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Adoption of Conservation Agricultural Practices Among Maize Farmers: An Alternative Livelihood to Mitigate Climate Change Impact in Bawku Municipality, Ghana

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Abstract: *Background and Objective*: The plight of farmers are worsening by the impact of climate change. This is evident in all agro-ecological zones in Ghana. Warming and variability in rainfall pattern is causing floods and long dry spells of drought with resultant effects of reduced food crop and livestock production. Conservation Agricultural (CA) practices was therefore introduced to address the challeges of conventional tillage. CA has therefore been identified as a substitute to conventional agriculture for sustainable agricultural productivity. The objective of the study was to assess the rate of adoption of CA practices in the Bawku Municipality in the Upper East region of Ghana. *Methodology*: The study was conducted in the Bawku Municipal area of Ghana. The research design used for the study was the mixed methods. The purposive sampling technique was used to select the Bawku Municipality as the major area where agricultural conservation practices occurs in the Upper East region. The simple random sampling technique was used to select ten (10) communities in the Municipality, whilst the systematic random sampling was used to select forty (40) respondents from each community for the study. The target population for the study was maize farmers in the Bawku Municipality. In all, a total of 358 respondents were interviewed for the study. Data was taken on socio-cultural and socio-economic characteristics of respondents. Data analysis was done using the Statistical Package for Social Sciences (SPSS). Descriptive statistics, such as frequencies, percentages, and means were computed. Cross tabulations of variables were also computed and the chi-square tests used to establish relationships. *Results*: The study revealed that age, sex, level of education, religion, household size, government policy, access to credit, source of income, farm size, and access to extension services were found to have significantly influenced adoption of CA practices. The results of the study indicated that majority of farmers were aware and had knowledge about CA practices. "No-tillage with cover crops, minimum tillage with cover crops, and crop rotation with cover crops" were the main practices of conservation agriculture in the study area. The study further revealed that majority of the farmers indicated that the practices of conservation agriculture reduces soil erosion, increases soil fertility, increases soil organic matter and improves agricultural productivity. *Conclusion*: Majority of farmers adopted CA practices in full. It is recommended that the Ghanaian government should boost CA practices by instituting an annual national award scheme to award hardworking CA practioners in Ghana.

Keywords: Conservation Agriculutral (CA) Practice, Conventional Tillage, Climate Change Mitigation, Adoption Rate, Socio-Economic Characteristics

1. Introduction

The socio-economic conditions of farmers are worsening by the impact of climate change which is evident in all agro-ecological zones in Ghana. Average annual temperatures are projected to increase between 0.8°C and 5.4°C, while average annual rainfall totals are projected to decline between 1.1% and 20.5% for the years 2020 and 2080 respectively [1]. Global

warming and variability in rainfall patterns are causing floods and long dry spells of drought with a resultant effects on food crop and livestock production. Anthropogenic activities such as crop farming, bush burning, deforestation, over-grazing and application of insecticides and chemical fertilizer on the agricultural land have exacerbated the impacts of climate change on the environment. Adaptation is needed as a response strategy to adjust to actual or expected climate and its effects, in order to moderate harm or harness potential opportunities. The practice of conventional tillage by farmers, which is suppose to mitigate the effect of climate change, is also grappled with many more challenges such as low yield, soil fertility decline, bad root development and compaction of underlined layer. Low productivity systems in Africa are often attributedto conventional farming practices. However, research and development partners also view the technology as one of the solutions to the adverse effects of climate change [2]. Conservation agriculture (CA) is one of the alternative sustainable agricultural production methods that could mitigate the impact of climate change. It is therefore likely to be the major solution to food security, biodiversity and water scarcity challenges worldwide [2].

Conservation Agriculture is defined as a set of agricultural technologies, which includes: minimum soil disturbance, zero tillage, permanent soil cover, diversified crop rotations, and integrated weed management [3], aimed at reverting the many negative effects of conventional farming practices such as soil erosion, soil organic matter decline, water loss, soil physical degradation, and fuel use [4]. The residue use as mulches also prevents soil erosion and rainfall infiltration which is common in sub-Sahara Africa. This degradation of the land resource base has caused crops yield and productivity to decline, hence the need to search for an alternative paradigm that is ecologically sustainable as well as profitable [5]. For instance, soil erosion, water losses from run-off, and soil physical degradation may be minimized by reducing soil disturbance and maintaining soil cover [6]. Using organic materials as soil cover, and including legumes in rotations may help to address the decline in soil organic matter and fertility [5]. Less soil disturbance results in less fuel use, resulting in lower carbon dioxide emissions, which is one of the gases responsible for global warming [3]. Again, CA helps to improve biodiversity in the natural and agro-ecosystems [3] complemented by other good agronomic practices, such as the use of quality seeds, integrated pest management, and nutrient and water management. Furthermore, CA provides a base for sustainable agricultural production intensification. Also, yield levels in CA systems are comparatively high and even higher than traditional intensive tillage systems [6]. Increasing the productivity of maize crops by using nitrogen fixation crops and biomass is a better alternative in increasing food security and food availabilty among smallholder farmers. CA is increasingly promoted as "a concept of crop production for a sustainable production levels to achieve acceptable profit, while saving the resources along with conserving the environment" [7]. In CA, modern and scientific agricultural technologies are applied to improve crop production by mitigating reductions in soil fertility, topsoil erosion and runoff; and improving moisture conservation and environmental footprints.

In Ghana, farming communities have gradually shifted towards no-tillage systems for potential fossil-fuel savings, reduced erosion, and runoff, and to minimize soil organic matter loss. A large percentage of agricultural land is cropped following CA principles [8]. Land preparation in the early 1980s for crop production in Ghana was mainly through the slash and burn method. As a results of low pressure on land, farmers could leave their farmlands for some years, after the soil has lost its fertility, to farm another fertile land while the abandoned land regains its fertility. This practice was considered as sustainable because of shifting cultivation [9]. However, as population growth, development and industrialization of the nation began to compete with agriculture over limited land; the practice of shifting cultivation has therefore, gradually diminished [9].

Adoption of conservation agricultural innovations has attracted the attention of agricultural scientists, because majority of the population in the less developed countries derived their livelihood from agricultural production [10]. Government and other development partners such as NGOs and CBOs have therefore provided materials, technical and logistics support to help improve the adoption of CA practices. Sustained governmental policies and institutional supportmay play a key role in the promotion of CA both in rain-fed and irrigated cropped lands, by providing incentives and required services to farmers to adopt CA practices and advance them over time [5]. The adoption of a new practice is basically an individual decision. The adoption process involves five stages as outlined by Rogers [11]. These stages include the following:

1. Awareness: The individual becomes aware of the existence of an innovation.
2. Interest: The individual develops interest and seeks further information.
3. Evaluation: The individual considers whether or not to adopt the new practice.
4. Trial: On a small-scale basis, the individual will try the new idea.
5. Adoption: The idea is used on a full-scale basis.

2. Methodology

2.1. Study Area

The Bawku municipal has a total land area of 247.24 km^2 and it is located approximately between latitudes 11° 11^1 and 100° 40^1 North and longitude 0° 18^1 W and 0° 6^1 E in the north eastern corner of the Upper East region of Ghana [12]. The Bawku Municipality has its administrative capital at Bawku. It is one of the 15 districts in the Upper East region. The Municipality has a total population of 98,254, and a farming population of 68,600. The urban population is 63.6 per cent whiles the rural population constitutes 36.4 per cent. It shares boundaries with Pusiga district to the North, Binduri district to the South, Garu-Tempane district to the East and Bawku West to the West [12]. The soils in and around Bawku are generally of the savannah ochrosol type. Detailed soil classification reveals three different soil series. These are: the Varempare

series, Tafali Iseries, Gule and Brenyasi series. The soils in the Bawku Municipality, as typified by the CSIR – Savanna Agricultural Research Institute at Manga, show low nutrient levels. The soils therefore requires more organic maure and chemical fertilizers and other management practices to support agricultural production [12].

2.2. Research Design

The research design is the overall plan for collecting data in order to answer the research questions [13]. It also includes the specific data analysis technique or methods that the researcher intends to use. Research design is th overall strategies and approaches used in the data collection. The research design used for the study was the mixed methods. That is, it combines quantitative and qualitative methods in data collection and analysis. The instruments that were used for data collection were questionnaires, interview guide and checklist for focus group discussion.

2.3. Sampling Techniques and Sample Size

Purposive sampling was used to select the Bawku Municipality as the major area where conservation agricultural practices occurs in the Upper East region. The simple random sampling technique was also used to select ten (10) communities in the Municipality, whilst the systematic sampling technique was used to select forty (40) respondents from each community. The target population for the study was maize farmers in the Bawku Municipality. In all, a total of 358 farmers were interviewed. The Snedecor and Cochran [14] sample size calculation formula was used to determine the sample size for the study:

$$n = \frac{N}{1 + N(\alpha^{2})}$$

Where; n=sample size,
N=sample frame
α=margin of error=5% (0.05)

A total of four hundred (400) farmers were selected. However, after screening, 358 were used for the study.

2.4. Data Collection and Analysis

Both quantitative and qualitative data were collected from primary source for the study. Data was taken from 358 maize farmers through a farm and market survey using interview guide and checklist. Key informants (including stakeholders, nucleus farmers, extension officers, district director of Agriculture and officials of CSIR-SARI at Manga and Garu Presby Agricultural Station) were also interviewedkusing questionnaire. Secondary data was also gathered from literature, MoFa and CSIR – SARI documents. Both qualitative and quantitative tools of analysis were employed in data analysis. Prior to the analysis, the data was coded. Analysis was done using the Statistical Package for Social Sciences (SPSS). Descriptive statistics, such as frequencies, percentages and means were computed. Cross tabulations of variables were also computed and the chi-square tests used to establish relationships. Summaries of findings were presented in graphs and tables.

3. Results

3.1. Socio-cultural Characteristics of Respondents

3.1.1. Gender of Respondents

The results in Table 1 indicate that 59.50% of the respondents were males, whilst 40.50% were females.

Table 1. *Distribution of respondents by gender, age and level of education.*

	Frequency	Percentage (%)
Gender		
Male	213	59.50
Female	145	40.50
Total	358	100.00
Age (years)		
20 – 39	250	69.83
40 – 59	71	19.83
60 and above	37	10.34
Total	358	100.00
Level of education		
No formal education	167	46.65
Basic education	173	48.33
Secondary education	9	2.51
Tertiary education	9	2.51
Total		100.00

Source: Field Survey, 2020.

3.1.2. Age of Respondents

Majority of the respondents (69.83%) were between the ages of 20 – 39 years (Table 1). The respondents within the age brackets of 40-59 years were 19.83%, while those from 60 years and above were 10.34%.

3.1.3. Respondents' Level of Education

The results show that 167 farmers (46.65%) had no formal education (Table 1). Farmers who had basic education were 48.33%, whilst minority of the farmers (2.51%) obtained tertiary education.

3.1.4. Respondents' Marital Status

Results in Table 2 reveal that 35.50% of the respondents were unmarried, 53.35% were married, 7.54% were divorced, 0.56% were widow (ers) and 3.35% were separated in their marriage.

Table 2. *Distribution of respondents by marital status, religion, access to extension services and access to government policy.*

	Frequency	Percentage (%)
Marital status		
Unmarried	126	35.50
Married	191	53.35
Divorced	27	7.54
Widow (er)	2	0.56
Separated	12	3.35
Total	358	100.00
Religion		
Christian	90	25.14
Islam	200	55.87
Traditionalist	68	18.99
Total	358	100.00
Access to extension services		

	Frequency	Percentage (%)
Yes	166	46.37
No	192	53.63
Total	358	100.00
Access to government policy		
Yes	295	74.02
No	93	29.90
Total	358	100.00

Source: Source: Field Survey, 2020.

3.1.5. Respondents' Religious Affiliation

On the religious affiliation of respondents, the results reveal that majority of the farmers (55.87%) were Muslims. Christians represented 25.14%, whilst Traditionalist (8.99%) were the least (Table 2).

3.1.6. Respondents' Access to Extension Services

Out of the 358 respondents, 166 representing 46.37%, had access to agricultural extension services whilst 53.63% did not have access to extension services (Table 2).

3.1.7. Respondents' Access to Government Policy

Respondents who had access to government policies was 295 (74.02%), while 93 (29.90%) of them had no access to government policies (Table 2).

3.1.8. Socio-cultural Characteristics of Respondents and Adoption of CA Practices

The study reveals a significant correlation between socio-cultural characteristics of respondents and adoption of conservation agricultural (CA) practices. The socio-cultural characteristics include: gender, age, religious affiliation, level of education, marrital status, access to extension services and access to government policies. The chi-square test results show that at 5% confidence level, there was a significant (X^2=4.260; df=2; P<0.01) difference between distribution of respondents by level of adoption of CA practices with respect to their ages (Table 3). However, the chi-square results did not show any significant (X^2=0.362; df=1; P>0.05) difference between distribution of resppondents by level of adoption of CA practices with respect to their gender.

Table 3. *Distribution of respondents by socio-cultural characteristics and adoption of CA practices.*

Socio-cultural characteristics	Adoption of CA practices
Gender	
Male	59.50
Female	40.50
X^2=0.362; df=1; P>0.05; Non-significant	
Age	
20 – 39	69.83
40 – 59	19.83
60 and above	10.34
X^2=4.260; df=2; **P<0.01; Significant	
Level of education	
No formal education	46.65
Basic education	48.33
Secondary education	2.51
Tertiary education	2.51
X^2=2.068; df=3; **P<0.01; Significant	
Religion	
Christian	25.14
Islam	55.87
Traditionalist	18.99
X^2=0.137; df=2; P>0.05; Non-significant	

X^2=chi-square; df=degrees of freedom.

3.2. Socio-economic Characteristics of Respondents

3.2.1. Source of Household Income

The study reveals that household's income comes from farming, rearing of animals and off-farm activities. Out of the total sample, 270 respondents (75.42%) earn their income from farming only, whilst 13 respondents, representing 3.63%, earn their income from both farming and rearing of animals (Table 4). The remaining 20.95% of respondents earn their income from farming, rearing of animals and other off-farm activities (Table 4).

Table 4. *Distribution of respondents by source of household income, farm size, household size and access to credit.*

	Frequency	Percentage (%)
Source of household income		
Farming	270	75.42
Farming + rearing of animals	13	3.63
Farming + rearing of animals + off-farm activities	75	20.95
Total	358	100.00
Farm size (acres)		
1 – 5	275	76.82
6 – 10	74	20.67
10 and above	9	2.51
Total	358	100.00
Household size		
1 – 5	229	63.97
6 - 10	111	31.00
11 and above	18	5.03
Total	358	100.00
Access to Credit		
Yes	147	41.06
No	211	58.94
Total	358	100.00

Source: Field Survey, 2020.

3.2.2. Respondents' Farm Size

From Table 4, majority of the respondents (76.82%) have their farm sizes ranging from 1 to 5 acres. Farm sizes of 6 to 10 acres, and 10 acres and above represented 20.67% and 2.51% respectively.

3.2.3. Respondents' Household Size

Majority of respondents' household size (63.97%) were between 1 to 5 people, while household size of 11 people and above was (5.03%) (Table 4).

3.2.4. Respondents' Access to Credit

The results in Table 4 show that 147 respondents, representing 41.06%, had access to credit while 211 of them (58.94%) had no access to credit.

3.2.5. Socio-economic Characteristics of Respondents and Adoption of CA Practices

The study reveals a significant correlation between socio-economic characteristics of respondents and adoption of conservation agricultural (CA) practices. The socio-economic characteristics include: household size, access to credit, farm size and source of household income. The chi -square test results show that at 5% confidence level, there was a significant (P<0.5) difference between distribution of respondents by level of adoption of CA practices with respect to their farm size, access to credit, household size and source of household income (Table 5).

Table 5. *Distribution of respondents by socio-economic characteristics and adoption of CA practice.*

Socio-economic characteristics	Adoption of CA practices
Household size	
1 – 5	63.97
6 – 10	31.00
11 and above	5.03
X^2=2.242; df=2; *P<0.5; Significant	
Access to credit	
Yes	41.06
No	58.94
X^2=1.068; df=1; **P<0.01; Significant	
Farm size (acres)	
1 – 5	76.82
6 – 10	20.67
10 and above	2.51
X^2=4.260; df=2; **P<0.01; Significant	
Source of household income	
Farming	75.42
Farming + rearing of animals	3.63
Farming + rearing of animals + off- farm activities	20.95
X^2=10.362, df=3, ***P<0.001 Significant	

X^2=chi-square; df=degrees of freedom.

3.3. Knowledge and Perception of Respondents About CA

The knowledge and perception of respondents about conservation agricultural practices is very essential in examining the factors that influences its adoption. Out of the total sample, 292 respondents (81.72%) agreed having heard about conservation agriculture, whilst 18.28% disagreed (Table 6).

Table 6. *Distribution of respondents by knowledge and perception about CA practices, and specific CA practices already adopted in the area.*

	Frequency	Percentage (%)
Farmers have heard about conservation agriculture		
Agreed	292	81.72
Disagreed	66	18.28
Total	358	100.00
CA practices		
No-tillage with cover crops	33	9.22
Minimum tillage with cover crops	249	69.55
Crop rotation with cover crops	65	18.16
Residue/Biomass retention	11	3.07
Total	358	100.00

Source: Field Survey, 2020.

3.4. Specific CA Practices Already Adopted in the Area

The results in Table 6 showed that majority of respondents (69.55%) were of the view that the most specific CA practice that is already adopted in the area was 'minimum tillage with cover crops'. This was followed by 'crop rotation with cover crops' (18.16%) and 'No-tillage with cover crops' (9.22%). However, the least specific adopted (3.07%) CA practice was 'residue/biomass retention'.

In a focus group discussion, the resondents expressed the following opinion:

[Some of the main CA practices in the Bawku municipal area include: No-tillage, minimum tillage, crop rotation, crop residues retention and other soil management practices like compose application, animal manure application, and tree planting. 'These CA practices are as old as Agricultural production itself', the respondents concluded. According to the respondents, the practices of conservation agriculture reduces soil erosion, increases soil fertility, increases soil organic matter and improves agricultural productivity].

3.5. Adoption of Conservation Agriculture

The survey reveals that majority of respondents (81.72%) adopted conservation agricultural practice whilst 18.28% did not (Figure 1).

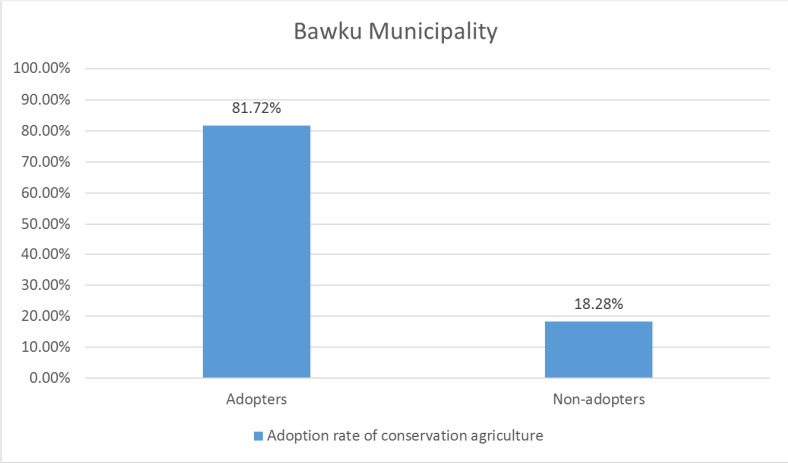

Figure 1. *Adoption of conservation agricultural (CA) practices among respondents in the Bawku municipal area.*

4. Discussion

4.1. Socio-cultural Characteristics of Respondents

The study revealed that majority of the farmers were males. The implication is that farming is a male dominated profession in the Bawku municipality. This finding support the observation made by GSS (2016) that 95.0% of farmers in the Bawku municipality are males with the remaining 5.0% being females. Males are traditionally seen as the ones that control the family lands and are at the centre-stage of decision-making regarding farming and its associated activities, whiles their female counterparts do not take an active decision regarding technology adoption [15]. This is reinforced by the cultural system which requires women to remain at home while men attend seminars, and yet do not always discuss/ teach the women what they have learnt [16]. The researchers also reported that women do not have access to the key productive resources of land, labour and capital, and that they are also underprivileged interms of education and knowledge.

Farmers within the age bracket of 20 – 39 years were in the majority. Farmers within this age group are considered to be in their active age. Amir [17] and Akudugu *et al.* [18] also reported that younger household heads are more dynamic with regards to the adoption of innovations. In Karatu district, many youths (20–25 years) and some adults (36–60 years) were ready to adopt conservation agriculture technologies. Youths were eager because they are more business-minded. However, lack of capital has prevented many from adopting. Some youths did not have their own land or they have only a small area obtained from their parents; hence they were not motivated to invest in agriculture [19]. Akudugu *et al*. [18] reported that older farmers tend to be risk-averse and may avoid innovations in an attempt to avoid the risk associated with the initiative. The researchers furthermore observed that older people are relatively more conservative and hence, resistance to change. [16] also reported that older farmers with high farming experience are more likely to practice all CA technologies. This is because, they are expected to use their farming experience to decide, whether or not, to adopt a new technology.

The study also revealed high illiteracy rate among majority of maize farmers. High illiteracy rate is likely to reduce adoption of conservation agricultural practices. This is because education helps to improve the farmer's ability to easily determine which agricultural activity to undertake in a particular area. Level of education and training influences adoption decisions because of the assumed link between education and knowledge.

Religious membership in a social grouping, such as faith based organization in social linkages influence access to information. The study showed that Islam is the major religious grouping in the Bawku municipal area. This implies that information relating to CA adoption should be targeted at the mosques, so it could descend to majority of the farmers. Mignouna *et al*. [20] reported that farmers within a social group learn from each other the benefits and usage of a new technology. They found membership in a social grouping, such as a faith based society, to have a positive and significant influence on the tendency to adopt improved pigeon pea varieties. In addition, Uaiene *et al*. [21] suggests that social network effects are important for individual decisions, and that, in the particular context of agricultural innovations, farmers share information and learn from each other.

The survey reveals that majority of farmers have access to and benefited from government policies. Government policies are likely to influence farmers' decisions to adopt or not to adopt conservation agriculture practices. The results coroborate the observation made by Arslan *et al*. [22] who reported that Government policies in the form of subsidies, fertilizer, inputs, and machines for CA farmers help farmers to adopt CA. However, Djokoto *et al*. [23] observed that government subsidies may serve as a desincentive to the use of organic soil amendments. Danso-Abbeam *et al*. [24] also reported that a high dependence on government grants and other benefits, rather than direct farm proceeds as an income source, may also demotivate smallholders to adopt innovations like CA**.**

4.2. Socio-economic Characteristics of Respondents

It was revealed from the study that majority of the farmers were in small households. The results further showed that majority of respondents were smallholder farmers with no access to credit. It is regularly hypothesized that owners of larger scale farms are more willing to invest in new technologies such as direct seed drills. Sodjinou *et al*. [25] explain that large households serve as potential labour for farming. They further argue that large families enable household members to earn additional income from non-farm activities. Though large households signify the availability of labour, it also has some financial implication in terms of feeding, healthcare, education and clothing. A large number of household size can therefore constitute an economic burden. Sodjinou *et al*. [25] also reported that access to credit increases the likelihood of a household adopting hybrid maize in their study area. They further observed that access to credit is a major constraint faced by households. However, access to funds/credit is likely to increase the rate of adoption of CA. Due to poverty and limited access to credit, most small-scale farmers in the country are unable to afford basic production technologies such as fertilizers and other agrochemicals resulting in low crop yields [26].

4.3. Socio-econo-cultural Characteristics of Respondents and Adoption of CA Practices

The study reveals a significant correlation between socio-cultural characteristics of farmers and adoption of conservation agricultural (CA) practices. The socio-cultural characteristics include: gender, age, religion, level of education, marrital status, access to extension services and access to government policies. The chi -square test showed that at 5% confidence level, there was a significant (X^2=4.260; df=2; $^{**}P<0.01$) difference between distribution of farmers by level of

adoption of CA practices with respect to their ages. This implies that adoption of CA practices is dependent on age of farmers. This results coroborates with the observation made by Okoye [27] who reported positive significant correlation between age and adoption of conservation agriculture. Clay *et al*. [28] however, reported negative correlation between age and adoption of CA practice. However, the chi-square results did not show any significant (X^2=0.362; df=1; P>0.05) difference between distribution of farmers by level of adoption of CA practices with respect to their gender. This implies that adoption of CA practices is not dependent on gender of farmers. The results also showed that at 5% confidence level, there was a significant (X^2=2.068; df=3; **P<0.01) difference between distribution of farmers by level of adoption of CA practices with respect to their level of education. This implies that adoption of CA practices is dependent on level of eduction of farmers. This finding, however, contravenes the report of Saltiel *et al*. [29] who found education to be an insignificant factor in technology adoption.

The study also reveals a significant correlation between socio-economic characteristics of farmers and adoption of conservation agricultural (CA) practices. The socio-economic characteristics include: household size, access to credit, farm size and source of household income. The chi-square test showed that at 5% confidence level, there was a significant (P<0.5) difference between distribution of farmers by level of adoption of CA practices with respect to their farm size, access to credit, household size and source of household income. The implication is that adoption of CA practices is dependent on household size, access to credit, farm size and source of income of farmers.

The survey shows that majority of the farmers in the study area already have some knowledge and perception about the conservation agricultural practice. Farmers' perception about the performance of the technologies significantly influences their decision to adopt them. This finding is in consonance with the observation made by Karugia *et al*. [30] who reported that it was important to involve farmers in the evaluation of new technologies before introducing it to them, so they can assess its suitability to their circumstances.

The results show that majority of farmers were of the view that the most specific CA practice that is already adopted in the area was 'minimum tillage with cover crops'. This was followed by 'crop rotation with cover crops' and 'no-tillage with cover crops'. However, the least specific adopted CA practice was 'residue/biomass retention'. This finding contradicts the observation of Kassam *et al*. [5] who found CA adoption rate to be low. The finding however, agrees with the position of Fernandes *et al*. [31] who share the view that conservation tillage (CT) is an old age practice that was borne out of the American dust bowl of the 1930s. However, conservation tillage was re-packaged by researchers and promoted as if it was a new technology.

5. Conclusion and Recommendation

The study was conducted to examine the adoption rate of conservation agricultural (CA) practices. From the findings, the following conclusions were deduced:

Majority of farmers (81%) were aware and had knowledge about CA practices. The conservation agricultural practices reduces soil erosion, increases soil fertility, increases soil organic matter and improves agricultural productivity. Majority of farmers (81%) adopted CA practices in full.

It is recommended that the Ghanaian government should boost CA practices by instituting an annual national award scheme to award hardworking CA practioners in Ghana.

Significant Statement

The impact of climate change is worsening the plight of farmers in the Bawku municipal area of northern Ghana. Global warming and variability in rainfall pattern is causing floods and long dry spells of drought with resultant effects of reduced food crop and livestock production. CA has therefore been identified as a substitute to conventional agriculture for sustainable agricultural productivity, and to mitigate the effect of climate change. This study discovered that majority of farmers have knowledge about CA and have therefore, adopted the CA practices. The study also discovered that the practices of conservation agriculture reduces soil erosion, increases soil fertility, increases soil organic matter and improves agricultural productivity.

Conflict of Interest Statement

All the authors do not have any possible conflicts of interest.

Data Availability Statement

Data used to generate the results in this manuscript is not available.

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