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Research Article

The impact of climate variability on agricultural food crop production and output: the case of some selected communities in Offinso South District of Ghana

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Abstract

In Ghana, there is evidence of the direct influence of climate change on the environment, such as rising temperatures, variable rainfall, and precipitation. These manifestations affect various facets of Ghana socio-economic structure especially with its high reliance on sectors that are particularly sensitive to climate change like agriculture. In the settlements of Bonsua and Amoawi in the Offinso South District, the study concentrated on the influence of climate change variables on food crop production and how farmers are adapting to the various climate change measures. Out of the total of 650 staple food crop farmers in the dorminated selected communities namely, Amoawi and Bonsua, 160 farmers were chosen for the study using systematic random sampling. The study included both primary and secondary data. Descriptive cross sectional survey was employed for the study. The data collection instrument employed was Structured and semi-structured interviews. SPSS was used to analyse the data. The data collected for the study were analysed using both descriptive and inferential analytical tools. Findings from the study indicate that climate change is a challenge to food crop production since agriculture activity in the two communities are mostly rain feed (97.5%). The majority of the crops grown in the two areas are climate change vulnerable. Another study finding reveals that most respondents have modified their coping mechanisms such as such as growing different crop varieties, early and late planting, irrigation and soil conservation to deal with how climate change is affecting agriculture. Therefore, the study suggests that both government and non-governmental organizations should support farmers in building irrigation systems to continuously irrigate their food crops during the dry season, increasing their farm productivity.

More Information

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Introduction

Climate change triggers reactions in numerous human and ecological systems in a system that is heavily regulated by humans. Human health, agricultural productivity, pest outbreaks, crop timing, flooding, biological dispersal, and extinction are all impacted by climate variation. Effects of climate change may be muted or confused by other causes, making them impossible to identify. At the farm, marketing, and policy levels, understanding climatic variability is crucial for agricultural decision-making. Furthermore, there are limited choices for addressing climate change, which makes the poor more susceptible to it. This is particularly true in Ghana, where the mainstream of the population relies on agriculture, forestry, and/or fishing as a primary source of income. Therefore, sensible or effective policies would reduce how much the climate has an impact on food security. Due to crop failure, an increase in disease, and a rise in livestock

mortality rates, climate change poses a danger to agriculture and food security. Weather alteration is defined by the United Nations Framework Convention on Climate Change (UNFCC, 1992) as an alteration in the weather that is directly or indirectly related to human activity that alters the global atmosphere's structure and that is added to ordinary weather unpredictability seen over equal periods. According to Zhu [1], weather alteration has both beneficial and adverse impacts on farming, but there may be a longer-term adverse impact that could result in food scarcity if quick action is not taken to address these issues. Crop yields are impacted by a wide range of climate change-related features, comprising temperature, rainfall, excessive weather events, climate variability, and even atmospheric carbon dioxide absorption, which is foreseen to root global warming and have an important influence on crop production, according to United States Data.

The most climatically reliant aspect of human life is agriculture. Agriculture continues to be a major contributor to the economies of many developing nations globally, including Ghana and the majority of sub-Saharan Africa. Everywhere in the world, weather issues are rarely steady and are categorized by significant seasonal to annual fluctuations. Climate change must be a major concern for nations like Ghana, where 70% of the population relies on agriculture for a living (FAOSTAT, 2010).

Most African economies are based mostly on agriculture. It is the main producer of savings and tax receipts, the largest determinant of the continent's Gross Domestic Product (GDP), and the major source of foreign exchange, accruing for over 40% of the landform's foreign cash profits. Additionally, according to the Food and Agriculture Organization of the United Nations, 56% of the workforce is involved in agriculture, and around two-thirds of producing value-added is based on agricultural raw supplies [2]. High evaporative claim, runoff, and drainage fatalities following severe rainfall that may be as high as 50% of usual rainfall can also lower crop output in dry land locations. In addition, there are additional factors that could worsen or contribute to the anticipated decrease in production, such as increased pest and disease pressure and the frequency of thrilling occurrences like droughts and floods. The aggregated effects on production across West Africa may conceal significant variations in the impacts of weather variation on Ghana's agricultural output [3].

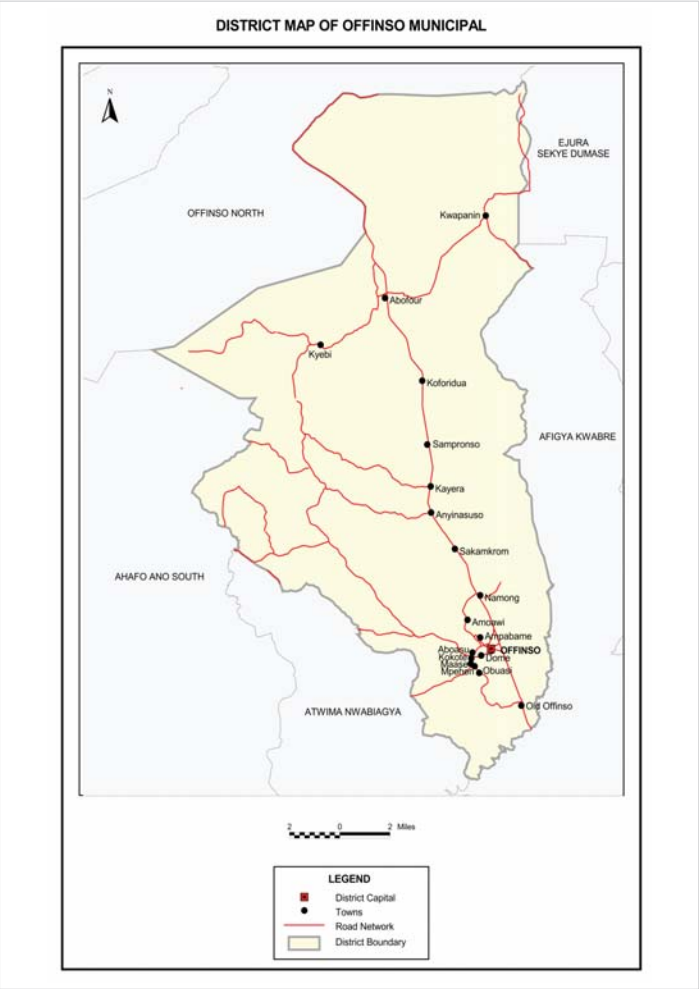
These impacts of climate variation, which have been foretold by the various models mentioned earlier and include rising air temperatures, altered precipitation patterns, intensified droughts in arid regions, increased frequency of thrilling weather activities, earlier mountain snowmelt, and rising ocean levels, have the potential to have a perverse effect on agricultural output and public health. The interplay between people, ecosystems, and natural resources is dynamic. People are both, directly and indirectly, responsible for changing ecosystems and natural resources, and those changes affect how well people are doing. The use of coping to lessen the effects of weather variations on ecosystems and natural incomes is extensively acknowledged in the literature.

This will be used in the investigation. This study aims to clarify the influence that weather alterations have had on food crop yield and the amount that it supplies for human consumption. The fact that the weather is altering is beyond dispute, but there is a great deal of ambiguity around its pace and scope, as well as its diverse effects on the regions, industries, countries, and communities of Sub-Saharan Africa. However, there isn't much research that uses a rigorous methodology and high-value data to examine comparable challenges in Ghana, an emerging country in Sub-Saharan Africa. One of the 27 Managerial Districts in the Ashanti Region is the Offinso South District. It was established in the latter half of 2007 and is situated in the Region's excessive north-western corner. Climate change has an important influence on the district's food crop output and the availability of food for human usage.

The non-existence of climatical data influences decisions on crop production and unprotected farmers to low crop output and production. According to the District Agriculture Development Unit (DADU, 2003), since farmers do not have complete knowledge of information concerning climate variations, this results in low production and consequently affects the agricultural output. The community, specifically Bonsua and Amoawi, are particularly affected. As a result, while evaluating how climate change would affect food in the district, the problem of food quality has not been given enough weight, which has an impact on countless farmers' livelihoods, the rural people, and the direction of the output scheme. A reading to determine the inspiration of weather inconsistency on agricultural food crop production and production is necessary because of the apparent adverse impact of weather alteration on livelihoods (yield).

Study area

The Offinso South Municipal is one of the new Municipalities created in Ashanti Region in 2007 as part of the decentralized policy of the Kuffuor led government. It was part of the then Offinso District Assembly that was divided into two: Offinso North District Assembly and Offinso South Municipal Assembly. The Municipality shares common boundaries with Offinso North District Assembly in the North, Afigya Kwabre in the East and South, Atwima Nwabiagya and Ahafo-Ano South District Assemblies in the West. It lies within latitude 7º151Nand 6º951S and longitude 1º351E and 1º501W and has a total land area of about 600km2. The Municipality comprises 22 suburbs with New Offinso as its capital (OSMP, 2010). Below is a map of Offinso Municipal.



Materials and methods

Research methods

Both qualitative and quantitative research methods were used in the study. Crop producers from the Amoawi and Bonsua areas in the Offinso South District are included in the reading population. All crop producers who produce staple crops and are susceptible to the influence of weather alteration made up the population. About 650 homes in the two chosen communities, which are staple crop producers according to the district profile, were used as the study's population. The study chose 160 crop growers, 80 from each of the two villages, using a systematic random sampling method. With the help of the systematic random sampling technique, every member of the population component have a noted equal possibility of being selected. The procedure demands that the first member of the sample is selected randomly using simple random sampling method and subsequent members of the sample are systematically determined. An exhaustive list all 650 food crop farmers in the population was produced via systematic random sampling. K = 650/160 = 4 when choosing 160 farmers out of 650 farmers (where K is the sampling interval). Randomly chosen from the list was the first sample component from the first 4th element on the population list. Next, the fourth element on each list was chosen. Therefore, a sample of 160 household food crop farmers were chosen for the study. To ensure a high level of representativeness, systematic random sampling had to be used because the population's associates are similar to one another on the subject being studied. The sample size of 160, though small, was used due to time and fiscal restraints.

Face-to-face structured interview was used in place of a self-completion questionnaire. The reason for this choice is that we anticipated that the literacy levels of the potential respondents would vary. Not all the potential respondents were expected to possess the skills of reading, comprehending and writing. Because of this, it would not be easy to look for such respondents who possess those skills and therefore, a face-to-face structured interview was preferred also for "standardization of both the asking of questions and the recording of answers". Since the interview instrument was to be translated into the local language, it was deemed easier to ask the respondents face-to-face than leaving them to write the answers themselves. Structured interview method was used to collect data from the farmers in the study area.

Unlike structured interview which has rigorous set of questions which does not allow one to divert, semi-structured interview is open, allowing new ideas to be brought up during the interview as a result of what the interviewee says. Semi-structured interview was used to obtain qualitative data for this study. Qualitative data in a form of attitudes, feelings and opinions were not collected through the use of the structured interview method but was rather collected separately through semi-structured interviewing. An interview guide, with a list of guiding questions was formulated with the intention to give the interviewee a wider scope within which to respond. The semi-structured interview method was therefore, used because of its flexibility (yet with delimited generality) and allowance it gives to the interviewee in responding as they deem important.

Both descriptive and inferential analytical techniques were employed to evaluate the study's data. The descriptive statistical evaluation made it possible to meaningfully characterize the data. While inferential approaches were utilized to analyze the qualitative data acquired, it was used to quantitatively describe the key aspects of the field data. Measures of central tendencies, measures of spread, and graphical and table displays were a few of the descriptive tools available. To analyze the quantitative data, the study focused on using tables and graphical representations. The surveys received responses from each of the 160 farmers who were sampled and chosen for the study, yielding a response rate of 100%. SPSS version 19.0 was used to edit, code, and analyze the data gathered. Frequency counting, bar charts, and percentages were used in the descriptive analysis. Tables were used to display the analysis findings. Only the qualitative data analysis directly presented edited quotes from respondents' comments.

Confidence intervals and hypothetical tests were the inferential method's tools. To infer associations among dependent and independent variables, the study used hypothesis testing. The T-test method using the *p* value approach was the hypothetical methodology applied. The t-test method involves selecting the variables to be evaluated, computing a sample mean, and comparing that sample mean to a predetermined value. Because it was the most effective way to ascertain whether there were alterations among the reliant and independent variables, the t-test approach was employed. The *p* - value approach evaluates whether something is "likely" or "unlikely," presumptuous that the null hypothesis is correct, by calculating the probability of detecting a test statistic that is more extreme in the course of the substitute hypothesis than the one seen. If the *p* - value is less than or equal to alpha level, the null hypothesis (H0) is rejected, then it is considered "unlikely." Additionally, it is "likely" if the *p* - value is high, say greater than alpha level (α), then the null hypothesis is disallowed in favor of the alternate hypothesis.

Results and discussion

Challenges of climate change to food crop production

Variations in a geological conditions have an impact on food production, while indirect effects of climate change on income expansion and distribution have an impact on the demand for agricultural products. Because prices would skyrocket, there would be a food shortage and increased insecurity [4]. Therefore, examining the difficulties presented by weather changes on agricultural food crop production was one of the research aims supporting the study. Participants were asked to identify the type of agricultural practice they engage in to accomplish this goal. Table 1 lists the agricultural activities that the study's respondents engaged in. According to the survey, the number of participants, or 97.5%, engaged in rain-fed agriculture, whereas 2.5% engaged in irrigation agriculture. This shows that the majority of the local agriculture is rain-fed. Farmers in some parts of South Africa, particularly Zimbabwe, believe that irrigation is the only way to combat climate variation [5]. The outcomes of this study, however, reveal that most of the farmers in the reading area are still unaware of the necessity for irrigation in light of climate change. This confirms Ndamani's [6] findings that irrigation is still rarely used in Ghana due to poor or non-existent irrigation systems in many areas. As a result, the adverse consequences of weather alteration on their agricultural activities would be particularly likely to affect these farmers [7].

Table 1: Type of agricultural practices undertaken by respondents.

Type of agriculture practices	Frequency	Percentage
Rain-fed	156	97.5
Irrigation	4	2.5
Total	160	100

Source: (Field data), 2020

Variations in land and water regimes are anticipated to be the primary cause of the influence of climatic variability on agriculture, and losses in agriculture are anticipated in susceptible places [7]. The researcher was looking for information on some of the difficulties the participants face as a result of climate variation.

According to Table 2, rice and maize make up the majority of agricultural food crop combinations that are vulnerable to climate variations, with a ratio of 37.5%. With a proportion of 23.8%, maize and plantains came in second and third place, respectively. Rice, plantains, and maize make up the third most common agricultural food crop combination, at 11.9%. Rice and maize, as well as maize, plantain, and rice, are the top three agricultural food crop combinations that are particularly vulnerable to weather variations. Especially if climate variability increases and precipitation decreases or becomes more unpredictable, the life cycle of grain and oilseed crops is likely to fail (U.S. Climate Change Science Program, 2008). Therefore, it should come as no surprise that participants said that maize and. In response to weather alterations, Chen, et al. [8] reported that between 2001 and 2009 in China, individuals switched from cultivating weather-susceptible crops to more climatically strong ones like potatoes, oil seeds and cotton seeds.

The extent of impacts of climate change on agricultural food crops

According to the Fourth Assessment Report of the interstate Panel on weather alteration (IPCC), weather alteration would certainly result in major decreases in agricultural production in some African countries [9]. Because of this, one goal of the reading was to look at how weather alteration has affected agricultural food crops. Respondents were questioned about whether they were aware of climate change to accomplish this goal. Cross-tabulation was utilized to assess their awareness and come to a relevant conclusion, as displayed in Table 3.

Table 2: Major crops that are vulnerable to climate change.

Type of food crop	Frequency	Percent
Maize and cassava	16	10.0
Maize and Plantain	38	23.8
Maize, Plantain, and Yam	14	8.8
Rice and Maize	60	37.5
Vegetables	4	2.5
Maize, Plantain, and Rice	19	11.9
Plantain and Cassava	1	.6
More than three crops	8	5.0
Total	160	100.0

Source: (Field data, 2020)

Table 3: Cross-tabulation of place of residence and awareness of climate change.

		Awareness of climate change		Total
		Yes	No	
Place of residence	Bonsua	70 (87.5%)	10(12.5%)	80
	Amoawi	52(65%)	28(35%)	80
Total		122(76.25%)	38(23.75%)	160

Source: (Field data, 2020)

Table 3 shows that several participants (76.25%) have heard about weather variation, whereas the remaining participants (23.75%) are not aware of it. It shows that the areas have a high level of climate change awareness. However, participants in Bonsua, who make up 87.5% of participants, have heard of climate change, compared to respondents in Amoawi, who make up 65% of respondents. This implies that the majority of participants will be able to implement coping mechanisms to limit the detrimental influence of weather variations on agricultural food crops. The respondents' high degree of consciousness of climate change may be related to their extensive exposure to climate variations material. The Asian Development Bank (2014) states that participatory techniques bridge information gaps for rural farmers and confirm a society's concerns about both climate variation and non-climate change to safeguard that the right adaption solutions are available.

Awareness of climate variations and awareness of how it affects agriculture are two very different things. This is because the two variables knowledge of climate variations awareness and knowledge of how it will affect agriculture signify and are interpreted differently. As a result, in addition to determining if participants were aware of climate change, the researcher also determined whether they were aware of how it had an impact on agriculture. Are you aware that agricultural food crops are easily impacted by climate change? Was the question provided to responders to accomplish this goal? As can be seen in the results, the majority of respondents 76.25% answered in the positive, while 23.75% did not (Table 4).

Regarding the participant's knowledge of the influence of weather alteration on agriculture and place of living, there were variations in their responses. Table 4 makes it evident that the majority of respondents in Bonsua 87.5% of the participants did state that climate variations had an impact on agriculture. Similarly, 65% of respondents in Amoawi specified that weather alteration influences food crops. Since the people in these communities are aware of the crisis and will help in finding a solution, it can be concluded that implementing policies to address weather alteration trials on food crop production will provide results. A question asking respondents if agricultural cultivation had changed in recent years was posed to the respondents Table 5.

The table indicates that rainfall has a significant impact on the production of food crops, as 33.1% of all respondents agreed. Due to the unpredictable and inconsistent rainfall patterns brought on by climate variation, food production in the study communities is negatively impacted. If prompt adaptation actions are not taken to mitigate the impending effects of weather variation variables on community food production, food supply, and food system stability are at risk.

Table 4: Cross-tabulation of the relationship between awareness of climate change impact on agriculture and place of residence.

		The consciousness of the influence of weather alteration on agriculture		Total
		Yes	No	
Place of residence	Bonsua	70 (87.5%)	10(12.5%)	80
	Amoawi	52(65%)	28(35%)	80
Total		122(76.25%)	38(23.75	160

Source: (Field data, 2020)

Climate change information to foster adaptive management and decision

The adoption of appropriate coping mechanisms by individuals to deal with the adverse effects of weather variation on agricultural food crops depends heavily on their knowledge of the issue. As an outcome, the reading examines the topic of weather alteration information while taking into account participants' experiences and expertise Table 6.

Despite the aforementioned results, 13.1% of participants claimed that they use early and late planting as a means of adjusting to how weather alteration is affecting agriculture and food crops. Regarding the dwelling, there were distinctions, nevertheless. Specifically, just 7.5% of respondents in Bonsua reported using early and late growing of yields as a means of coping with the effects of weather alteration on agricultural food yields, compared to 18.8% of respondents in Amoawi.

The capacity of stakeholders to address the challenges of climate change on agriculture food crop production

Two solutions have been developed by the Food and Agriculture Organization [10] for farmers to use, particularly those in rural areas. To reduce long-term climate harm, mitigation measures that directly reduce anthropogenic emissions or improve carbon sinks are required. Adaptation methods are also required to reduce the hazards associated with current and future inevitable residual climate change. The local economy must be more diverse and workers must have access to alternative vocations to prevent agricultural production from resulting in lower rural wages. To reduce food

Table 5: Climate variables that agriculture food production depends on.

Climate Variables	Frequency	Percentage
Excessive temperature	24	15%
Weak rainfall	53	33.1%
Variations at the start of the rainy periods	6	3.8%
Excessive temperature and weak rainfall	27	16.9%
Excessive temperature, weak rainfall, and alterations at the start of the rainy period	50	31.2%
TOTAL	160	100%

Source: (Field data, 2020)

Table 6: Adaptation strategies employed to minimize the impact of climate change.

Strategies	Frequency	Percentage
Dissimilar crop varieties	102	63.4%
Soil conservation	3	1.9%
Early and late planting	21	13.1%
Irrigation	2	1.3%
No coping technique used	32	20%
TOTAL	160	100

Source: (Field data, 2020)

miles, rural farmers are now choosing to use more environmentally friendly farming methods like organic farming, integrated crop management, and local purchasing [11].

In light of this, the participants were questioned on what adaptations or coping strategies they have implemented in their farming to deal with the long-term climate change. This issue elicited a variety of replies from respondents, including changing the crop variety, irrigating more crops, looking for work off the farm, and using soil conservation methods. Overall, changing crop kinds is a significant method that respondents adapt to long-term climatic changes. Following the survey, 61.2% of respondents gave these answers. 68.8% of respondents in Bonsua utilize this coping technique, compared to 50.9% of respondents in Amoawi, even though this feature reports the majority of coping mechanisms in the area. As a result, participants in Bonsua are more likely to switch up their crop type as a coping strategy Table 7.

In addition, whereas 5.3% of participants in Amoawi turn to irrigation schemes to deal with local climate change, 14.3% of respondents in Bonsua do so. The irrigation system in the area has not yet taken hold, but it is far better in the Bonsua town than in the Amoawi society. Additionally, it was noted that participants in Amoawi, or 38.6% of the participants, turn to non-farm activities as a means of adjusting to the impacts of weather alteration on agriculture and food crops in the regions. To better understand or prepare for the consequences of weather alterations on agricultural and food crops, respondents were asked to list the many difficulties they encounter. Therefore, the respondents answered that lack of knowledge, a lack of resources, and low irrigation potential are their three main challenges when adapting to or coping with climate change Table 8.

Manifestly, respondents said that there was a lack of information in 50.6% of their responses. However, in Amoawi and Bonsua communities, respectively, 51.2% and 50% of respondents did state that a lack of information is a significant obstacle to their attempts to adapt to climate alterations. People can adapt to and cope with the varied effects of weather alterations with the help of information flow, which is very effective. According to the majority of respondents to the field survey, access to information becomes extremely difficult when considering the research area's rural nature.

The limited potential for irrigation was another issue that responders had to deal with. The responders responded to this challenge in 45% of the cases. It was shown that 45% of respondents in Bonsua and 45% in Amoawi said that having limited irrigation potential is a problem for them. The majority of respondents did not mention poor income as a barrier to coping with the many impacts of weather alteration on agriculture. One would have anticipated that in a typical rural context, farmers would not have easy access to funds that would allow them to deal with the impacts of climate alteration on agriculture. The drift in the research zones, however, contradicted this notion. It can imply that the majority of farmers have come together to create a group that aims to meet their demands for funding. As a result, they do not perceive a lack of money as a barrier.

Respondents were questioned about what they have done to address this issue in light of these difficulties and how they are likely to make the already severe food insecurity in the areas worse. According to the study, participants have adapted in a variety of ways, including by conveying water from their homes to their farms, switching their crop varieties, accessing leeway officers for advice on weather alteration issues, turning to agriculture credit unions for loans to expand their farms, relying on off-farm employment, praying to Almighty God for rain, and also receiving advice from the extension officers to help them make decisions on climate change. This paper goes into further detail about how the respondents responded to the measures they implemented to deal with the effects of alteration change.

For instance, one female respondent noted that

Money is scarce in my town, and as a peasant farmer, I don't make much money from my work. I use the majority of the food I grow to feed my family, so the money I make from the sales of my product is meager. What can I do? I occasionally turn to the

Table 7: Cross tabulation showing the relationship between coping mechanism and place of residence.

		What adjustment/ coping mechanisms in your farming have you made				
		change crop variety	irrigate more	look for off-farm jobs	Implement soil conservation techniques	Total
Which part or area of Offinso do you stay	Bonsua	53(68.8%)	11(14.3%)	13(16.9%)	0(0%)	77
	Amoawi	29(50.9%)	3(5.3%)	22(38.6%)	3(5.3%)	57
Total		82(61.2%)	14(10.4%	35(26.1%)	3(2.2%)	134

Source: (Field data, 2020)

Table 8: Cross tabulation showing the relationship between place of residence and perceived constraints to adapting to climate change.

		what are the perceived constraints of adapting to this climate change			Total
		lack of information	lack of money	poor potential for irrigation	
Which part or area of Offinso do you stay	Bonsua	40(50%)	4(5%)	36(45%)	80
	Amoawi	41(51.2%)	3(3.8%)	36(45%)	80
	Total	81(50. 6%)	7(4.4%)	72(45%)	160

Source: (Field data, 2020).

agricultural credit officers for a loan to grow my farm, but even after accepting the loan, I occasionally do not have the funds to repay it, making it challenging to return to them for a loan." (Respondent 5, interview/ 16th February 2020).

Additional male participants in the Amoawi society also shared alike sentiments to this view. He said:

I borrow money from credit officers so that I can extend my farm, but the main drawback of financial assistance from agricultural credit facilities is that the amounts are occasionally tiny, but I have no other options. I have to accept it that way. I would like money right now, but I have to pay back the money I stole from these guys before I can get any more…." (Respondent 3, interview/ 16th February 2020).

The comments imply that the agricultural credit officers' loans to respondents are insufficient because they complain that the loans are too meager. This has supported the findings of Walthall et al. [12] that the variables limiting farmers' ability to adapt to weather alteration are financial and credit availability.

Conclusion

The following conclusions are made based on the findings of the study:

According to reports, Ghana's agricultural food crops are suffering as a result of alteration change, especially in the Offinso Municipality. To approximate the effects of weather alteration on agriculture and food crops in Offinso Municipality, mostly Amoawi and Bonsua, there is, however, a paucity of study. This made it necessary to conduct this reading to look into the effects of weather alteration on agricultural food yields. To accomplish the goal of the reading, a sample size of 160 farmers was chosen using a systematic sampling procedure. With the aid of SPSS (version 19.0), data were evaluated using percentage count and frequency, and the results were displayed in a form table. It is clear from the analysis of how climate change affects food crops for human consumption that these crops have been affected. It has been noticed that plants sensitive to climate change include maize, rice, and plantains. Crop productivity for farmers declined, however, the decline was not great. However, farmers have developed coping mechanisms to deal with the effects of weather alteration on their food crops, including producing diverse crop varieties, early and late planting, irrigation, and soil preservation. The main obstacles these farmers faced in their attempts to deal with weather alteration were mostly a lack of knowledge, a lack of resources, and low irrigation potential, thus the tactics weren't successful and, for that matter, weren't beneficial to the farmers.

Recommendations

The following suggestions have been made to resolve the issues raised by the primary findings, to help make the research study a commendable endeavor.

First, the government, corporate organizations, and non-governmental organizations should help farmers build irrigation systems so that their food crops would always have contact with water during the dry season. To boost agricultural yields, farmers will benefit from having a sufficient and reliable water supply on their properties. Since most farmers transport water from their homes to the agricultural site to work with, it will further minimize the cost and burden on them.

Additionally, cooperative organizations should be established in the two towns to offer sufficient information on climate change to help farmers make planting decisions that will boost crop yield. The government can support agronomic research to create new types that are more resilient to the effects of global warming.

Additionally, to discourage farmers from applying for loans to expand their farms, the procedures for obtaining loans from rural banks and agricultural development banks should not be onerous. Collateral security should not be required so that farmers can opt for loans without restriction. The state should assist farmers in the implementation of straightforward norms and principles (reduced procedure) in their pursuit of loans to grow farms in coordination with rural banks and agricultural development banks.

Again, agriculture extension staff and the government should educate and teach farmers about the types of crop varieties appropriate for switching during the dry season. Farmers should be informed about environmentally friendly farming methods and crops that use less water. To avoid losses in crop production, this will assist farmers to adjust to the alteration and recognize the types of crops suitable for alteration.

Additionally, the government should provide farmers with sufficient funding to buy seedlings. Because they would be affordable, seedlings will be available to farmers whenever they need them.

Additionally, local communities should be involved in the discussion of climate alteration by legislators. This is to support adaptation measures to weather alteration and its influence on agricultural food crops and to help local farmers stay up to date on climate change information that can be integrated.

About the authors

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