Constraints to Farmers' Choice of Climate Change Adaptation Strategies in Ondo State of Nigeria

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Abstract

Nigeria being dependent on rain-fed agriculture and with low level of socio-economic development is highly affected and vulnerable to climate change. It

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is crucial for farmers to adapt to the never ending climate change. However, there are constraints to adaptation strategies used by the farmers. This study therefore identified some of the constraints to the farmers' choice of climate change adaptation strategies in Ondo State, Nigeria. A multistage sampling procedure was used in selecting one hundred and sixty respondents for the study. Data collected with a well-structured interview schedule were analyzed using frequency, percentage, and mean statistic, while Pearson Product Moment Correlation was used to test hypothesis. Crops competing for nutrient, inadequate access to climate information, inadequate finance, scarcity of labor, and inadequate farm input supplies were among the major constraints to choice of climate change adaptation strategies used by the respondents. The study recommended that weather forecast information should be published and made available to the farmers through agricultural extension agents. Training on how to improve mixed cropping technique and avoid vulnerability should be pursued.

Keywords

Constraints · Climate change · Adaptation strategies · Farmers · Farm-inputs

Introduction

Background

Climate change is one of the major sources of risk in agriculture (De and Badosa 2015). In sub-Saharan Africa, it is set to hit the sector severely and cause suffering, particularly for smallholder farmers. The potential of agriculture to generate a more pro-poor growth process depends on the creation of new market opportunities that most benefit the rural poor (Culas and Hanjra 2011). This could be attributed to the fact that climate change affects the two most important direct agricultural production inputs: precipitation and rainfall (Deschenes and Greenstone 2006). Climate change also indirectly affects agriculture by influencing emergence and distribution of crop pests and livestock diseases, exacerbating the frequency and distribution of adverse weather conditions, reducing water supplies for irrigation, and enhancing severity of soil erosion (IPCC 1998).

Nigeria, which is dependent on rain-fed agriculture together with low level of socio economic development, is highly affected and vulnerable to climate change. Thus, a better understanding of farmers' concerns and their perception of climate change is crucial to design effective policies for supporting successful adaptation of the agricultural sector (Kumar and Sidana 2018). Adaptation helps farmers achieve their food, income, and livelihood security objectives in the face of changing climatic and socioeconomic conditions, including climate variability, extreme weather conditions such as droughts and floods, and volatile short-term changes in

local and large-scale markets (Kandlinkar and Risbey 2000). Farmers can reduce the potential damage by making tactical responses to these changes.

Adaptation strategies which are applicable to climate change are not exhaustive. These strategies vary with scope, approach, purpose, use, application, and timing. The choice of adaptation methods by farmers depends on various social, economic, and environmental factors (Bryan et al. 2013). Adaptation is therefore important for finding ways to help farmers adapt in the rural economies of Africa by providing effective adaptation strategies such as the use of irrigation facilities, improved and resistant crop varieties, modern farm mechanization among others in combating the adverse effect of climate change.

However, there are constraints to adaptation strategies of the farmers, which vary across countries. Satishkumar et al. (2013) categorized constraints faced by farmers in India into personal, institutional, and technical constraints. Small scale fragmented land holdings, low literacy level, inadequate knowledge of how to cope or build resilience, and traditional beliefs were categorized as personal constraints; poor access to extension services, poor access to information sources, and nonavailability of institutional credit were categorized as institutional constraints, while non-availability of drought tolerant varieties, lack of access to weather forecasting information, dependent on monsoon irrigation, high cost of irrigation facilities, shifting of cropping pattern, and lack of technical know-how were categorized as technical constraints.

Fagariba et al. (2018) ranked the constraints affecting farmers' efforts to curb the impact of climate change in Northern Ghana. The study reported unpredictable weather conditions to be the most serious constraint to climate change adaptation strategies. Inadequate government support, lack of access to weather information, land tenure issues, high cost of input, inadequate extension officers, lack of formal education, and poor soil fertility were the other constraints. Otitoju and Enete (2016) grouped the constraints to the use of adaptation strategies among food crop farmers in South-western Nigeria into four. The groups include public, institutional, and labor constraints; land, neighborhood norms, and religious beliefs constraints; high cost of inputs, technological and poor information on early warning systems constraints; and far farm distance, poor access to climate change adaptation information, off-farm job, and credit constraints. Evers and Pathirana (2018) submit that greater communication, cooperation, and coordination of both policy and scientific work that cut across both disciplinary and geographical boundaries are needed to help reduce uncertainties in future climate projections and inform adaptation decisions.

As site-specific issues require site-specific knowledge, it is very important, therefore, to clearly understand what is happening at community level, because farmers are the most climate vulnerable group. In the absence of such location specific studies, it is difficult to fine tune interventions geared towards alleviating the constraints faced by the local farmers. It is on this note that this study seeks to know the socio economic characteristics of the farmers' and also identify the constraints to farmers' choices of climate change adaptation strategies in the study area.

Description of the Study Area and Methodology

Study Area

The study was carried out in Ondo State, one of the 36 states in Nigeria, and a member of the Niger Delta commission (NDDC) in Nigeria. Ondo State was created on third of February 1976 from the former western state. It originally included what is now Ekiti state, before the separation in 1996 (ODGS 2016). It is bounded in the North West by Ekiti State, west central by Osun State, South East by Ogun State, South East by Edo and Delta states, and the South by the Atlantic Ocean. The state lies between latitude $5^{\circ} 45'$ and $8^{\circ} 15'$ north and longitude $4^{\circ} 45'$ and $6^{\circ} 05'$ east. Its land area is about 15,500 square kilometers (ODGS 2016).

Ondo State's climate is of two distinct seasons (wet and dry season). In the south, the mean monthly temperature is 27°C with a mean monthly range of 2°C , while mean relative humidity is over 75%. However, in the northern part of the state, the mean monthly temperature and its range are about 30°C and 6°C , respectively. The mean monthly relative humidity is less than 70%. Also, the mean annual total rain fall exceed 2000 mm. However, in the northern part, there is marked dry season from November to march when little or no rain fall, hence, the total annual rain fall in the North drops considerably to about 1800 mm (Fasina et al. 2016; ODSG 2016).

The natural vegetation is the high forest, composed of many varieties of hardwood timber such as *Melicia excelsa*, *Antaris toxicaria*, *Lophira alata*, *Terminalia superba*, and *Symphonia globulifera*. An important aspect of vegetation of the state is the prevalence of tree crops. The major tree crops include cocoa, kola, rubber, coffee, oil palms, fruits, and citrus (Institute of Food Security, Environmental Resource and Agricultural Research (IFSERAR) 2010). Ondo state is predominantly an agricultural state with over 60% of its labor force deriving their income from farming. It is the leading Cocoa producing state in Nigeria. Other agricultural products include yam, cassava, cocoyam, plantain; thus, the state can support the cultivation of a large variety of crops. It also has the longest coastline in the Country which favor fishing activities in the riverine areas (IFSERAR 2010). The population of the study includes all arable crop farmers in Ondo State, Nigeria.

Research Methods

Study Site Selection and Sampling Methods

A multistage sampling procedure was used in selecting the respondents for this study. In the first stage, two out of the three senatorial districts in the state were randomly selected. The selected senatorial districts are Ondo Central and Ondo North. The second stage involved a random selection of two (2) Local Government Areas (LGAs) from each of the two selected senatorial districts. The selected LGAs

are: Akure South, Ifedore, Ose, and Owo LGAs. The third stage involved purposive selection of four (4) villages, based on the predominance of arable crop farming in the LGAs, making a total of sixteen (16) villages. In the final stage, ten arable crop farmers were randomly selected. Thus, a total of one hundred and sixty (160) respondents constituted the sample size for the study. Data were collected with the aid of a well-structured interview schedule.

Data Source and Collection Method

Data Analysis

Data analytical techniques that were used in achieving the objectives for this study are descriptive statistics. They include frequency counts, percentage and mean.

The socio-economic characteristics of the farmers were analyzed using frequency, percentage, and mean statistic. To identify the constraints to choice of adaptation strategies used by the respondents, a list of possible constraints were made available for the farmers to tick on a three-point Likert-type scale of major constraint, minor constraint, and not a constraint, with the value of 2, 1, and 0, respectively. These values were added up to 3 and divided by 3 to get a mean value of 1. Any variables with mean value greater than or equals to 1 imply that they are constraints to climate change adaptation, while mean value of less than 1 implies that they are not a constraint. Any variable with a mean value of greater than or equals to 1.5 are major constraints. The responses were analyzed using mean statistic.

Hypothesis H_0 : There is no significant relationship between some socio economic characteristics of the respondents and constraints to choice of adaptation strategies used by the respondents. This was tested using the Pearson Product Moment Correlation (PPMC).

Limitations of the Study

The study covered only four (4) LGAs out of the eighteen (18) LGAs in the state. Only one hundred and sixty respondents out of several hundred thousands of arable crop farmers in the state were included in the study. This was due to the paucity of funds to carry out the study. A funded research can cover a larger sample for a similar study in the future. Furthermore, access to some farmers was very difficult due to bad access roads, which is a feature of many rural communities in Nigeria. Responses gotten from the respondents were based on memory recall which may not be perfectly and correctly stated. The effects of this limitation were minimized by repeating some questions but reframed, so as to confirm the response to the previous question. Uncooperative attitude of some farmers in terms of giving accurate information about themselves was another limitation. These limitations propelled the researchers to put extra effort to collect reliable data, which will be affected by the identified limiting factors.

Results and Discussion

Socio-Economic Characteristics of the Respondent

The distribution of respondents by their socio-economic characteristics is presented in Table 1. It was revealed that 38.8% were between 50 and 59 years of age, 24.5% were between 40 and 49 years, 20.7% were between 60 and 69 years, while 10.5% of the respondents were above 70 years of age. Also, 4.9% of the respondents were between 30 and 39 years, while only 0.6% of the respondents were less than 30 years of age. It was further revealed that the average age of the respondents was 54.6 years. This is an indication that arable crop farmers in the study area are fairly old, although they are still within the active age with the strength and vigor to carry out all the laborious activities involved in agricultural production. This agreed with the findings of Oluwasusi and Tijani (2013), who reported an average age of 53.9 years in a study conducted in Ekiti State, Nigeria.

Farming in the study area was dominated by the males (62.5%), while the female respondents accounted for 37.5% of the respondents. This might be attributed to the laborious nature of all the activities involved in arable crop production/farming in the study area. However, the females were believed to be more involved in the processing and marketing of farm by-products. This agreed with the findings of Ibitoye et al. (2014) who reported that the males dominated agricultural production in a study on the constraints to climate variability adaption among arable crop farmers in Ekiti State, Nigeria.

It was further revealed that majority (87.5%) of the respondents were married, while only 1.9% of them were still single, 6.3% of the respondents were divorced, while 4.4% of them were separated. The fact that majority of the farmers in the study area were married might be a reflection of the strong moral values attached to marriage institution in the study area. This also agreed with the findings of Ibitoye (2012) and Oguntade et al. (2014) who reported in their separate studies that arable crop farmers that are married dominated arable crop farming activities in Nigeria. Majority (62.5%) of the arable crop farmers in the study area were Christians, 32.5% of the respondents were Muslims, while 5.0% of the respondents practiced traditional religion.

Average household size of the respondents was 7 people. It was revealed that majority (71.2%) of the farming households had between 5 and 9 people, while 16.3% had less than 5 people in their household. However, 12.5% of the respondents had 10 people and above in their respective households. The average household size of about 7 people implied that the household size among farming households in the study area is fairly large. However, this is expected to be a very good source of labor (family labor) for their farming activities and it is expected to enhance their level of productivity.

It was observed that 28.1% of the respondents had no formal education, 21.9% completed primary school education, while 15.6% of them completed secondary school education. It was also revealed that 11.3% attempted primary school education, 8.1% of the respondents acquired adult education, 8.1% of the respondents

Table 1 Socio-economic characteristics of the respondents

Socioeconomic characteristics	Frequency	Percentage (%)	Mean ($\bar{X}$)
Age (years)			54.6
<30 years	1	0.6	
30–39 years	8	4.9	
40–49 years	39	24.5	
50–59 years	62	38.8	
60–69 years	33	20.7	
70 years and above	17	10.5	
Sex			7
Female	60	37.5	
Male	100	62.5	
Marital status			
Single	3	1.9	
Married	140	87.5	
Widowed	10	6.3	
Divorced	7	4.4	
Religion			
Christian	100	62.5	
Islam	52	32.5	
Traditional	8	5.0	
Household size (number)			7
<5 persons	26	16.3	
5–9 persons	114	71.2	
10 persons and above	20	12.5	
Level of education			27.5
No formal education	45	28.1	
Adult education	13	8.1	
Attempted primary school	18	11.3	
Completed primary school	35	21.9	
Attempted secondary school	13	8.1	
Completed secondary school	25	15.6	
Attempted tertiary education	1	0.6	
Completed tertiary education	10	6.3	
Farming experience (years)			27.5
<10 years	16	10.1	
10–19 years	29	18.1	
20–29 years	41	25.5	
30 years and above	74	46.3	
Farm size (hectares)			0.91
<1	114	71.4	
1–1.99	28	17.5	
2–4.99	16	10	
≥5	2	1.1	

(continued)

Table 1 (continued)

Socioeconomic characteristics	Frequency	Percentage (%)	Mean ($\bar{X}$)
Annual income (₦)			318,595.91
<100,000	14	8.7	
100,000–499,999	113	70.6	
500,000–999,999	28	17.5	
1,000,000 and above	5	3.2	

Source: Field Survey, 2017

attempted secondary school education, while 6.3% of them completed tertiary education. However, 0.6% of the respondents attempted education at tertiary level, without completing it. The fact that only 15.6% of the total respondents completed secondary school education and that only 6.3% of them completed tertiary education is an indication that the level of education among the farmers in the study area is low, in agreement with the findings of Oluwasusi and Tijani (2013). This is believed to have an effect on their level of awareness about climate change effects and also on their level of adoption on strategies in mitigating its effects.

It was further revealed that respondents that had farming experience of 30 years and above constituted 46.3% of the total respondents sampled for this study. However, 25.5% of the respondents were reported to have between 20 and 29 years of farming experience, 18.1% had between 10 and 19 years of farming experience, while only 10.1% of the total respondents had less than 10 years of farming experience. It was also revealed that the average years of farming experience among the arable crop farmers in the study area was 27.5 years. This is an indication that respondents are well experienced in farming activities in the study area. This is expected to enhance the knowledge of the farmers in how to select the appropriate measures to mitigate and cope with the effect of climate change in the study area, in agreement with the findings of Oguntade et al. (2014).

Majority (71.4%) of the respondents had less than one hectare of farm land, 17.5% have between 1–1.99 ha, while 10.0% of the respondents had a farm size of between 2 and 4.99 ha. However, 1.1% of the respondents had a farm size of five hectares and above. The average farm size was approximately one hectare. This suggests that respondents in the study area are small holder arable crop farmers, who practice farming on subsistence basis. This finding is in agreement with the findings of Babatunde (2008), who reported that majority of arable crop farmers in Nigeria are small holder farmers who practice subsistence farming on a small piece of land.

Majority of the respondents (70.6%) earned between ₦100,000 and ₦499,999 per annum, 17.5% of them earned between ₦500,000 and ₦999,999 per annum, while 8.7% of the respondents earned less than ₦100,000 per annum. However, 3.2% of the respondents earned above ₦1,000,000 per annum. The average annual income of the respondents was also revealed to be ₦318,595.91. This suggests that the average annual income of the respondents was fairly low. This could, however, be attributed to the fact that the arable crop farmers in the study are operating on a subsistence scale, with majority of them farming on less than one hectare of land as reported

earlier. The low income earned by the arable crop farmers might equally be due to low output that usually occurs as a result of the adverse effects of climate change. This is in agreement with the findings of Falola et al. (2012); also, low income earned by the arable crop farmers may also be as a result of extra costs incurred by the arable crop farmers in an attempt to mitigate the adverse effects of climate change.

Constraints to Choice of Adaptation Strategies Used by the Respondents

Table 2 presents the constraints to choice of adaptation strategies used by the respondents in the study area. It was revealed that inadequate finance ($\bar{X} = 1.8$), scarcity of labor ($\bar{X} = 1.8$), and inadequate technical know-how knowledge ($\bar{X} = 1.7$) were the major constraints militating against the choice of irrigation as a coping strategy to the effect of climate change in the study area. The problems of inadequate finance would not enable the arable crop farmers to acquire the necessary irrigation equipment and facilities which might be too expensive for them to acquire from the proceeds from their farming activities. Also, inadequate knowledge and technical know-how in operating the modern irrigation equipment will to a greater extent limit the farmers use of irrigation as an adaptation strategy to the effect of climate change in the study area.

It was further revealed that poor agricultural extension services ($\bar{X} = 1.6$), high cost of fertilizer and other inputs ($\bar{X} = 1.5$), as well as pest and diseases ($\bar{X} = 1.6$) were the major constraints militating against the choice of planting of cover crops as a coping strategy to combat the effect of climate change in the study area. This implied that inadequate dissemination of information as a result of poor extension services limits the level of awareness of the farmers on the potentials the planting of cover crops has in reducing the effect of adverse climatic condition (e.g., drought) on arable crops in the study area. This is in conformity with the findings of Satishkumar et al. (2013) Also, high cost of fertilizer and other inputs required in planting and maintaining cover crops constrained some of the arable crop farmers to use the planting of cover crops to combat the adverse effect of climate change in the study area. This is in line with the findings of Otitoju and Enete (2016). High possible incidence of pest and disease infestation associated with the use of cover crops can also be a constraint to the use of cover crop in mitigating the effects of climate change in the study area.

It was further revealed that the major constraints militating against the use of weather forecasting as an adaptation strategy against the effects of climate change included inadequate access to climate information ($\bar{X} = 1.8$). This corroborates the findings of Fagariba et al. (2018). This suggests that inadequacy of climatic information available to the arable crop farmers in terms of accuracy and consistency of metrological information greatly constrained them from choosing weather forecasting as an adaptation strategy against the effects of climate change. Also, the high cost of accessing the weather forecast information as well as the incompatibility of such information constrained the farmers in adopting weather forecasting as a reliable means of coping with the effect of climate change in the study area.

Table 2 Constraints to choice of adaptation strategies used by the respondents

Constraints to adaptation strategies	Major constraints (2)	Minor constraints (1)	Not a constraint (0)	Mean ($\bar{X}$)	Std. dev.
Irrigation					
Inadequate finance	38 (86.4)	4 (9.1)	2 (4.5)	1.8*	0.5
Land related issue	35 (79.5)	1 (2.3)	8 (18.2)	1.6*	0.8
Scarcity of labor	37 (84.1)	6 (13.6)	1 (2.3)	1.8*	0.4
Inadequate technical know-how knowledge	36 (81.8)	2 (4.5)	6 (13.6)	1.7*	0.7
Planting of cover crops					
Poor agricultural extension services	38 (77.6)	3 (6.1)	8 (16.3)	1.6*	0.8
Farm distance	30 (61.2)	4 (8.1)	15 (30.7)	1.3	0.4
High cost of fertilizer and other inputs	34 (69.4)	6 (12.2)	9 (18.4)	1.5*	0.8
Pest and diseases	38 (76.0)	4 (8.0)	8 (16.0)	1.6*	0.8
Use of weather forecasting					
Inadequate access to climate information	30 (83.3)	3 (8.3)	3 (8.3)	1.8*	0.6
Cultural incompatibility	26 (72.2)	6 (16.7)	4 (11.1)	1.6*	0.7
It is expensive and depends on technologies	28 (77.8)	2 (5.6)	6 (16.7)	1.6*	0.8
Inconsistent government policies	22 (62.9)	5 (14.3)	8 (22.9)	1.4	0.6
Use of resistant crop varieties					
Availability of the varieties	44 (88.0)	1 (2.0)	5 (10.0)	1.8*	0.6
Cost of the varieties	41 (83.7)	—	8 (16.3)	1.7*	4.1
Farm distance	32 (65.3)	6 (12.2)	11 (22.4)	1.4	0.8
Off farm job and credits	34 (70.8)	5 (10.4)	9 (18.8)	1.5*	0.8
Change in planting date					
Poor agricultural program and service delivery	50 (82.0)	4 (6.6)	7 (11.5)	1.7*	0.7
Neighborhood norms and religious believes	29 (47.5)	11 (18.5)	21 (34.4)	1.1	0.9
Reduction in output	41 (67.2)	9 (14.8)	11 (18.0)	1.5*	0.8
Inadequate access to hybrid seeds	50 (82.0)	6 (9.8)	5 (8.2)	1.7*	0.6
Change in harvest date					
Inaccurate agro-metrological information	19 (79.2)	1 (4.2)	4 (16.7)	1.6*	0.8
Time of dissemination of agro-meteorological information	17 (70.8)	3 (12.5)	4 (16.7)	1.5*	0.8
Poor storage and processing facilities	16 (66.7)	2 (8.3)	6 (25.0)	1.4	0.9
High cost of farm operations	14 (58.3)	2 (8.3)	8 (33.3)	1.3	0.9

(continued)

Table 2 (continued)

Constraints to adaptation strategies	Major constraints (2)	Minor constraints (1)	Not a constraint (0)	Mean ($\bar{X}$)	Std. dev.
Use of sand bags by river banks					
High cost of labor	9 (100.0)	—	—	2.0*	0.0
Inadequate finance and credit facilities	9 (100.0)	—	—	2.0*	0.0
Drudgery of making the sand bags	8 (88.9)	1 (11.1)	—	1.9*	0.3
Longer time in making the sand bags	8 (88.9)	—	1 (11.1)	1.8*	0.7
Use of mulching materials					
Over grazing of the land	25 (39.1)	6 (9.4)	33 (51.6)	0.9	0.5
Urbanization	21 (31.8)	9 (13.6)	36 (54.5)	0.8	0.9
High cost of labor in applying the mulching material	51 (73.3)	11 (16.7)	4 (6.1)	1.7*	0.6
Durability of the mulching materials	29 (44.6)	21 (32.3)	15 (23.1)	1.2	0.8
Mixed cropping					
Vulnerability to pest and diseases	42 (52.5)	11 (13.8)	27 (33.8)	1.2	0.9
Crops competing for nutrient	48 (60.8)	17 (21.5)	14 (17.7)	1.4	0.8
Depletion of the soil nutrient	38 (48.1)	17 (21.5)	24 (30.4)	1.2	0.9
Poor extension delivery services	35 (44.9)	19 (24.4)	24 (30.8)	1.1	0.9
Crop rotation					
Life span of the crop grown	11 (47.8)	6 (26.1)	6 (26.1)	1.2	0.9
Inadequate farm input supplies	15 (68.2)	6 (27.3)	1 (4.5)	1.6*	0.6
Depletion of the soil nutrient	8 (36.4)	3 (13.6)	11 (50.0)	0.9	0.9
Nonavailability of labor	6 (27.3)	8 (36.4)	8 (36.4)	0.9	0.8
Use of intercropping					
Complication of crop management and harvesting	7 (43.8)	3 (23.1)	3 (23.1)	1.3	0.9
Problem of separating seed crop yield	4 (30.8)	5 (38.5)	4 (30.8)	1.0	0.8
Community customs and laws	3 (25.0)	2 (16.7)	7 (58.3)	0.7	0.9
Nonfarm income diversification					
Government policies due to taxes	1 (8.3)	3 (25.0)	8 (66.7)	0.4	0.9
Inadequate finance and credit	23 (71.9)	1 (3.1)	8 (25.0)	1.5*	0.9
Poor skills	22 (66.7)	4 (3.0)	7 (24.2)	1.5*	0.8
Low wages and poor condition of work	24 (72.7)	1 (3.0)	8 (24.2)	1.5*	0.9

Key: 0–0.9 = Not a Constraint; 1.0–1.4 = Minor Constraint; 1.5 and above = Major Constraint

*denotes major constraints

Note: Values in parenthesis are Percentages

It was further revealed in this study that the major factors militating against the use of resistant crop varieties as an adaptation strategy against the effects of climate change in the study area included nonavailability of the disease resistant varieties ($\bar{X} = 1.8$), high cost of the varieties ($\bar{X} = 1.7$), as well as off farm job and credits of the farmer ($\bar{X} = 1.5$). The high cost, coupled with the unavailability of improved varieties of arable crops that are resistant to pest and diseases, is a major constraint preventing the arable crop farmers from adopting the use of resistant crop varieties to cope with the effect of climate change in the study area. Otitoju and Enete (2016) reported a similar finding.

Poor agricultural program and service delivery ($\bar{X} = 1.7$), inadequate access to hybrid seeds ($\bar{X} = 1.7$), and reduction in output ($\bar{X} = 1.5$) were the major constraints militating against the use of change in planting date as an adaptation strategy against the effects of climate change in the study area. Also, inaccurate agro-metrological information ($\bar{X} = 1.6$), time of dissemination of agro-metrological information ($\bar{X} = 1.5$), and poor storage and processing facilities ($\bar{X} = 1.4$) were the major constraints militating against the use of change in harvest date as an adaptation strategy to the effects of climate change in the study area. This implied that inaccurate and unseemliness of agro-metrological information greatly constrains the arable crop farmers in the adoption of both change in planting and harvest dates as a coping strategy in combating the effects of climate change in the study area.

It was also observed that major constraints that militated against the use of sand bags by river banks as an adaptation strategy to the effects of climate change in the study area included high cost of labor ($\bar{X} = 2.0$), inadequate finance and credit facilities ($\bar{X} = 2.0$), and drudgery of making the sand bags ($\bar{X} = 1.9$). This implied that the use of sand bags as an adaptation strategy might be very expensive for the arable crop farmers to adopt. Therefore, with the limited finance available to the arable crop farmers, it might be difficult to adopt the use of sand bags as an adaptation strategy to combat the effect of climate change in the study area. Also, drudgery of making the sand bags might be a discouraging factor preventing the farmers from adopting the use of sand bags as an adaptation strategy to combat the effect of climate change in the study area.

Furthermore, high cost of labor in applying the mulching material ($\bar{X} = 1.7$) and the durability of the mulching materials ($\bar{X} = 1.2$) were the major constraining factors militating against the use of mulching materials as an adaptation strategy against the effects of climate change in the study area. This suggests that the higher the cost of labor in applying the mulching materials, the lesser the adoption of mulching materials as an adaptation strategy in combating the effect of climate change in the study area. It was further observed that the constraints militating against the use of mixed cropping system as an adaptation strategy in the study area were minor ones. They included crops competing for nutrient ($\bar{X} = 1.4$), vulnerability to pest and diseases ($\bar{X} = 1.2$), and depletion of the soil nutrient ($\bar{X} = 1.2$). This might be attributed to the fact that the practice of mixed cropping increase the vulnerability of the crops planted to different pests and diseases. Also, practicing mixed cropping will make the different crops compete for the limited available nutrients, and ultimately this will lead to quick depletion of soil nutrients.

Table 3 PPMC Correlation between some socioeconomic characteristic of the respondent and constraints to choice of adaptation strategies

Variable	r-value	p-value	Decision
Age	−0.028	0.729	Not significant
Household size	0.122	0.128	Not significant
Level of education	−0.074	0.354	Not significant
Farming experience (years)	0.126	0.116	Not significant
Farm size (plots)	0.170 ^a	0.034	Significant

^aCorrelation is significant at the 0.05 level (2-tailed)

Furthermore, the major constraining factor against the use of crop rotation as an adaptation strategy to the effects of climate change was observed to be inadequate farm input supplies ($\bar{X} = 1.6$), while the life span of the crop grown ($\bar{X} = 1.2$) was a minor constraint. Moreover, there were only minor constraining factors against the use of intercropping as an adaptation strategy to the effects of climate change in the study area. They include complication of crop management and harvesting ($\bar{X} = 1.3$) and problem of separating seed crop yield ($\bar{X} = 1.0$). However, inadequate finance and credit ($\bar{X} = 1.5$), poor skills ($\bar{X} = 1.5$), and low wages and poor condition of work ($\bar{X} = 1.5$) were the major constraints preventing the arable crop farmers from choosing nonfarm income diversification as an adaptation strategy against the effects of climate change in the study area.

Relationship Between Some Socioeconomic Characteristic of the Respondents and Constraints to Choice of Adaptation Strategies

Table 3 presents the result of the null hypothesis which states that “There is no significant relationship between some socioeconomic characteristic of the respondent and the constraints to choice of adaptation strategies used by the respondent.” It was revealed that the farm size of the respondent was the only socioeconomic characteristic that had a strong positive correlation ($r = 0.170$; $p = 0.034$) with the constraints to choice of climate change adaptation strategies used by the respondent in the study area. This suggests that constraints to choice of climate change adaptation strategies increases with increase in the farm size, implying that respondents with larger arable crop farms were faced with more constraints to choice of climate change adaptation strategies in the study area compared with those with smaller farm size.

Conclusions

From the findings, it can be concluded that many of the farmers, who happened to be males, fairly old, and are arable crop farmers. The major constraints to the various adaptation strategies were inadequate finance, scarcity of labor, poor agricultural extension services, inadequate access to climate information, nonavailability of

resistant varieties, poor agricultural program, inaccurate agro-meteorological information, high cost of labor, low wages and poor condition of work, complication of crop management and harvesting, inadequate farm input supplies, and crops competing for nutrient. These constraints have hindered arable crop farmers in their choice of the identified adaptation strategies in coping with the adverse effect of climate change; it is also reduced farmers level of food production in a bid to ensure food security in the society and also elevate their own economic standard. Hence, respondents with larger arable crop farms were faced with more constraints to choice of climate change adaptation strategies in the study area compared with those with smaller farm size.

It is recommended that weather forecast information should be published and be made available to the farmers for them to be aware of situations to be prepared for at the beginning of each production season through agricultural extension agents. Also, training on how to improve the mixed cropping technique and avoid vulnerability should be pursued. This could also avert crop failure.

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