Effect of Climate Smart Agricultural Practices on Cassava Production in Essien-Udim LGA, Akwa Ibom State.

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Abstract
Farming activities with climate change challenges are having counter effect on each other. However, Productivity and farmers income is challenged by adverse climate change, hence the need for the triple win effect climate smart agricultural practices on cassava production in Essien-Udim, Local Government Area of Akwa Ibom, State, Nigeria. The study used a two stage sampling technique to draw 118 cassava-based farmers in the area. Data were analyzed using simple descriptive statistics such as mean and climate smart practices (CSP) incidence index. The result shows that the cassava farming households are married (56.8%) mainly female-headed (54.2%) of a mean age of 44 years with above secondary education (40.7%). They have unequal decision-making power especially with access to farm inputs but they can take up innovative ideas quickly given their youthful age and are likely built up with high knowledge and skill in farming. Four practices, which include; crop diversification (2.17±0.21), improved crop varieties (2.07±0.33), integrated farming system (2.23±0.40) and disease resistant varieties (2.05±0.32) practices) out of the 13 included practices were frequently engaged by the farmers. However, low frequency of use of small irrigation scheme (1.75±0.49), contingent crop planning (1.96±0.48), tools for scanning plants genomes (1.08±0.10), lesser leveling (1.16 ±0.17) and screened of cassava varieties (1.07±0.10) are not frequently engaged by cassava farmers in the area. The incidence of integrated farming system (0.339), rain water harvesting and contingent crop planning (0.22) are very high but they are rather engaged for other uses rather that climate smart agricultural practice. The study recommends that effort should be made by the relevant agencies like Agricultural Development Programmes should scale up awareness on these practices not only for cassava production but also for other crops like cereal production in the area.

Keywords: Climate, Smart Agricultural Practices, Cassava, and Production

1.0 Introduction

Climate change is variation in weather condition due primarily to global warming. The variations in weather condition observed over a very long period (usually with 35 years) is due to some natural earth forces or disturbances from adverse human activities on the earth, and the release of greenhouse gases on the atmosphere that sparked up global warming and provoke adverse weather extremes (Kompas, Pham and Che 2018). Climate change with food and nutrition insecurity poses two of the greatest development challenges in recent times. Yet the planate needs a more sustainable food system that can not only heal the planet, but ensure food security after all. The global agri-food system emits one-third of all emissions and this is exacerbated by the global food demand, which is estimated to increase for a high projected global population of 9.7 billion people by 2050 emissions (Kaushik, 2021). Traditionally, the need for increased food production is already fingered in the unsustainable use of land and resources. Hence, the resultant vicious circle green house gas (GHG).

Even the crops that adapt to marginal soils like cassava is seriously threatened by climate change challenges in Nigeria. Cassava, a starchy root vegetable and an important source of calories in Nigeria after rice and maize, is an important famine crop that withstands marginal soils and extreme weather events like drought. Due to climate change, water scarcity and declining soil fertility, declining cassava yield has expanded the recent food shortages and malnutrition, implying that the challenges of climate change is exacerbating food crisis (Ehirim *et al.,* 2018). Evidence of crop failures due to nutrient-mining is recently compounded by environmental degradation prevalent paste invasion and disease pandemics. The resultant food shortage and the inability to meets the desired food requirments for healthy living, inadvertently exerts expanded pressure on already existing food insecurity status of Nigeria.

Extreme weather events have serious impacts both on the environment, farmers' health, yields and declined economic activities (Ehirim *et al*., 2018). Climate change affects agriculture either directly, reducing food production and socio - economic disposition of the farming households and indirectly by exerting multiple stress on the biophysical, social or institutional environments that underpine food production (IPCC, 2007). These impacts with concomitant crop failures and disease endemic are increasingly hindering all efforts to meet human needs. In another development, there is empirical evidence that agriculture activities have serious implications on climate change. Agriculture is fingered in deforestation, which threaten the ecosystem (World Bank, 2024). Fraval *et al.* (2019) warned that increased (crop) productivity may lead to decreased food security and even malnutrition. The contextual issues that increase in food production using some traditional farming practices and technologies are posing serious threat to climate have not been addressed in Nigeria and Akwa-Ibom State in particular. Effort to enhance food security have more emphasized on improvement in production and productivity increases without guidance on how the resultant should be assessed in the study area.

Expansion of farmland for monoculture no doubt increased food production in Essien Udim, but not without desertification and low carbon sink due to green house emissions (GHG). No study, especially in the study area has factored in farming practices that looked beyond increased production to other dimension sustainable food security. Cassava production in the state must set to deliver on multiple fronts of nutrition, adapt to changing climate, and mitigate changing climate, this is called climate smart agricultural (CSA) practice. CSA is the use of farm technologies, methods, strategies or services to simultaneously increase crop yield (net income) and improve the climate (Nwajiuba, Tambi, Bangali, 2015; Onyeneke *et al.,* 2018; Onyeneke *et al.,* 2021). The triple win concept of CSA practices will address productivity and deliver on sustainable food security in cassava. Farming practices in Essien-Udim Local Government Area of Akwa-Ibom State. The study looked into the effect of frequency of engaging CSA practices in cassava production for increased and sustainable yield in the study area.

2.0 Conceptual Frame Work

Climate change is predicted to complicate the existing rural farming problems in Nigeria. Agriculture is the most vulnerable sector to climate change, owing to its huge size and sensitivity to weather parameters, thereby causing huge economic impacts. The concept of crop failure due to climate change is driven by the principle of rising greenhouse gases implications on rising temperature of the atmosphere and negative externalities on crop environments. Hence the theory of declining crop yields and increased food prices with absurd effect on agriculture and farmers welfare globally is traced to extreme weather events and climate change. Climate change represents a significant change in the average values of meteorological elements, such as precipitation and temperature, which disrupts food quality and availability, reduced access to food and expanded food insecurity. Malhi, Kaur and Kaushik (2021) noted that climate change is a global threat to the food and nutritional security of the world. As greenhouse-gas emissions in the atmosphere are increasing, the temperature is also rising due to the greenhouse effect. The concentration of CO_2, which accounts for the major threat to climate will increase tremendously increase the global heat with temperature increasing continuously. It is predicted to rise by 2 °C until 2100 causing substantial economic losses at the global level. Empirical studies have projected that the changes in temperature, rainfall patterns and extreme weather events, such as heat waves, droughts, and extreme rainfall across Nigeria and other sub-Saharan Africa will exacerbate hunger and poverty in the near future (Niang *et al.,* 2014 and NOAA, 2020). Although this prediction came with varying confidence, the current prevalence of crop pest and disease that ravages arable crops is an indication that decline crop yield will escalate the risk of food insecurity (Ongoma *et al.*, 2017; FAO et al., 2018). Particularly affected will be those households that are already food insecure, i.e., rural households and subsistence farmers, who'll become most vulnerable in the future (Müller *et al.*, 2011; Vermeulen *et al.*, 2012). This simply means that the recent reduction in food production will continually ravage food supply and famers welfare if climate change events are not controlled.

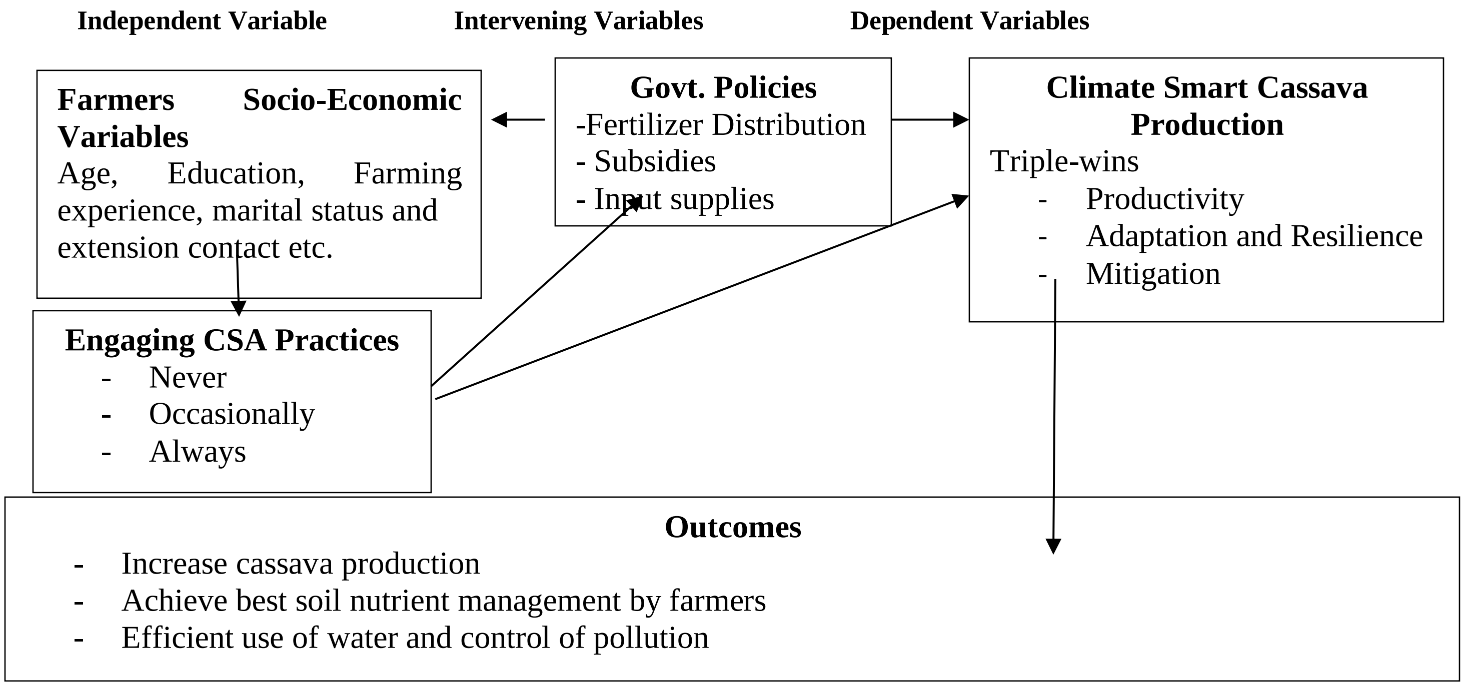

Fig 1: Engaging CSA in Cassava Production (*Adopted from World Bank (2024), modified by the author)*

Most food production practices intensify extreme weather events and pose more challenges to productivity. Expansion of land for cassava monoculture could be a major reason for desertification and low carbon sink in Nigeria. Hence, agriculture is a primary cause of deforestation and threat to pristine ecosystems just as farmers in food production system, record the highest methane emissions and biodiversity loss globally (World Bank, 2024). Therefore, sustainable food security must advance beyond farm intensification processes and productivity to adaptation and mitigation, by using climate smart agricultural (CSA) practices (Rasmussen *et al.,* 2018). The principle of CSA practices in agro-food sector drives the needed increase and sustainable food production in Nigeria through its targets on food security, adaptation and mitigation to climate change. According to World Bank (2024), climate smart agriculture practices and technologies, which simultaneously boost productivity, enhance resilience and reduce green house gas (GHG) emissions. Although the definition emphasized on building the existing agricultural knowledge, technologies, and sustainability principles, CSA is distinct in several ways because of its systematic practice combinations that targeted at the triple wins of productivity, adaptation and mitigation (World Bank, 2024). The extent farmers engage climate smart agriculture practices in cassava production will depend largely on farmers socio-economic disposition which invariably achieve the triple win of CSA. Carrying out this study in Essien–Udim LGA is wrapped within the concept of increased output using climate resilient and mitigating practices to climate change.

The socio economic disposition of the farmers determines the nature, frequency and extent climate smart agricultural (CSA) practice can be used to achieve a climate-resilient agriculture. The study establishes an adaptive composite approach that interlinked components of productivity and food security systems and mitigate climate change. According to FAO (2018), climate-smart agriculture is a "triple win" that tackles and achieves: **e**nhanced productivity, resilience and carbon sequestration**.** It facilitates high food productivity to foster food security by increasing the quality and quantity food produced, improves nutrition and farmer income. This is targeted at 75% of the world's poor who live in rural areas and are agro-dependent. Closely related to productivity and food security objective of climate smart agriculture is the resilience of the practice to climate changes. The efforts reduce susceptibility to water scarcity, pests' invading and other climate-related adverse events. It also improves the capacity to adapt and grow crops in the face of longer-term stresses like shortened seasons and erratic weather patterns. The last effort is **c**arbon sequestration, which targets a reduce emission of green house gases (GHG) in the process of food production, avoid deforestation, and promote methods to capture and remove carbon dioxide from the atmosphere.

3.0 Methodology

3.1 The Study Area: The study area is area Essien – Udim LGA of Akwa – Ibom State, which lies at latitude 5°08'0"N and longitude 7°41'0"E. The study area has two major seasons; the dry and the rainy seasons with average temperature, precipitation and relative humidity of 25^0C, 3550mm, and 86% respectively. The area with many rivers and tributaries is rich in alluvial deposits and fertile soils to support a large number of farming human population. The area is made up seven (7) clans and they are known for fishing and farming activities. Other important economic activities are trade and craft making. Forest crops in the area include oil palm and rubber while the arable crops are cassava, yam, maize and different vegetable such as fluted pumpkin.

3.2 Study Population, Research Design and Sampling procedures: The population of the people in the area was the number of cassava producers in the study area. The study uses a survey design with the sample size is drawn from the population using a multi stage sampling procedure. There are seven clans which include; Adiasm, Afaha, Ekpenyong Atai, Ikpe-Annang, Odoro-Ikot, Okon, and Ukana with 137 communities and a population of 271,500 farming households (NPC, 2016). Cassava production is a common arable crop production across all these communities in the area.

In the first stage, a community from each clan was randomly selected giving a total of 7 communities for the study. In the second stage, the unequal representation of farming households across the selected communities in the sample frame resulted to 0.06% proportionate selecting using a simple random sampling procedure. This gave 14, 24, 23, 25, 19, 27 and 14 farming households from Adiasm, Afaha, Ekpenyong Atai, Ikpe-Annang, Odoro-Ikot, Okon, and Ukana respectively and was administered with a well structure questionnaire. The study finally retrieves a total of 118 valid responses from the selected households and used for data analyses.

3.3 Sources and Methods of Data Collection

The survey design engaged primary data source like questionnaire to obtain information on the farmers' socio-economic characteristics of respondents, climate smart agricultural practices engaged by these farmers in cassava production, and the factors affecting cassava production in the area using a questionnaire as an instrument. The instruments were tested using content validity method of testing so as to cover all relevant part of the research work. The reliability of the instruments was carried out using test- retest method where the questionnaires were administered twice to the same group of respondents within a specific interval. The data or scores obtained was correlated using Pearson Product Moment Correlation Coefficient (r), which gave 0.92 reliability index.

3.4 Methods of Data Analysis and Measurements of Variables: The data collected were analyzed using descriptive and inferential statistics such as mean ($\ddot{X}$) well as CSP incidence (CSAI) index and relative rank order of positioning (RROP). The mean value captured the mean frequency of engaging climate smart agricultural practices in the area. This is expressed as:

$$\ddot{X} = \frac{\sum_{n=i}(FX)}{\sum F}$$

This will be operated by ranking extent of engaging the CSA practices using a likert scale of 1, 2 and 3 that measured never engaged, occasionally engaged and always engaged respectively. A discriminating value (DV) of 1 + 2 + 3 = 6/2 = 2.0 was used to discriminate the CSA frequently engaged from others not frequently engaged in the area. The frequency of CSA practice incidence index (CSAII) and Relative Rank Order of Positioning (RROP) the practices are index of ranking and positioning respectively, the CSA practices engaged in the study area.

RESULTS AND DISCUSSIONS

1. Socio-Economic Features of the Farmers

The socio-economic features of the farmers in the study area are presented in Table 1.0 below.

Table 1.0: The Socio-Economic Features of Cassava Farmers in the Area

Socio-Economic Features	Frequency	Relative Frequency	*n = 118*
Sex			
Male	64	54.2	
Female	54	48.8	
Age			
20 – 29	21	17.8	
30 – 39	41	34.7	
40 – 49	29	24.6	
50 – 59	12	10.2	44 Years
60 – 69	3	2.5	
≥ 70	12	10.2	
Marital Status			
Married	67	56.8	

Single	36	30.5	
Divorced	2	1.7	
Widowed	13	11	
Educational Attainment			
No Formal Education	9	7.6	
Primary Education	14	11.9	
Secondary Education	56	47.5	
Tertiary Education	39	33.0	
Extension Contact			
Yes	76	64.4	
No	42	35.6	
Type of Religion			
Christianity	76	64.4	
Traditional	28	23.7	
Islamic	14	11.9	
Occupation			
Farming Alone	45	38.1	
Trading	19	16.1	
Civil Service	25	21.2	
Artisan	18	15.3	
Unemployed/Schooling	11	9.3	
Household Size			
1 – 4	23	19.5	
5 – 9	81	68.6	
10 – 14	14	11.9	7
Income			
30,000.00 – 50,000.00	33	28.0	
51,000.00 – 80,000.00	62	52.5	N65,000.00
81,000.00 – 120,000.00	23	19.5	

Source: Field Survey Analysis, 2024

i. Sex of the Respondents: The results Table 1 above presents the sex distribution of the farmers in the area. It can be seen that 54.2% is female while the male respondents is 45.8%. Division of labour in agricultural production is gender specific. Although Okpara (2015) opined that men and women perform different functions, have unequal decision-making power and differences in access to agricultural production, the production is female dominated in the area. This is because cassava was regarded as a women's crop (Lagat, Maina, Gitau and Nyang'aya, 2017). The findings of Nwaobiala, Alozie and Anusiem (2019) showed that women were more involved than the male cassava farmers in cassava production activities because cassava production is a crop mostly engaged by female because its production is not very strenuous and can allow the women combine its production with other house activities.

ii. Age of the Respondents: It could be seen from the result in Table 2, that the farmers' mean age of 44 years is young, active and can take any cassava production and technology innovation without much problems. It could be deduced from the result that climate smart agricultural practices can easily be adopted by farmers at a younger age than at old age and with majority (34.7%) of the farmers is 40-49 and only a few (2.5%) of them who are at 70-79 years climate smart agricultural practices will be high engaged by cassava farmers in the area. This finding is consistent with Nwafor, Anosike, Adegbola and Ogbonna (2016), who observed that the mean age of the cassava farmers in Abia State was 44 years representing an active young and productive age group with more innovative ideas than other age categories.

iii. Educational Attainment and Extension Contact: The result of farmers' distribution based educational attainment shows that 40.7% and 22.0% of the farmers had secondary and tertiary education respectively. In the same way, the result shows that 64.4% of the farmers had contact with extension agents on climate smart agricultural practices. Climate change practices require more skills and knowledge to facilitate its combinations for better results, which formal and extension education provide. However, high formal education attainment is important in this regard since it offers the farmers' better skills and knowledge to effectively increase cassava production with resilience and mitigate practices to climate change in the area. However, the high literacy level and extension contact with farmers in the area suggests that the farmers could comprehend with extension services with a special reference to technology advancement. This is in consonance with Tambudzai and Vincent (2017).

iv. Marital Status and Household Size: The result shows the farmers' marital status distribution with 56.8% of them married implying that the farmers have enormous marriage responsibilities in the area. Again, 30.5% of them are single while 11.0% and 1.7% are widowed and divorced respectively. In a similar manner, the mean household size as shown in Table 1.0 is 7 persons per household and majority (68.6%) of the farming household has a large household of between 5 to 9 persons per household. Again, 11.9% of them have 10 – 14 and only few (9.3%) of them have 1 – 4 persons per household. It could be deduced from this result that with the high level of married status, the farming households are most likely to have enough labour available for cassava production with more people to feed from the farm output. The findings of (Kaine and Okoye 2014) agrees with is result that most married household heads sustain their large family with part of their output and given the enormous burdens associates with marriage responsibilities farm income from cassava production may be seriously affected by catering arrangement of the affected farming households.

v. Religion: Majority (64.4%) of the farmers are Christians while 23.7 and 11.9% are affiliated with traditional and Islamic religion respectively. It could be deduced from the result above that more farming households are Christians followed by traditionalists. Religious affiliation has a serious implication on climate change and climate smart agricultural practices. While keeping and maintenance of shrines are important to traditionalist, other religions are interested in massive constructions that required deforestations followed by a continuous reduction in carbon sink with high green house gas emission in the area. These activities are have no positive impact on climate change although it encourages development of the area.

vi. Occupation: The result of farmers' occupation also presents the sources of livelihood and majority (38.1%) of them is engaged in farming activities alone. Others engage in farming with other activities such as Civil service (21.2%), Trading (16.2%) and artisans (15.3%). Only 9.3% of them are unemployed or still schooling in the area. The major proportion of farmers who are into full time farming activities suggests that the area is majorly agrarian. This study is in agreement with Udoh (2015) that the state in general dominated by farmers. Hence, the use of climate smart agricultural practices in seriously needed to help ensure that climate change challenges are put in check.

vii. Income: The result in Table 1.0 shows the monthly income distribution of the farmers in the area. The result shows that majority (52.5%) of the farmers earn between ₦51,000.00 to ₦80,000.00 while 27.9% earned between ₦30,000.00 to ₦50,000.00 and 19.5% earned higher than ₦81,000.00 in the area. The mean income by the farmers in the area is ₦65,000.00 implying that the farmers earn above the country's minimum wage of ₦30,000.00> Minimum wage is expected afford the minimum standard of living of a country (Melaku *et al* 2017).

2. The Climate Smart Agricultural Practices Engaged by the Farmers in the Area

The result of the frequency of engaging in climate smart agricultural practices by the farmers in the area is presented in Table 2.0 below.

Table 2.0: Frequency of Engagement in Climate Smart Agricultural Practices by Cassava Farmers in the Area

Climate Smart Practices *(n = 118)*	Always	Occasionally	Never	Mean	SD	Remark
Crop Diversification	20.3 (24)	76.8 (90)	3.4 (4)	2.17	0.21	Engaged
Improved Crop Varieties	20..3 (24)	66.1 (78)	13.6 (16)	2.07	0.33	Engaged
Small Irrigation scheme	15.3 (18)	44.9 (53)	39.8 (47)	1.75	0.49	Not Engaged
Integrated farming system	33.9(40)	55.1 (65)	11 (13)	2.23	0.40	Engaged
Contingent crop planning	22 (26)	51.7 (61)	26.3(31)	1.96	0.48	Not Engaged
Crop insurance	14.4 (17)	49.2 (58)	36.4(43)	1.78	0.46	Not Engaged
Rain water Harvesting	26.3 (31)	44.9 (53)	28.8 (34)	1.97	0.55	Not Engaged
Weather based crops agro advisory	9.3 (11)	33.9 (40)	56.8 (67)	1.53	0.44	Not Engaged
Site specific nutrient management	16.9 (20)	47.6 (56)	35.5(42)	1.81	0.49	Not Engaged
Laser land leveling	1.7 (2)	12.7 (15)	85.6 (101)	1.16	0.17	Not Engaged

Tools for scanning plants genomes	1.7 (2)	5.1 (6)	93.2 (110)	1.08	0.11	Not Engaged
Pest and disease resistant varieties	18.6 (22)	67.8 (80)	13.6 (16)	2.05	0.32	Engaged
Screener of cassava varieties	1.7 (2)	3.4 (4)	94.9 (112)	1.07	0.10	Not Engaged

Source: Field Survey Analysis, 2024

The result shows that four of the included climate smart agricultural practices were frequently engaged in the area. They are: crop diversification (2.17 ± 0.21), improved crop varieties (2.07 ± 0.33), integrated farming system (2.23 ± 0.40) and disease resistant varieties (2.05 ± 0.32) were practices frequently engaged in cassava production in the area. There low frequency of use of practices like: climate smart agricultural practices like; small irrigation scheme (1.75±0.49), contingent crop planning (1.96±0.48), Crop insurance (1.78±0.46), rain water harvest (1.97±0.55), weather base crop advisory services (1.53±0.44), site specific nutrient management(1.89±0.55), Tools for scanning plants genomes (1.08±0.10), lesser leveling (1.16 ±0.17) and screener of cassava varieties (1.07±0.10) are important climate smart agricultural practices that are not frequently engaged by cassava farmers in the area.

i. **Crop Diversification Practices:** It could be deduced from the result that the practice of growing more than one crop is frequently engaged by cassava farmers in the area. These farmers engage in crop diversification because it is cost effectiveness and the also resilient to climate change. The farmers approach to crop diversity is either by species diversity such as: planting different varieties or genetic diversity within crop species, changing the cropping system such as mixed to inter-planting and crop rotation and or adding more crops into the existing rotation. This approach to farming common in the area because it does not only target increased the farmers' income but also ensure resilience to climate change.

The farmers engage in this practice to overcome high cost of land and sharing of farm input cost and reduced nutrient mining, varying weather factors such as drought, pest and diseases endemic minimized the cost of land and farm inputs thereby increasing their profit in cassava production. Crop diversification n a mixed cropping system is very conservative in the allocation of farm inputs like fertilizers, irrigation water and pesticides. This fined is supported by Makate, Wang, Makate & Nelson Mango (2016) who noted that crop diversification resulted to two outcomes of climate smart agriculture of increased productivity (legume and cereal crop productivity), household income, food security and nutrition with the combination of legumes and cereals and also enhanced resilience in rural Zimbabwe.

ii. **Improved Varieties:** The mean frequency of engaging improved cassava varieties in cassava production in the area shows that this is another way of engaging climate smart agricultural practices to boost production without endangering the climate. Improved varieties such as early maturing and drought tolerant varieties, high yielding varieties, planting new crop varieties with greater heat tolerance, new crop varieties with lower water requirements and cassava fortified with vitamin A were common improved varieties of cassava planted by the farmers in the area to achieve food security, increase productivity and resilient to climate change in the area. This is supported by Onyeneke, Igberi, Uwadoka & Aligbe (2017) that improved cassava varieties were necessary in the southeast because of the role cassava plays in food security. Hence farmers engaging in such practice will not only attain food security in the study area but also increase its resilience to climate change in the area.

iii. **Integrated Farming Systems:** The result shows that the cultivation of crops like cassava with other agricultural activities like livestock production fisheries and forestry is frequently engaged in the study area. Agro-forestry is a common practice in the area and it has proved to be a valuable and cost-effective climate-smart production system. It increases carbon sink and reduces green house gas emissions (GHG). Farmers in the area engage in a land-use systems and technologies where woody perennials such as: trees, shrubs, palms or bamboos are raised together with arable crops like cassava, maize, vegetables and shrubs or grasses for animals are deliberately done on the same parcel of land in some form of spatial and temporal arrangement. This approach to farming is efficient because it minimizes the cost of land and farm inputs while increasing farmers' income and ensuring food security in the area. This is consistent with FAO (2024) observation that agro-forestry as a dynamic, ecologically-based natural resource management system that integrates trees with livestock production on arable crop farmlands. It provides an agricultural landscape in-which arable crop products with forest products, can sustain production for increased economic, social and environmental benefits for the land users at both the farm and landscape levels.

iv. Pest and Disease resistant varieties: This practice is found common in the study area with improved cassava varieties. Climate change comes with it pest and disease endemic, in which farmers can overcome using the practice in the area but the use of resistance varieties are important cultural disease management practices. The production of cassava stems with resistance to many important diseases caused by different pathogens like fungi, oomycetes, bacteria, virus and nematodes although not all is a positive management drive to keep diseases of cassava far from reducing the yields per hectare in the area

However, the engagement of contingent crop planning is contingency strategy by farmers in response to major weather related aberrations such as delay in onset and breaks in monsoon causing early, mid and late season droughts, floods, unusual rains, extreme weather events such as heat wave, cold wave, frost, hailstorm and cyclone. When formed synergies with weather base crop advisory services of metrological stations, it defile weather aberrations and prepares farmers to take up highly profitable crops available in the area on adverse climate change challenges and provide enough resilience. Again, laser land leveling, which helps to prepare the land using a machine 'laser leveler equipped with laser guided bucket to quickly level the land to a flat table-top like surface so that irrigation can be made available to every part of the land before sowing. The practice helps farmers to reap massive returns with increased yields, save water by providing an even water distribution to every part of the farm, thus minimize waste from fun-off or water logging and reduce greenhouse gas emissions.

3. The Incidence and Position of Climate Smart Agricultural Practices in The Area

The result in Table 3.0 is the rate of use and farmers placement of CSA practices in the area

Table 3.0: Rate and Position of CSA Practices Cassava Farmers in the Area

Climate Smart Practices *(N = 118)*	**Always**	**Occasionally**	**Never**	**CSAPII**	**RROP**
Crop Diversification	20.3 (24)	76.8 (90)	3.4 (4)	0.203	4th
Crop Improved Varieties	20..3 (24)	66.1 (78)	13.6 (16)	0.203	4th
Small Irrigation Scheme	15.3 (18)	44.9 (53)	39.8 (47)	0.153	8th
Integrated farming system	33.9(40)	55.1 (65)	11 (13)	0.339	1st
Contingent crop planning	22 (26)	51.7 (61)	26.3(31)	0.22	3rd
Crop insurance	14.4 (17)	49.2 (58)	36.4(43)	0.144	9th
Rain water Harvesting	26.3 (31)	44.9 (53)	28.8 (34)	0.263	2nd
Weather based crops agro advisory	9.3 (11)	33.9 (40)	56.8 (67)	0.093	10th
Site specific nutrient management	16.9 (20)	47.6 (56)	35.5(42)	0.169	7th
Laser land leveling	1.7 (2)	12.7 (15)	85.6 (101)	0.017	11th
Tools for scanning plants genomes	1.7 (2)	5.1 (6)	93.2 (110)	0.017	11th
Disease resistant varieties	18.6 (22)	67.8 (80)	13.6 (16)	0.186	6th
Screener of cassava varieties	1.7 (2)	3.4 (4)	94.9 (112)	0.017	11th

Source: Field Survey Data 2023

The result shows that integrated farming system (0.339) is the first positioned climate smart agricultural practices in the area. This is because farmers have this practice as traditional practices in the area, which helps them reduce cost of arable crop and livestock production. The area saddle with rainforest vegetation is already noted for non-timber forest production where some vegetables not naturally grown as arable crops are produced. This is followed by rain water harvesting (0.263). Even when it is not frequently practices as a climate smart agriculture, the farmers commonly harvest rainfall for domestic uses other than agriculture, implying that such techniques has always lived with the indigenous practices of the farmers. This finding implies that farmers do not know the importance of saving rainwater for all year round farming activities. Hence, extension agents should take advantage of this to demonstrate to farmers how rain water can be harvested beyond domestic use for dry season agriculture. This is tandem with Makate (2019), who observed that most indigenous livelihood practices are climate and environmentally friendly although farmers may not take cognizance of them.

Contingent crop planning (0.22) is the third positioned practices which the farmers engage but not necessarily for climate smart agriculture. Farmers are sensitive to first rainfall of the year and that informs them when to start planting. However, because of their inability to scientifically follow the weather, miscalculation can lead to crop failure when weather predictions are not properly followed. Crop diversification and improved varieties with an index of 0.203 each are the next common practices that farmers engaged in for cost minimization and increased income.

However, weather based crops agro advisory (0.093) with screener of cassava varieties, laser land leveling, tools for scanning plants genomes each with an index of 0.017 are not commonly practices engaged by the people. These practices exist but they are not prevalent in the area. Effort should be made by the relevant agencies like ADP to scale up awareness on these practices not only for cassava production but also for other crops like cereal production in the area.

Conclusion

The adverse effect of climate on cassava production depends on the farming practices used by farmers. The frequency of climate smart agricultural practices in the area is very minimal even though the incidence of the practices seems very high. CSA practices have provided a way of increasing productivity, farmers' income at a minimum possible cost, increase resilience and mitigation to climate change in the area. The study therefore recommends that:

i. Effort should be made by the relevant agencies like ADP to scale up awareness on these practices not only for cassava production but also for other crops like cereal production in the area.
ii. Farmers should be provided with incentive to addop CSA practices especially the synergies which weather base crop advisory services of metrological stations can form with contingent crop planning. This will defile weather aberrations and prepares farmers to take up highly profitable crops available in the area on adverse climate change challenges and provide enough resilience.
iii. Farm machines such as laser levelers which helps to prepare the land to a flat table-top like surface so that irrigation can be made available to every part of the land before sowing should be made available either through subsidies or grants. The practice helps farmers to reap massive returns with increased yields, save water by providing an even water distribution to every part of the farm, thus minimize waste from fun-off or water logging and reduce greenhouse gas emissions.
iv. Rain water havesting is a very high incidence practices in the area but are for domestic uses. Farmers should also take advantage of that to ensure all year round farming in the area.

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