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Climate Change Adaptation Measures Practiced by Rice Farmers in Benue State, Nigeria

[1]Mbah E.N. and [2]Ezeano C.I,
[1]Department of Agricultural Extension and Communication, University of Agriculture, Makurdi, Nigeria
[2]Department of Agricultural Economics and Extension, Nnamdi Azikiwe University, Awka, Nigeria

Abstract: The study identified climate change adaptation measures practiced by rice farmers in Benue state, Nigeria. Data were collected from a sample of 90 respondents using questionnaire/interview schedule. Frequency distribution, percentage, mean score and standard deviation were used in analyzing data for the study. Results revealed climate change adaptation measures practiced by rice farmers in the study area to include use of mixed cropping (M=1.89), zero tillage (M=1.87), adjustment of planting dates (M=1.81), value addition of produce (M=1.81), crop rotation (M=1.76), diversification in crop and livestock production (M=1.73), improved land management techniques (M=1.69), afforestation/planting of trees (M=1.69), early planting of rice (M=1.68), early harvesting of rice (M=1.66), among others. The respondents were constrained to use of climate change adaptation measures by non-availability of modern farm inputs (M=1.68), lack of access to weather forecasts (M=1.60), poor access to information relevant to adaptation to climate change (M=1.59), lack of modern processing facilities (M=1.52), poor extension service delivery (M=1.51), high cost of storage facilities, (M=1.50), etc. Stakeholders in agriculture should set up policies that will enhance rice farmer's access to relevant farm inputs such as improved seeds and drought resistance varieties to encourage greater productivity as well as improve their livelihoods. The study highlights that efforts are needed by the Nigerian government to encourage and promote the use of local languages in rural radio stations in disseminating information on climate change.

Keywords*: Climate Change, Adaptation, Constraints, Rice Farmers, Nigeria.*

I. INTRODUCTION

Smith and Skinner (2002) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of global atmosphere and which in addition to natural climate variability observed over comparable time periods. According to Intergovernmental Panel on Climate Change (IPCC) (2007), climate change is one of the most critical challenges facing humanity. It can cause worst forms of economic and security problems to humanity. It determines the health of the resources on which the economy depends and this phenomenon is one of the challenges confronting West Africa among other sub-regions of the world. Climate change however, arises from the release of greenhouse gases, carbon dioxide, water vapours and nitrous oxide into the atmosphere due to human activities, such as fossil fuel burning, gas flaring and deforestation.

In Nigeria, some areas like the Niger Delta regions receive more than normal rainfall, while some areas in the northern region such as Benue state receive small amount of rainfall as a result, growing seasons are changing, ecological zones are shifting and rainfall is becoming more unpredictable and unreliable both in its timing and volume (Breth, 2009). Remitez (2010) notes that unforeseen changes associated with global warming in temperature, carbon dioxide and rainfall are expected to impact negatively on rice production. Studies have shown in Benue State, Nigeria that increase in temperature due to climate change adversely affect rice crop physiology ultimately decreasing crop yield and grain quality (Smith and Skinner, 2002; Gumm, 2010).

Adaptation to adverse effects of climate change is a key issue for all countries, especially developing countries who are often the most vulnerable and least equipped to adapt. Adaptation is widely reorganized as a vital component of any policy response to climate change because it helps farmers achieve their food, income and livelihood security objectives in the face of changing climatic and socio-economic conditions such as drought and flood, and volatile short term changes in local and large-scale markets (Kandlinkar and Risbey, 2000).

Studies show that without adaptation, climate change is generally detrimental to the agriculture sector, but with adaptation, vulnerability can largely be reduced (Easterling *et al.*, 1993; Rosezwerig and Parry, 1994; Reilly and Schimmelpfennig, 1999; Smith and Skinner, 2002). The degree to which an agricultural system is affected by climate change depends on its adaptive capacity. Adaptive capacity is the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage to take advantage of opportunities or to cope with the consequences (IPCC, 2001). Thus, the adaptive capacity of a system or society describes its ability to modify its characteristic or behavior so as to cope better with changes in external conditions (Gladys, 2009).

Adaptation to climate change requires that farmers and/or communities first notice that the climate has changed, and then identify useful adaptation measures and implement them (Maddison, 2006). Adaptation to Climate change refers to any adjustment that occurs naturally within ecosystems or in human systems response to climate change that either moderates harm or exploits beneficial opportunities in response to actual or expected climate related environmental changes (IPCC, 2007). It looks into ways of responding to changes that pose greater risks to lives and livelihood with increasing damage related costs as climate change effects.

Adaptation measures always seek to reduce the risks and impacts of climate change, moderate the negative effects and exploit beneficial opportunity. Adaptation is a proactive process because it envisages possible future changes in the climate. The devastating effects of climate change can be reduced if appropriate adaptation measures are employed. Many agricultural adaptation options have been suggested in the literature which includes practicing zero tillage, planting of early maturing varieties of rice, use of high yielding varieties of rice, planting of cover crops to reduce loss of water from the soil, adjustment of planting dates, use of drought resistant rice varieties, use of weed tolerant varieties of rice, and use of organic manure, etc (Smith and Lenhart, 1990; Smith and Skinner, 2002; Kurulasuriya and Rosenthal, 2003; Maddison, 2006).

De Chavez and Tauli-Corpus (2008) noted that in Africa local farmers are practicing zero tilling in cultivation, mulching, control of diseases and harmful pests and improved land management techniques. Others are use of mixed cropping, crop rotation, diversification in crop and livestock production and planting of cover crops to conserve soil moisture.

Analysis of barriers to climate change adaptation indicates that there are constraints to climate change adaptive measures which includes lack of information, high cost of adaptation measures, shortage of labor, poverty and inadequate link to input and output markets. Most of these constraints are associated with poverty. Lack of funds hinders small- scale farmers from getting the necessary resources and technologies (Nwafor, 2007; Jagtap, 2007).

Apata *et al.*, (2009) reported that the most adverse effects of climate change are felt mainly by developing countries especially those in Africa due to their low level of coping capabilities. International Fund for Agriculture and Development (IFAD) (2009) noted that the capacity of local communities to adapt to climate change and mitigate its impacts will also depend on their socio- economic and environmental conditions as well as available resources. The questions therefore are: What are climate change adaptation measures practiced by the respondents? What are constraints to use of adaptation measures by the respondents?

The study therefore aims to:

1. Identify climate change adaptation measures practiced by the respondents; and
2. Ascertain constraints to use of adaptation measures by the respondents.

II. METHODOLOGY

The study was carried out in Benue State, Nigeria. Benue State was created on February 3, 1976. The state derives her name from River Benue, the second largest river in the country and the most prominent geographical feature in the state. Benue State has a land mass of about 33,955 square kilometers with a population of 4, 219244 people (National Population Commission (NPC), 2006). Benue State is made up of 23 Local Government Areas and three (3) geopolitical zones namely; Zone A, B and C. The major tribes are Tiv, Idoma and Igede. Other tribes in the state are Etulo, Jukum, Fulani/Hausa, Akweya and Nyifon. Major economic activities of the people are mostly farming, fishing and trading. Crops grown in these zones include roots and tubers such as yam, cassava, cocoyam, and sweet potatoes, cereals like sorghum, maize, millet and rice. Rice is a major staple produced in large quantities in the state. Oil seed crops that are produced include soybeans and groundnut. Citrus, mango, oil palm, cashew nut and guava are also produced in appreciable quantities. Livestock namely; cattle, sheep, goats, poultry and pigs are also kept.

The population of the study consisted of all rice farmers in the study area. Zone C was selected out of the three zones in the state because of proximity and due to the fact that rice is one of the major crops grown in the area. Zone C is made up of nine (9) blocks. Two out of the nine blocks were selected for the study. Also, two (2) circles were selected randomly from each of the blocks. In Agatu block, Obagagi and Aila circles were selected using simple random sampling technique. Obagaji had a total population of 200 rice farmers, and Aila had 150, while in Apa block, Edikwu and Adijah circles were also selected using simple random sampling technique. Edikwu had a total population of 100 rice farmers, while Adija had a total of 50 rice farmers. Due to the enormity of the population not all the respondents were selected for the study. In Obagaji, 36 rice farmers were selected, 27 rice farmers were selected in Aila, while in Edikwu and Adija, 18 and 9 rice farmers were selected, respectively using 18% of the population, giving a total sample size of 90 respondents used for the study.

Data were collected using interview schedule/ questionnaire. The questionnaire/interview schedule was divided into two (2) sections (A-B) based on the specific

objectives of the study. Section A focused on climate change adaptation measures practiced by the respondents, while section B centered on constraints to use of adaptation measures by the respondents. Data were analyzed using frequency distribution, percentage, mean score and standard deviation.

III. RESULTS AND DISCUSSION

A. Climate Change Adaptation Measures Practiced by Rice Farmers

Adaptation measures to climate change as indicated by the respondents were use of mixed cropping (M=1.89), zero tillage (M=1.87), adjustment of planting dates (M=1.81), value addition of produce (M=1.81), crop rotation (M=1.76), diversification in crop and livestock production (M=1.73), improved land management techniques (M=1.69), afforestation/planting of trees (M=1.69), early planting of rice (M=1.68), early harvesting of rice (M=1.66), planting improved varieties of rice (M=1.57), mulching (M=1.57), bush fallowing to increase soil fertility (M=1.54) and use of weed tolerant varieties of rice (M=1.51) (Table 1). The finding supports a study carried out by IPCC (2007) which emphasized the need for diversification into new plant species and varieties that would have higher resistance to increased temperature and reduced rainfall, adapting zero/minimum tillage and other appropriate techniques to reduce soil erosion and loss of organic nutrients, increase in soil moisture availability as well as reduction in weeds and pests infestation.

Table 1: Distribution of respondents according to climate change adaptation measures in rice production

Adaptation measures	Mean scores (M)	Standard deviation (SD)
Zero tillage	1.87	0.747
Planting early maturing varieties of rice	1.61	0.534
Use of high yielding varieties of rice	1.44	0.543
Afforestation/planting of trees	1.69	0.512
Planting of cover crops to reduce loss of water from soil	1.32	0.545
Early harvesting of rice	1.66	0.584
Mulching	1.57	0.601
Adjustment of planting dates	1.81	0.517
Use of drought resistant rice varieties	1.31	0.593
Erection of dams for storing water	1.44	0.547
Early planting of rice	1.68	1.225
Use of organic manure	1.49	0.625
Bush fallowing to increase soil fertility	1.54	0.689
Planting of improved variety of rice	1.57	0.619
Diversification in crop and livestock production	1.73	0.536
Value addition of produce	1.81	0.579
Crop rotation	1.76	0.659
Use of mixed cropping	1.89	0.679
Use of weed tolerant varieties of rice	1.51	0.675
Improved land management techniques	1.69	0.627

Source: Field survey, 2015

B. Constraints to Use of Adaptation Measures of Climate Change in Rice Production

Major constraints to use of adaptation measures to climate change include non-availability of modern farm inputs (M=1.68), lack of access to weather forecasts (M=1.60), poor access to information relevant to adaptation to climate change (M=1.59), lack of modern processing facilities (M=1.52), poor extension service delivery (M=1.51), high cost of storage facilities, (M=1.50), government inability to response/come to the aid of people affected with climate change e.g. flood (M= 1.49) and high cost of farm inputs such as fertilizer, herbicides, etc (M=1.48), among others (Table 2). This finding agrees with Mendelson and Williams (2004) who stated that lack of money hinders small scale farmers from getting the necessary resources and technologies due to the fact that adaptation strategies are very costly which make farmers vulnerable to the negative effects of climate change. This is in agreement with a study carried out by Apata *et al.*, (2009) which reported that the most adverse effects of climate change are felt mainly by developing countries, especially those in Africa due to their low level of coping capacities.

Table 2: Distribution of respondents according to constraints to use of climate change adaptation measures

Constraints to climate change adaptation measures	Mean score (M)	Standard deviation (SD)
Limited knowledge on adaptation measures	1.27	0.450
High cost of farm inputs such as fertilizer, herbicides, etc	1.48	0.939
High cost of irrigation facilities	1.27	0.536
Poverty among people living in rural areas	1.29	0.479
Unavailability of labour saving technologies for easy farming operation	1.27	0.536
Lack of access to credits facilities	1.29	0.479
Government inability to respond/come to the aid of people affected with climate change such as flood	1.49	0.544
Poor access to information relevant to adaptation to climate change	1.59	0.559
Lack of access to weather forecasts	1.60	0.577
Lack of financial resources	1.33	0.599
High cost of improved rice varieties	1.44	0.563
Poor extension service delivery	1.51	0.546
High cost of farm labour	1.41	0.634
Non-availability of modern farm inputs	1.68	0.632
High cost of storage facilities	1.50	0.707
Lack of modern processing facilities	1.52	0.691

Source: Field survey, 2015

CONCLUSION AND RECOMMENDATIONS

Adaptation measures to climate change indicated by the respondents were zero tillage, planting early maturing varieties of rice, afforestation/planting of trees, improved land management techniques, use of mixed cropping, crop rotation, value addition of produce and diversification in crop and livestock production. Constraints to use of adaptation measures to climate change indicated were poor access to information relevant to adaptation to climate change, lack of access to weather forecasts, non-availability of modern farm inputs, poor extension service delivery and lack of modern processing facilities, among others. Stakeholders in agriculture should set up policies that will enhance rice farmer's access to relevant farm inputs such as improved seeds and drought resistance varieties to encourage greater productivity as well as improve their livelihoods. Efforts are highly needed by the Nigerian government to encourage and promote the use of local languages in rural radio stations in disseminating information on climate change.

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