of okra in the okra intercropped plots. It might also be due to the fact that the stems and minor crops (groundnut, cotton and cowpea) had served as protectant/breakers against the effects of wind on the leaves of okra plant which if not could have result in a serious defoliation. Furthermore, the nitrogen fixation properties of groundnut and cowpea could be an added advantage.

Table 1: Number of leaves per Okra Plant during the Rainy Seasons of 1998 and 1999

Treatments	Number of Leaves per Plant						
	20DAP	30DAP	40DAP	50DAP	60DAP	70DAP	80DAP
Data for the 1998							
SLV	2.01	2.95	4.00	6.17	8.22	7.59	8.00
ILWV	3.00	4.12	5.17	7.16	10.11	8.43	10.13
SLV and Cotton	2.98	4.00	5.14	8.89	13.40	13.00	14.25
ILWV and G/nut	3.27	5.00	7.01	10.41	16.00	17.00	16.11
SLV and Cowpea	2.85	4.00	5.80	9.00	13.70	15.11	15.30
ILWV and Cotton	2.81	4.99	8.00	9.02	15.43	15.70	17.74
SLV and G/nut	2.93	4.11	5.46	9.09	15.00	13.86	15.00
ILWV and Cowpea	3.11	6.00	9.24	10.11	17.11	16.22	19.48
LSD (p= 0.05)	0.61	1.61	1.00	1.81	4.72	6.00	2.60
Data for the 1999							
SLV	2.32	3.03	3.60	6.47	8.69	5.52	7.58
ILWV	2.05	3.66	4.81	7.62	11.38	8.00	11.53
SLV and Cotton	2.15	4.11	6.32	9.04	13.51	10.54	14.71
ILWV and G/nut	2.44	4.28	6.05	10.10	15.28	12.58	17.06
SLV and Cowpea	2.88	3.89	5.71	8.06	14.01	13.75	16.00
ILWV and Cotton	2.98	4.30	7.45	9.04	15.70	15.70	18.15
SLV and G/nut	2.72	4.24	5.60	9 .00	13.26	14.00	14.34
ILWV and Cowpea	3.53	5.73	10.00	12.87	17.98	18.31	20.00
LSD (p= 0.05)	0.53	1.48	0.81	2.06	4.07	5.77	2.29
Average Data for the 1998 & 1999							
SLV	4.33	5.98	7.60	12.64	16.91	13.11	15.58
ILWV	5.05	7.78	9.98	14.78	21.49	16.43	21.66
SLV and Cotton	5.13	8.11	11.46	17.93	26.91	23.54	28.96
ILWV and G/nut	5.71	9.28	13.06	20.51	31.28	29.58	33.17
SLV and Cowpea	5.73	7.89	11.51	17.06	27.71	28.86	31.30
ILWV and Cotton	5.79	9.29	15.45	18.06	31.13	31.40	35.89
SLV and G/nut	5.65	8.35	11.06	18.09	28.26	27.86	29.34
ILWV and Cowpea	6.64	11.13	19.24	22.98	35.09	34.53	39.48
LSD (p= 0.05)	1.14	3.09	1.81	3.87	8.79	11.77	5.52

ILWV = Indian Long White Variety, SLV = Short Local Variety
DAP = Days After Planting, G/nut = Groundnut

Populations of *Podagrica* spp. on okra plant obtained during the wet seasons of 1998 and 1999 are presented in Table 2. Statistical analysis of the results shows that population of *Podagrica* spp. in some treatments were significantly reduced as a result of the various cropping arrangements.

The result also shows that all the okra intercropped plots in 1998 and 1999 trials had lower populations of *Podagrica* beetles when compared with okra sole cropped plots. The reduction of *Podagrica* spp. in okra-intercropped plots could be expected because there was no freedom for the movement of *Podagrica* spp. in okra-intercropped plots as in okra sole crop treatments. This is because the continues feeding attitude operated by *Podagrica* beetles in sole cropping is disrupted in the intercropping plots as the insects have to fly or crawled a longer distance over the intercropped plots. The lack of freedom of movement of *Podagrica* spp., which makes it difficult for the insects to multiply rapidly as in the case of sole cropping. Absence of alternate host plants in the okra sole crop treatments could be another reason for the high population of *Podagrica* spp. among the pest spectrum of cowpea. Uvah (1978) had indicated the potentials of some insect pests of cowpea as natural enemies of insect pests of other crops.

Table 2: Population of *Podagrica* spp. on Okra Plant during the Rainy Seasons of 1998 and 1999

Treatments	Population of *Podagrica* spp. on Okra Plant						
	20DAP	30DAP	40DAP	50DAP	60DAP	70DAP	80DAP
Data for the 1998							
SLV	5.11	12.05	11.15	13.40	15.11	15.00	11.23
ILWV	7.46	12.16	13.22	21.45	17.15	20.00	18.20
SLV and Cotton	2.02	7.11	6.00	5.11	7.16	8.12	5.33
ILWV and G/nut	2.36	6.15	4.98	5.28	7.00	7.50	6.04
SLV and Cowpea	2.45	5.00	5.10	4.87	5.28	5.11	4.11
ILWV and Cotton	2.12	5.00	5.28	6.00	7.51	7.05	5.81
SLV and G/nut	1.48	6.00	5.98	6.15	7.00	7.18	6.00
ILWV and Cowpea	1.00	4.80	4.20	5.00	4.25	5.61	3.50
LSD (p= 0.05)	1.20	1.10	0.91	1.05	1.28	1.60	1.82
Data for the 1999							
SLV	4.02	8.46	14.23	17.10	14.89	15.96	10.57
ILWV	8.00	15.00	16.11	15.19	22.48	18.04	9.49
SLV and Cotton	3.06	7.15	6.12	5.88	7.08	6.89	5.65
ILWV and G/nut	3.06	6.45	6.56	5.68	7.29	7.62	5.02
SLV and Cowpea	2.48	4.14	5.08	4.69	4.65	5.27	4.22
ILWV and Cotton	3.17	4.79	6.66	6.18	6.75	8.19	6.00
SLV and G/nut	2.30	5.41	5.68	6.66	7.26	7.48	5.86
ILWV and Cowpea	0.96	4.28	4.20	4.06	5.60	4.02	3.30
LSD (p= 0.05)	1.11	1.05	0.86	0.83	1.18	1.56	1.90
Average Data for the 1998 & 1999							
SLV	9.13	20.51	25.38	30.50	30.50	30.96	21.80
ILWV	15.46	27.16	29.33	36.69	39.63	38.04	27.69
SLV and Cotton	5.08	14.26	12.16	10.99	14.24	15.01	10.98
ILWV and G/nut	5.42	12.60	11.54	10.96	14.29	15.24	11.06
SLV and Cowpea	4.93	9.14	10.18	9.56	9.93	10.38	8.33
ILWV and Cotton	5.29	9.79	11.94	12.18	14.26	15.24	11.81
SLV and G/nut	3.78	11.41	11.66	12.81	14.26	14.66	11.86
ILWV and Cowpea	1.96	9.08	8.40	9.06	9.85	9.63	6.80
LSD (p= 0.05)	2.31	3.15	1.77	1.88	2.46	3.16	3.72

ILWV = Indian Long White Variety, SLV = Short Local Variety
DAP = Days After Planting, G/nut = Groundnut

Effects of intercropping pattern on the height of okra plant during the 1998-1999 wet season are presented in Table 3. During the period, individual cropping arrangements seriously influenced the height of both the Nigerian kwando short local and Indian long white varieties of okra that were intercropped with the selected crops (groundnut, cotton and cowpea). The reason for the good performance of okra plant under intercropping environments is probably because of the low population trend of *Podagrica* spp. in the intercropped plots while possible reason for the poor performance of okra plant in sole cropped plots maybe attributed to the high population of *Podagrica* spp. in those plots and hence more damage to the plant by the pests which will subsequently lead to the poor yield of the plant.

The yield of fresh okra fruits obtained during the wet season of 1998 and 1999 is also presented in Table 3. Analysis of the result shows that quantity of yield obtained corresponded with the performance of the crops during the periods in question. The quantities of fruit yield obtained in okra inter crop plots were significantly higher than the corresponding sole crop plots. The low incidence of *Podagrica* spp. and the high number of leaves recorded in the okra-intercropped plots were responsible for the high fruit yield.

In conclusion, farmers stand a good chance of increasing okra production via intercropping with cotton,

cowpea or groundnut. This is because the result of the present investigation has shown and confirmed the importance of intercropping. Additionally, the method is economically viable in the sense that the cost of the practice is affordable to the small scale farmers in Nigeria. The method is also humane and compatible with the farmers because it does not involve the use of sophisticated equipments. However, much remain to be learnt about the range of interaction between pests and crops as well as the mechanism operating in mixed cropping systems. Extensive studies on the farmer's field are therefore required in this regard.

Table 3: Effects of Cropping Pattern on the Height and Yield of Okra during the Rainy Seasons of 1998 and 1999

Treatments	Heights of Okra Plant (cm)		
	Vegetative Growth Stage	Flowering/ Fruiting Growth Stage	Fruit Yield (Kg/ha)
Data for the 1998			
SLV	23.11	30.00	295.11
ILWV	31.14	48.10	326.11
SLV and Cotton	25.00	48.11	970.95
ILWV and G/nut	43.10	94.17	2,230.10
SLV and Cowpea	25.00	52.00	137.00
ILWV and Cotton	44.11	90.43	2,401.41
SLV and G/nut	24.11	50.00	1,810.18
ILWV and Cowpea	51.00	108.00	2,529.15
LSD (p= 0.05)	6.11	5.74	10.12
Data for the 1999			
SLV	24.58	29.87	294.39
ILWV	31.29	47.03	319.39
SLV and Cotton	24.30	49.25	954.95
ILWV and G/nut	41.00	88.47	2,264.70
SLV and Cowpea	25.00	51.81	260.55
ILWV and Cotton	43.52	90.00	2,366.99
SLV and G/nut	25.25	48.33	1,798.22
ILWV and Cowpea	49.35	105.21	2,539.15
LSD (p= 0.05)	6.13	6.15	189.38
Average Data for the 1998 & 1999			
SLV	47.69	59.87	589.5
ILWV	62.43	95.13	645.5
SLV and Cotton	49.30	97.36	1,925.9
ILWV and G/nut	84.93	182.64	4,494.8
SLV and Cowpea	50.00	103.81	2,742.5
ILWV and Cotton	87.63	180.43	4,768.4
SLV and G/nut	49.36	98.33	3,608.4
ILWV and Cowpea	100.35	213.21	5,068.3
LSD (p= 0.05)	12.24	11.89	379.5

ILWV = Indian Long White Variety, SLV = Short Local Variety
DAP = Days After Planting, G/nut = Groundnut

REFERENCES

Ahmed, B. I., 2000. Control of Insect Pests and Diseases of Irrigated Crops in Bauchi State. A paper presented at the Monthly Technology Review Meeting (MTRM) of Bauchi State Agricultural Development, Bauchi, Nigeria, February, 2000, 10pp.

FAO., 1997. Quarterly Bulletin of Statistics. Food and Agricultural Organization of United Nations, Rome, Italy, 66pp.

Ireminren, G. O., 1988. Effects of Artificial Defoliation on the Growth and Yield of Okra (*Abelmuschus esculentus* (L.) Moench). Experimental Agriculture, 23: 1-7.

Jodhan, N. S., 1979. Intercropping in Traditional Farming Systems. International Workshop on Intercropping. International Crop Research Institute for Semi Arid Tropics. Hyderabed, India, January, 10-13.

Kumar, R., 1984. Insect Pests Control with Special Reference to African Agriculture. Edward Arnold Publishers Ltd., London, 186pp.

Norman, D. W., 1971. Crop Mixture under Inadequate Condition in Northern Nigeria. In proceeding, 3rd International Conference on Factors of Agricultural Growth in West African Region. 205pp.

Raheja, A. K., 1977. Pest and Diseases Relationship with various Crop Mixture. Research Program of 1977-1978 Cropping System, Institute of Agricultural Research, Samaru, Zaria, Nigeria.

Rao, M. R. and Willey, R. W., 1989. Current Status of Intercropping Research and some Suggested Experimental Approaches. Presented at the 2nd Inputs Review Meeting East-West Centre 7-8 May, Honolulu, Hawaii.

Steel, R. C. and Torie, T. H., 1981. Principles and Procedures of Statistics. Macmillan Press, New York, 358pp.

Tindall, H. D., 1986. Vegetables in Tropics. Macmillan Press, London, 533pp.

Udom, G. N., 1995. Effects of Sowing Date of Cotton Fertilizer Nitrogen and Plant Density of Components Crops on Production of Cotton/Maize Mixture. Ph.D. Thesis, Abubakar Tafawa Balewa University, Bauchi, Nigeria, 125pp.

Uvah, I. I., 1978. A study of Insect Pests of Cowpea in some Indegeneous Cropping Systems in Zaria Area of Nigeria. M.Sc. Thesis, Ahmadu Bello University, Zaria, Nigeria.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 207 - 209
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

PROXIMATE AND PHYTOCHEMICAL COMPOSITION OF GARCINIA KOLA AND VERNONIA AMYGDALINA

H. A. IBEKWE, M. U. ETENG and E. ANTIGHA

(Received 8 February, 2007; Revision Accepted 4 April, 2007)

ABSTRACT

The study on the proximate and phytochemical compositions of *Garcinia Kola* seeds (Bitter cola) and *Vernonia amygdalina* leaves (Bitter leaf) was carried out to ascertain an aspect of their nutritive values having compared their therapeutic usefulness. The proximate analysis was carried out for 3 consecutive times for each fraction using AOAC method (1990) whereas the phytochemical screening was done using qualitative chemical tests-specific to each phytochemical compound suspected. The result obtained revealed a high percentage proximate fraction in *Vernonia amygdalina*. However, the percentage nitrogen free extract (NFE) fraction is higher in *Garcinia kola* seeds than percentage of *Vernonia amygdaline* leaves reflecting a low percentage of crude protein, crude fibre, ether extract and Ash. The phytochemical constituents detected are similar with respect to phenols and divergent in the case of alkaloids, flavonoids, tannins, saponins, and hemicellulose. *Vernonia amygdalina* leaves are higher in crude protein, crude fibre, ether extract and ash than *Garcinia kola* seeds.

KEY WORDS: Proximate, Phytochemical, *Garcinia kola* ,*Vernonia amygdalina.*

INTRODUCTION

The use of plants and plant parts (root, stem, leaves, fruits, seeds etc) both for food and medicinal purposes is not new in our modern society (Sofowora, 1982). Both *Garcinia kola* and *Vernonia amygdalina* share common medicinal properties. Both contain active principle phenols. *Vernonia amygdalina* contains vernonioside B' which has antibacterial and antiparasitic effect (Huffman et al., 2001). Aqueous as well as ethanolic extract of *Garcinia kola* has antibacterial effect (Ebana et al., 1991).

Platel, K (1997) reported that *Vernonia amygdalina* can be used in the management of diabetes mellitus whereas (Iwu et al. 1990) reported that biflavonones of *Garcinia kola* exhibited hypoglycaemic effect.

The antiinflamatory effect of both *Vernonia amygdalina* and *Garcinia* kola left much to be desired as it is often seen in use to control wound bleeding as a result of matchet cut. (Ijeh et al. 1996).

There seem to be dearth of opinion with respect to their nutritional importance. *Vernonia amygdalina* has been a leaf of choice in soup making especially in south-Eastern Nigeria but *Garcinia* kola is often used as a substitute for common cola nut (Kola nitida) Its seed is consumed by many people for various reasons and that is why it is necessary to find its nutrient composition as well as phytochemical constituents so as to advise the consumers properly on its values.

The phytochemical principles of these plants lend credence to their pharmacological uses as medicinal plants. Both are multipurpose plants as they play essential role in the treatment of disease such as stomach pains, kidney disorders asthma, menstrual cramps, hiccups etc (Orgirima et al. 2003; Braide, 1989).

This study therefore is aimed at providing base line study or primary data, which could be used for further studies relating to the nutritive value of these all important medicinal plants. The phytochemical analysis of these plants will help to elucidate their chemical and biochemical action and hence their therapeutic values.

MATERIALS AND METHODS

Two bales of mature *Vernonia amygdalina* leaves each weighing 500g were procured from Wat market Calabar whereas 10kg of *Garcinia* kola seeds were bought from Ecka Ika Qua market Calabar by the month of August 2005. One Hundred gram of each sample was taken for dry matter determination while the remaining samples were dried at 60^{0}C for 24 hours. The leaves of *Vernonia amygdalina* were milled separately and stored in a 500 millilitre conical flask tightly corked to prevent air penetration. The testa of *Garcinia kola* seeds were removed before milling. The milled sample was stored in an air tight flask until the commencement of chemical analysis.

Proximate Analysis: (Adapted from AOAC 1990)

Fifty (50g) grams of the fresh sample of *Vernonia amygdalina* was dried in an oven in a controlled temperature of 80^{0}C for 4 hours. The loss in weight due to loss of moisture is calculated as percentage of the original weight of sample before oven drying. This gives the percentage moisture content of the sample milled (*Vernonia amygdalina*). The same procedure was used to determine the percentage moisture content of milled *Garcinia kola* seeds.

The percentage crude ash was determined by igniting 50g of milled *Vernonia amygdalina* in a crucible inside a muffled furnace of a temperature of 600^{0}C. The ashing was terminated on formation of white ash from the sample. The ash formed was cooled in a desicator and weighed. The weight after ashing is expressed as a percentage of sample before ashing and this gives the percentage crude ash of the sample *Vernonia amygdalina*. The same process was carried out to determine the percentage crude ash of *Garcinia* kola.

The crude protein content of the sample was determined by kjeldahl method. Twenty milligrams was digested with concentrated tetraoxosulphate VI acid using lithium tetraoxosulphote VI as catalyst. This oxidized the organic matter and the nitrogen present in the form of ammonium tetraoxosulphate VI $(NH4)_2$ SO4 were distilled with the aid of excess caustic soda (Na0H) during which NH_3 was released. The NH_3 released was allowed to react with 0.1ml HCL in the presents of methyl red and brom-cresol green indicator. The percentage crude protein was estimated by multiplying the titre with 6.25 and expressed as percentage of weight of sample before digestion. The same procedure was repeated for the determination of crude protein content of *Garcinia kola*.

The ether extract or lipid content of the sample was determined using soxhlet extractor. Five grams of the milled

H. A. Ibekwe, Dept. of Animal Science and Fisheries, Cross River Univ. of Technology, Obubra Campus. Cross River State Nigeria
M. U. Eteng, Department of Biochemistry, University of Calabar, Calabar. Nigeria.
E. Antigha, Dept. of Animal Science and Fisheries, Cross River Univ. of Technology, Obubra Campus. Cross River State Nigeria

sample of *Vernonia amygdalina* was weighed and placed into a dry soxhlet thimble suspended in a beaker. The beaker was placed in soxhlet condenser attached to a flask containing sufficient ether to fill the thimble. Heat was supplied to the flask by means of electric hot plate so as to keep the ether gently boiling. The ether vapour passes up the side tube of the extractor to the reflux condenser where it is condensed and returned back into the sample in a thimble. When the thimble is practically full, the either is returned to the flask by an automatic siphoning device carrying with it some of the fat from the sample.

The siphoning process was terminated after the 24th time just before the next lot of ether entered the point of siphoning over. The flask was dried of in the air and the fat washed out of the soxhlet flask by chloroform. It was dried and weighed again. The percentage crude lipid was estimated by expressing the weight of lipid as percentage of sample weight before extraction.

The crude fiber (structural carbohydrate) was determined by defatting 20grams of the sample with petroleum ether. The sample was boiled first with 1.25% dilute tetraoxosulphate VI acid and washed with distilled water. The same sample was again boiled with 1.25% potassium hydroxide (KOH) with each boiling lasting for 30 minutes. The insoluble residue was separated by filtration, washed, dried, weighed and ashed. The loss of weight resulting from ashing was expressed as percentage of the sample weight before ashing.

Phytochemical Screening of *Vernonia Amygdaline* and *Garcinia kola*.

An extract each *Vernonia amygdalina* leaves and *Garcinia kola* seeds was prepared by macerating a 50g of each fresh sample with redistilled methylated spirit in a blender. The extract of each sample was then suction filtered and the process repeated until all soluble compound has been extracted as judged by loss of colour of the filtrate. The total extract from each plant sample was evaporated to dryness in vacuo at about 45^{0}C and further dried to constant weight of the same temperature in a hot air oven. The yield of residue was noted and a portion of it was used to test for the plant constituents present.

Test For Presence of Alkaloid: (Adapted from Wall et al. 1952 & 1954)

One gramme of each of *Vernonia amygdalina* and *Garcinia* kola seed extract was treated with 40% calcium hydroxide solution ($Ca(OH)_2$) until the extract was distinctly alkaline to litmus paper and then extracted twice with 10ml portion of chloroform. The extracts were concentrated in vacuum to about 5ml. The chloroform extract was then spotted on thin-layer plates. Four different solvents systems of widely varying polarity were used to develop each plant extract. The presence of alkaloids in the developed chromatograms was detected by spraying the chromatograms with freshly prepared dragendorff's spray reagent. This confirmed the presence of alkaloid in the crude extract.

Test For Saponins: (Wall et al. 1952 & 1954)

The ability of saponins to produce frothing in aqueous solution and to haemolyse red blood cells was used as screening test for these compounds. One gram each of the extract of the samples under screening was boiled briefly with 50ml phosphate buffer PH 7.4 and each filtrate was passed for 3 hours through an asbestos disc which had been previously soaked with 3 drops of 1% cholestrol in ether and dried. After filtration, the disc was washed with 1.0ml of distilled water, dried and boiled in 20ml of oxylol for 2 hours. The disc was then washed in ether, dried and placed on a 7% blood nutrient agar. There was haemolysis of red blood cells around the disc after 6 hours confirming the presence of saponins in the crude extracts.

Test For Tannins: (Trease & Evans 1978)

Five grams each of the crude extracts of *Vernonia amygdalina* and *Garcincia kola* seed were stirred with 10ml of distilled water, filtered and ferric chloricle reagent added to the filtrate. A blue-black precipitate was formed which indicates the presence of tannins in the plant extracts.

Test For Anthraquinones: (Courtesy of Trease & Evans 1978)

Five grams of each plant extract was shaken with 10ml of benzene, filtered and 5ml of 10% ammonia solution was added to the filtrate. The mixture shaken and there was violet colour in the ammonical (lower) phase which indicates the presence of anthraquinones.

Result:

Table 1: Chemical Composition (% of Dry Matter)

Components %	Vernonia amygdalina	Garcinia kola seeds
Moisture	81.60	14.60
Crude protein	24.00	0.58
Crude fiber	9.50	0.10
Ether extract	14.69	3.00
Crude Ash	12.80	5.00
Nitrogen free extract	40.08	91.32

Table II: Phytochemical Constituents

Vernonia amygdalina	Garcinia kola seeds
Saponin	Alkaloids
Phenol	Polyphenol
Tannin	Flavonoids
Hemicellulose	Benzophenone

RESULT AND DISCUSSION

The result of proximate chemical compositions of *Vernonia amygdalina* and *Garcinia kola* seeds are presented in table I. The result obtained showed a general high percentage proximate fractions (CP,CF, EE & Crude Ash) in *Vernonia amygdalina*. *Vernonia amygdalina* leaves have high nutrient composition. Their use in soup making is therefore justified. In the proximate fraction (CP, CF, EE and Ash) of Garcinia kola seeds rather revealed low percentage composition. It is however, very high in NFE fraction indicating its relatively low contents of (CP, CF, EE and crude ash).

The appreciably high content of crude protein and fiber in *Vernonia amygdalina* leaves as obtained in this analysis agrees with that of (Ijeh et al. 1996).

The low levels of crude protein and crude fiber (indices of nutritive value) in *Garcinia kola* seeds lend credence to their use as anti-obese agent (Iwu et al. 1990). Noboru (2001) also reported anti-adipogenic effect of *Garcinia kola* extract, which inhibits the accumulation of lipid droplets in fat cells. His report lends weight to the low level of ether extract 3.0% as obtained in this study.

The predominant phytochemical principles detected in the study samples elucidate their roles in trado-medicine and are presented in table II. The phytochemical principle or active principle of any plant contributes directly or indirectly to their therapeutic usefulness in herbal medicine. *Vernonia amygdalina* contains tannins, phenols, saponins and hemicellulose. The presence of saponin in *Vernonia amygdalina* supports its use as natural antibiotics (Riley et al 2000). Its cholesterol lowering ability confirms its use in the treatment of hypercholesteremia (Rene et al. 1995). The disinfecting property of phenol is utilized when *Vernonia amygdalina* is used in wound treatment. This explains the reason why people applied the squeezed out moisture in open wound or fresh cuts (Ijeh et al. 1996).

The presence of alkaloids and biflavonoids in *Garcinia kola* seeds account for their numerous uses in traditional medicine. Biflavononones of *Garcinia kola* exhibited hypoglycemic effects comparable to those of tolbutamide (Iwu et al. 1990). The crude flavonoid extract of *Garcinia kola* seeds contains, hydroxyl citrate which inhibits fatty acid synthesis and lipid accumulation in the rat liver (Lowenstein 1971; Sullivan et al. 1974). Ibekwe et al. (2006) reported a significant ($P< 0.05$) reduction in serum level of testosterone of Albino rats treated with crude flavonoid extract of *Gracinia kola*. This finding agreed with that of Braide et al. (2003) who equally reported a decreased serum levels of testosterone of rats treated with crude alkaloid extract of *Garcinia kola* seeds. Whereas *Garcinia kola* seeds have little or no nutritional value, their medicinal values are tremendous. *Vernonia amygdalina* leaves have both nutritional, (though limited) as well as medicinal values.

CONCLUSION

Vernonia amygdalina (bitter leaf) though contains a high percentage of crude protein and fiber, its nutritive value as animal feed resources might be hindered by the presence of tannins which is one of its active principles. *Garcinia kola* seeds (Bitter kola) on the other hand have poor nutrient composition and as such very poor nutritive value but highly valued in trado-medicine due to its useful active principles or phytochemical composition. In conclusion therefore, both bitter leaf (*Vernonia amygdalina)* and bitter cola (*Garcinia kola*) have divergent herbal usefulness but limited nutritional values, if used as livestock feed.

REFERENCES

Association of analytical chemist., 1980. proximate analysis of feed ingredient. OUP Publisher. London.

Braide, V. B., 1989. Antispasmodic effect of extracts from seeds of Garcinia kola. *Fitoterapia*, Lx. 120-123.

Braide, V. B., Agube, G. A., Essien, G. E. and Udoh, F. V., 2003. Effect of Garcinia kola seed alkaloid extract on levels of gonadal hormones and pituitary gonadotrophin in rat serum. Nigerian Journal of physiological sciences, 18 (1 – 2): 59 – 64.

Ebana, R. U., Madunaga, B. E., Ekpe, E. D. and Otung, D. N., 1991. Microbiological exploitation of cardiac glycosides and alkaloids from *Garcinia Kola*, Borreria Ocynioides, kola nitida and citrus aurantifolla. Journal of applied Bacteriology 71(5): 398-401.

Huffman, M. and Wesley, W., 2001. Ethnobotany and zoo pharmacognosy of *Vernonia amygdaline*, medicinal plants used by humans and chimpanzees. *Proceedings of the international compositae conference*. Kenyaa. 10 (28), 351 –360.

Ibekwe, H. A., Braide, V. B., and Udoh, F. V., 2006. Effects of crude flavnoid extract of *Garcinia kola* seeds on gonadotrophins and testosterone levels of male albino rats. *Proceedings of annual conference of IRDI Research and development network*. Vol 1 (3). 89-93.

Ijeh, I. I., Nwaugo, V. O and Obiadua, O., 1996. Comparative study on the nutritive, phytochemical and antimicrobial properties of two varieties of *Vernonia amygdaline* plant products. *Research communication*, (1):71 – 75.

Iwu, M. M., Igboko, A. O. and Tempesta, M. S., 1990. Antidiabetic and aldose reductase activities of biflavones of *Garcinia kola*. *Pharm. Pharmacol.* 44(4), 290 – 292.

Lowenstein, J. M., 1971. Effect of hydroxyl citrate on fatty acid synthesis by rat liver in vivo. Journal of biological chemistry, 246. 629 – 632.

Noburu, H., 2001. *Garcinia Kola* extract inhibits lipid droplet accumulation without affecting adipose tissue conversion in $3T_3$-L_1 cells. *Phytotherapy* Research. 15,172 – 173.

Ogirima, M., Asuku, M. E., Ukwenye, A. Y. and Udeze, N. O., 2003. Effect of the treatment of aqueous extract of Vernonia amygdaline on human breast cell line. Plant Research. 2 95). 12 –13.

Platel, K., 1997. Plant foods in the management of diabetes mellitus: Vegetables as potential hypoglycemic agents. Nahrung publisher. 64 – 74.

Rene, J. and Bruneton, H., 1995. Pharmacognosy, photochemistry of medicinal plants. Hampshire: Berner Publishers 70 –74.

Riley, K. W., Mateo, N., Hawtin, G. C. and Yada, R., 2000. Mountain Agriculture and crop genetic resource aspect. Canada: Greenly publish: 30 –40

Sofowora A., 1982. Medicinal plants and Traditional Medicine in Africa. New York: John Wiley.

Sullivan, A. C., Triscari, J., Hamilton, J. G., Miller, O. N. and Wheatley, V. R., 1974. Effect of hydroxyl citrate on the accumulation of lipids in rat lipogenesis, lipids, 9, 121 –128.

Trease, G. E. and Evans, W. C., 1978. Pharmcognosy. Loudon: Bailiere Tindal, 229-253, 401-404, 529-534.

Wall, M. E., Eddy, C. R., William, J. J., Correl, D. S., Schubert, B. C. and Gentry, H. S., 1952. Steroid al sapoherins (XII) Survey of plants for steroidal sapogerins and other constituents. Journal of Chemical society 158:13167-13169.

Wall, M. E., Krider, M. C., Krwson, Correll, S. D. and Gentry, H. S., 1954. Steriodal sapoginios (VII) Survey of plants for seriodals sapoginins and other constituents. Journal of Chem. Society 136: 363 9- 3642.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 211 - 214
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

EFFECT OF CONCENTRATE SUPPLEMENTATION OF GROUNDNUT HAY OR LABLAB HAY ON DRY MATTER INTAKE, DIGESTIBILITY AND GROWTH PERFORMANCE OF FATTENING RAMS

A. A. NJIDDA

(Received 9 May, 2007; Revision Accepted 6 July, 2007)

ABSTRACT

An experiment was conducted to determine the effect of concentrate supplementation on feed intake, nutrient digestibility and growth performance of fattening rams offered a basal diet of groundnut hay or lablab hay. Sixteen rams aged 18 months with mean live weight of 39 ± 1.0kg were used for the study. The animals were divided into four groups of four rams per group per treatment based on similarity in live weight and were assigned to one of the four dietary treatments. The treatments compared were: Treatment 1 received lablab hay ad-libitum without supplementation, Treatment 2 received lablab hay ad-libitum + 0.5kg concentrate supplement, Treatment 3 received ground hay ad-libitum without supplementation and Treatment 4 received groundnut hay ad-libitum + 0.5kg concentrate supplement in a randomized complete block design. The mean dry matter intake (DMI) were 2.17, 2.13, 2.02 and 1.85kg/day for T_1, T_2, T_3 and T_4 respectively. There were significant difference ($P<0.05$) for DMI. The result reveals significant difference ($P<0.05$) for dry matter digestibility, crude fibre digestibility, crude protein digestibility and ether extract digestibility. The daily live weight gain shows no significant effect ($P>0.05$). The cost analysis shows no significant effect due to supplementation. The result of this study indicated that liberal supplementation of concentrate diet to rams on good quality forage legume has no beneficial effect.

KEY WORDS: Concentrate, supplement, hay, sheep and growth performance

INTRODUCTION

Sheep are important animals in tropical livestock production. Sheep account for approximately 34% of the total population of the world's grazing ruminants. The sub-sahelian region is among the most important sheep producing areas in Nigeria with estimated sheep population of about 2.4 million (RIMS, 1992).

In Northern Nigeria, sheep are kept mostly by agro-pastoralists and managed under traditional methods. During the wet or raining season, flocks are shepherd away from crop fields to natural rangeland surrounding villages or are individually tethered on edges of crop fields along roadsides. Feed lot which entails the feeding of animals under confinement in which high quality feeds are given to the animals with the main objective of fattening young animals within a very short time, is the recent management system in Northern Nigeria. Fattening of rams is a profitable venture, with return of premium to the farmer. The sales of fattened rams during festivals such as Eid-El-Kabir are a potential source of income for the smallholder producers.

Forages from range lands and harvested crop fields are the cheapest and main sources of feed for sheep in Northern Nigeria. Improved animal performance is dependent on the supply of good quality feed throughout the year. The fattening of rams in this zone is affected by the short duration of rainfall and long period of dry season. Poor nutrition especially during the long dry season is one of the major factors militating against livestock production in Northern part of Nigeria. The dry season results in rapid decline in the quality and quantity of forages leading to lower intake and with resultant poor animal performance (Zemmelink, 1973). During the wet season, there is plenty of green pasture available for the animals, thus fattening of ruminant could be done through grazing natural pasture or cut and carry basis. Sheep could be managed and fattened during the dry season using local feeds resources such as dry grains, legume hay, crop residue, bran or oil seed cakes (Mshelbwala, 1996).

The most popular crop residue used by farmers for fattening sheep in Northern Nigeria is groundnut hay. It is used extensively in feeding ruminant animals especially during the dry season to reduce live weight loss (Rains and Thorpe, 1969). Groundnut hay becomes available in large quantities and cheaper at the time of harvest. But become scarce and expensive towards the end of dry period. The need to reduce the high cost of feed for fattening rams has necessitated the search for cheaper and alternative sources of feed, such as forage legumes, browse plants and tree fodder legume, which constitute an important feed resource for ruminants. These feeds are good sources of fermentable nitrogen and of by-pass protein. When fed to animals forage legumes tend to increase the efficiency of feed utilization. Lablab is a dual-purpose forage legume that is rapidly gaining acceptance by agro-pastoral farmers in Northern Nigeria (Tanko, *et al.*, 1990). Lablab has high seed and forage yield as well as good hay curing ability compared with other commonly grown forage legume and is drought resistance (Mbahi, 2001). The bean as meal and forage for livestock feed makes lablab a suitable forage legume (Lucke, 1965).

MATERIALS AND METHODS

Animals and Treatments

Sixteen Balami rams aged 18 months with mean live weight of 39.00 ± 1.0kg were used for the study. The rams were bought from livestock market in Maiduguri. The animals were divided into four groups of four rams each based on live weight and each group of four rams were assigned to one of the four dietary treatments in a randomized complete block design.

The treatment diets are:

Treatment 1	=	lablab hay ad-libitum without supplement
Treatment 2	=	lablab hay ad-libitum plus 0.5kg concentrate Supplement
Treatment 3	=	groundnut hay ad-libitum without supplement
Treatment 4	=	groundnut hay ad-libitum plus 0.5kg concentrate Supplement

Each group was offered water and mineral salt lick ad libitum.

Groundnut hay was bought from farmers after harvest and was allowed to dry on the farm and chopped before feeding to the animals. Lablab was harvested at flowering stage. After harvest, the forage was allowed to dry then chopped before feeding. Components of the concentrate mixture contained wheat bran, cotton seed cake, bone meal and table salt.

A. A. Njidda, Department of Agricultural Science and Technology, Ramat Polytechnic P.M.B 1070, Maiduguri – Nigeria

Feeding and Management

Prior to the experiment, the animals were dewormed against endo-parasite with (Albendazole bolus) and were allowed a 10 day period during which basal diet was offered to them.

At the commencement of the experiment, animals were offered the experimental diets. They were housed in pens with concrete walls and floor. The floor was cleaned daily. The supplement and the basal diets were weighed daily and offered twice at 8:00am and 3:00pm. The experiment lasted for 3 months (12 weeks). Sub-samples of feed offered daily were collected for chemical analysis. Live weights of the animals were measured at weekly intervals.

Digestibility Trial

At the end of the feeding trial, one ram from each treatment were randomly selected and maced in metal metabolism cages. Feed, faces and urine were collected separately. Digestibility of feeds were determined using the formula given below:

$$\text{Apparent digestibility} = \frac{\text{DM feed consumed} - \text{DM faecal output} \times 100}{\text{DM feed consumed}}$$

Total faecal output was collected from each animal in the last 7 days of the experiment. Sub samples of faeces were collected for chemical analysis.

Chemical Analysis

The feed and faecal samples were ground to pass through a 1mm sieve and analyzed in triplicate for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), nitrogen free extract (NFE) and total ash according to the methods of A.O.A.C. (2002).

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) based on complete randomized block design (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Chemical Composition of the Experimental Feeds

The Composition of the experimental diet is shown in Table 1, while the result of the proximate composition of the experimental diet is shown in Table 2. The dry matter (DM) content ranged from 91.1% (concentrate) to 93.22% (groundnut hay). The crude fibre in lablab was higher than in groundnut hay and concentrate diet. This value is lower than the range of 27.8% - 28% reported by Norton and Poppi (1995). Crude fibre content of legumes increases with maturity of the crop at harvest (Minson, 1990). Concentrate supplement was higher in crude protein, ether extract and ash, but nitrogen free extract was higher in groundnut and lablab hays. Ash content recorded for this study is close to the values (6.01) reported by Mbahi (2001) for groundnut hay. Ash contents of leguminous crops vary due to the nutritional status of the soils on which they are grown and the variety as well. Ash content of lablab for this study is lower than results reported by Murphy, (1998).

Table 1: Composition of concentrate supplement

Ingredients	% Inclusion
Wheat offal	70
Cotton seed cake	27
Bone meal	2
Table salt	1
Total	100

Table 2: Chemical composition of experimental feeds

Feeds	Dry Matter	Crude Protein	Crude Fibre	Ether Extract	Ash	Nitrogen Free extract
Groundnut hay	93.65	9.65	25.51	1.89	5.67	57.28
Lablab hay	91.52	14.08	27.12	1.83	5.51	51.50
Concentrate	91.10	18.16	22.68	3.45	9.92	45.79

Feed Intake

The result of the mean dry matter intake (DMI) is shown in Table 3. Total feed intake was not significantly different (P>0.05) among treatment groups, although animals on groundnut hay supplement tend to consume less forage. However, forage intake was significantly (P>0.05) higher in unsupplemented groups. Higher intake of the basal diet by the unsupplemented groups suggests that forage legumes can sustain ruminant animals without concentrate supplementation. The observation made in this study agrees with the work of Kay (1979) who reported no significant difference in feed intake of rams when forage legume with a high level of crude protein was supplemented with a concentrate. Similarly, Jakmola and Pathank (1981) reported that mean voluntary intake of sheep fed lablab was satisfactory, indicating good palatability of lablab at vegetative stage of growth. Hendrickson *et al.* (1981) recorded a high dry matter intake when sheep were fed with forage legumes.

Table 3: Dry matter intake and growth rate of rams offered either groundnut hay or lablab with or without concentrate supplement

Parameters (Kg)	TREATMENTS				SEM
	Lablab without supplement	Lablab with supplement	Groundnut without supplement	Groundnut without supplement	
Supplement intake (kg) DM/day)	-	0.91	-	0.75	0.03^{NS}
Hay intake (kg DM/day)	21.7^{a}	1.23^{b}	2.02^{a}	1.10^{b}	0.27*
Total feed intake (kg DM/day)	2.17	2.13	2.02	1.85	0.17^{NS}
Substitution rate (kg/kg)	0.94	-	0.92	-	-
Initial live weight (kg)	39.87	39.25	39.63	39.13	-
Weekly weight gain (kg)	19.8	20.7	19.8	19.8	0.02^{NS}
Daily weight gain (kg)	0.22	0.23	0.22	0.22	0.004^{NS}
Total weight gain (kg)	10.92^{b}	11.16^{a}	10.80^{b}	10.80^{b}	0.13*

a, b, c = means in the same row bearing different superscripts differ significantly (P<0.05); *=Significant (P<0.05)
NS = Not Significant (P>0.05)

Live Weight Change

There was significant (P<0.05) difference among treatments for total live weight change. Higher gain was obtained in lablab-supplemented group while a similar gain was obtained in all other groups (Table 5).

The better performance of lablab supplement group was similar to the findings of Umunna *et al.* (1995) who fed oat

hay with lablab hay on voluntary in take of sheep and Ndlovu and Sibanda (1996) who fed dolichos lablab (lablab purpureus) and Acacia tortili's pods to goat. However, daily weight gain of 0.22kg per head per day obtained from this experiment is higher than the 0.13kg per head per day reported by Mubi (2002) when groundnut hay was offered to sheep. Also Kaka (2000) obtained lower result when groundnut hay was offered to sheep. This supplement provides energy and protein, which are critical for the growth rate of sheep. It stimulates growth due to supplies of nitrogen co-factors, minerals and vitamins required by the rumen microbes (Reed *et al*, 1988; Galal *et al.*, 1981). The result of this present study tend to support the contention that supplement provision of supplement when the basal diet is of good quality forage legume has no beneficial effect on growth rate of ruminant (Nyaki, 1981 and Massae, 1984).

Nutrient Digestibility

The result of the nutrient digestibility is shown in Table 4. There was significant difference (P<0.05) in all nutrient digestibility among treatment groups. A range of 58.01 – 70.07% dry matter digestibility was obtained for all the treatment groups. Supplementation with groundnut hay depressed nutrients digestibility when compared to other treatment groups. The digestibility obtained in this study is higher than the values reported by (Minson, 1977; Minson *et al.*, 1981) when sheep were fed lablab forage in Australia. However, Murphy (1998) recorded a higher DM digestibility of 76% when sheep were fed lablab forage in Canada. Work carried out in Maiduguri where sheep were offered groundnut hay with liberal supplementation reported similar dry matter digestibility (Mubi, 2001; Kaka 2000). There were significant differences (P<0.05) among treatment groups in crude fibre digestibility. Crude fibre digestibility of lablab-unsupplemented groups recorded a higher digestibility (73%) than any other treatment groups and lower digestibility (62%) was obtained for groundnut hay supplemented. This difference is as a result of differences in hay intake, which suggest that rams on lablab were able to digest hay more than rams on groundnut hay. This supports the contention of Umunna *et al.*, (1995) who reported that rumen ammonia concentration and fibre digestibility in sheep fed lablab with supplement were improved. However, the results obtained for fibre digestibility in this study are higher than a range of 41-67% reported by Kaka (2000). The difference could be due to nutritional status of the hay used. Ether extract digestibility was in the range of 44.58 – 52.48 for all treatment groups. Ether extract digestibility in animals offered lablab supplement was significantly (P<0.05) higher than those on groundnut hay groups. The differences in digestibility might be attributable to the variation in ether extract of plant components (Van Soest, 1982).

Table 4:Nutrient digestibility of the experimental diet

Nutrients %	Lablab sole	Lablab Suppl.	Groundnut hay sole	Groundnut hay suppl.	SEM
Dry matter digestibility	71.07^{a}	70.51^{a}	67.44^{ab}	58.01^{b}	2.23*
Crude fibre digestibility	73.18^{a}	63.31^{b}	68.85^{ab}	62.06^{b}	3.46*
Crude protein digestibility	66.67^{a}	64.73^{a}	65.05^{a}	56.57^{b}	3.29^{NS}
Ether extract digestibility	52.48^{a}	51.44^{a}	44.58^{b}	44.73^{b}	3.38*

a, b, c = means in the same row bearing different superscripts differ significantly (P<0.05); *=Significant (P<0.05)
NS = Not Significant (P>0.05)

ECONOMIC ANALYSIS

Results of the cost benefits analysis of ran fattening using lablab and groundnut hay with or without supplementation is summarized in Table 5. The results indicated total cost of feed per animal was lowest on lablab-unsupplemented treatment (₦206.70) and highest on groundnut hay unsupplemented (₦4, 545). The mean cost of daily feed intake ranged from ₦2.30 to ₦33.79 for all the experimental diets. Cost of feed per kilogram gain was highest on groundnut hay unsupplemented (₦438.28) and lowest on lablab unsupplemented (₦7.62). Profit margin was higher in lablab-unsupplemented group, followed by lablab-supplemented group, with slight increase on groundnut hay unsupplemented and with supplement. The similarity in total output is because the fattened rams were sold in bulk during Sallah festival. It is not advantageous but has no economic lost during the study.

Table 5: Cost benefit analysis of fattening rams using groundnut or lablab hay with or without supplementation

PARAMETER	Lablab sole	Lablab Suppl.	Groundnut hay sole	Groundnut hay suppl.
Initial body weight (Kg)	39.87	39.25	39.63	39.13
Final body weight (Kg)	67.00	55.00	50.50	48.80
Total feed cost/animal (₦)	206.70	2313.25	4545	3040.65
Feed Cost/head / day (₦)	2.30	25.70	50.50	33.79
Mean Feed Intake / head / day	2.17	2.13	2.02	1.85
Total feed Intake/animal (Kg)	195.30	191.70	181.80	166.50
Total cost of feed per Kg gain	7.62	146.87	438.28	342.80
Initial cost of rams (₦)	31,500	31,500	31,500	31,500
Total input (₦)	32506.70	34613.25	36545.00	35340.00
Total output (₦)	60,000	60,000	60,000	60,000
Profit margin (₦)	27493.30	25386.75	23155.00	24660.00

CONCLUSION

From the results, it clearly shows that animals offered lablab sole and groundnut sole recorded an improved feed intake, live weight gain and nutrient digestibility. Supplementation did not increase the cost of input in formulation of the concentration diet. Therefore, it is imperative that fattening programme with liberal supplementation of concentrate diet to rams on good quality forage has no advantage. The result also shows that supplementation with groundnut hay as basal diet depress nutrient digestibility.

REFERENCES

A. O. A. C., 2002. Official methods of analysis. 15th Ed. Association of Official Analytical Chemist. Washington, D.C.

Galal, E. S. E., Taylr, M. S. Tadesse, T T. and Yohames, C., 1981. Dry season grazing of lambs on cultivated pastures and their subsequent finishing performance, Ethiopian Journal of Agricultural Science. 3: 15-30.

Hendrickson, R. E., Poppi, D. P. and Minson, D. J., 1981. The voluntary intake, digestibility and retention time by cattle and sheep of stem and leaf fractions of a tropical legume (lablab purpureus). Australian Journal of Agricultural Research. 3: 389 – 398.

Jakmola, R. C. and Pathank, N. N., 1981. Evaluation of the nutritive value of field bean (lablab purpureus) for sheep. Kerala Journal of Veterinary Science. 12 (2): 295-300

Kaka, A. B., 2000. Utilization of local feed resources for ram fattening in Borno State. M.Sc. Thesis, Department of Animal Science, University of Maiduguri.

Kay, D. E., 1979. Hyacinth bean-food legumes. Crop and Product Digest No.3. Tropical Products Institute. XVI: 184 – 196.

Lucke, P. E., 1965. Dolichos lablab. A valuable grazing crop. Queensland Agricultural Journal, May: 308-309.

Massae, E. E., 1984. A study on compensatory growth in Tanzanian Sheep. Master of Science Thesis, University of Dar-es-Salaam, Tanzania.

Mbahi, T. F., 2001. Effect of stage of harvest on rumen degradation of lablab (Dolichos lablab) in the semi arid region of Nigeria. M.Sc. Thesis Department of Animal Science, University of Maiduguri.

Minson, D. J., 1977. Chemical composition and nutritive value of tropical legumes. In: tropical forage legumes (P. J. Skerman ed). Plant production and protection service, No. 2 Rome, Italy, FAO. 186-194, 569-582.

Minson, D. J., 1990. Forage in ruminant nutrition. Academic press Inc., Toronto P. 483.

Mshelbwala, D. M., 1996. Fattening of rams using local feeds. Journal of Animal Production Research 6 (1): 32-36

Mubi, A., 2000. The utilization of groundnut haulms and cowpea husk for Fattening in the sub-sahelian region of Nigeria. M.Sc. Thesis Department of Animal Science, University of Maiduguri.

Murphy, A. M., 1998. Analysis of the growth and nutritional characteristics of lablab purpureus and evaluation of two digestibility techniques. Master of Science Thesis, University of Guelph, Canada.

Ndlovu, L R. and Sibanda, L. M., 1996. Potential of Dolichos lablab (lablab purpureus) and Acacia tortili's pods in small holder goat kid feeding systems in semi-arid areas of Southern Africa, Small Ruminant research 21: 273-276.

Norton, B. W. and Poppi, D. P.,1995. Composition and nutritional Attributes of pasture legumes. In: Tropical legumes in Animals Nutrition. D'Mello, J. P.F. and C. Devendra (Eds) CAB International, Wallingford, UK 23-47.

Nyaki, F. P., 1981. Meat production from sheep. The effect of breed and Concentrate supplementation on the growth performance and carcass composition. Master of Science Thesis, University of Dar-es-Salaam, Tanzania.

Rain, A. B., Thorpe, R. J., 1969. The nutritive value of Agronomic. Aspect of some fodder in Northern Nigeria. VI. J. Brit. Grass Land. Sec. 22: 52-60.

Reed, J. Ebong, C. Tanner, J. Gebra, G and Akalework, N., 1988. The nutritive value and use of feeds for fattening small ruminants on African highlands. A perspective of ILCA Research. Small ruminants research Network Nwsletter 12: 10-27. ILCA (International Livestock Centre for Africa), Addis Ababa, Ethiopia.

RIM., 1992. Nigerian livestock resources. Four volumes report to the Federal Government of Nigeria by Resources Inventory and Management Limited. Executive summary and Atlas (II) National Synthesis State Reports (IV) reports and Commercially managed livestock survey reports. Pp. 1-1612.

Steel, R. G. O. and Torrie, J. H., 1980. Principles and Procedures of Statistics – a biometrical approach. Second edition. McGraw Hill Book Company, New York, U.S.A. P. 633

Tanko, R. J. Kallah, M.S. and Otchere, E. O., 1990. Livestock production in northern Nigeria. Dry matter yield and chemical composition of dual purpose legumes. Paper presented at the 15th Annual Conference of the Nigeria Society for Animal Production, Ago-Iwoye, Nigeria.

Umunna, N. N., Osuji, P. O., Nsahlai, I. V., Khalil, H. and Mohammed Saleem, M. A., 1995. Effect of supplementing oat hay with lablab Sesbania tagaste or wheat middling on voluntary intake, N. Utilization and weight gain of Ethiopian Menz Sheep. Small Ruminant Research 18: 113-120.

Vansoest, P. J., 1994. Nutritional ecology of the Ruminant (2nd Ed.) Cornstock Publishing Association, Cornell University Press, Ithaca.

Zemmelink, G., 1973. Utilization of poor quality roughages in Northern Guinea Savanna Zone. Prod. Of Int. Symps. – an animal production in Tropics. (Ed). K. Loosenli, V. A. Oyenuga and G. W. Babatunde. Heinemann Educational Book (167).

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 215 - 217
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1696 – 2903

EFFECT OF PHYLLANTHUS AMARUS ON BREEDING EFFICIENCY OF FEMALE ALBINO RATS

H. E. ETTA, P. B.UDOH, B. O. ASUQUO, and B. OKON.

(Received 8 December, 2006; Revision Accepted 6 February, 2007)

ABSTRACT

Effect of *P. amarus* whole plant extract on breeding efficiency of female albino rate was studied. A total of twenty four (24) sexually matured female albino rats were treated with different concentrations of the ethanol extract of the whole plant of *P. amarus*. The female rats were mated with normal male rats of reproductive age after every administration. The different concentrations of the extract served as treatment. Under Complete Randomized Design (CRD), parameters studied were growth rate, litter sizes and weights at birth and weaning. Dominant Lethal Mutation Index and conception rates were also calculated with appropriate formulae. The result showed significant ($p<0.05$) reduction in the litter size at birth and weaning, due to administered doses of the extract. Litter weight at birth showed no significant ($p>0.05$) different. No runts or stillbirths were recorded. There was no significant ($p>0.05$) change in body weight of extract fed (treated) animals indicating no alteration in general metabolic status. Conception rates were negatively correlated with doses of treatment, with higher doses showing lower rates. Dominant Lethal Mutation index showed increase in Mutation with increase in concentration of extract. Pre-weaning litter sizes remained the same as litter size at birth, indicating that there was no mortality. This study suggests that a component or components of the herb. *P. amarus* may affect the internal milieu that governs breeding efficiency in female albino rats.

KEYWORDS: *Phyllanthus amarus*; breeding efficiency; female albino rats.

INTRODUCTION

There is so much being said about this wonder herb *Phyllanthus amarus* that one is forced to wonder if medical science has finally found the cure for all ailments (Lui and Huang, 2001). Infusions, teas, tablets and capsules of *Phyllanthus amarus*, are being consumed world wide (Srivdya *et al*, 1995) to treat a broad spectrum of disorders which include HIV (Japan), kidney and Gall stones (Spain), Colic, Malaria, Flu, Tumours and Jaundice (Brazil) (Thyagarajan *et al*, 1998). Here in Nigeria, *P. amarus* is used to treat malaria, diabetes, mental disorders and as an abortifacient drug (Adedapo, *et al* 2003).

Based on its various uses, the effect of the herb on the breeding efficiency of female albino rats was studied. Breeding efficiency encompasses a wide range of characteristics. How well an animal nurtures and cares for its young before and after birth up to the weaning age is termed Breeding Efficiency. (Dalton, 1982).

MATERIAL AND METHODS

The experiment was carried out in the Zoology experimental animal house of the University of Calabar. Twenty for (24) female and twelve (12) male sexually matured colony bred albino rats weighing between 120g and 150g, were used for this research. Three doses of the *P. amarus* extract was fed intraperitonially to the female rats in three treatment groups. The doses were 100mg/kg bw for treatment. Gp 1. 150mg/kg bw for treatment Gp II. 200mg/kg bw for treatment Gp. III. The control female rats in treatment Gp IV had no extract administered to them. *Phyllanthus amarus* plant was harvested from a farm in Calabar South LGA of Cross River State. They were air-dried for three days at room temperature and ground to powder in a manual grinder. A fixed quantity of 10g of the powder was dissolved in 10ml ethanol and allowed to stand for 48hrs. After which the solution was sieved and allowed to stand for another 48hrs to evaporate the ethanol completely. This was then used to prepare the three dosages of the extract on the basis of the body weight of the rats. Six female and three male albino rats were assigned per treatment under completely Randomized Design (CRD) arrangement.

After a two-week acclimatization period, the female rats within each treatment group were given the extract intraperitionially for a period of 15 days before mating for the first litter parameters. Female rats were mated to normal males within the treatment group at a ratio of 2:1 (female: male) for three days to ensure copulation. A parturition period of 21 days was allowed before the litter sizes and weights at birth were recorded. The conception rates of the female rats were calculated after pregnancy was confirmed.

A total of three litters (parities) were studied using the same mating arrangement. Three female rats from each group and the control were sacrificed 14 days after the extract was administered to the last parity. This was to count implantations on the horns of the uteri to determine the dominant lethal mutation index. The following formulae were used to calculate the corresponding parameters:

Conception rates:

$$\frac{\text{No. of preg. Females}}{\text{Total No. of female mated}} \times \frac{100}{1}$$

(Ostle, 1996).

Absolute growth rate:

$$\frac{Wi - Wj}{T}$$

Where Wi = final wt.
Wj = initial wt.
T = time under observation (days)

(Mullan, 2001)

D.L.M.I: -

$$1 - \frac{\text{Mean life implant in treated gp}}{\text{Mean life implant in control gp.}}$$

(Montgomery, 1976)

The analytical design used for this work was the complete randomized design (CRD) using the linear model;

$$Yij = \mu + Tj + eij$$

Where:

Yij represents any individual observation
μ represents the overall mean
Tj represents the treatment mean
Eij represent the experimental error

(Obi, 2002).

H. E. Etta, Department. of Genetics and Biotechnology, University of Calabar, Nigeria
P. B. Udoh, Department of Environmental Biology and Zoology, University of Calabar Nigeria
B. O. Asuquo, Department. of Animal Science, University of Calabar, Calabar, Nigeria
B. Okon, Department of Animal Science, University of Calabar, Calabar, Nigeria

Analysis of variance at 5% ($p<0.05$) probability was used to analyze data collected on the body weight of treated rats, litter weight and size at birth and at weaning. Level of significance were tested using least significance difference (LSD) technique. Students t-test was used to test for significance among the dominant lethal mutation indices.

RESULTS AND DISCUSSIONS

Absolute growth rate, conception rate (%) and dominant lethal mutation index.

Table I, show these results. From the table, absolute growth rate values of the treated rats show that the herb *P. amarus* did not affect their body weights. This trend corresponds with observation of Singh (1990) who reported that the body weight of the rts were not affect when treated with *S. Sesban* seeds to test for fertility control of female rats. Rao and Alice (2001) also had similar results in their research on the contraceptive effects of *P.amarus* in female mice. These may be an indication that herbs that confer anti-fertility effects on female rats do not affect their body weights. Conception rates decreased with increase in doses of extract. Group II rats in the 3rd parity did not conceive at all. These results show the anti implantation effect of *P. amarus* on female albino rats which could be as a result of a component or components in either the roots, or stem or leaves of the herb. The Dominant Lathal Mutation Index result showed increase in mutation with increase in doses of *P. amarus* administered. There was no mutation in the control group (IV). Implantation on the utern horn reduced as the dose was being increased from 100mg/kg bw to 200mg/kg bw.

Table 1: Absolute growth rates (±SE), Conception rates (%) and dominant lithal mutation index

Parameters	Parity 1				Parity 2				Parity			
	100mg/kg	150mg /kg	200mg/kg	0mg/kg	100mg /kg	150mg /kg	200mg /kg	0mg/kg	100mg /kg	150mg /kg	200mg /kg	Omg/kg
Absolute	I	II	III	IV	I	II	III	IV	I	II	III	IV
Growth	0.0067 ±0.3	0.047 ±0.00	0.027 ±0.6	0.053 ±0.3	0.029 ±0.4	0.013 ±0.8	0.021 ±0.7	0.23 ±0.01	0.46 ±0.01	0.43 ±0.5	0.47 ±0.5	0.48 ±0.32
Conception Rate (%)	83.3	83.3	66.67	100.0	66.67	33.3	0.0	100.0	66.7	0.0	33.3	100.0
D.L.M.I.									0.23	0.5	0.76	1.00

Litter size and weight at birth:

On table 2, the result for litter size and weight at birth have been shown. Litter sizes decreased with increase in the doses of the herb administered (100mg/kg bw, 150mg/kg bw and 200mg/kg bw) showing that litter sizes were dependent. This corresponds with investigation of Ghosh and Bhattachanya (2004) on anti implantation activities of *Thespesia* seed extract on female rats. Genetic mutation in the mother rats as a result of the administered herb may have caused this decrease in litter sizes. Litter birth weight also decreases with increase in administered doses. (Table 2).

Table 2: Litter size and weight (g) at birth (MEAN *±SE)

PARITY	GPI		GPII		GPIII		GPIV	
	SIZE	WEIGHT	SIZE	WEIGHT	SIZE	WEIGHT	SIZE	WEIGHT
1.	5.5	47.0	5.0	45.08	4.5	45.0	10.0	56.6
2.	6.0	55.0	5.2	35.0	0.0	0.0	9.3	58.0
3.	7.0	48.02	0.0	0.0	5.4	40.1	8.5	60.02
	X 6.2ab±0.42		3.4a±0.7		3.3a±0.1		9.3b±0.45	

* means followed by same case letters indicate no significance ($p>0.05$)

Litter size and weight at weaning

Table 3 shows these results. There was a steady decrease in size of pups at weaning, which was the same for litter size at birth, thus this could be an indication that the herb dose not contain principles that can harm the pups. The weight at weaning was not dose dependent but the trend obtained as shown on the table could be due to some environmental influence. (Table 3).

Table 3: Litter size and weight (g) at birth (MEAN *±SE)

PARITY	GPI		GPII		GPIII		GPIV	
	SIZE	WEIGHT	SIZE	WEIGHT	SIZE	WEIGHT	SIZE	WEIGHT
1.	5.5	178.15	5.0	105.51	4.5	129.4	10.0	178.0
2.	6.0	166.6	5.2	104.28	0.0	0.0	9.3	166.8
3.	7.0	133.62	0.0	0.0	5.4	108.3	8.5	145.62
	X 6.2ab±0.42	159.4±1.0	3.4a±0.7	69.93±0.83	3.3a±0.1	79.18a±0.34	9.3b±0.45	163.47b±0.51

SUMMARY AND CONCLUSION

Twenty-four (24) female albino rats were used as mammalian models to demonstrate the effect of the herb *P. amarus* extract on the breeding efficiency of female rats of reproductive age. The result of this study showed no effect of the extract on the body weight of treated rats. Conception rates were affected by doses administered. D.L.M.I. showed a number of early foetal deaths and non-implantation on the horns of the uteri. Litter size at birth and weaning decreased with increase in doses administered. Litter weights at birth were also dose dependent, but at weaning, the litter weight could have been affected by other factors other than the administered herb extract. There was no-pre-weaning mortality of pups.

It is obvious from this study that at high doses, the whole plant extract of *P. amarus* affected the conception rates, dominant lethal mutation index, litter size and birth weight of female albino rats. A component or components of the extracts could have altered the normal ovarian cycle of the female rats hampering implantations on the uterine horns, and reducing rates of conception which then affected both litter sizes and birth weight of rats that successfully kindled.

It then appears that if the herb extract of *P. amarus* could reduce litter sizes in the female albino rats from a normal size of about 12 to 4, then it may also prevent conception in larger laboratory animals.

Thus this research project can therefore be used as a basis for further studies and chemical trials of the herbs on higher mammals like guinea pigs and monkeys to ascertain tolerable doses for treating particular ailments.

REFERENCES

Adedapo A. A., Abatan M. O., Akinloye A. K., Idowu S. O. and Olorusogo O. O., 2003. Morphometric and Histopathological Studies on the Effect of Some Chromatorgraphic Fractions of Phyllanthus amarus and Euphorbia hirta on the Male Reproductive Rats. J. of Vet Sc. 4(2) 181-185.

Dalton C., 1982. An introduction to Practical Animal Breeding Granada Publishing Company, London.

Ghosh K. and Bhattacharya T. K., 2004. Preliminary Study on the Anti Implantation Activity of Compounds from Extracts of seeds of *Thespesia*. Indian J. of Pharm. 36:288-291.

Lui Ray-Ling H. and Huang Y. 2001. Genus *Phyllanthus amarus* for Chronic Hepatitis 8(5): 358:366.

Mullan, B., 2001. Guilt Management to Maximize Lifetime Productivity. Pigtales Australia.

Montgomery, D. C., 1976. Design and Analysis of Experiments. John Wiley and Sons, New York.

Obi, I. U. 2002. Statistical Methods of Detecting between Treatment Means and Research Methodology Issues in Laboratory and Field Experiments (2nd ed.) the Iowa state University Press, U.S.A.

Ostle, B., 1996. Statistics in Research, Basic Concepts and Techniques for Research Workers. (2nd ed.) the Iowa state University Press, U.S.A.

Rao M. V. and Alice K. M., 2001. Contraceptive Effects of *Phyllanthus amarus* in Female Mice, Phyto. Res. 15(3); 265-267.

Singh S. V., 1990. Fertility Control of Female through *Sesbani Sesban* Seeds. The J. of Res. And Edu. In Indian Medicine 9(4); 23-32.

GLOBAL JOURNAL OF AGRICULTURAL SCIENCES VOL. 6 NO. 2 2007: 219 - 222
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA. ISSN 1596 – 2903

SOCIO-ECONOMIC CONDITIONS OF RURAL SETTLERS IN KPASHIMI FOREST RESERVATION AREA OF NIGER-STATE NIGERIA: IMPLICATIONS FOR RESOURCE CONSERVATION.

F. S. GANA

(Received 29 May, 2006; Revision Accepted 20 February, 2007)

ABSTRACT

The survey examined five village communities adjacent to kpashimi forest reserve and how their activities in search of livelihood had depleted the abundant natural resources of the forest reserve. These communities were purposely sampled for this study because they had direct and indirect influence on the reserve. Primary and secondary data were collected from various sources. The participatory rural appraisal approach was used to collect the primary data, while secondary data were collected from relevant published literature and unpublished reports. The result revealed that about eighty three percent (83.3%) of the community members said that they had depended largely on the reserve for livelihood. It is suggested that the community members are fully involved in the management programmes of government to restore the biodiversity of the reserve. The educational attainment of the respondents showed $\chi^2 = 149.90$ significant at ($p < 0.05$). The provision of basic infrastructural facilities such as good water supply, health care facilities, access to good roads and schools among others were found to be grossly inadequate. This situation the respondents had said largely contributed to the endemic poverty found in the communities as they lived on less than N135 per day. Government should set up functional programmes such as provision of potable water, health care facilities, education, access roads, housing and markets among others. It is hoped that the income generated by the inhabitants living around the forest reserve would be sustained when the villages are encouraged to be part of decision making process on all aspects relating to the developments of the community. Government should regularly train the personnel who work in the reserve on new technologies that would lead to sustainable developments of the reserve.

KEY WORDS: Poverty among village forest settlers

INTRODUCTION

Today, Nigeria faces a number of developments challenges. Environmental degradation and poverty have continued to affect the socio-economic well being of the rural settlers around the forest reserves of the nation (FEPA, 1999 a). The environmental problems such as deforestation, loss of biodiversity, and soil erosion among others do impose high social and economic costs to people who live around the forest reserves. Nigeria is the 6th largest world producer of oil, and blessed with abundant human (population of over one hundred forty million people) and natural resources, nevertheless, she ranks as one of 25 poorest countries in the world (FGN, 2002). Poverty is a significant persistent problem in the developing world. Therefore, it is essential that concrete steps are taken in order to solve these problems, if this nation is to be reckoned with by the developed nations of the world. The earth summit held in Rio de Jeneiro a decade ago recognized the inherent dangers caused by the environmental degradation and destruction of biodiversity as a result of climate change. Nigeria participated in the conference hence, she signed two legally binding treaties, the Rio declaration on environmental development. The treaties are now being implemented in order to bring about sustainable forest development not only to protect the nation's forest reserves, but also ensuring the improvement of standard of living of rural communities that reside in the vicinity of the forest reserves (Gana, 1999). Kpashimi forest reserve was constituted by defunct Lapai Native Authority Forest Reserve order of 1961. It was later gazetted in the Northern Regional Public Notice N.R.N 20 of 1961 of the forest ordinance on 26th January, 1961. The village communities around kpashimi forest reserve live on less than N135 (U.S $1) per day. Their main income is derived from the resources of the forest. This has led to unwanted destruction of flora and fauna, resulting in the extinction of many species of plants and animals in the reserve. Migrants from neighboring states such as Sokoto, Kebbi and the Federal Capital Territory do contribute to incessant removal of trees, wildlife and fruits from the forest reserve. (MOA/NR 1990). In the face of increasing pressure for available resources in Kpashimi forest reserve and its periphery by the village settlers, there is need for a comprehensive assessment, which is currently lacking on the existing situations with respect to the availability of the vast potentials of the forest reserve. Hence, it is considered that new information emanating from this study will, among other things, ensure the adoption of appropriate measures which will lead to sustainable developments of the reserve and ensuring continuous improvement of standard of living of the village settlers. Diagnostic survey was conducted in five village communities adjacent to Kpashimi forest reserve in order to find out how their activities had depleted the abundant natural resources of the forest reserve.

The objectives of the study are: (i) examining how to preserve the renewable and non-renewable natural resources of Kpashimi forest reserve; (ii) to manage the resource of the forest reserve in a sustainable yield basis in order to alleviate the poverty of the village settlers; and (iii) to provide basic infrastructure for the village settlers.

METHODOLOGY

Area of study

The Kpashimi forest reserve is located in Lapai Local Government Area of Niger State. It lies between latitude $8^0 45'$N and $8^0 48'$N longitudes $6^0 46'$E and $6^0 50'$E. It is at an altitude of about 300m above sea level. The total area of the forest reserve is 167.04km^2. The reserve consists of 60% savanna woodland, 30% forest outline and 10% transition forest (Okojie, 1992). The reserve has great potentials of wildlife such as giant rats, grass cutters, antelopes, partridges, buffaloes and bees, which can be domesticated. The five village communities randomly selected for the diagnostic study were Mayaki, Nasarawa, Kunko, Gulu Angwar and Fapo. The choice of these village communities was based on variation in

F. S. Gana, Dept. of Agricultural Economics and Extension Tech., School. of Agriculture and Agricultural Technology, Federal University of Technology, Minna.

terms of ethnic groups and physical access. The survey was conducted between 12th October 2005 and 13th Feb, 2006. Participatory rural appraisal method was used to gather relevant information. Primary data were obtained through discussion with the community leaders, Government forestry officials, women groups and individual informants. Structured interview schedule were centered in the village's social life, community history, migration background, village governance, land tenure, occupation and the importance of the forest reserve in meeting the basic needs of the settlers. Secondary data were collected from published literature and unpublished reports. One hundred and five well completed and useful copies of the interview schedule were selected for analysis. The data were analyzed using percentages, frequency distribution, and chi-square χ^2 test at 0.05 level of significance to test the existence of relationship between the characteristics of respondents and the variables under consideration.

RESULTS AND DISCUSSION

The ethnic structure of the settlers consists mainly of Nupe, Gwari, Bassa, Mada and Pangu tribes. The remaining were Hausa, Igbo and Yoruba.

Table 1: Demographic Characteristics of Respondents around Kpashimi Forest Reserve.

S/B	Age (years)	Frequency	Percentage
1.	Below 21	15	10.0
2.	21-30	26	17.3
3.	31-40	65	43.3
4.	41-50	15	10.0
5.	51-60	14	9.3
6.	61 and above	9	6.0
7.	Not sure	6	4.0
Total		150	100

Mean = 30.5

The result in Table 1 shows that the majority of the respondents (60%) were between the ages of 21 and 40 years, while 10% of them were either under the ages 21 or between 41-50 years old. From the distribution, it could be inferred that majority of the sampled respondents were young and middle aged, having a mean age of 31 years hence they were still active members of the community.

Table 2: The Educational Status of Respondents in and around Kpashimi Forest Reserve

Variables	Frequency	Percentage
No formal education	50	33.3
Adult education	30	20.0
Islamic education	35	23.3
Primary education	20	13.3
Secondary education	15	10.0
Others	09	0
Total	150	100

The results showed that χ^2_{cal} at 0.05 level is 149.90 while the χ^2 tabulated at the same level is 90.53.

Table 2 reveals that (33%) of respondents have no formal education, (23%) had Islamic education, while (20%) had adult education. There is clear indication that those who were educated did not go beyond secondary school and this might be attributed to the remote nature of the area under study, which is mainly rural. Those that completed secondary education represent (10%) of the respondents. The opportunity opened to rural communities with respect to education attainment is not encouraging since 23% of them had only Islamic education. This might also be due to financial constraint due to poverty, which abounds in rural areas, (Adeyeye and Carim, 2002).

Table 3: Distribution of Respondents by access to infrastructural facilities around Kpashimi Forest Reserve

S/B	Variables	Do not have access Frequency	Percentage	Have access Frequency	Percentage
A.	Rural Physical Infrastructures				
	i. Reliable roads	145	96.6	5	3.4
	ii. Cottage industries	135	90.0	15	10.0
	iii. Storage facilities	146	97.3	4	2.7
B.	Rural social Infrastructures				
	i. Provision of schools	148	98.6	2	1.4
	ii. Health care facilities	148	98.6	2	1.4
	iii. Good water supply	147	98.0	3	2.0
	iv. Electric supply	143	95.3	7	4.7
	v. Security	148	98.6	2	1.4
C.	Rural institutional Infrastructures				
i.	i. Cooperatives	146	97.3	4	2.7
ii.	ii. Markets	130	86.6	20	3.4
iii.	iii. Credit facilities	143	95.3	7	4.7

Table 3 revealed the dearth of basic infrastructure such as pipe borne water, health care facilities (dispensaries, clinics and drugs) electricity supply, accessible roads, literacy and numerical skills to mention a few were almost not available. This agrees with Igbozurike, (1983) that reported the situation of inadequacy of social services in rural Nigeria and accessibility to basic infrastructure among the village dwellers.

Table 4: Income of the Respondents in and around Kpashimi Forest Reserve

S/No	Activities	Income ₦	Frequency	Percentage
i.	Collection of fruits, vegetables, building materials and medicinal herds e.t.c.	6075	45	30.0
ii.	Farm produce e.g. cereals, legumes and root crops.	4725	35	23.3
iii.	Poaching of wildlife			
iv.	Fishing	3375	25	16.7
v.	Trading	2700	20	13.3
vi.	Others (e.g. weaving, tailoring and barbing e.t.c.)	2160	16	10.7
		1215	9	6.0
Total		20250	150	100

Table 4 revealed that there was a lot of economic activities in and around the reserve by village community members and visitors from neighbouring states. There was a lot of farming for food crops on small fragmented holding. This situation has given rise to serious erosion problems and depletion of the flora and fauna in the forest reserve. The villagers engaged in collection of fruits (shea butter, locust beans, palm oil and bush mango) medicinal herbs, building materials, fishing and trading. Poaching of wildlife on a large dimension without consideration to their replacement continued unabated. It was found that up to 83.3% of the village dwellers lived on income of less than ₦135.00 (US$1) per day, (FEPA, 1999b). The majority of village community members had agreed to totality of collaboration with the government in the management of the forest reserve. Village Forestry Management Committee (VFMC) had already been set-up by the Niger State Forestry Division to assist Government in finding solutions to the problems of the Forest Reserve. A few Non-Governmental organizations (NGOs) such as Agricultural, Environmental and Rural Developments Agency (AERDA) assisted Government in providing potable water by constructing cemented hand-dug wells for the rural communities. The village communities had requested for cottage industries to enable them (villagers) process shea butter and oil palm fruits harvested from the reserve.

Implications for Nigeria's Position Regarding Sustainable Forestry Developments and Recommendations.

Nigeria signed the treaty on climate change and biodiversity in 1998. The Federal Government, through decree No.58 of 1998, later amended by decree 59 established the Federal Environmental Protection Agency (FEPA). Through this body, a national policy on environment was formulated with overall goal of achieving sustainable developments based on proper management of the reserve. The policy stipulated that communities living around the forest reserve should benefit from the exploitation of the natural resources of the forest reserve.

To achieve this goal, the communities were to fully participate in the decision making process of exploiting the potential resources of the forest reserve. Forest reserves in Nigeria were established for the benefit of both urban and rural communities. The rural communities should therefore be involved in the planning and management of the forest reserves. It is hoped that solutions will be found in achieving sustainable forest developments in a short time.

CONCLUSION

From the foregoing, the Kpashimi forest reserve is one of the dormant rural reserves yet untapped. It requires a quick intervention of Government and stakeholders to bring about practical sustainable developments to the reserve. The petroleum resource which the nation sorely depends on is fast dwindling. It is assumed that the Kpashimi forest reserve and the rest of the forest reserves of the nation will contribute positively to the much needed alternative revenue base for the nation.

Therefore there is need to develop essential infrastructure and social services found to be grossly inadequate in the study area. These measures would motivate the inhabitants to generate higher income for their livelihood. Subsequently the standard of living of both the present and future rural communities around Kpashimi forest reserve would be improved upon, on a continuous basis. The rural poverty will be minimized and finally eliminated

RECOMMENDATIONS

Based on the findings, the following recommendations are put forward for consideration:

(i) The village communities around Kpashimi forest reserve should be directly involved in the decision-making process of all aspects related to the development of the forest reserve.

(ii) Government should set-up a machinery to encourage village communities establish mixed forest farming of economic trees to ensure availability of raw materials for cottage industries in the area.

(iii) Functional cooperative groups and development associations should be established to enable the village communities manage the resources of the reserve in line with government aspirations.

(iv) Government and stakeholders should provide basic infrastructure such as potable water, health care facilities, electricity, access road and housing among others to the village communities.

(v) Personnel who work in the reserve should be adequately trained regularly on new technologies that will bring about sustainable improvement of the reserve.

ACKNOWLEDGEMENTS

The author highly appreciates the Forestry Management, Evaluation and coordinating Unit (FORMECU) Federal Department of Forestry – Abuja, Niger State Ministry of Agriculture, Forestry Division and Lapai Local Government for their assistance and cooperation during the course of survey.

REFERENCE

Adeyeye, V.A. and Carim, A. A., 2002. Food Cricis and Rural Poverty in Nigeria: Implications for Programming

Community level Participation in Rural Developments. Nigeria Journal of Rural Sociology. Vol. 3, Nos 1 and 2: 118 – 129.

FEPA., 1999a. National Master plan for Awareness on Environmental and Natural Resources Conservation in Nigeria: 50.

FEPA., 1999b. National Masterplan for Awareness on Environmental and Natural Resources Conservation in Nigeria: 50.

FGN., 2002. Sustainable Developments in Nigeria. Ten years after Rio (UNCED). National Assessment for presentation at the World Summit on Sustainable Developments held Johannesburg. South African between August 26th – 4th September 2002: 126.

Gana F. S., 1999. Socio-Economic survey of eight village communities around Kpashimi forest Reserve. Federal Department of Forestry – Nigeria: 40.

Igbozurike, U. M., 1983. Rational for Rural developments efforts. Social services in rural Nigeria: Location and Accessibility. Development and Quality of life. (Proceedings of the seminar on quality of life in rural Nigeria) held at the Agricultural and Rural Management Training Institution: 46-55.

MOA/NR., 1990. Ministry of Agriculture and Natural Resources, Forestry Annual Report, Niger State.

Okojie., 1992. Cited by Environmental Assessment Forest Reserve Management Component, Kpashimi Forest Reserve. Report of February 1994.