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EFFECTS OF CLIMATE CHANGE ON IRRIGATED RICE PRODUCTION IN BADAGRY LOCAL GOVERNMENT AREA OF LAGOS STATE, NIGERIA

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ABSTRACT

The study focused on the effects of climate on irrigated rice production in Badagry Local Government Area of Lagos State. It also examines the constraints the farmers faces in adapting to climate unpredictability. Purposive sampling was used to select a total of 120 farmers and were interviewed using a well structured questionnaire, descriptive statistical tools were used to describe the socio-economic characteristics and Regression model was used to determine effect of climate change on irrigated rice. The descriptive statistics and regression model was used to analyzed the data collected, the result revealed that 50.8% of farmers were between the ages of 31-40 years 29.2% of the respondents were less than 30 years giving a mean age of 36years, 71.7% were married, 28.3% of the irrigated farmers were single 50.8% of the farmers had tertiary education 45.9% had secondary education 84.2% of the sample survey had household size that ranges between 1-5 and 15.8% had household size that ranges between 6-10 85.8% signified farming had their primary occupation while 2.5% of the respondents were teachers. The farm size of the respondents were measured in acres, the largest number of the respondents which is 65% had between 1-5 acres of land. The empirical results of the regression analysis model revealed that vocational and adult education were significant at ($P<0.05$), farm size ($P<0.05$), income ($P<0.1$), level of awareness ($P<0.01$), primary education ($P<0.01$), level of adaptation ($P<0.1$), favourable education ($P<0.01$), sunlight intensity ($P<0.1$) all had significant impact on the effect of climate change on irrigated rice with intercept of -49225.13. It was revealed from the study that significant numbers of the respondents were mainly farmers and they were educated, this might be due to having more knowledge about the effect of climate change and the way to cope with it. The results however suggest that with increasing access to extension services, credit facilities, improved electricity supply, access to adequate water supply, farmers can adopt various adaptation measures that can lead to improvement in practicing irrigated rice production.

KEYWORDS: Effects, Climate Change, Irrigation, Rice, Production, Nigeria

INTRODUCTION

Rice is the seed of the monocot plant also known as mono-cotyledon (one seed) *Oryza sati*va (Asian rice) or *Oryza glaberrima* (African rice) and it is also a member of the grass family (Gramineae). Rice is a cereal grain, which is the most important staple food (a food that is eaten regularly and in such quantities as to constitute the dominant part of the diet and supplies a major proportion of energy and nutrient needs) for a large part of the population in Nigeria. It is the grain with the second highest production after Maize (Wikipedia, 2013). Rice is relatively easy to produce and is grown for both sale and consumption. In some areas, there is a tradition of growing but for others its cultivation is relatively recent.

Rice is mostly eaten steamed or boiled, but it can also be dried and grinded into flour. Like most grains, rice can be used to make beer and liquors. Rice is used to make paper and can also be woven into mats, hats, and other products. Rice is used as livestock feed formation with recent development in livestock production. Rice by-products such as rice bran, rice husk are mixed with other ingredients as livestock feed. Rice bran can also be used in poultry as litters (Onwueme and Sinha, 1991).

The traditional method of cultivating rice is flooding the field, while or after, setting the young seedlings. This simple method requires sound planning and servicing of the water damming and channelling, but reduces the growth of less robust weed and pest plants that have no submerged growth state, and deters vermin while flooding is not mandatory for the cultivation of rice, all other methods of irrigation requires higher effort in weed and pest control during growth periods and different approach for fertilizing the soil (Imolehin et al., 2000). Once the field has enough water the rice grows quickly with some varieties reaching maturity within three months. Some farmers grow the rice seedlings in nurseries and then transplant them into the main field, as this reduces vulnerability to disease, other see the transplanting process as too costly in time. Varieties which mature quickly are preferred by farmers, as this reduces the risk of exposure to disease and allows the land to be used for other crops (Adu-Kwarteng, 2003).

According to (Odjigo, 2010) the production of irrigated rice in Nigeria is mostly in the rural areas, which is dominated by aged people and children. Young and able-bodied men that are capable of farming have migrated into the urban areas searching for greener pastures, thus leaving older men, who are not strong enough to work on the farm, making the farm work slow and less productive. The Nigerian government, both past and present recognized the importance of rice farming in Nigeria.

Statement of Problem

Rice production in Nigeria is faced with a lot of problem. The problem confronting rice cultivation and production in some part of Nigeria may be due to drought, flooding, salt stress, and extreme temperatures, insufficient rainfall, all of which are expected to worsen with climate change. Changes in rainfall patterns and increase in temperature will bring about unfavourable growing conditions into the cropping system there by modifying growing season which could subsequently reduce the crop productivity. Local rice has not kept up with the domestic consumption demand of the Nigerian's populace and consequently rice is still imported (Singh and jain, 1997).

Climate change is perhaps the most serious environmental threat facing mankind worldwide. It affects agriculture for instance in several ways, one of which is its direct impact on food production. Climatic change, which is attributable to natural climate cycle and human activities, has adversely affected agricultural productivity in Africa (Ziervogel et al., 2006). As the planet warms, rainfall patterns shift, and extreme events such as droughts, floods, and forest fires become more frequent(Zoellick 2009), which results in poor and unpredictable yields, thereby making farmers more vulnerable, particularly in Africa (UNFCCC, 2007). Farmers (who constitute the bulk of the poor in Africa), face prospects of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases (Zoellick 2009). It is projected that crop yield in Africa may fall by 10-20%by 2050 or even up to 50% due to climate change (Jones and Thornton, 2003), particularly because African agriculture is predominantly rain-fed and hence fundamentally dependent on the vagaries of weather. As the people of Africa strive to overcome poverty and advance economic growth, this phenomenon threatens to deepen vulnerabilities, erode hard-won gains and seriously undermine prospects for

development (Zoellick 2009). There is therefore the need for concerted efforts toward tackling this menace. Much of climatic change agricultural research has tended to concentrate on assessing the sensitivity of various attributes of crop systems (e.g. crop/livestock yields, pest, diseases, weeds etc) - the bio-physical aspects of food production, with little or no regard to the socioeconomic aspects. These partial assessments, most often consider climatic change effects in isolation, providing little insight into the level of awareness of the farmers on the issue, what and how they are doing to cope with climate change, etc. To better address the food security concerns that are central to economic and sustainable development agenda, it is desirable to also address these aspects of climate change and agriculture. Wisner et al., (2004) reports that the vulnerability of agriculture is not determined by the nature and magnitude of environmental stress like climate change per se, but by the combination of the societal capacity to cope with and/or recover from environmental change. While the coping capacity and degree of exposure is related to environmental changes, they are both also related to changes in societal aspects such as land use and cultural practices. This could be at the root of the much talked about poverty alleviation and food security for the vulnerable groups in Africa, who are most at risk when agriculture is stressed by climate change, as noted before. In addition, there is need for increased awareness, teaching, learning and research by Universities and Research Institutes so as to develop a multi-pronged capacity to tackle this imminent danger which is slowly eroding the gains of the fight against starvation, hunger and poverty among farming communities in Africa. This study aims to provide the most cost-effective and sustainable indigenous climate change adaptation practices in southeast Nigeria.

- What are the socio- economic characteristics of the respondent in the study area?
- How does climate change affect the production of rice farming in the study area?
- What is the effect of irrigation on rice production?
- What are the factors that determine rice productivity?

Objectives of Study are to:

- identify the socio- economic characteristics of rice farmers in the study area.
- examine the effect of climate change on the production of rice faming in the study area.
- evaluate the importance of irrigation on rice production in the study area.
- Analyze the factors that determine rice productivity among farmers in the study area.

Materials and Methods

The Study Area: This study was carried out in Badagry local government area, a coastal town in Lagos state, Nigeria. Badagry is traditionally known as 'Gbagi'. It is situated between metropolitan Lagos and the border with Benin at Seme. It was founded in the early 15th century on a lagoon off the gulf of guinea; it protected harbour led to the town becoming a key port in the export of slaves to the Americans, which are mainly Salvador, Bahia in Brazil. The study area is located between a latitude of 6.4167/6^{o}25`38`` N and a longitude of 2.8833/2$^{o}$ 54`23`` E. It has a land size of 170 sq metres (441km^2). Has an altitude of 118feet/35metres. As of the preliminary 2006 results, the municipality had a population of 241, 093. While using the 3.2% growth rate, the 2012 estimated population for the local government is 287, 382. It is situated in the South-West of Lagos state. The area subsists on fishing, salt extraction and arable crops production like

maize, yams, cocoyams, oil palms and cassava which is probably the most cultivated as it could be planted and harvested throughout the year among other varieties of crops. The climate is tropical with two distinct seasons. Usually, the wet season lasts from April to October while its dry season lasts from November to March. The Mean annual rainfall is between 2000 and 2200mm. Maximum temperature is 32.5^{o}C and relative humidity at 79.9%.

Source of Data

Primary data was collected through the use of structured questionnaires. The information elicited from the rice farmers include information on their socio-economic characteristics like sex, household size, farming experience, age, formal education, level of family head, access to credit facilities, primary occupation, yield of rice seed, variable input and output, price and capital assets among others. Personal observations were also made on the field.

Analysis of Data

The data collected were analyzed through the use of descriptive analysis, and regression model.

Explanation of Independent Variables

$Y = (X_1+X_2 +X_3..... X_n)$

X_1 = age of farmer

X_2 = sex

X_3 = marital status

X_4 = educational level

X_5 = sunlight intensity

X_6 = family size

X_7 = number of dependent person

X_8 = primary occupation

X_9 = rainfall

X_{10} = religion

X_{11} = income

X_{12} = farm size

X_{13} = years of farming experience.

Regression Analysis of the Determinant of the Effect of Climate Change on Irrigated Rice

The result of regression analysis shows the extent of the relationship between the independent variable (Farm size, income, level of awareness, level of adaptation, sunlight intensity, favourable climatic condition, disease prone environment, other education, and primary occupation) and the dependent variable Y.

The model used for the analysis is given below:

$Y = f(x_1, x_2, x_3, x_4, x_5, x_6, x7, x_8, x_9)$

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + e$

Where Y = output of Rice

X_1 = Level of education

X_2 = Farm size

X_3 = income

X_4 = level of awareness

X_5 = primary occupation

X_6 = level of adaptation

X_7 = favourable climatic conditions

X_8 = disease prone environment

X_9 = sunlight intensity

This was achieved using regression model as specified in the methodology. The result indicates that the F-value of 31.47 with $P < 0.01$. The R^2 is 0.8760 and the adjusted R^2 is 0.8482 which depicts that 84.82% of the dependent variable is been explained by the regressor, while the remaining 15.18% is due to factors outside those represented in the expression. Generally speaking the model has a good fit to the data. In the analysis, nine (9) of the nineteen (19) variable estimated were statistically significant at varying degree ranging between $P < 0.01$ and $P < 0.1$. The intercept is -49225.13 and this represent the autonomous coefficient for the irrigated rice farmers in the study area.

Vocational and Adult Education

The coefficient of vocational and adult educationist 117606.7 and it is statistically significant at $P < 0.05$. This means that vocational and adult educationist a significant determining factor of the effect of climate. It implies that a unit increase in vocational and adult education of education results in 117606.7 in the output level of irrigated rice. This might be due to having more knowledge and also being informed on the devastating effect of climate change and the ways to cope with it.

Primary Occupation

The coefficient of primary occupation is 84607.62 and it is statistically significant at $P < 0.1$. This means a unit increase in primary occupation (as more of the respondents tend to become full farmers) leads to 84607.62 increases in the level of output of the irrigated rice. This means the concentration on farming will give them the privilege to quickly notice any effect due to climate change which will help them to respond quickly and promptly and this will subsequently result in increased output.

Income

The coefficient is 1.770112 and it is statistically significant ($P < 0.01$). This means it is a significant determining

factor of the impact of climate change on irrigated rice production. It means a unit increase in income is a result of 1.770112 increases in the output of the irrigated rice.

Farm Size

The coefficient of farm size is 4, 119.223 and it is statistically significant (P < 0.05). It means a unit decrease in farm size leads to reduced output by N4119.223. this is in accordance with the apriori as decrease in farm size leads to a decrease in output.

Level of Awareness

The coefficient of level of awareness is 47277.4 and it is statistically significant (P < 0.01). This is in concordance with the apriori as it is expected that increased awareness on climate change effect should lead to minimized effect on output.

Level of Adaptation

The coefficient of level of adaptation is -37101.21 and it is significant at P<0.01. This means a unit increase in level of adaptation reduce the rice output by 37101.21 and this is in line with the apriori because high level of adaptation results from high impact of the climate change.

Sunlight Intensity

The coefficient of sunlight intensity is 149589.20 and it is statistically (P<0.1). This is not in line with the apriori because high intensity results in high evaporation and evapotranspiration which reduces the water content of the soil and plant which subsequently affect the level of production of the plant.

Favourable Climate Condition

The coefficient of climate condition being perceived by the respondent's is51608.56 and it is statistically significant at P < 0.05. This implies that a unit increase in favorability of climate condition results in 51608.56 increases in the output. This mean the respondents are of the view that the change in climatic condition is favorable to the irrigated rice.

Diseases Prone Environment

The coefficient of the environment being prone to diseases is 43622.73 P<0.1. This result shows that the environment is not prone to diseases and invariably it favours the improvement in the yield of irrigated rice.

Table 1: Regression Result

Variable	Coefficient	P-Value
Other education	117606.7	0.05
Farm size	4119.223	0.05
Income	1.770112	0.01
Level of Awareness	4720.4	0.01
Primary Education	84607.62	0.01
Level of Adaptation	-3710121	0.01
Favourable climatic condition	51608.56	0.05
Disease Prone Environment	43622.73	0.1
Sunlight intensity	149589.20	0.1

Source: Field survey, 2013.

*** Significant at 0.05%
** Significant at 0.01%
R-square = 0.8760
Adjusted R- squared = 0.8482

The R^2 is 0.8760 depicts that 87.60% of the dependent variable is been explained by the regressor, while the remaining 12.40% is due to factors outside those represented in the expression.

RESULTS AND DISCUSSIONS

Socio-economic Characteristics of Respondents

Age of the Respondents: Table 2 shows that, 50.8% were between the ages of 31-40 years, 29.2% of the respondents were less than 30 years of age, 14.2% were between 41-50 years of age and 5.8% falls between the ranges of 51-60 years. This implies that majority of the sampled respondents' fell between the ages of 31-40 years. The mean age is 36 years, which implies that majority of the respondent are still in their active and productive age.

Sex of the Respondents: Table 3 revealed that majority of the respondents (70%) was male, while the remaining 30% were female. This implies that male were the majority involved in farming and the cultivation of irrigated rice and this might be due to the enormous physical activities involved in irrigated rice farming operations.

Marital Status of the Respondents: Table 4 revealed that, 71.7% of the irrigated rice farmers were married, and 28.3% were single. This implies that majority of the respondents involved with irrigated rice production were married and their respective spouse can assist in the farming operation thereby reducing cost of hiring labour.

Level of Education of the Respondents: Table 5 revealed that, 50.8% of the farmers had tertiary education, 45.9% had secondary education, and 3.3% of the farmers had primary education. This implies that majority of the respondents were educated, but with different qualifications. The average years is spent in school is 16 years.

Household Size of the Respondents: Table 6 shows that, 84.2% of the sample surveyed had household size that ranges between 1-5 and 15.8% had household that ranges between 6 -10. This shows that majority of the respondents enjoy the luxury of family labour.

Income of the Respondents: Table 7 reveals that, 90% of the respondents earn less than or approximately 20 thousand naira. 5% of the respondents earn between 21-40 thousand naira, also 2.5 % earn between 61-80 thousand naira while 1.7% earn 81thousand and 0.8% of the respondents earn greater or equal to 41-60 thousand naira. This implies majority of the respondents are low class earners. The average income of the respondents is ₦19, 358.33

Farm Size of the Respondents: Table 8 shows that, 65% have between 1-5 acres of land, 21.7% have land size of 10.1 – 15.1 acres, 7.5% have between 5.1 – 10.0 while the lowest percentage of 5.8 have no land at all meaning they work on other peoples farm. This might be as a result of various land policies and may affect rice production. The average farm size is 6acres.

Years of the Farming Experience of the Respondent: Table 9 shows that, 95.8% of the respondent had 11-20 years experience in the practice, 3.3% had less or equal to 10 years' experience, while 0.8% of them had an experience of 21 years and above in the practice. This implies that majority of them had been in the system for long with only 3.3% of the having an experience that ranges from 0-10 years. The average year of experience is 9 years.

Farming System Adopted by the Respondents: Table 10 revealed that, 72.5% of the farmers practice mono cropping, 23.3% of the farmers practice mixed cropping, 1.7% practiced shifting cultivation, 1.7% practice shifting cultivation, while 0.8% of the farmers practice intercropping. This implies that majority of the farmers practice mono-cropping.

Years of Using Irrigation Farming: Table 11 shows that, 69.2% of the respondent had practiced irrigation for a period of two years, 15.8% have practiced irrigation for a period of one year, 10% had practiced irrigation for a period of three years, 4.2% had practiced irrigation for a period of 5 years, while 0.8% does not practice irrigation.

Source of Irrigation: Table 12 reveals that, 89.2% of the respondents were using borehole as their source of irrigation. 7.5 % of the respondents' used river, 0.8% used stream, while. This implies that majority of the respondents used borehole as their source of irrigation.

Adequacy of Irrigation: Table 13 reveals that, 91.7% of the respondents signified that their source of water is adequate enough for the practice of irrigation, while 8.3% signified that their source of water is not adequate enough for the practice of irrigation. We can infer that majority of the respondents had adequate source of water for the practice of irrigation

Rice Output in Naira Per Annum: Table 14 reveals that, 38.3% of the respondents earned between N101-200, 00 per annum, 33.3% of the respondents earned between N100, 000 per annum, 25% of the respondents earned between N301 -400, 000 per annum while the remaining 3.3% of the respondents earned between N401 – 500, 000 per annum.

Table 2: Distribution of Respondents According to Their Socio-Economic Characteristics

Age	Frequency	Percentage
<30	35	29.2
31-40	61	50.8
41-50	17	14.2
51-60	7	5.8
Total	**120**	**100**

Table 3

Sex	Frequency	Percentage
Male	84	70
Female	36	30
Total	**120**	**100**

Table 4

Marital Status	Frequency	Percentage
Single	34	28.3
Married	86	71.7
Total	**120**	**100**

Table 5

Education	Frequency	Percentage
Primary	4	3.3
Secondary	55	45.9
Tertiary	61	50.8
Total	**120**	**100**

Table 6

Family Size	Frequency	Percentage
1 – 5	101	84.42
6 – 10	19	15.8
Total	**120**	**100**

Table 7

Income	Frequency	Percentage
≤ 20 000	108	90.0
21 000 – 40 000	6	5.0
41 000 – 60 000	1	0.8
61 000 – 80 000	3	2.5
≥ 81 000	2	1.7
Total	**120**	**100**

Table 8

Farm Size (Acres)	Frequency	Percentage
0	7	5.8
1.0 – 5.0	78	65.0
5.1 – 10.0	9	7.5
10.1 – 15.0	26	21.7
Total	**120**	**100**

Table 9

Farm Experience	Frequency	Percentage
≤ 10	4	3.3
11-20	115	95.8
≥ 21	1	0.8
Total	**120**	**100**

Table 10

Farming Systems	Frequency	Percentage
Crop rotation	2	1.7
Mixed cropping	28	23.3
Shifting cultivation	2	1.7
Intercropping	1	0.8
Mono-cropping	87	72.5
Total	**120**	**100**

Table 11

Years of Irrigation	Frequency	Percentage
None	1	0.8
1	19	15.8

Table 11: Contd.,

2	83	69.2
3	12	10
5	5	4.2
Total	**120**	**100**

Table 12

Source of Irrigation	Frequency	Percentage
Well	3	2.5
Borehole	107	89.2
Stream	1	0.8
River	9	7.5
Total	**120**	**100**

Table 13

Adequacy of Irrigation	Frequency	Percentage
No	10	8.3
Yes	110	91.7
Total	**120**	**100**

Table 14

Rice Output Per Annum in Naira	Frequency	Percentage
≤ 100 000	40	33.3
101 000 – 200 000	46	38.3
201 000 – 300 000	30	25
401 000 – 500 000	3.3	4
Total	**120**	**100**

Source: Field Survey, 2013.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The general objective of this study is to analyze the effect of climate change on irrigated rice production in Badagry Local Government Area of Lagos State.

The mean age of the respondent is 36 years which implies that they were in their active age. The level of education of the respondent showed that 3.3% of the farmers had primary education, 45.9% had secondary education and 50.8% of the farmers had tertiary education. This implies that majority of the respondents were educated but with different qualification and the average years spent in school is 16 years.

Majority of the respondents were married 71.7% while the others are single 28.3%. It was revealed that 84.2% of the sampled surveyed had household size that ranges between 6-10. This shows that majority of the respondents enjoy the luxury of family labour.

The study also revealed that 95.8% of the respondents had no vocational or adult education while 4.2% of the respondents had adult education. 85.8% signified farming has their primary occupation while 2.5% of the respondents were teachers. Also 23% signified farming had their secondary occupation, 21.7% were involved in trading, also another 45% were teachers and the remaining 8.3% were involved in other things. This implies that majority of the sampled respondents are farmers.

It was revealed that 90% of the respondent earned less than or approximately ₦20, 000, 5% of the respondent earned between ₦21, 000 – ₦40, 000 also 0.8% earned between ₦41, 000 – ₦60, 000 while 2.5% earned ₦61, 000 – ₦80, 000 and 1.7% of the respondents earned greater or equal to 81, 000. This implies that majority of the respondents were low class earners. Majority of the farmers 72.5% practiced monocropping, while 1.7% of the farmers practiced intercropping, 1.7% of the respondents experienced low rice yield, while 98.3% of the respondents experienced high rice yield. Most of the farmers view climate change due to the causes of increase and decrease in agricultural productivity, 1.7% of the farmers did not view climate change as anything, while 94.2% of the farmers view climate change due to changes in environmental factors. It was also revealed that 26.7% of the farmers had high level of awareness, 70% of the farmers had moderate level of awareness while the remaining 3.3% of the farmers has low level of awareness, 80.8% of the respondents experienced favourable climate on their rice production activities, while 19.2% of the respondents experienced unfavourable climate on their production activities.

In addition 0.8% of the respondent does not practiced irrigation, 13.8% practiced irrigation for a period of one year, 69.2% practiced irrigation for a period of 2 years, 10% of respondents practiced irrigation for a period of 3 years, while 4.2% practiced irrigation for a period of 5 years.

Also it was revealed that 2.5% of the respondents were using well as their source of irrigation, 89.2% of the respondents uses borehole, 0.8% uses stream while 7.5% uses river. 8.3% of the respondents signified that the source of water is not adequate enough for the practices of irrigation while 91.7% signified that the source of water is adequate enough for the practice of irrigation. The main problems encountered during irrigation in the study area were inadequate source of water supply and financial constraints.

The effect of climate change in the world is sine-qua-non as the extinct of annual, plant species sporadically increase and this is tantamount to the depletion in the quality of life of human race. The study highlights some relatable climatic factors that affect irrigated rice production in the study area. These climatic factors were mainly rainfall, sunshine intensity and temperature. The socio-economic characteristics of the effect of climate change on irrigation rice farmers indicates that most of the respondents were male and most of them indulged in the cultivation of irrigated rice.

Based on the findings of the study in the study area, the following recommendations were made:

- Land tenure system in Nigeria should be reviewed so as to favour agriculture. This will increase availability of land for agriculture.
- There should be provision of labour-saving technologies so as to reduce work load on family and hired labour. This will increase rate of returns and also enhance the rice farmers to operate efficiently.
- There is need for the government to look into the electricity sectors because irrigation farming requires electricity/power supply to operate the system.
- The existing Dams should be monitored and put in use and also new dams should be created by both the federal and state government.
- Agricultural economist should work with other stakeholders such as Agronomist, Rural Sociologist, and Agricultural Extension Agencies to embark on massive campaign at helping the farmers to respond and cope

effectively with global warming as most of the farmers foreseen the effect of climate change on irrigated rice production as due to environmental conditions.

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APPENDICES

Questionnaire on the Effects of Climate Change on Irrigated Rice Production in Badagry Local Government Area of Lagos State

SECTION A (Respondent Details)

1. Age _____ years
2. Sex of respondent male/ female
3. Marital status: Single () married (), widow(er) (), divorced (), separated ()
4. Educational level: Number of years spent in formal school _____ years
5. Other education: vocational training (), adult education ()
6. Family size _____ persons
7. Number of dependent persons _____
8. Primary occupation: Teacher (), Farmer (), Others _____ please specify
9. Secondary occupation: Teacher (), Farmer (), Trader (), others _____ please specify
10. Religion: Christian (), Islam (), Traditional Religion (), Others _____ please specify
11. Income N_____ per hour/Day/week/month/year
12. Farm size _____acres
13. Years of farming experience: _____ years

SECTION B: EFFECT OF CLIMATE CHANGE ON RICE PRODUCTION

14. Farming system Adopted: Crop rotation (), Mixed cropping (), Shifting cultivation (), Intercropping (), Monocropping ()
15. Has there been any increase in rainfall pattern in the last year: Yes (), No ().
16. Has there been any change in Rice yield over the last year Yes (), No () If yes
17. What are the adaptive and management practices used to manage the prevailing effect of climate change?
18. What effect does the climate generally have on your rice production activities: Favourable (), unfavourable ()
19. Level of awareness: High (), Moderate (), Low ()
20. Level of adaptation: High (), Moderate (), Low ()
21. How do you view climate change? Increased agricultural activities (), punishment from God (), punishment from ancestors (), due to increased evil acts ()

SECTION C: EFFECT OF IRRIGATION ON RICE PRODUCTIVITY

22. How long have you been using irrigation? _____ Years

23. What is the source of irrigation? Well (), borehole (), stream (), river (),

dam (), pond (), others specify _____

24. Is the source of water adequate in supply to support the practise of irrigation?

Yes (), No ()

25. Is there any existing irrigation scheme or programme operating in your area or locality? Yes (), No ()

26. If yes, what kind of assistance have they rendered to you?

_____

27. The following are some likely problems encountered by the respondents; which one suit your conditions

a. There is no source of water at all

b. inadequate supply of water

c. others specify_____

SECTION D: FACTORS THAT DETERMINE RICE PRODUCTIVITY

28. What kind farming do you practice? Subsistence () Commercial ()

29. What is your rice output in naira per annum during the period of climate change?

₦…….

30. Do effects of climate change affect the price at which you sell? Yes () No ()

31. Which elements of climate affect your farm's level of production and at what level?

Elements	High	Low
Rainfall		
Temperature		
Relative humidity		
Wind		
Sunlight intensity		

32. Is the soil favourable for the production of rice? Yes () No ()

33. Is this locality prone to pest and diseases of rice? Yes () No ()

34. If yes what kinds of pests affect rice production in this locality _____

35. What kind of diseases affects rice production in this locality? _____

36. What method do you use in combating this pest and disease on your farm?

a. insecticides () d. weed control ()

b. herbicides () e. others specify _____

c. mixed cropping ()