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ASSESSMENT OF THE IMPACT OF TUNGAN-KAWO IRRIGATION DAM ON RICE PRODUCTION IN ZUNGERU, NIGER STATE, NIGERIA

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ABSTRACT

Tungan-Kawo Rice irrigation schemes in Zungeru, Niger state, Nigeria, has not reach its potential in terms of yield which has been so low that it creates a huge consumption deficit leading to huge rice import bill. The management of this scheme has noted with poor record keeping and high operational and maintenance cost. The objective of this study is to analyze rainfall distribution in the study area from 2000-2010 and to identify the impact of the irrigation dam on rice production in the study area. The method adopted to meet these objectives are Structured questionnaires were randomly distributed to the selected rice farmers in the study. A fixed responsive technique was used in other to serve as a guide to the respondents and Descriptive Statistics was adopted for this study, Microsoft excels and statistics package for social scientist (spss) was used in calculations as well as plotting of graphs. The result indicated that the mean of year 2006 was very alarming, where there was a rise in the rainfall pattern which led to flooding and erosion. This confirms global warming in the study area. The minimum rainfall is l020.31mm which occurred in 2004. The highest rainfall of 1833.8 mm occurred in 2006. From this, it is clear that there was a little variation in the distribution of rainfall in the study area. Majority of the farmers agree that irrigation system is the way to greater rice production anywhere in the world. The rice irrigation capacity utilization in the existing schemes is unsatisfactorily, the reasons for the current situation are indicated as poor management practices, lack of governmental support to promote the scheme and heavy dependence on natural rainfall. Rainfall is unpredictable, a situation which is a draw back on existing rice irrigation schemes. For a complete self-sufficiency, rice irrigation practices must be seen in its right perspective to ensure the success of the scheme and become integral variable in the national economy.

Keywords: Rainfall, Agriculture, Rice Production**,** Food, Dam.

INTRODUCTION

Agriculture is still a major sector in many countries, and agricultural activities provide developing countries with food security and revenue. The average rate of irrigation development for the countries of sub-Saharan Africa from 1988 to 2000 was estimated at 43,600 ha/year (FAO, 2001). If this rate continues, then an additional 1 million hectares will be brought into irrigated production by the year 2025. Irrigated agriculture is a later day philosophy which was promoted by the fact that natural rainfall is largely seasonal and heavily unreliable.

Rice is the seed of the monocot plants *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. It is the grain with the third-highest worldwide production, after sugarcane and maize, according to data of (FAOSTAT 2012). Rice is normally grown as an annual plant, although in tropical areas it can survive as a perennial and can produce a Raton crop for up to 30 years. The rice plant can grow to 1–1.8 m tall, occasionally more depending on the variety and soil fertility. It has long, slender leaves 50–100 cm long and 2–2.5 cm broad. The small wind-pollinated flowers are produced in a branched arching to pendulous inflorescence 30–50 cm long. The edible seed is a grain (caryopsis) 5–12 mm long and 2–3 mm thick (Molina *et al*., 2011).

Rice cultivation is well-suited to countries and regions with low labor costs and high rainfall, as it is labor-intensive to cultivate and requires ample water. However, rice can be grown practically anywhere, even on a steep hill or mountain area with the use of water-controlling terrace systems. Studies by the West Africa Rice Center (WARDA) show that the issue of rice availability in Sub-Sahara Africa (SSA) is complex and should be viewed from a deeper perspective that takes account of technology, policy, and socio-economic factors within a purely African context.(Kanayo *et al.*, 2005). With more than 124 million inhabitants in 1999, Nigeria is by far the most populous country in Africa. The farm sector has been the backbone of the economy since independence, employing more than 70 percent of the country's population. Small farmers dominate the sector and provide the bulk of the nation's domestic food supply. The Nigerian farm sector is characterized by low productivity that has persisted since the early sixties (60s). World Bank reports put the growth rate in total food production a less that 1.5% in the 1990s, compared to an average annual population growth rate of about 3% during the same period. This has placed tremendous pressure on the farm sector and the economy at large. (Kebbeh *et al.*, 2003) Rice is an important cereal in Nigeria, with the share of rice in cereals consumed increasing from 15% in the 1970s to 26% in the early 1990s (Kanayo, *et al*., 2005). Projections from the food and agriculture organization (FAO) indicate rice consumption growth rates of 4.5 percent per annum through the 2000s, which will represent a 70% increase in total rice consumption by the end of the decade. Although total rice production has increased over the last two decades, the increases have not been sufficient to meet the increasing demand from the rapidly growing population. Mean annual paddy production increased from 332,800 metric tons during the period 1961-1975 to 3,189,833 metric tons during 1995-1999.

However, most of this increase has been attributed to an expansion in the area under cultivation. During the same period, rice imports increased from 2036 to about 687,925 metric tons (Papademetriou, 2001). The inability to meet rice consumption needs through local production has resulted in high cash outlays for importation. In 1998 for example, the value of rice imported into Nigeria was estimated at US$ 259 million. Recent policies have placed emphasis on increasing local rice production in order to reverse import trends and free up limited foreign reserves for use in other sectors.

Review in Nigeria of irrigation system and rice production

Irrigation can be described as the application of water to the soil to make available essential moisture for plant growth. It also serves as insurance against drought and to provide a cooling effect on the soil environment for plant growth and development. So, irrigation is aimed at improving and raising the productivity of soil resources. The principle, according to Hudson (1975) is that the environment is characterized by fair to good soils but poor and unreliable low precipitation as it is the case in dry and semi-dry lands. Irrigated rice cultivation in Nigeria has a long history dating back to the colonial era, but it

was not until the droughts of the early-to-mid seventies (70s) that concerted efforts were paid to irrigation development in the country. A substantial government investment of more than US$ 200 million was put into irrigation development between 1976 and 1990 (Musa, 1997). Irrigation perimeters range from large and medium-scale schemes found in the north where drought effects are more probable, to small-scale schemes developed in inland valley bottoms in the south and other parts of the country. Rice is the main irrigated crop, but other crops such as wheat and vegetables are also important (Shaib *et al*., 1997). Irrigated rice systems account for 10-16% of the total rice area in the country (Fagade and Ojo, 1977).

In most parts of the world, dams and reservoirs are constructed as an efficient and desirable means of harnessing water for irrigation and domestic purpose or mitigating problem of flood (Adams, 1985). These uses, however, depends on which part of the world, whether humid or semi – arid region, the dams are constructed. Most dams in the semi-arid regions are constructed to harness water while in the humid; dams are usually constructed for mitigating problems of flood. Other secondary benefits may include recreation, fishery, wildlife conservation etc. Dams are categorized into large, medium and small. They are so classified in accordance with the definition of International Commission on Large Dams (ICOLD) which is a global association effectively used. Average irrigated rice yields of 3.5 tons/ha are generally higher than yields obtained in other rice production systems, but much lower than the potential yield of more than 6 tons/ha for irrigated rice. The relatively poor performance of irrigated rice schemes in the country can be attributed to a number of biophysical, socioeconomic and institutional constraints (Fagade and Nguyen, 2001). These factors have together contributed to low irrigated rice productivity, and the performance of irrigated rice schemes in northern Nigeria continues to be below those of similar schemes in the Sahel region of West Africa. Also, an important issue revolves around the viability of large and medium-scale irrigation schemes in terms of investment, maintenance and operational costs. Identifying and addressing constraints and opportunities for improving the performance of these schemes will result in significant increases in productivity and farm incomes, improve the competitiveness of the domestic rice sector and reduce rice importation needs.

There is obviously no dispute about the fact that water is an important input in agricultural production in Nigeria beside labour force. Virtually, all agricultural production in Nigeria depends heavily on natural rainfall which can be unpredictable. According to available statistics, Nigerians consume 6,000,000 metric tons of rice annually out of which our local farmers produce only 15% of the demand. The remaining two-thirds, worth over 256 billion naira, are imported. The figure is alarming when it is juxtaposed against the situation in 1999-2000 when the rice import bill was 75 billion naira.. (vanguard newspaper August 11th, 2014) The aim of this study is to assess the Impact of Tungan-Kawo Irrigation Dam on Rice Production in Zungeru, Niger State and the specific objectives of the study are; to analyze rainfall distribution in the study area from 2000-2010, to identify the impact of the irrigation dam on rice production in the study area and to identify the constraints and opportunities for improving the performance of the irrigated rice production in the study area

Study Area

Zungeru is a town located at the center of the Niger state, along that Zungeru is located at lat $09^0 48'19.37''$N and longitude $06^0 09'02.97^0$E. It is surrounded by very old and important towns such as Kotongora to the north west, Kagara to the north, Minna to the north east and Bida to the South. It has a good network of roads run through Tegina to the north, Wushishi and Bida to the South and Minna to the North. The main occupants are: Hausa, Fulani, Gwari and Nupe, with others especially Yoruba present in significant number. The main occupations of the people include farming, rearing of livestock, production of local craft and trading.

Zungeru is a low lying town located in a valley and is therefore surrounded by high land and features of mountain and rocks which forms the bank of its river system. These include the River Kaduna and smaller rivers such as the Innamayi and Tansheta. The soil is laterite soil and is suitable for the growing of many savanna and cereals.

Presently Zungeru enjoys a climate typical of the middle belt zone, the raining season start around April and last till October; it has a mean annual rainfall of 1302 mm with September recording the highest rain of 300 mm. The mean monthly temperature is high in March at 30.50^0 C (85^0 F) and lowest in August at 22.3^0 C (72^0 F). The Zungeru has two distinctive weather, namely the rainy season which begins around March and runs through October, and the dry season which begins from October and ends in March. However, within these tow s seasons is a brief Harmattan season that is occasioned by the north east.

Figure 1. Map of Nigeria showing Niger state
Source: Geography Department, Federal University of Technology Minna

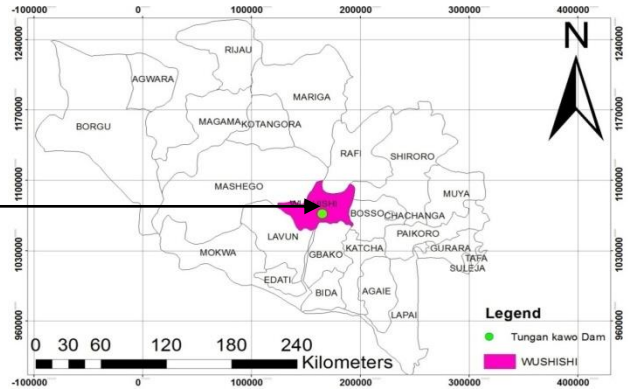

Figure 2. Map of Niger state showing the Study Area
Source: Geography Department, Federal University of Technology Minna

RESEARCH METHODOLOGY

1. To meet the requirement of the study two basic types of data source will used. That is primary and secondary data source.

i.Primary data-: These are data that were obtain by the student directly from the field. These include terrestrial photograph of the study area and administration of questionnaire to rice farmers and management of the Dam, ground trotting.

ii. Secondary data- These are rainfall data for 10yeras (2001-2010) to be obtained from Nigeria Meteorological Agency (NIMET).

2. Questionnaire-: Structured questionnaires will be design and distributed randomly to the selected rice farmers in the study. A fixed responsive technique was used in other to serve as a guide to the respondents. Options was provided for the respondent to choose from. The questionnaires will prove pertinent and adequate data sourcing method because the technical response required was obtained. Because of time limit of the research and the population of the study area, only 100 questionnaires was distributed. The questionnaire was structured in other to assess the Impact Assessment of Tungan-Kawo Irrigation Dam on Rice Production in Zungeru, Niger State. The questions was on impact of the Dam, challenges, causes of poor yield, government intervention, disaster e.t.c. See the forms of questionnaire in the appendix of the project report.
3. Sampling Techniques-: A random sampling technique was used in the distribution of the questionnaires. All areas in the study areas has an equal and independent chances of been given a questionnaire. These make the task easier. The areas are:

i.Zungeru
ii.Tungan Kawo

4. Method of Analysis-: Descriptive Statistics was adopted for this study, Microsoft excels and statistics package for social scientist (spss) was used in calculations as well as plotting of graphs.

i. Numerical measures : Finding the mean of all weather variables through the use of the following equation:

$$X = \frac{\sum x}{n}$$

Where:

$x =$ Rainfall mean

$n =$ Total number of weeks under study.

$\sum =$ Summation of all weather variables.

ii. Tabular Methods: This tabular method analyzes the summary of the rainfall data obtained and administered questionnaires.

iii. Graphical Method: A bar chart was use to depict the trend and the level of contributor of rainfall to rice cultivation.

RESULTS AND DISCUSSIONS

Figure 3 shows the yearly rainfall distribution over Zungeru community of Niger State for the period of ten years from 2001-2010. It shows the yearly amounts in mm. The minimum rainfall is l020.31mm which occurred in 2004. The highest rainfall of 1833.8 mm occurred in 2006. From this it is clear that there is little variation in the distribution of rainfall in the study area.

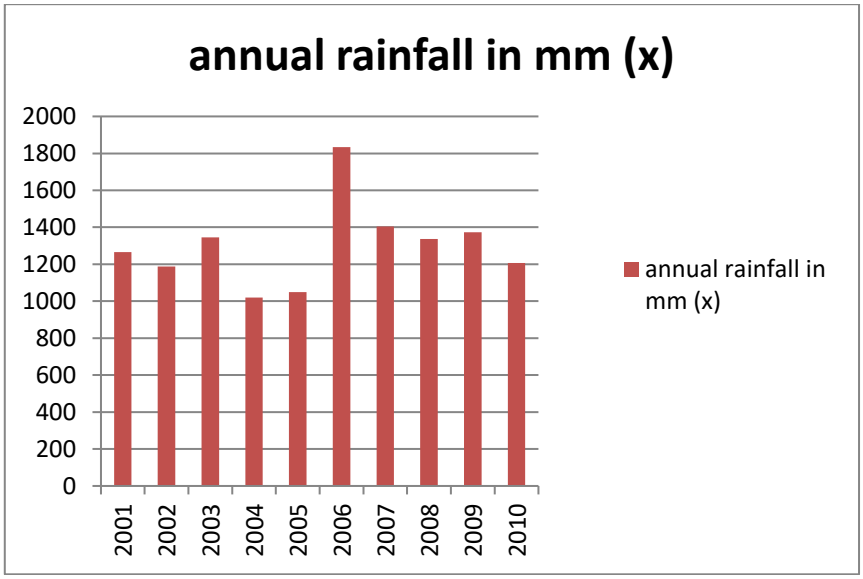

Figure 3: Annual Rainfall distribution of Zungeru from 2001-2010.
Source: Feild Survey, 2014

Table 1. Means Monthly Rainfall

Month	Mean (mm)
January	0
February	0
March	0.27
April	90.45
May	110.71
June	175.12
July	259.04
August	280.15
September	268.3
October	113.79
November	2.45
December	0

Source: NIMET, 2014

Table 2. Mean Annual Rainfall

Years	**Annual rainfall in (mm)**	**Mean in (mm)**
2001	1265.20	105.43
2002	1167.90	97.33
2003	1345.20	112.10
2004	1020.31	85.03
2005	1049.15	87.43
2006	1833.80	152.82
2007	1403.80	116.98
2008	1337.35	111.45
2009	1372.90	114.41
2010	1206.99	100.58

Source: NIMET, 2014 (2001-2010)

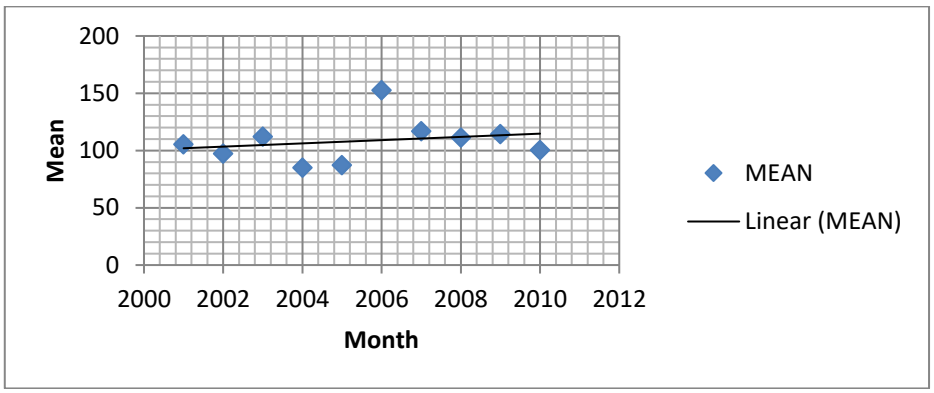

Figure 4: Pattern of Mean Monthly rainfall in the Study Area
Source: Field Survey, 2014

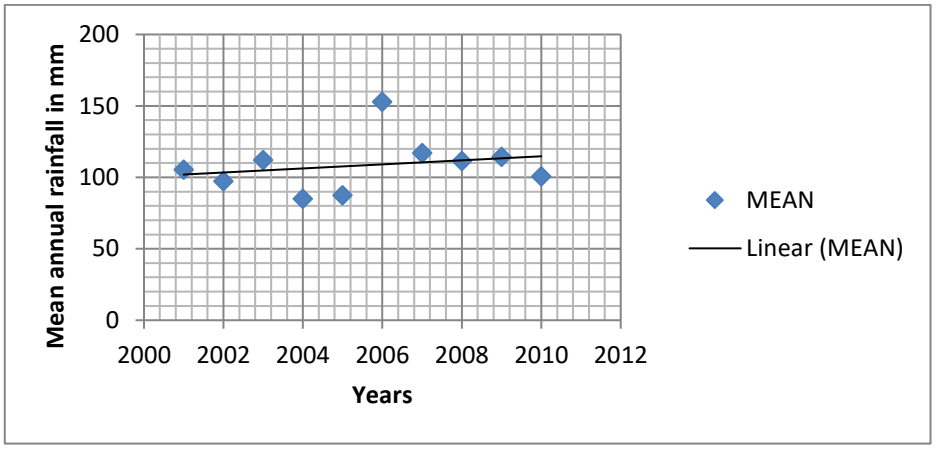

Figure 5: Pattern of Mean Annual rainfall in the Study Area
Source: Field survey, 2014

The means were calculated from the monthly distribution of rainfall for the same interval of years (2001-2010). Figure 3 shows the pattern of mean annual rainfall distribution of the study area. The mean of year 2006 was very alarming, where there was a rise in the rainfall pattern which could lead to flooding and erosion. This confirms global warming in the study area. The minimum rainfall is l020.31 mm which occurred in 2004. The highest rainfall of 1833.8 mm occurred in 2006. From this it is clear that there is little variation in the distribution of rainfall in the study area.

Table 3: responds from farmer in the study area

Opinion	Strongly agree (x5)	Agree (x4)	Undecided (x3)	Disagree (x2)	Strongly Disagree (x1)
Dam is one of the major factors that affect your yield	39	33	11	13	4
Is there increase in yield over the years?	28	42	19	9	2
Adequate water supply from the dam is a factor contributing to the increase in yield over the years	55	32	10	2	1
Is decrease in yield attributed to rainfall?	49	29	5	3	14
Is decrease in yield attributed to poor supply of water from d dam?	55	22	9	10	4
Does excess release of water from the dam affects your yield.	49	30	7	10	4
Agro-hydrological research should be encouraged to improve yields.	50	29	7	5	9
Do u think the parcel of land is adequate?	4	7	2	36	51
Do you thinks you can cultivate more if you have more land	50	28	8	9	5
Aids from government or non-governmental organization should be employed.	59	37	1	2	1

Sources: Field survey (2014).

Table 4: Sum of farmers responds

Opinion	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree	Sum
Dam is one of the major factors that affect your yield	195	132	33	26	4	390
Is there increase in yield over the years?	140	168	57	18	2	385
Adequate water supply from the dam is a factor contributing to the increase in yield over the years	275	128	30	4	1	438
Is decrease in yield attributed to rainfall?	245	116	15	6	14	396
Is decrease in yield attributed to poor supply of water from d dam?	275	88	27	20	4	414
Does excess release of water from the dam affects your yield.	245	120	21	20	4	410
Agro-hydrological research should be encouraged to improve yields.	250	116	21	10	4	406

Do u think the parcel of land is adequate?	20	28	6	72	51	177
Do you think				85	5	409
Aids from go				4	1	451

Sources: Field survey (2014).

1-1.50 = Strongly Disagree; 1.51-2.49 = Disagree; 2.50-4.49 = Undecided; 3.50-4.49 = Agree; >4.50 = Strongly Agree

This is used to classify the consensus opinion of the farmers (Table 4. in the study area.

Table 5: Consensus opinion of farmers

Opinion	Sum	Mean (Sum/100)	Interpretation (consensus opinion)
Dam is one of the major factors that affect your yield	390	3.90	Agree
Is there increase in yield over the years?	385	3.85	Agree
Adequate water supply from the dam is a factor contributing to the increase in yield over the years	438	4.38	Agree
Is decrease in yield attributed to rainfall?	396	3.96	Agree
Is decrease in yield attributed to poor supply of water from d dam?	414	4.14	Agree
Does excess release of water from the dam affects your yield.	410	4.10	Agree
Agro-hydrological research should be encouraged to improve yields.	406	4.06	Agree
Do u think the parcel of land is adequate?	177	1.77	Agree
Do you thinks you can cultivate more if you have more land	409	4.09	Agree
Aids from government or non-governmental organization should be employed.	451	4.51	Strongly Agree

Sources: Field survey (2014).

The minimum rainfall is l020.31 mm which occurred in 2004. The highest rainfall of 1833.8 mm occurred in 2006. From this it is clear that there is little variation in the distribution of rainfall in the study area. Majority of the farmers agree that irrigation system is the way to greater rice production anywhere in the world. The rice irrigation capacity utilization in the existing schemes is unsatisfactorily, the reasons for the current situation are indicated as poor management practices, lack of governmental support to promote the scheme and heavy dependence on natural rainfall. Rainfall is unpredictable, a situation which is a draw back on existing rice irrigation schemes. For a complete self-sufficiency, rice irrigation practices must be seen in its right perspective to ensure the success of the scheme and become integral variable in the national economy.

CONCLUSION AND RECCOMMENDATIONS

Conclusion

The findings show that variation in the annual amount of rainfall in Zungeru, Niger state is minimal The rice farmers in the study confirmed to me that Tungan Kawo dam has contributed immensely to the annual yield of rice in Zungeru..

Given the existing structure of the local rice farming in Zungeru and Niger state at large, increasing the tariff rates on imported rice would not be detrimental to the importers but will rather affect the common urban poor consumer. In the long run, however, if the structures are put in place, local rice production and marketing can benefit directly. What is needed is effective organization and intermediary actions by the government to enhance efficiency of the local rice farming in the study area and Nigeria at large.

Recommendations

Based on the findings above and the practicable conclusion of this study, and it is there recommended that,

1. Agricultural policies should be more realistic and achievable. More Agricultural Research Institutes should be established not only in the study area, but also in the entire state to develop hybrid crops, establish more scientific and research farms as well as embarking on seminars to enlighten the farmers on the current trend in farming system.
2. There is need for government to give aid and loan to the farmers in order to carry out their farming activities effectively and efficiently.
3. A solid foundation must first and foremost be laid to enable the domestic rice sector to take off without any ripple effect.
4. A number of adaptation options in agriculture face a dilemma. Increasing water availability and increasing the reliability of water in agriculture, i.e. through irrigation, is one of the preferred options to increase productivity and contribute to poverty reduction.
5. Prospects for rice irrigation development now and the future are bright provided it will be accorded the required priority at the highest level.
6. The issue of cost has always bedeviled the irrigation schemes. This should be contained by the government through clear cut policies in order to make irrigation and its management affordable.
7. Research must also aim at improving the yields and optimizing water usage on projects. Lastly local capacity to manage rice irrigation schemes should also be developed by running good irrigation training programmes at the training institutions.

REFERENCES

Adams, W.M. (1985). 'The downstream impacts of dam construction: a case study from Nigeria', Transactions of the Institute of British Geographers N.S. 10: 292-302

Fagade, S. O. and Nguyen, V.N. (2001). Evolution of irrigated rice yields in sub-Saharan Africa. In Yield gap and productivity decline in rice production. Proc. of Expert consultation, Rome 5-7 Sept.2000, p.143-161, FAO, Rome, Italy.

Fagade, S. O. and Ojo, A. A. (1977). Influence of plant density and nitrogen on yield and milling quality of lowland rice in Nigeria. Exp. Agr. 13, 17-24

FAO. (2001). Smallholder Irrigation Technology: Prospects for Sub-Saharan Africa. International Programme for Technology and Research in Irrigation and Drainage, Knowledge Synthesis Report No. 3, Rome.

FAOSTAT; Production-Crops data, (2011) Food and Agriculture Organization of the United Nations. 2011.

Hudson, (1975). Irrigation." ln Field Engineering for Agricultural Development, Oxford: Clarendon Press pp.117.

Kanayo F. Nwanze; Savitri Mohapatra; Patrick Kormawa; Shellemiah Keya; Samuel Bruce-Oliver (2005). Africa Rice Center (WARDA), pp. 2-3, 01 BP 2031, Cotonou, Benin.

Kebbeh, M., Haefele, S. and Fagade, S. O. (2003). Challenges and Opportunities for Improving Irrigated Rice Productivity in Nigeria; West Africa Rice Development Association (WARDA), Sept,2003 pp. 2-4, Abidjan, Cote d'Ivoire.

Musa, I. K. (1997). Food production in Nigeria: The critical role of irrigated agriculture. In: Shaib, B, Adedipe, N. O., Aliyu, A. and Jir, M. M. (Eds.). Integrated agricultural Production in Nigeria: Strategies and mechanisms for food security. pp. 171-188, NARP Mono.5.

Papademetriou, M. K. (2001). Issues and perspectives of rice production in Asia and the Pacific region. In Yield gap and productivity decline in rice production. Proc. Of Expert consultation, Rome 5-7 Sept.2000, p.39-67, FAO, Rome, Italy.

Shaib, B, Adedipe, N. O., Aliyu, A. and Jir, M. M. (1997). Federal Republic of Nigeria position Paper presented to the World Food Summit, Rome 1996. In: Shaib, B,

Adedipe, N.O., Aliyu, A. and Jir, M. M (Eds.). Integrated agricultural Production in Nigeria: Strategies and mechanisms for food security. pp.13-74, NARP Mono.5.

Vanguard Newspaper (2014). Rice consumption and importation in Nigeria, no solution in sight August 11th, 2014.