



Indigenous technologies for adaptation to climate change by crop farmers in Ogbia local government area of Bayelsa state, Nigeria

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General Note



Article is recommended to print as color version in recycled paper. *Save Trees, Save Climate.*

ABSTRACT

This study investigated indigenous technologies for adaptation to climate change by crop farmers in Ogbia Local Government Area of Bayelsa State. Specifically, the study assessed the socio-economics characteristics of crop farmers, farmers' awareness to climate change, indigenous technologies employed by crop farmers and constraints to adaptation practices. A simple random sampling technique was used to select two hundred (200) respondents for the study. Data collected from the respondents through questionnaires were analyzed using descriptive statistics (simple mean and percentages). Results obtained from the study

showed that farmers in the study area were mostly male, with a mean age of 42.2 years. Major climate related constraints observed were increasing hotness, increasing flood, coastal erosion, rise in sea level, early arrival of rain, late arrival of rain, incidence of drought, unpredictable rain, low rainfall intensity, drying of rivers, streams and lakes, high wind speed, provenance of pests and diseases, high rate of weed growth, premature ripening of fruits and low crop yield. Indigenous technologies employed by farmers in Ogbia local government area of Bayelsa State for climate change adaptation are early planting of crops, use of early maturing crop varieties, employing mixed cropping, use of climate tolerant varieties, mulching of farms, application of organic manures, reduction of farm size, use of zero tillage, diversification into off-farm activities, and clearing the land during flooding. It is therefore recommended that relevant bodies should from time to time hold seminar and workshop in the study area on the issue of climate change, disseminate information early on climate change issues, empower farmers by granting them loan and credit facilities as well as provision of early maturing and climate change tolerant crop varieties. It is further suggested that Extension Workers regularly visit farmers to ascertain their challenges so as to prepare them ahead of time.

Key words: Indigenous Technologies, Climate Change, Crop Farmers, Adaptation

1. INTRODUCTION

Climate change refers to any long term significant change in the average weather that a given region experiences. According to the intergovernmental panel on climate changes (IPCC, 2014), the basic concept of climate change is simple, change in atmospheric concentration of gasses changes the behavior of the climate is expected to change. Thus climate change is the result of high concentration of green house (Heat trapping) gases could be anthropogenic (human factors) or due to natural causes; anthropogenic factors have been proven to be the chief causes of the rapid rise of global warming (United Nations Framework Convention on Climate Change, 2007). Human factors causing this unequivocal rise in atmospheric temperature include electricity generation activities, industries, agriculture, transport and domestic activities (WHO, 2013; IPCC 2014),

Climate change upsets seasonal cycles, destroys ecosystems and water supply, causes sea levels to rise and affects agriculture and food production. Brown, et al (2003) postulated and predicted that one of the sectors most sensitive to global warming is agriculture and its productivity in general could decline between 10 to 20 percent by 2080. For some countries, the decline in yield in rain-fed agriculture could be as much as 50 percent.

In developing countries, the least emitters of green house gases, are feeling the impacts of climate change more than the developed countries due to their high dependence on climate variable agriculture and poor coping capability (Odjugo; 2010; WHO, 2013). Nigerian is one of such developing countries with prediction that it would be one of the countries that would be most hit by climate change in the near future (Mendelson, et al. 2000). Reports show that Nigeria is already facing the deleterious effect of climate change such as change in rainfall pattern, desertification, changes in natural flora and fauna, flooding and drought (Odjugo, 2010b; IPCC, 2014; WHO, 2013). Bello et al (2012) reported that within the period of 105 years, data gotten from various sources show that temperature increase by 1.1°C while rainfall decreased by 1mm in Nigeria.

Attaining food security is one of the critical challenges bedeviling many developing countries especially those of the sub-Saharan Africa occasioned by the impacts of climate change on agriculture. There is no gain saying that climate change is already impacting adversely on agriculture but innovation to tame it for positive production comes handy. For centuries, rural farmers have evolved various survival strategies to combat the adverse effects of climate variability on crop production though site-specific. Some of the schemes are multiple cropping systems, cultivating drought resistant or tolerant crops and diversification of livelihood activities (Oyewole, 2015).

Ogbia Local Government Area of Bayelsa state has a large arable land for the production of varieties of crops such as plantain, banana, cassava, water yam, cocoyam, groundnut, sugar cane, sweet potato and vegetables. Several studies (Wassmann and Dobermann, 2007; Agarwal, 2008; Abu, et al, 2011; Hassan, 2014; Idoma, et al, 2016) have examined the effects of climate change on crop production and various adaptation technologies of farmers in sub-Saharan Africa and beyond. However, the outcome in a given site depends on the level of change, the response of the particular crops and site-specific management. Thus, to understand site-specific impacts of climate change on crop production and to recommend appropriate remedial measure, it is pertinent to investigate climate change impact and farm level adaptation technologies using farm level survey data. This is the rationale for this present study: indigenous technologies for adaptation to climate change by crop farmers in Ogbia Local Government Area of Bayelsa State, Nigeria.

Hence the following objectives guided the study:

1. identify the socio economic characteristics of crop farmers in Ogbia Local Government Area of Bayelsa State.
2. evaluate the awareness level of crop farmer to climate change in Ogbia Local Government Area of Bayelsa State.
3. assess the various indigenous technologies employed by crop farmers in Ogbia Local Government Area of Bayelsa State for climate change.
4. examine crop farmers' constraints to adaptation to climate change in Ogbia Local Government Area of Bayelsa State

2. MATERIALS AND METHODS

Description of the Study Area

Ogbia Local Government Area of Bayelsa State was created out of the old Brass Local Government Area of old Rivers State on 1st October, 1996 alongside Bayelsa State. It is made up of three political constituencies of Ayama, Emeyal and Oloibiri, respectively. Ogbia is on latitude 4.47°N and longitude 6.33°E. Ogbia LGA has a total land area of 695km² with a population of 179,926 people (2006 Census) and it is bordered by the North by Yenagoa LGA, West by Southern LGA, South by Nembe and Brass LGAs and East by Abua-Odual LGA of Rivers State. It has two distinct seasons, the rainy season (2000 – 2500mm) which lasts from February to October and the dry season which begins from late November to January, with short harmattan between December and January. Ogbia Local Government Area is an agrarian community lying on the fertile alluvial soils impacted by the seasonal flooding along the Ikoli River, a tributary of river Nun.

Methods

This study was carried out in ten communities of Ogbia Local Government Area of Bayelsa State. The communities were purposefully chosen because of their involvement in crop production. The communities include, Otabi, Otuogidi, Abobiri, Olobiri and Otuakeme, Otuasega, Imiringi, Kolo, Otuokpoti and Onuegbum. A simple random sampling technique was used to select 20 crop farmers from each of the ten communities, taking cognizance of gender balance.

Both primary and secondary data were used for the study. Primary data were collected using structured questionnaire administered to crop farmers in the study area, while secondary data came from Bayelsa State Ministry of Agriculture, journals and other relevant publications. The secondary data were used to validate information gathered from primary data. The questionnaire was given to educated farmers to fill, while illiterate ones were interviewed orally with the aid of trained research assistants.

Data Analysis

Objective 1: Information elicited from respondents on socio-economic activities was analyzed using descriptive statistics such as frequency counts and percentages. Objectives 2, 3 and 4: Respondents' responses to questions on Likert scale for agreement levels (1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree) were analysed using mean distribution. The values of four responses were added to get 10, which was divided further by 4 to get a mean of 2.5. Thus, variables with mean of 2.5 and above were significantly accepted and *vice versa*. Data were presented using tables.

3. RESULTS AND DISCUSSION

Socio economic characteristics of Respondents

Age, Sex and Marital Distribution

Table 1 shows data on the distribution of respondents by age, sex and marital status. It reveals further that majority (28%) of the respondents were between the ages of 46 – 50 years with mean age of 42.2years. This indicates that most of the crop farmers in Ogbia Local Government Area of Bayelsa State were within Middle Ages and are still active in farm business.

With respect to sex, Table 2 indicates that larger percentage (75%) of the respondents were male. This implies that crop farming in the area is male dominated. This present finding agrees with those reported by Idoma *et al.* (2016); Oluwasola, (2012). Idoma *et al.* (2016) found out that 68.8% of rice farmers in Agatu Local Government Area of Benue State were male, while Oluwasola, (2012), reported 94% of farmers in Ekiti State as males.

The marital status shows that 75% are married, 5% single, 20% divorced and 15% widowed as shown in Table 2. This shows that married people were more involved in crop farming. This finding is in line with those of Idoma *et al.* (2016); Fabiyi *et al.* (2007). Idoma *et al.* (2016) observed that out of the sample studied 35.8% of the farmers in Agatu Local Government Area of Benue were married. Fabiyi *et al.* (2007) in Gombe State observed about 50% of their sampled farmers being married, while 13% and 17% were divorced and widowed, respectively.

Table 1

Distribution of respondents by gender, age and material status

Parameter	Frequency (F)	Percentage (%)
Gender:		
Male	150	75%
Female	50	25%
Age:		
18-24	16	8%
25-30	24	12%
31-36	34	17%
37-45	44	22%
46-52	56	28%
53-59	20	10%
60 & above	6	3%
Marital Status:		
Single	10	5%
Married	150	75%
Divorced	40	20%

Source: field Survey, 2018

Household size, Education and Income

Table 2 is shows that 50% were fishers, 5% are training, 10% were civil servant, and 15% were politicians while 20% were hunters. Table 2 indicates that majority (80%) of the farmers had household size of 5 – 10 members. This study reveals that there is adequate labour for crop production in the study area. Blessing and Goodness (2015), confirmed this finding that household size as a proxy to labour availability reduces labour constraints.

On level of educational qualification, larger proportion (40%) of the farmers had First School Leaving Certificate. This implies that proper understanding of crop production technologies and agricultural programmes on climate change would be impaired. Wamsler *et al.* (2008) affirmed that formal education is a way to increase farmers' adaptive capacity to climate change. Thus, the higher the farmers' educational qualification the better their understanding of the necessary information on climate change as affect crop production in the study area.

Regarding estimated income per annum, majority (45%) of the farmers earn 51,000 - 100,000 naira. This is an indication crop farmers in Ogbia Local Government Area of Bayelsa State are of low income holdings, which could impact negatively on their capacity to acquire required inputs for adaptation to climate change. The finding is in tandem with that of Idoma *et al.* (2016) that farmers in Agato Local Government Area of Benue earned an annual income of less than 50,000 naira, making them low income holdings. It also consistent with Deressa *et al.* (2009) who found a positive impact of farm income on the probability of adoption of climate change adaptation strategies in Nile basin of Ethiopia.

Table 2

Distribution of respondents by household size, education and income status

Parameter	Frequency (F)	Percentage (%)
Household (Family) Size		
0-4	38	19%
5-10	140	70%
11 & above	22	11%
Income Per Annum		
10,000 – 50,000	80	40%
51,000 – 100,000	90	45%
101,000 – 150,000	20	10%
Above 150,000	10	5%

Educational		
FSLC	80	40%
WAEC	40	20%
NCE/OND	38	19%
HND/B.Sc	20	10%
M.Sc	0	0%
Ph.D	0	0%
None	20	5%
No formal Education	12	6%

Source: Field Survey, 2018

Farm size, Occupation, Types of crop cultivated and Farming experience

Table 3 shows that greater proportion (50%) of the crop farmers had farm sizes of 1-3 hectares. This implies that these farmers are mainly small scale producers. The finding agrees with Olayide (1992) that Nigerian farmers are small scale farmers that cultivated small areas of land.

Based on farming experience, Table 4 indicates that nearly half (48%) of the sampled farmers have farming experience of 21-30 years. This is an indication that the farmers have sufficient knowledge of crop production and impacts of climate change on crop production in the study area. The result agrees with the finding of Obinne (1991) who reported that long farming experience is an advantage for increased production.

Regarding types of crop cultivated, Table 4 shows that majority (27%) of the farmers cultivate plantain. This corroborates with the higher number of male farmers in the study area stated. Plantain is a base crop cultivated mainly by male farmers most plantain producing communities in the tropics.

Table 3

Distribution of respondents by farm size, occupation, types of crop cultivated and farming experience

Parameter	Frequency (F)	Percentage (%)
Farming Experience		
1-10	18	9%
11-20	74	37%
21-30	96	48%
31-40	12	6%
41-50	0	0%
Above 50		
Types of crop cultivated		
Cassava	22	11%
Water yam	10	5%
Other yam	10	5%
Cocoyam	24	12%
Plantain	54	27%
Banana	40	29%
Okra	12	6%
Pumpkin	8	4%
Pepper	0	0%
Maize	0	0%
Rice	0	0%
Sugarcane	6	3%
Garden egg	14	7%
sweet potato	0	0%

Source: Field Survey, 2018

Knowledge and Awareness of Climate Change

The data presented in Table 4 above show the level of awareness of farmers to climate change in Ogbia local government area of Bayelsa State. The table indicates that more than half of the farmers strongly agreed and accepted that increasing hotness, increasing flood, coastal erosion, rise in sea level, early arrival of rain, late arrival of rain, incidence of drought, unpredictable rain, low rainfall intensity, drying of rivers, streams and lakes, high wind speed, provenance of pests and diseases, high rate of weed growth, premature ripening of fruits and low crop yield are indications of climate change in Ogbia local government area of Bayelsa State. This finding is in agreement with Oladipo (2011) that Nigeria has been experiencing temperature increase of about 0.2 – 0.3°C per decade in all the ecological zones.

Table 4

Mean responses on the level of awareness of farmers to climate change in Ogbia Local Government Area of Bayelsa State

S/N	Level of Awareness	SA	A	D	SD	Total	$\bar{X}$	Remarks
1	Increasing hotness	102	84	8	6	200	3.41	Accepted
2	Increasing flood	120	60	16	4	200	3.48	Accepted
3	Coastal erosion	110	62	20	8	200	3.37	Accepted
4	Rise in sea level	122	60	18	0	200	3.52	Accepted
5	Early arrival of rain	112	84	8	6	200	3.41	Accepted
6	Late arrival of rain	132	62	6	0	200	3.63	Accepted
7	Incidence of drought	124	60	16	0	200	3.54	Accepted
8	Unpredictable rain	120	60	16	4	200	3.48	Accepted
9	Low rainfall intensity	106	52	30	12	200	3.26	Accepted
10	Drying of rivers, streams and lakes	140	50	10	0	200	3.65	Accepted
11	High wind speed	110	44	40	6	200	3.19	Accepted
12	Provenance of pests and diseases	124	60	16	0	200	3.54	Accepted
13	High rate of weed growth	140	50	10	0	200	3.65	Accepted
14	Premature ripening of fruits	120	52	18	10	200	3.41	Accepted
15	Low crop yield	118	80	2	0	200	3.57	Accepted

Source: Field survey, 2018

Indigenous Technologies employed by farmers for Climate change Adaptation

The data presented in Table 5 show the indigenous technologies employed by farmers in Ogbia Local Government Area of Bayelsa State for climate change adaptation. The table contained items 16-25 with their mean scores of 3.72, 3.96, 3.56, 3.84, 3.40, 3.04, 3.70, 3.68, 3.20 and 2.97 respectively. These indicate that early planting of crops, use of early maturing crop varieties, employing mixed cropping, use of climate tolerant varieties, mulching of farms, application of organic manures, reduction of farm size, use of zero tillage, diversification into off-farm activities, and clearing the land during flooding are the indigenous technologies employed by farmers in Ogbia Local Government Area of Bayelsa State for climate change adaptation. This investigation agree with those of

Idoma *et al.* (2016) and Speranza *et al.* (2010) who have shown that resource poor farmers have rich and sophisticated indigenous agro-ecological knowledge for climate change adaptation.

Table 5

Mean responses on the indigenous technologies employed by farmers in Ogbia Local Government Area of Bayelsa State for climate change adaptation

S/N	Indigenous Technologies	SA	A	D	SD	Total	$\bar{X}$	Remarks
16	Early planting of crops	168	24	0	2	100	3.72	Accepted
17	Use of early maturing crop varieties	192	8	0	0	100	3.96	Accepted
18	Employing mixed cropping	120	72	8	0	100	3.56	Accepted
19	Use of climate tolerant varieties	184	8	0	8	100	3.84	Accepted
20	Mulching of farms	140	40	0	0	200	3.4	Accepted
21	Application of organic manures	100	60	10	8	200	3.04	Accepted
22	Reduction of farm size	140	60	0	0	200	3.7	Accepted
23	Use of zero tillage	152	30	0	8	200	3.68	Accepted
24	Diversification into off-farm activities	140	20	0	20	200	3.2	Accepted
25	Clearing the land during flooding	70	62	60	8	200	2.97	Accepted

Source: Field Survey, 2018

Farmers' constraints to adaptation to climate change in Ogbia Local Government Area of Bayelsa State

The data presented in Table 6 reveal farmers' constraints to adaptation to climate change in Ogbia Local Government Area of Bayelsa State. The table contains item 26-34 with their mean scores of 3.25, 2.93, 3.33, 3.28, 3.54, 3.41, 3.53, 3.42 and 3.61 respectively, which is above of 2.50. Thus, this implies that the respondents accepted that insufficient credit facilities, lack of credit facilities, poor information on climate change, poor knowledge of mitigation and adaptation, poor economic status of farmers, lack of improved and early maturing varieties, insufficient early maturing crop varieties, inadequate extension services, and lack of storage facilities during harvest for future use are the farmers' constraints to adaptation to climate change in Ogbia Local Government Area of Bayelsa State. This result is in line with the findings of Idoma *et al.* (2016). Other workers (Smith, 2007; Bryan *et al.*, 2009) further confirmed the present finding. They postulated that the constraints of farmers adaptation to climate change include unavailability of capital, rate of capital stock turnover, rate of technological development, risk attitudes, need for research and outreach, consistency with traditional practices, pressure for competing uses of agricultural land and water, demand for agricultural products, high costs for certain enabling technologies.

Table 6

Mean responses on the farmers' constraints to adaptation to climate change in Ogbia Local Government Area of Bayelsa State

S/N	Constraints	SA	A	D	SD	Total	$\bar{X}$	Remarks
26	Insufficient credit facilities	90	80	20	10	200	3.25	Accepted
27	Lack of credit facilities	70	64	48	18	200	2.93	Accepted
28	Poor information on climate change	50	34	15	1	200	3.33	Accepted
29	Poor knowledge of mitigation and adaptation	94	72	30	4	200	3.28	Accepted
30	Poor economic status of farmers	124	60	16	0	200	3.54	Accepted
31	Lack of improved and early maturing	120	52	18	10	200	3.41	Accepted

	varieties							
32	Insufficient early maturing crop varieties	120	66	14	0	200	3.53	Accepted
33	Inadequate extension services	108	70	20	2	200	3.42	Accepted
34	Lack of storage facilities during harvest for future use.	140	42	18	0	200	3.61	Accepted

Source: Field Survey, 2018

4. SUMMARY AND RECOMMENDATIONS

The study accessed indigenous technologies for adaptation to climate change by crop farmers in Ogbia Local Government Area of Bayelsa State. Primary data were collected using structured questionnaire, while secondary data were sourced from journals and other relevant publications. Data collected from the respondents were analyzed using simple mean and percentages.

The farmers in the study area mostly male, and were elderly people, married, with family sizes, of 5-10, having farm sizes of 1-3 hectares with farming experience of 21-30 years. Farmers are very much aware of the impact of climate change such as increasing hotness, increasing flood, coastal erosion, rise in sea level, early arrival of rain, late arrival of rain, incidence of drought, unpredictable rain, low rainfall intensity, drying of rivers, streams and lakes, high wind speed, provenance of pests and diseases, high rate of weed growth, premature ripening of fruits and low crop yield.

Indigenous technologies employed by farmers for climate change adaptation include, early planting of crops, use of early maturing crop varieties, employing mixed cropping, use of climate tolerant varieties, mulching of farms, application of organic manures, reduction of farm size, use of zero tillage, diversification into off-farm activities, and clearing the land during flooding. However, farmers are faced with challenges in climate change adaptation as follows: insufficient credit facilities, lack of credit facilities, poor information on climate change, poor knowledge of mitigation and adaptation, poor economic status of farmers, lack of improved and early maturing varieties, insufficient early maturing crop varieties, inadequate extension services, and lack of storage facilities during harvest for future use.

It is therefore recommended that

1. Government should from time to time hold seminar and workshop in the study area in order to educate farmers on the issue of climate change
2. Government should empower farmers in Ogbia Local Government by granting them loan and credit facilities.
3. Early information should be given to farmers concerning climate change issues to enable them prepare and provide means of adapting to such change
4. Extension workers should regularly visit farmers in Ogbia Local Government Area to know the challenges they face in their farms in order to proffer solution to them.

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