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Assessment Level of Use of Climate Change Adaptation Strategies Among Arable Crop Farmers in Oyo and Ekiti States, Nigeria

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Abstract

The study assessed the level of use of climate change adaptation strategies among arable crop farmers in Oyo and Ekiti States, Nigeria. Multistage sampling procedure was used in the selection of 235 farmers. Both structured interview schedule and Focus Group Discussion were used to elicit information from the respondents which were analysed with both descriptive and inferential tools. The mean age of the respondents was 49.43 years, 63.0% and 37.0% of males and females' arable crop farmers were involved in the study with mean household and farm sizes of 6.09 and 9.18 hectares respectively. The most highly used climate change adaptation strategies include; cultivation of improved varieties, altering of planting date, fertilizer application and mixed cropping and the associated constraints were; capital unavailability, irregular extension services, inadequate production inputs and poor access to information on climate change. Ordered probit analysis revealed significant relationship between sex (1.72; p>0.1), religion (5.14; p>0.01), years spent in school (1.77; p>0.1), source of information (3.39; p>0.01) and level of use of climate change adaptation strategies. The study recommends that advisory services, provision of production inputs and infrastructural facilities should be encouraged as well as the use of strategies on low side level of usage by the various stakeholders in agricultural development while efforts should be redirected in the provision of necessary assistance especially capital, subsidizing arable crop production inputs and reintegration of climate information into Nigeria national policies.

Keywords: Climate change; Adaptation strategies; Arable crop farmers; Nigeria

Introduction

Climate remains the basic factor that determines agricultural production irrespective of crops and farmland. It is evidenced that climate change will have a strong impact on Nigeria-particularly in the areas of agriculture; land use, energy, biodiversity, health and water resources. Nigeria, like all the countries of Sub-Saharan Africa, is highly vulnerable to the impacts of Climate Change [1,2]. (IPCC 2007; NEST 2004). It was also, noted that Nigeria specifically ought to be concerned by climate change because of the country's high vulnerability due to its long (800 km) coastline that is prone to sea-level rise and the risk of fierce storms by Apata et al. [3].

Food crop farmers in South Western Nigeria provide the bulk of arable crops that are consumed locally, also, major food crop supplies to other regions in the country. The local farmers are experiencing climate change even though they have not considered its deeper implications as reported by Apata and Adeola. Though different information has been disseminated on climate change to farmers through the extension and other related services, but in order to address this issue appropriately, one must take into account climate change strategies adopted and used among the crop farmers. Thus, the human response to climate change is critical to understanding and estimating the level of use of adaptation strategies employed by the farmers to mitigate the effect of climate change on crop production. Assessment of the rural farmers' level of use of adaptation strategies and adjustment is necessary in order to estimate and need to intensify effort on the full use of appropriate climate change adaptation measures. This is important because of the fact that rural farmers championed and responsible for production of food for the thousands population. This study intends to assess the level of use of climate change adaptation strategies among arable crop farmers of Oyo and Ekiti States, Nigeria.

According to Sha, Fischer and Van Velthuizen [4] the adverse consequences of climate change will take an irreplaceable toll on food production and food security especially in developing countries which have a low capacity to cope and adapt to these challenges. The impacts of climate change on agriculture forestry and fisheries are projected to manifest through changes in land and water regimes, specifically, changes in the frequency and intensity of droughts, flooding, water shortages, worsening soil conditions, desertification, disease and pest outbreaks on crops and livestock are going to impact negatively on agriculture. Recent food crises in countries such as Nigeria are reminders of the continuing vulnerability of the region to the unexpected change of climatic conditions (IPCC, 2007). This development was due to weak institutional capacity, limited engagement in environmental and adaptation issues, and lack of validation of local knowledge in African countries among other factors. Accordingly, there is the need to gain as much information as possible and learn the position of rural farmers about what they perceive about climate change, in order to offer adaptation practices that meet their needs. Otherwise, Nigeria will suffer more negative effects of climate change as the bulk of food producers today are the small-scale crop farmers in the country (IPCC, 2007).

It is very clear that climate change has different adverse effects on crop production has revealed from literatures [1,2,5] (IPCC, 2007; BNRCC, 2008 and NEST, 2004). Therefore, adaptation of crop to the challenges of climate change will involve exploiting the continually

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developing technologies, resources and the expertise of science base by Newton et al. This study is an attempt in this direction. The general objective of the study was to assess the level of use of climate change adaptation strategies among arable crop farmers in Oyo and Ekiti States, Nigeria. The specific objectives described the socio-economic characteristics of arable crop farmers; examined the climate change adaptation strategies used by the farmers; determined the level of use of various climate change adaptation strategies among the arable crop farmers and investigated constraints associated with the use of climate change adaptation strategies in the area.

Methodology

The study was carried out in Oyo and Ekiti States of South-west, Nigeria. The two States are from South-West zone of Nigeria and this zone lies between latitude 6.00°N and 9.00°N and between longitude 2.00°E and 7.00°E. The climate in the two States favours the cultivation of crops like maize, yam, cassava, millet, rice, plantains, cocoa, palm produce, cashew, etc. Agriculture has been the backbone of the economy of the two States providing income and employment opportunities for over 70% of the population. The States are significantly producers of arable crops in Nigeria. The two States together with Kogi, Benue and Kwara are responsible for the production of 70% of arable crops output in Nigeria with about 2.5 million hectares under arable cultivation [6]. Multistage sampling method was adopted for the study. During the first stage, 12% of the Local Government Areas (LGAs) was selected from the two States; therefore, 3 LGAs and 2 LGAs were involved in the study. These LGAs were selected because of the concentration of arable crop production. Thereafter, 15% arable crop farmers were randomly selected from Oyo (154) and Ekiti (81) States which amounted to a total of 235 arable crop farmers that constituted the sample size of the study. Data were collected with aid of structured interview schedule and FGD was also conducted to make a ratification of various responses during the interview. Collected data were analyzed with frequency counts, percentages, mean and ranking as the main descriptive statistical tools. Socio-economic variables influencing level of use of climate change adaptation strategies was determined using ordered probit regression?

Level of use of climate adaptation strategies by arable crop farmers were measured on five level of Likert scale of measurement of Very High (5), High (4), Moderate (3), Low (2) and Very Low (1). Thereafter composite score of each identified strategy was used to recatigorized level of use into 3 level of high (3), moderate (2) and low (1) with mean (x) ± SD and this correspond to censoring values 3, 2, and 1 respectively used for the Ordered probit analysis. This is implicitly stated as:

Y = Level of use of climate adaptation strategies (3 = high, 2 = moderate, 1 = low).

x_1 = Age (Years)

x_2 = Sex (Dummy, Male=0, Female=1)

x_3 = Marital status (Dummy, 1= Married; 0= Unmarried)

x_4 = Religion (Dummy,1= Christian; 0= Islam)

x_5 = Years spent in school (Years)

x_6 = Years of farming experience (Years)

x_7 = Source of information (Dummy, yes = 1, No = 0)

x_8 = Farm size (hectares)

e = error term

The Likert type measurement instrument is presented as by the formula:

x = (Σf x) /n, when:

x = mean score

Σ = summation sign

f = frequency

n = No of responses

5 different scaling statements were used namely, very high, high, moderate, low, and very low. The mean of the scaling statement was found as:

(5+4+3+2+1)/5=15/5=3

Therefore, 3 is the weighted mean of the scaling statement.

Decision rule: Any mean value greater or equal to 3 is high; any mean value less than 3 is low.

Results and Discussion

Socio-economic characteristics of arable crop farmers

Age, sex, marital status, religion and level of education of arable crop farmers: Table 1 revealed that less than half (43.4%) of the respondents were in the age of 50 years and above, while almost one third (31.1%), 17.0% and 8.5% respectively were between the age of 41-50 years, 31-40 years; less and equal to 30 years. The mean age is 49.43 years. This implies that majority of the arable crop farmers sampled were adult and matured, an indication that they should be conversant of various effects of climate change on crop production and possess the ability to take appropriate measures to combat its effects in order to improve arable crop production in the area. This finding is in line with assertion of Deressa et al. [7] that the older the farmer, the more

Socio-economic characteristics	Frequency	Percentage
Age (years)		
≤ 30	20	8.5
31-40	40	17
41-50	73	31.1
>50	102	43.4
X= 49.43		
Sex		
Male	148	63
Female	87	37
Marital status		
Married	219	93.2
Unmarried	16	6.8
Religion		
Christianity	173	73.6
Islam	62	26.4
Level of education		
Non formal education	44	18.7
Primary uncompleted	24	10.2
Primary completed	65	27.7
Secondary uncompleted	40	17
Secondary completed	42	17.9
Tertiary	20	8.5
Total	235	100
Source: Field Survey, 2016.		

Table 1: Distribution of respondents by age, sex, marital status, religion and level of education of arable crop farmers.

experienced he/she has in farming and the more he/she is exposed to past and present climatic condition over as longer horizon of his/her life span. Also more than half (63.0%) of the farmers sampled were males and more than one third (37.0%) were females. This implies that both male and female are involved in arable crop production in the area. Though most of them are male which is the usual assumption that male dominates agricultural production. This corroborates assertion by Ejembi and Ejembi [8] that, an indication that the traditionally recognized "visible" human input in the agricultural sector is the male contribution.

On the marital status, majority of the farmers (93.2%) were married; while only 6.8% were single. It implies that most arable crop farmers sampled were married and in their adulthood, a stage that is expected to give them insight and need to employ possible strategies to mitigate various climate change effects on crop production. This is in conformity with Aphunu and Otoikhian [9], stated that marital status is a factor, which is likely to encourage the sustainability of adoption decisions. Again, more than two-third (73.6%) of the respondent's practices Christianity, while 26.4% were Muslim. This implies that arable crop production does not have religion bias. Their religion membership is expected to provide them medium for exposure to other people's experience on climate change issues and ability to take initiative on the strategies considered to be appropriate among others.

The above is expected to influence the use of different climate change adaptation strategies among the arable crop farmers in the area. On the level of education, 27.7% completed primary education, 18.7% of the farmers do not have formal education, while 17.9% completed secondary education and 8.5% have tertiary education. This implies that most of the farmers sampled are literate though with different educational background. Their literacy level is expected to guide them insight in the identification and use of different climate change strategies that may be appropriate to curb its effects on arable crop production. This is also suggesting that socio-economic characteristics of the farmers are likely to influence use of climate change adaptation strategies in the area. This finding corroborate IPCC [10] who reported that adaptation depends on factors such as wealth, technology, education, information, skills, infrastructure, access to resources and management capability.

Household size	Frequency	Percentage
≤ 5	97	41.3
06-Oct	121	51.5
Nov-15	16	6.8
>15	1	0.4
X=6.09		
Primary occupation		
Farming	214	91.1
Others	21	8.9
Other occupation		
Farming	10	4.3
Trading	93	39.6
Civil service	39	16.6
Artisan	93	39.6
Farming experience		
≤10 -26	1	1.1
Nov-20	43	18.3
21-30	67	28.5
31-40	75	31.9
>40	24	10.2
x = 26.64		
Total	235	100
Source: Field survey, 2016.		

Table 2: Distribution of respondents by household size, primary occupation, secondary occupation and farming experience.

Source of information	*Frequency	Percentage
Extension service	232	98.7
NPFS/Fadama	219	98.2
Farmers field school	73	31.1
Co-farmers/	163	69.4
Farm size (ha)	**Frequency**	**Percentage**
≤ 10	46	19.6
6-10	98	41.7
11-15	68	28.9
>15	23	9.8
X= 6.09		
Total	235	100.0
Source: field survey, 2016 *: Multiple responses		

Table 3: Distribution of respondents by source of information on climate change.

Household size, primary occupation, secondary occupation and farming experience: Table 2 revealed that more than half (51.5%) of the arable crop farmers have between 11-15 household size, and less than half (41.3%) indicated less and equal to 5, while the mean household size is 6.09. This implies that the farmers sampled were of different household size compositions. The variation in their household size may be due to differences in the number of wife, children and other dependent. This may be so because most people in the rural area bear more children with the intention to substitute hired labour required for agricultural production activities and norm that large house size appeared to be more efficient in terms of productivity and this assertion is in line with Awudu and Richard [11] that large families appeared to be more efficient than small families. Majority (91.1%) of the farmers engages in farming as primary occupation; more than one-third (39.6%) each indicated trading and artisan; while only 16.6% were civil servants. This implies that most of the respondents sampled are full-time farmers. This may be so because it believes that farming as occupation is associated with the people in the rural area. This is in line with Liverpool et al. [12] who reported that half of Nigerians (approximately 70 million individuals) still live in rural areas; most of them engage in subsistence agriculture. More than one-third (31.9%) of the farmers have between 31-40 years of farming experience, 28.5%, 18.3% and 11.1% have between 21-30 years, 11-20 years; less and equal to 10 years of farming experience. The mean years of farming experience is 26.64 years. This implies that all the farmers sampled in the area have different years of farming experience. The variation in their years of farming experience may be due to their age differences. The years of experience under arable crop production, their years of experience is expected to be a function of type of climate change adaptation strategies to be used against its effects on crop production.

Source of information on climate change and farm size under arable crop production

Table 3 revealed the various sources where arable crop farmers obtains information on climate change and almost all (98.7%) the farmers indicated extension service; similar percentage of 93.2% indicated National Program on Food Security (NPFS)/Fadama programme, while 69.4% and only 31.1% indicated other sources (i.e., co-farmers and farmers' association) and farmers field school (FFS). This implies these farmers have alternative sources of information through which they obtained information on climate change with the intention to improve crop production in this part of Nigeria. This finding corroborate Baethgen et al. [13], reported that availability of better climate and agricultural information helps farmers to make comparative decisions among alternative crop management practices and this allows them to better choose strategies that make them cope well with changes in climatic conditions. These sources were also soughed during the Focus Group Discussion (FGD) as their major sources of information on climate change matters.

On the farm size cultivated 41.7% of them indicated farm size of between 6-10 hectares of land, while 28.9% and 19.6% cultivated farm size of between 11-15 hectares of land and less/equal to 5 hectares of land as farm size cultivated. Again, only 9.8% cultivates more than 15 hectares of farm size of land, while the mean farm size cultivated is 9.18 hectares. This implies that all the farmers cultivate different farm sizes of land. It is expected that the high the farm size cultivated the high the crop yield which of course may determine the income level of the farmers and a factor that is expected to influence the use of climate change adaptation strategies among the arable crop farmers in the area. This is in conformity with assertion of Gershon et al. [14] who reported that the bigger the size of the farm, the greater the proportion of land allocated and hence the adaptation strategies that the farmer is likely to adopt. The variation in the farm size cultivated may be due to differences in their access to production inputs require for cultivation of various arable crops (such as land, capital, fertilizers, seeds and labour) and land tenure (land ownership status).

Climate change adaptation strategies used by arable crop farmers

The farmers used different climate change adaptation strategies to against different effects of climate change on arable crop production in the area (Table 4). The strategies used include fertilizer application (98.7%), mixed cropping (97.4%), cultivation of improved varieties (94.5%), mulching (87.2%) and altering of crop planting date (86.4%) respectively. It further revealed, planting of cover crop (68.9%), construction of ridges across the slope (60.9%), crop rotation (33.6%) and irrigation (26.4%). Others include alley cropping (8.9%) and shifting cultivation (7.7%). The result implies that farmers combined different climate change adaptation strategies to guide against its effects on arable crop production in the area. The variation in the type of strategies used may be due to differences in the access to capital, information on the use of different climate change adaptation strategies and type of arable crop grown by the individual farmers. This implies that crop farmers use different climate change adaptation strategies in the area. Similar strategies were soughed during the FGD.

The adaptation strategies identified in this study is similar to the study of Bradshaw et al. [15], which affirmed that important adaptation options in the agricultural sector include: crop diversification, mixed crop-livestock farming systems, using different crop varieties, changing of planting date and harvesting dates, and mixing less productive, drought-resistant varieties and high-yield water sensitive crops. The

Climate change adaptation strategies used	*Frequency	Percentage
Cultivation improved varieties	222	94.5
Altering of crop planting date	203	86.4
Mulching	205	87.2
Fertilizer application	232	98.7
Compost application	21	8.9
Ridges across the slope	143	60.9
Planting of cover crops	162	68.9
Crop rotation	79	33.6
Shifting cultivation	18	7.7
Alley cropping	21	8.9
Irrigation	62	26.4
Mixed cropping	229	97.4
Source: field survey, 2016*: Multiple responses		

Table 4: Distribution of respondents by climate change adaptation strategies used.

Climate change adaptation strategies used	Frequency (Percentage)							
	Level of use							
	Very high	High	Moderate	Low	Very low	WMS	Rank	Decision
Cultivation of improved crop	107 (45.5)	76 (32.3)	25 (10.6)	14 (10.6)	-	4.0	4th	High
Altering of planting date	153 (65.1)	50 (21.3)	-	-	-	4.1	3rd	High
Mulching	78 (33.2)	86 (36.6)	27 (11.5)	7 (3.0)	7 (3.0)	3.6	5th	High
Fertilizer	174 (74.0)	44 (20.0)	14 (6.0)	-	-	4.7	1st	High
Compost application	-	16 (6.8)	3 (1.3)	2 (0.9)	-	0.3	11th	Low
Ridges across	121 (51.5)	9 (3.8)	13 (5.5)	-	-	2.9	7th	Low
Planting of cover	96 (40.9)	39 (16.6)	18 (7.7)	7 (2.9)	2 (0.9)	3.0	6th	High
Crop rotation	-	11 (4.7)	37 (15.7)	21 (8.9)	10 (4.3)	0.9	9th	Low
Shifting cultivation	7 (3.0)	4 (1.7)	1 (0.4)	2 (0.9)	4 (1.7)	0.3	11th	Low
Alley cropping	8 (3.4)	6 (2.6)	7 (3.0)	-	-	0.4	10th	Low
Irrigation	24 (10.2)	28 (11.9)	10 (4.3)	-	-	1.1	8th	Low
Mixed cropping	182 (79.1)	27 (12.3)	9 (3.8)	11 (4.7)	-	4.7	1st	High

Source: Field survey, 2016
WMS: Weighted Mean Square
Figures in parentheses are percentages

Table 5: Distribution of respondents by level of use of identified climate change adaptation strategies used.

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Constants	Frequency (percentage)					
	Level of severity					
	Very severe	Severe	Mild	WMS	Rank	Decision
Capital unavailability	136 (57.9)	64 (27.2)	22 (93.4)	2.4	1st	High
Irregularity of extension service	123 (52.3)	29 (12.3)	48 (20.4)	2.0	3rd	High
Inadequate required production inputs (e.g land, seeds, fertilizer etc)	101 (43.0)	97 (41.3)	37 (15.7)	2.3	2nd	High
No subsidies of planting materials	52 (22.1)	44 (18.7)	49 (20.9)	1.2	6th	Low
Poor access to information on climate change	58 (24.7)	58 (24.7)	68 (28.9)	1.5	4th	High
Low/poor awareness level on climate change variability	96 (40.9)	18 (7.7)	11 (4.7)	1.4	5th	Low
Time consuming exercise/ practice	32 (13.6)	21 (8.9)	14 (6.0)	0.6	7th	Low

Source: Field survey, 2016
WMS: Weighted Mean Score
Figures in parentheses are percentages

Table 6: Distribution of respondent by level of severity of constraints associated with the use of climate adaptation strategies.

changing of planting date also corroborated by Gbetibouo [16] who suggested that smallholder farmers can adapt to climate change by changing planting dates and diversifying crops.

Level of use of climate change adaptation strategies

Under this objective level of use of different climate change adaptation strategies among arable crop farmers were determined as shown in Table 5. Five Likert scale level of measurement was used and weighted mean score (WMS) was calculated and ranked accordingly. The adaptation strategies scaling mean was later used to recatigorized them into high and low. From the various strategies used fertilizer application and mixed cropping were have the highest WMS of 4.7 each and were ranked first (1st), which was followed by altering of planting date (3rd), cultivation of improved crop varieties (4th), mulching (5th) and planting of cover crops (6th) with WMS of 4.1, 4.0, 3.6 and 3.0 respectively. Furthermore, construction of ridges (7th) (WMS=2.9), use of irrigation (8th) (WMS=1.1), crop rotation (9th) (WMS=0.9) and alley cropping (10th (WMS=0.4) were raked least, while compost application and shifting cultivation came last from that order of ranking with WMS of 0.3 each (11th).

The above implies that crop farmers employed different adaptation strategies to curb various effects of climate change on arable crop production in the area. The variation in the level of use of various adaptation strategies among the farmers may be responsible by some factors such as type of arable crops cultivated, income level, land tenure, etc., and more importantly availability and accessibility to information on climate change may be responsible for their level of use of different climate change strategies in the area. This finding is in line with Hassan and Nhemachena [17] in their study on micro- level analysis of farmers' adaptation to climate change in southern Africa found that access to information about climate change forecasting, adaptation options and other agricultural activities remain important factors determining use of various adaptation strategies.

The level of use of some of the adaptation strategies are on the high side, which also may have certain negative effect over time on the soil and crop. Therefore, need for extension service which would focus and encourage the use of other strategies that are on low level of use should be considered necessary in the study area.

Constraints associated with the use of climate change adaptation strategies/level of severity

The study further examined the constraints associated with the use of climate change adaptation strategies and their level of severity in Table 6. Four rating scale of very severe, severe, mild and not severe were used, weighted mean score was also calculated and ranked accordingly to determine the severity level of different constraints as it affect the use of climate change adaptation strategies. The scaling mean of identified constraints was used to recatigorized them into high and low. Capital unavailability had the highest weighted mean score (WMS=2.4) and was ranked first (1st), followed by inadequate production inputs (eg. land, seeds, fertilizer, chemicals) (WMS=2.3) (2nd); irregularity of extension service (WMS=2.0) (3rd); while poor access to information on climate change was ranked forth (4th) with WMS of 1.5. Low/poor awareness level on climate change variability was ranked fifth (5th) (WMS=1.4), and time consuming exercise and also referred to duplication of effort had the least WMS and ranked least (7th).

This finding suggests that farmers sampled were able to identify all these afore-mentioned constraints as it affects the use of climate change adaptation strategies under arable crop production. More importantly the problem of inadequate production inputs is corroborated by Adesoji and Farinde [18] who reported that among problems hampering farmers arable crop yield is non-availability and non-affordability of agricultural inputs such as fertilizer, improved seeds, agrochemicals and tools. The variation in the level of severity of various constraints may be due to differences in their years of farming experience and their perception towards climate change as it affects arable crop production over the years. As these constraints affect the application of various climate change adaptation strategies, the arable crop yield would not be left out and likewise the household revenue of the farmers in the area. This is in line with Ole et al. [19], in their analysis of 9000 farmers in 11 African countries predicted falling in farm revenues with current climate scenarios.

Ordered probit analysis

Ordered probit and marginal effect regression estimate from the fitted model (which follows a standard normal distribution) in which the response variable is the level of use of climate change adaptation strategies, while the explanatory variables are the selected socio-economic characteristics of the arable crop farmers. The estimate revealed from the result in Table 7; an LR chi^2 of 51.39, pro > chi^2 of 0.0000 and pseudo R^2 of 0.1176. The coefficient of sex is positive and statistically significant at 10% ($p<0.1$), which suggests that increase in the either of the sexes involvement in arable crop production, would lead to the likelihood of level of use of climate change adaptation

Socio-economic variables	Coefficient	Std. Error	z-value
Age	-0.0009	0.0027	-0.35
Sex	0.0776	0.451	1.72*
Marital status	0.1230	0.0417	2.95***
Religion	0.1688	0.0328	5.14***
Year spent in school	-0.0650	0.0368	-1.77*
Year of farming experience	-0.0041	0.0025	1.67*
Source of income	0.0900	0.0265	3.39***
Farm size	-0.0009	0.0038	-0.24

Source: Data analysis, 2016
***Significant at 1%
*Significant at 5%

Table 7: Test of significant relationship between selected socio-economic characteristics of respondents and strategies using ordered probit regression analysis – Marginal effect.

strategies by 7.76%. Also the coefficient of marital status and religion is positive and both were statistically significant at 1% (0.01), which implies that marital status and religion of arable crop farmers have significant influence on the likelihood of level of use of climate change strategies by 12.30% and 16.88%. The result further revealed that coefficient of years spent in school is negative and statistically significant at 10% (p>0.1), suggests that the more the years spent in school, the decrease in the likelihood of level of use of climate change adaptation strategies by 6.5%.

The coefficient of source of information is positive and statistically significant at 1% (p>0.01), which implies that increase in information sources on climate change would lead to increase in the likelihood of level of use of climate change adaptation strategies among arable crop farmers. In the same vein, the coefficient of farm size is positive and statistically significant at 1% (p>0.01), suggests that an increase in the size of arable farm land cultivated is the increase in likelihood of level of use of climate change adaptation strategies by arable crop farmers in the area. This result suggests that all the afore-mentioned socio-economic variables (sex, marital status, religion, years spent in school, source of information and farm size) have decisive influence on the level of use of climate change adaptation strategies identified with the arable crop farmers in the area.

This suggests that socio-economic characteristics of the arable crop farmers determine level of use of climate change adaptation strategies in the area. This finding is in line with Deressa et al. [7] where education level, use of extension services, availability of credit (as part of selected socio-economic characteristics) positively and significantly affected adaptation to climate change but size of the farm negatively affected adaptation. Also Hassan and Nhemachena [17] in their study of climate change adaptation strategies in southern Africa noted that more farming experience increases the probability of a farmer adapting to climate change. They found out that farmer's experience increases the probability of up-take of all adaptation options.

Conclusion

Climate change impacts on agriculture generally are not only regionally distinct but also highly heterogeneous spatially; changes in the frequency and severity of extreme climate events will have significant consequences for food production and food security. Arable crop farmers use combinations of climate change adaptation strategies and some of the strategies are on the high side level of usage especially mixed cropping, fertilizer application, altering of planting date, cultivation of improved seed varieties, mulching among other strategies identified in the study.

Capital unavailability, inadequate required inputs, irregularity of extension service, poor access to information on climate change, low/poor awareness level of climate variability constrained the farmers on the of use of climate change adaptation strategies for arable crop production. Socio-economic characteristics of the arable crop farmers influence level of use of climate change adaptation strategies identified in the area.

The study therefore recommends that advisory services, provision of production inputs and infrastructural facilities should be provided and encouraged use of strategies that are on low side level of usage by various stakeholders in agricultural development while efforts should be redirected in the provision of necessary assistance especially capital, subsidizing crop production inputs and reintegration of climate information into national policies.

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