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Adoption of climate change mitigation technologies among farmers: The case of Mamprugu Moaduri District of the North East Region of Ghana

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Abstract
This study investigates the climate change mitigation technologies adopted by farmers in the Mamprugu Moaduri District of the North East Region of Ghana. The objectives were to assess the demographic characteristics of farmers, their perceptions of climate change, and the impact of adopted mitigation strategies on agricultural productivity. A sample of 80 farmers was selected using random and purposive sampling techniques, and data were collected through structured questionnaires. The analysis employed descriptive statistics using the Statistical Packages for Social Sciences (SPSS). Results indicated that the majority (75%) of farmers engaged in subsistence farming, with access to climate information primarily through radio and television. Farmers reported experiencing climate change variations, including higher temperatures, delayed rainfall, and flooding. Knowledge of climate change occurrences was prevalent, with many farmers recognizing the adverse effects on crop yield and agricultural practices. The study identified several climate change mitigation strategies employed by farmers, such as using improved seed varieties, tree planting, and improved farming methods. However, challenges such as limited access to capital, inadequate knowledge of mitigation options, and insufficient labor hindered effective implementation. The findings underscore the need for enhanced education and support systems to empower farmers in adopting effective climate change mitigation strategies. Overall, the study highlights the critical role of climate-smart agriculture in improving resilience and productivity in the face of climate change, emphasizing the importance of targeted interventions to address the unique challenges faced by farmers in the region.

Keywords: Mamprugu Moaduri, Ghana, climate change, mitigation technologies, agricultural productivity

Introduction
Debates and dialogues on international environmental change are presently focused on climate change (O'Neill *et al.*, 2017) [1]. The effects of climate change on the environment have called for a combine effort globally towards unbiased policy action that will work effectively and efficiently (Harris, 2007) [2]. In the coming years, the effects of climate change such as higher temperatures, irregular precipitate, flooding and life threatening weather conditions in global south are projected to be severe. However, these climate change effects pose risks for agriculture, forests and supply of basic necessities including food and water (Kifle, 2008) [3].

Climate change and its consequences from the early 1970s up to date is being experienced in Africa in terms of the environmental changes such as an increase in temperature, decline in agrarian production, changes in weather and spread of disease (Girvetz *et al.*, 2019)[4]. Africa's climate vulnerability is purported to be as a result of a series of factors including fragility of their adaptive capacity, over dependence on outmoded agrarian practices for their survival on ecosystem commodities among others (Ofoegbu *et al.*, 2019)[5].

According to Kurukulasuriya *et al. (*2006)[6], agricultural practices are at risk to climate change more than any other sectors of an economy even though the menace of climate change is both to the agriculture and non-agricultural sector. Smith and Skinner (2002) [7] reported that, climate change has a significant effect on agricultural productivity especially when it comes to soil moisture and fertility. So, climate variability such as irregular rainfall can adversely affect farming from cultivation to harvest.

Even when there is sufficient rain, but it is not available during the critical growing stage of crops, it can adversely affect crop yield (Witt & Waibel, 2009) [8].

Climate change mitigation and adaptation are the two key policies identified by the United Nations Framework Convention on Climate Change (UNFCCC, 2008) [9] to be used in tackling climate change. Climate change mitigation aims at decreasing 'greenhouse gases (GHGs) presence in the atmosphere while keeping carbon emission low through climate change response that targets the reduction of climate change impacts via climate-smart agriculture[1].

Climate-smart agriculture, an intervention for climate change mitigation and adaptation, is being used by farmers to tackle the challenges such as prolonged dry seasons and irregular rainfall caused by climate change and climate change variability. Climate-smart Agriculture is also used to reduce the burden on natural forests (Nyasimi *et al.*, 2017) [11]. For instance, the tree component in agroforestry helps seasonal crops to tolerate climatic conditions such as drought while supporting food grower's food security by preventing complete crop failure (Charles *et al.*, 2013, Ekpo and Asuquo, 2012, Uisso, 2015) [12-14].

Given that the global food and nutrition security is at risk because of the effects of climate change and it is anticipated to deteriorate in future because of unpredictable nature of environmental and weather conditions including floods and drought (Barasa *et al.*, 2021) [15]. According to Zakaria and Matsui (2020) [16], in Africa and Ghana the impacts of climate change on agriculture have been debated. Although, presently, in Africa continent climate change has not peak yet especially in Sub-Saharan Africa (SSA), nonetheless historically data such as rainfall and temperature revealed possible repercussions with respect to food production and to some extent food security (Serdeczny *et al.*, 2017) [17]. It is reported that climate change could worsen local experience such as malnutrition and poverty because high temperature, flood and drought occurrences aggravated crop productivity with its attendants effects on quality of life as well as health (Asante & Amuakwa-Mensah, 2015)[18].

Perhaps appropriate climate that are suitable for living organisms both on land and in water is predicted to deviate from typical value since average weather appears warmer. In this regards some region specifically West Africa is considered as a "climate change hotspot" and it is believed that the changing climate will reduce crop output that will affect food security in this part of the region (Müller *et al.*, 2014) [19].

Research conducted on climate mitigation technologies adopted by farmers with respect to changing climate is inadequate, although several studies have thrown light on farmers' perception on climate change (Zakaria and Matsui 2020; Makate *et al*. 2017; Ghosh *et al*. 2015; Zampaligré *et al*. 2014; Gbetibouo, 2009) [16, 20-23]. However, adoption of mitigations technologies among farmers received limited attention in research and our study strive to fill out this research gap and therefore seeks to find out the climate mitigation technologies adopted by farmers and their effect in the Mamprugu Moaduri District.

[1] Climate–smart agriculture is an approach that has the potential to sustainably increase productivity, reduces greenhouse gases (mitigation) enhances resilience (adaptation), where possible and extends the achievement of food security and development goals. Climate–smart agriculture acts as an intervention for climate change mitigation and adaptation (Palombi & Sessa, 2013) [10].

Methodology

The target population for this study was farmers in the farming communities in the Mamprugu Moaduri District of the North East Region of Ghana. The study employed a sample size of five percent (5%) which is a valid representation according to Bailey and Mouton (1998) [24] who recommended that, for studies that use statistical data analysis, a minimum of 30 respondents is enough to represent the population.

The study employed random and purposive sampling techniques to collect data. A simple random sampling technique was used to select the required number of farming communities for the study and eighty (80) farmers were selected from farmer-based group within the farming communities in the Mamprugu Moaduri district who are leaders of the farmers group.

Questionnaires were used to collect information on demographic characteristics, perception of climate change, climate change mitigation technologies and impact of the climate change mitigation technologies. Data collected from this study was analyzed using the Statistical Packages for Social Sciences (SPSS) software package. The results of this study were presented in percentages in tables for analysis and discussion.

Results and Discussion

Demographic characteristics of respondents

Result in Table 1 presents the socio-economic characteristics of farmers. The demographic results of farmers Mamprugu Moaduri district farming communities revealed that, majority (37%) of the farmers were within the 31-40 years age range followed by the 41-50 years age range (35%). Majority (72%) of the farmers are youth between the age bracket of 31-50 years which indicate that, most farmers in the district were in their active ages, thus Mamprugu Moaduri farmers are energetic, dynamic and well equipped to cope with the daily agricultural challenges and the effects of climate change. Majority (72%) of the farmers was involved in farming activities because farming remains the main occupation of the people which confirms the findings of Nwachukwu (2003) [25] that farmers in their 40's are mature in age, energetic and capable of agricultural production.

The results also revealed that, 80% of farmers were male implying that more male (64 respondents) were involved in farming than female (16) in the study area. This result contradicts the assertion of Akpabio (2005) [26] that, females dominate the present farming population; women are often more easily motivated than men to adopt innovations. Similarly, majority (72%) of the farmers had household size of between 8-14 persons which indicates that, the farming system in the Mamprugu Moaduri district farming communities requires more labour, thus there will be labour available for farming activities although it can also be influenced by age, gender, and health status of the household.

The mean of farmer's household size in the Mamprugu Moaduri district is twenty (20) which means that, the average household size of farmers in the farming communities is twenty (20). Despite the average household size of twenty (20) and an average farm size of thirteen

(13.33) acres, farmers identified inadequate labour force as one of the most pressing problems they encounter because most farmers used indigenous farming methods and farm control measures which requires more labour force and increased farm duration.

The community farmers (45%) had varying educational qualifications even though fifty five percent (55%) of them had no formal or informal education. The primary data on farmers' level of education showed that most farmers (25%) have completed senior high school while ten percent (10%) of farmers completing basic and tertiary education. Farming accounted for seventy five percent (75%) of community members occupation while secondary occupations (trading, civil service, tailoring, hunting among others) accounted for the remaining percentage.

Livelihood characteristics of respondents

The findings from the study (Table 2) reveals that, majority (75%) of respondents are engaged in subsistence farming with the remaining (25%) engaging in commercial farming. 43%, 37% and 20% of farmers in the Mamprugu Moaduri District farming communities are involved in crop farming, mixed farming and agroforestry respectively. The study further shows that, 32%, 24% and 22% of the respondents had farming experience range between 21-25, 16-20 and 26-30 years respectively whilst 11% of farmers had more than thirty years (30) of experience in farming. The results implies that, majority of the respondents had been in farming for many years and may have significant knowledge and understanding about climate change, its effects and mitigation strategies in the study area. This finding supports the study of Shetty (2005) [27], who reported that, more years of farming experience improve awareness of potential benefits and willingness to participate in natural resource management.

Economic status of respondents

With respect to respondents' economic status, Table 3 shows that, fifty two 52 (65%) and forty four 44 (55%) of the respondents owned radio and television respectively, thus majority of the farmers in the communities have access to climate change information through radio and television.

Also, majority (68%) of the farmers had small farm size of between 1-20 acres whilst few (7% and 3%) farmers had large farm size of between 81-100 acres and above 100 acres. This indicate that, few farmers (10%) in the farming communities practice commercial farming, thus not many farmers harvest high yield of agricultural produce in the Mamprugu Moaduri.

The findings from the study shows that, most of the respondents' source of funding is farmers' co-operatives (42%) followed by relatives or friends (25%) and commercial banks (13%), however significant number of farmers (20%) financed their farming activities on their own. Majority of farmers (30%) earn annual income of between the ranges of 3100-6000 Ghana cedis, meanwhile some commercial farmers (10%) earn annual income above nine thousand (9000) Ghana cedis. Few farmers (10%) in the district practicing subsistence farming earn less than thousand (1000) Ghana cedis or do not earn income at the end of the year.

Farmers earning less than thousand (1000) Ghana cedis in a year means that they have low income level, which can be attributed to the subsistence level of farming prevalent in that particular farming community. This finding supports the study of Barnett & Webber (2009) [28] who reported that, small-holder farmer livelihood assets lead to better and enhanced livelihood outcomes which include more income, increased well-being and improved food security, thus the nature of farmer livelihood assets influences smallholder farmers' capacity to respond to environmental shocks.

Small-holder farmers with less income focus on activities that are less dependent on climate. An analysis of national household survey data in Burkina Faso between 1998 and 2007 showed that, the average wealth increased for almost all major livelihood groups and the number of wealthy people steadily increased. These results highlight the importance of off-farm income which generates opportunities, especially in marginal rural areas, for long-term adaptation strategies to climate variability and change (Nielsen and Reenberg 2010) [29].

Access to climate information

From table 4, eighty percent (80%) of farmers access to climate or weather information presuppose that, farmers in the Mamprugu Moaduri have enough information on climate change mitigation strategies which is in line with the Bernstein (2008)[30] assertion that, climate change adaptation involves taking the right measures to reduce the negative effects of climate change or exploiting positive effects of climate change by making the appropriate adjustments and changes in natural or human systems in response to actual or expected climatic stimuli or effects which moderates harm or exploits beneficial opportunities.

The respondents in the communities use communication tools such as radios and televisions and communication services rendered by weather station and extension officers to access climate information on climate or weather variations. Communication tools and services provides climate information such as the time farmers have to expect rain, sunlight and other factors relating to rainfall.

Result in Table 5 shows that, farmers' sources of climate information in the district include household or personal radio and television, weather station and extension services. Respondents interviewed revealed that eighty percent (80%) of farmers have access to climate or weather information and they rely or acquired 85%, 65%, 50% and 75% climate information from household radio, household TV, extension services and weather information respectively.

Climate change perception of respondents

Climate change is perceived by respondents to be a threat to agricultural production in the study area. The data analyzed reveals that, respondents perceive higher temperature, delayed rainfall, unusual heavy rainfall, undefined season, flooding, late fruiting of tree crop and longer days than night as the climate change variations they experienced.

Table 6 shows that, farmers perceived flooding (97%) as the most experienced occurrence that depicts climate change or variability, followed by higher temperature (80%) and delayed rainfall (75%). However, undefined season (23%) was realized by farmers as the least experienced climate occurrence or change, meanwhile late fruiting of tree crop and longer days than night were not perceived by farmers as climate variability. This suggests that majority of farmers in the study area perceived flooding, higher temperature and delayed rainfall as the key determinants of climate change.

This findings is similar to the study of Sjogersten *et al.*, (2013) [31] which showed that, farmers perception closely matched climatic data, such that, majority of the farmers they interviewed in lowland Nepal indicated they have personally experienced climate change and have observed erratic rainfall, a decreased in water level of nearby rivers and wells, as well as an increase in the level of cold waves in the last fourteen (14) years. Studies show that, majority of African farmers are aware of climate change but have limited capacity to deal with its impact due to challenges due to poor access to credit, high cost of adaptation measures, and lack of access to information and extension services (Juana *et al.*, 2013) [32].

Respondents' knowledge of climate change occurrences

Almost all the respondent interviewed are in the known that climate plays a dominant role in agriculture production, thus perceive climate change as a primary determinant of agricultural productivity. Farmers engaged are more knowledgeable of climate change occurrences such as increase temperature, unpredictable rainfall pattern, strong tides of wind, dried up of water bodies, drought, excessive flooding, erosion, increase pests and diseases, frequent disease outbreak and poor yield.

From Table 7, forty (40) farmers representing fifty percent (50%) of the total number of farmers in the farming communities had excellent knowledge of the fact that, climate change leads to poor crop yield whiles thirty eight (38) of these farmers (47%) had good knowledge of the fact that climate change leads to poor yield. Majority of the farmers had good knowledge of climate change causing increase temperature (47%), unpredictable rainfall pattern (47%), dried-up of water bodies (57%), drought (52%) and excessive flooding (45%).

Apata *et al.* (2009) [33] reported that, local farmers are experiencing climate change even though they have not considered it deeper implications. This is evidenced in the late arrival of rain and the drying-up of stream which are the effects of climate disturbances. Furthermore, most farmers had fair knowledge about climate change leading to strong tides of wind (82%) and erosion (35%) but poor knowledge about climate change triggering increase pests and diseases (65%) and frequent disease outbreak (57%).

Climate change effect on agricultural production

Based on respondents' response to effect of climate change, it is evidence that respondents have the view that climate change has a negative impact on agriculture and presume it influence agricultural production thus perceive that their agricultural activities are highly vulnerable to the impacts of climate change. Respondents believed that seedling drying after germination, easy spread of pest and disease, ineffectiveness of agricultural chemical, stunted growth and low crop yield are the effect of climate change on agricultural production.

The study identified low crop yield (97%) to be the dominate effect of climate change on agricultural production followed by seedling drying after germination (65%) and stunted growth (62%). Easy spread of pests and diseases (28%) and ineffectiveness of agricultural chemicals (20%) were further revealed from (Table 8) to be the least dominate effect of climate change on farming activities.

Farmers' experience of low crop yield as dominate effect of climate change on their agricultural production is associate with the observation of Witt & Waibel (2009) [8] that, adverse climate effects can influence farming outputs at any stage from cultivation through the final harvest. Even if there is sufficient rain, its irregularity can affect yields adversely if rains fail to arrive during the crucial growing stage of the crops.

Climate change mitigation technologies adopted

Table 9 presents climate change adaptation strategies adopted by farmers. Climate change strategies implemented by farmers include: treatment of seeds (30%), using improved varieties (92%), improved farming methods (38%), prevention of bush burning (18%), control of tree felling (30%), tree planting (97%) and windbreak planting (5%). Climate change mitigation technologies were adopted by respondents to mitigate the impact of climate change such as seedling drying after germination, easy spread of pest and disease, ineffectiveness of agricultural chemical, stunted growth and low crop yield on agricultural production. Climate change mitigation strategies that were employed include treatment of seeds, using improved varieties, improved farming methods, prevention of bush burning, control of tree felling, tree planting and windbreak planting.

Apata *et al.*, (2009) [33] opined that, rural communities to a large extent have been able to develop their livelihood strategies in a way which enables them to constantly cope with and adapt to an erratic climate change, severe pest attack, changing agricultural policies at local, national, global levels and other natural factors. Vaast & Somarriba (2014) [34] supported the fact that, farmers in West Africa including Ghana have interest in planting more types of trees in their farms to sustain production, diversify revenues and improve their adaptation capacity.

Deressa *et al.* (2009) [35] observed that, irrigation, crop rotation, use of improved seeds, timely planting and soil conservation are the most common strategies employed by farmers to cope with climate change impact. Farmers used these methods to minimize the impact of climate. Deressa *et al.* (2009) [35] study further indicated that, wealth of a household head, level of education, gender, access to extension services and information, temperature, credit facilities and geographical location of farmers have impact on the climate change mitigation strategies adopted by farmers. However, availability and access to information largely affect adaptation strategies.

Challenges encountered when implementing climate change mitigation

The problems encountered by the respondents while implementing climate change mitigation technologies are presented in Table 10. Limited access to capital (95%), insufficient land (72%) and inadequate knowledge on climate mitigation options (70%) were identified as the most pressing problems faced by farmers while implementing climate change mitigation technologies in the Mamprugu Moaduri district.

Farmers associated most of these constraints with limited credit facilities, thus they are hindered from getting the necessary resources and technologies that could facilitate adaption of climate change. Also, insufficient land emphasized by farmers as a challenge is due to the fragmentation of lands and high population pressure which has led them to continuously and intensively cultivate available small parcel of land without giving reasonable consideration to the use of climate change mitigation technologies.

Climate change mitigation effects

From table 11, majority of the farmers said that, the climate change mitigation strategies they implement has contributed to the reduction of flooding, reduced temperature and reduced drought representing 87%, 75% and 52% of their response respectively. Implementation of climate change mitigation strategies by farmers led to less significant effect of the following; predictable rainfall pattern, increase level of water bodies, decreased pest and disease infestation, improve crop and animal resilience, predictable farm yield, increase productivity and reduction of greenhouse gas emission. Hence, climate change mitigation effects identified by respondents include reduced temperature, reduced drought, predictable rainfall pattern, increase level of water bodies, reduced flooding, decreased pest and disease infestation, improve crop and animal resilience, predictable farm yield, increase productivity and reduction of greenhouse gas emission. Vernooy *et al.,* (2017) [36] reported that, benefits derived from climate change mitigation strategies include pest and disease reduction, increased production, increased production stability and climate stress buffering as climate adaptation strategies.

Tables on adoption of Mitigation technologies

Table 1: Demographic characteristics of farmers

Category	Frequency	Percentage (%)
Age		
17-30	12	15
31-40	30	37
41-50	28	35
Above 50	10	13
Gender		
Male	64	80
Female	16	20
Level of Education		
Basic Education	8	10
Secondary Education	20	25
Tertiary Education	8	10
Non-formal Education	44	55
Household Size		
1-7	8	10
8-14	58	72
15-22	12	15
Above 23	2	3
Religion		
Traditional Religion	26	32
Islamic Religion	44	55
Christian Religion	8	10
Non-Religious	2	3

Source: Field survey, 2022

Table 2: Livelihood characteristics of farmers

Category	Frequency	Percentage (%)
Method of Farming		
Subsistence farming	60	75
Commercial farming	20	25
Type of Farming		
Crop farming	34	43
Animal farming	0	0
Mixed farming	30	37
Agroforestry	16	20
Years of Farming		
11-15	10	11
16-20	20	24
21-25	26	32
26-30	18	22
Above 31	10	11

Source: Field survey, 2022

Table 3: Economic status of farmers

Category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Farmer's Asset				
Radio	52	28	65	35
TV	44	36	55	45
Tractor	10	70	12	88
Farm Size				
1-20 acres	54	-	68	-
21-40 acres	8	-	10	-
41-60 acres	6	-	7	-
61-80 acres	4	-	5	-
81-100 acres	6	-	7	-
>100 acres	2	-	3	-
Source of Finance				
Relatives or friends	20	25	-	-
Farmer cooperatives	34	42	-	-
Commercial banks	10	13	-	-
Nil	16	20	-	-
Annual Income				
Nil	8	10	-	-
<1000	6	8	-	-
1100-3000	20	25	-	-
3100-6000	24	30	-	-
6100-9000	14	17	-	-
>9000	8	10	-	-

Source: Field survey, 2022

Table 4: Access to climate information

Category	Frequency	Percentage (%)
Access to Information		
Yes	64	80
No	16	20

Table 5: Sources of farmers' climate information

Category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Source of Information				
Household radio	68	12	85	15
Household TV	52	28	65	35
Weather station	40	40	50	50
Extension service	60	20	75	25

Source: Field survey, 2022

Table 6: Climate change perception of farmers

Category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Climate Change Perception				
Higher temperature	64	16	80	20
Delayed rainfall	60	20	75	25
Unusual heavy rainfall	32	48	40	60
Undefined season	18	62	23	77
Flooding	78	2	97	3

Source: Field survey, 2022

Table 7: Farmers knowledge of climate change occurrences

Category	Excellent (Frequency)	Good (Frequency)	Fair (Frequency)	Poor (Frequency)	Excellent (%)	Good (%)	Fair (%)	Poor (%)
Knowledge of Climate Change								
Increase temperature	26	38	6	10	32	47	8	13
Unpredictable rainfall pattern	4	38	22	16	5	47	28	20
Strong tides of wind	2	12	66	0	2	15	83	0
Dried-up of water bodies	2	46	28	4	2	57	36	5
Drought	36	42	2	0	45	53	2	0
Excessive flooding	32	36	8	4	40	45	10	5
Erosion	0	18	36	26	0	23	45	32
Increase pest and disease	0	2	28	50	0	2	35	63
Frequent disease outbreak	0	10	24	46	0	12	30	58
Poor yield	40	38	2	0	50	48	2	0

Source: Field survey, 2022

Table 8: Farmers response to effect of climate change on agricultural production

Category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Effect of Climate Change				
Seedling drying after germination	52	28	65	35
Easy spread of pests and diseases	22	58	28	72
Ineffectiveness of agricultural chemicals	16	64	20	80
Stunted growth	50	30	62	37
Low crop yield	78	2	97	3

Source: Field survey, 2022

Table 9: Climate change mitigation technologies adopted by farmer

Category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Climate Change Mitigation Technologies				
Treatment of seeds	24	56	30	70
Using improved varieties	74	6	92	8
Improved farming methods	30	50	38	62
Prevention of bush burning	14	66	18	82
Control of tree felling	24	56	30	70
Tree planting	78	2	97	3
Windbreak planting	4	76	5	95
Taungya system	0	0	0	0
Establishment of firebreak	0	0	0	0

Source: Field survey, 2022

Table 10: Climate change mitigation challenges faced by farmer

Category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Challenges of Climate Change Mitigation				
Delay in delivery of climate information	40	40	50	50
Inadequate knowledge on climate mitigation options	56	24	70	30
Lack of improved seeds	30	50	38	62
Inadequate labour force	30	50	38	62
Lack of access to capital	76	4	95	5
Insufficient land	58	22	72	28

Source: Field survey, 2022

Table 11: Farmers response to effect of climate change mitigation

Category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Effect of Climate Change Mitigation				
Reduced temperature	60	20	75	25
Reduced drought	42	38	52	48
Predictable rainfall pattern	22	58	28	72
Increase level of water bodies	22	58	28	72
Reduced flooding	70	10	87	13
Decreased pest and disease infestation	26	54	33	67
Improve crop and animal resilience	10	70	13	87
Predictable farm yield	8	72	10	90
Increase productivity	20	60	25	75
Reduction of greenhouse gas emissions	4	76	5	95

Source: Field survey, 2022

Conclusions

We assessed climate change mitigation technologies adopted by farmers in the Mamprugu Moaduri District of the North East Region of Ghana. Descriptive statistics was employed to analyze data and present responses of farmers in percentages.

The study revealed that majority (75%) of farmers in the study area engaged in subsistence farming while the remaining (25%) engaged in commercial farming. Most of the farmers have access to climate change information through radio, television, weather station and extension services.

Furthermore, we found out that, respondents experienced climate change variations such as higher temperature, delayed rainfall, unusual heavy rainfall, undefined season, flooding, late fruiting of tree crop and longer days than night. Also, the result showed that, farmers in the Mamprugu Moaduri have knowledge of climate change occurrences such as increase temperature, unpredictable rainfall pattern, strong tides of wind, dried up of water bodies, drought, excessive flooding, erosion, increase pests and diseases, frequent disease outbreak and poor yield.

Further findings showed that, respondents experienced climate change effects such as seedling drying after germination, easy spread of pest and disease, ineffectiveness of agricultural chemical and low crop yield on their agricultural production. However, farmers employed climate change mitigation strategies including treatment of seeds, using improved varieties, improved farming methods,

prevention of bush burning, control of tree felling, tree planting and windbreak planting.

In addition, farming activities in the district faced numerous challenges and among these constraints were access to capital, high price of improved seeds, inadequate labour, inadequate knowledge on climate mitigation options and delay in delivery of climate information.

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