ASSESSMENT OF CLIMATE SMART-AGRICULTURAL PRACTICES ADOPTED ON FOOD SECURITY AMONG ARABLE CROP FARMERS IN EKITI STATE, NIGERIA

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ABSTRACT
The study assess the climate smart-agricultural practices adopted on food security among arable crop farmers in Ekiti State, Nigeria. A sample unit of 120 respondents from each ADP Zones was used for the study through a multistage random sampling procedure. The data were analysed using descriptive statistical tools like percentage, frequency counts, mean score and standard deviation. Majority of the respondents were males (65.8%), married (67.5%) with secondary education (40.8%) and no-formal (24.2%). Mean age of the respondents is 43 years, average farming experience of 12 years, household size of 5 persons (99.2%) and farm size of 3 hectares (82.5%). Majority of the respondents were aware (86.0%) of climate smart agricultural practices. The main sources of information on climate smart practices is extension agents (30.0%). The adopted practices are cultivating short duration crop varieties, mulching, cover cropping and crop rotation (0.34±0.48) and inadequate training (0.29±0.46) amongst others. It was recommended that sources of awareness with wider spread should be used for information dissemination on climate smart practices, extension services should be strengthened and made proactive to be able to live to expectation of spreading information on smart-agricultural practices. Socio-economic factors that will foster positive perception of climate smart practices should be done and periodic capacity building and advisory services should be done to assist the clienteles to be abreast of current information on climate smart practices.

KEYWORDS: Food Security, Arable, Crop Farmers, Climate, Smart Practices

INTRODUCTION

Several eco-friendly innovations have been developed to ensure agricultural activities become more environmental friendly in the first world countries. Among the various technologies include: vertical farming, digital sensors, zero tillage, organic farming, integrated pest management, irrigation monitoring, renewable energy and biotechnology (Pisante, et al, 2012). When adopted in farming, one or a combination of these innovations and practices help to lessen the effects of changing climate on agricultural activities. Changing climate is the alteration in the earth's atmospheric process with which the cause is basically accredited to many human activities such as gas flaring undertakings, deforestation, and other anthropogenic engagements bringing about pollution of the atmosphere (Ajieh and Okoh, 2012; Olorunfemi et al., 2020). The extreme effects of changing climate are identifiable in agriculture, water resources, forestry, human health and settlements because the impacts disrupt precipitation, temperature distribution and clouds formation. The effects of changing climate in agriculture are noticeable from

reduction in crop yield and soil fertility thus putting countries' food-security on a low-slung and impeding progresses towards the suppression of malnutrition, poverty and hunger (Ajieh and Okoh, 2012; Olorunfemi et al., 2020).

Climatic Smart Agricultural Practices (CSAPs) are on farm practices conceived by farmers out of the indigenous technical-knowledge or their innovativeness to reduce the negativities posed by climatic-variabilities on plants to increase production and or productivity. These CSAPs include a list of organic agricultural-practices such as cover cropping, minimum to zero tillage, crop rotation, mulching, composting, solar powered greenhouses among others that assist in reducing the consequences of changing climate by giving a futuristic ecological health to soil, air, water and landscape for a sustainable-development in agriculture. Smart-Agricultural Climatic Practices consist of the use of ingenuities which upsurges resilience and stability in agriculture thus helping farmers adapt to changing climatic risks (Oladele, 2015; Olorunfemi et al., 2020). The significance of CSAPs in order to maintain farm productivity, needs thorough understanding by clienteles to improve mitigation of the environmental impacts of change climate for steady and or increased crop yield. Many barriers to implementing these adaptation practices needs to be overcome by farmers, these includes but not limited to inadequate information on climate change characteristics, lack of financial resources, lack of local involvement in policy decision making and other climate information (Antwi-Agyei et al., 2015a; Yiran and Stringer, 2017). Additionally, complexity and non-compatibility of some CSAPs to the policy, environment and economy of the clientele can also pose as obstacle to the narrow spread in Nigeria.

The problem of changing climate is a universal problem and its influence is made obvious especially in the agronomic sector where it has meaningfully affected production in many developing countries (Elum et al., 2017; Olorunfemi et al., 2020) which has led to a high vulnerability of people to food insecurity. Escamilla and Correa (2008); Oyawole, et al, (2020) posited that, food security subsists once all people, every times, have economic, physical and social access to adequate, nutritious and safe food that meets their food preferences and dietary needs for healthy and active life. In spite of all efforts put into the attainment of universal food security, barely has any progress been achieved in Africa compared to other regions (United Nations Development Program-UNDP 2016). Furthermore, a comprehensible downturn in per capita agronomic production for the past three decades was recorded only by Africa (Sasson, 2012; Oyawole, et al., 2020). As most of the food insecure and poor Sub-Saharan Africa derive maintainability from agriculture, changing climate is still a threat to both future and present sweats to nutritionally secure its growing population (Williams et al. 2015; Oyawole, et al., 2020). Precisely, the proportion of food insecure individuals has noticed increase in Nigeria, with a steady rise from about 18% from 1986 to about 33.6% in the year 2004 and 41.0% in the year 2010 (NBS, 2012).

Majority of the farmers are predominantly engaged in rain-fed agriculture in the south western Nigeria, growing varying arable crops and tree not limited to bitter kola, leafy vegetables, oil palm, cocoa; tubers (sweet potatoes, cassava, yam); grains (rice, maize, guinea corn); legumes (groundnuts, melon, soya beans, cowpea). Requirement on rainfall for a productive farming season exposes their living to varying degrees of climatic changes in forms of high temperatures and erratic rainfall patterns with negative impacts like erosion, leaching, increased flooding of the top soil therefore leading to poor quality of crops leading to low demand and farmers' profit, increase in crop yield gaps, decline in the availability, increase in post-harvest losses of

agricultural commodities and quality of forage and high mortality and morbidity of livestock (Okoli and Ifeakor, 2014). These difficulties affect Nigeria's agriculture and thus, the people's livelihoods with severe implications for food-security (NBS, 2012; Moyo, 2016). This makes changing climate adaptation serious for agricultural production systems, hence the promotion of CSAPs.

Despite the promising concept and acceptance of CSA globally, its success under Nigeria's varying agro ecologies and socioeconomic environment are declared to be sparse in terms of empirical data. This study therefore contributes to filling this knowledge gap in the literature by assessing Climate Smart Practices for food security among arable crop farmers in Ekiti State, Nigeria. Specifically, this study seeks to address the following objectives;

1. describe the socio-economic characteristics of the respondents;
2. examine respondents' awareness of Climate Smart Practices;
3. determine the Knowledge-Adoption-index of CSAPs among respondents;
4. ascertain farmers' perception of CSAPs and;
5. identify constraints to adoption of Climate Smart Agricultural Practices (CSAPs)

METHODOLOGY:

Study Area:

The Ekiti State lies entirely within the tropics. It is situated within longitudes 40°51′ and 50°451′ East of the Greenwich meridian and latitudes 70°151′ and 80°51′ north of the Equator. It lies south of Kogi and Kwara State, Eastward of the State of Osun and surrounded by Ondo State Eastward and in the south. It has a total land mass of 5887.890sq-km. Ekiti State has 16 Local Government Councils (1991 Census). The population of the State was 1,647,822 while the estimated population upon its creation on October 1st 1996 was estimated at 1,750,000 with the capital located at Ado-Ekiti. The 2006 population census by the National Population Commission put the population of Ekiti State at 2,384,212 people. The State enjoys a tropical climate with two distinct seasons. These are the dry season (November – March) and the rainy season (April – October). Temperature varies between 21°C and 28°C and increased humidity. The North East Trade and the south – westerly winds blow in the dry (Harmattan) seasons and rainy seasons respectively. There exists the tropical Forest in the south, while the guinea savanna prevails in the northern peripheries. The main occupation of the people of Ekiti is agriculture, and it serves as the major source of livelihood for majority in the inhabitants therein. Agriculture offers employment and income for over 75% of the population in Ekiti State, Nigeria. Some of agricultural produce in Ekiti State are: Oil Palm, Kolanut, Cash crops such as Cocoa, Plantain, Cashew, Bananas, Timber and Citrus; Arable /Food Crops such as Cassava, Rice, Yam, Cowpea and Maize (Ekiti State Government, 2022).

Sampling Procedure and Sample Size

A 4-stage sampling procedure was employed in representative samples for the study. During the first-stage a purposive selection of all the 3 ADP-Zones of the state was done due to the fact that crop farmers abound in all the ADP zones. During the second-stage a random selection of two local government areas from each of the three zones to obtain a total of 6 LGAs was done. At the third-stage a random selection of two communities each from the selected local government areas was made, to make a total of 12 communities, while at the fourth-stage a random selection of ten arable crop farmers from each the selected communities to make a sample size of 120 respondents for the study was also done. Data were composed using both questionnaire and interview schedules. The

obtained data were analysed using descriptive statistics such as percentages, means score, frequency counts, standard deviation, figures and Tabulations.

RESULTS AND DISCUSSION:

Table 1: Distribution of the respondents based on socio-economic characteristics (n=120)

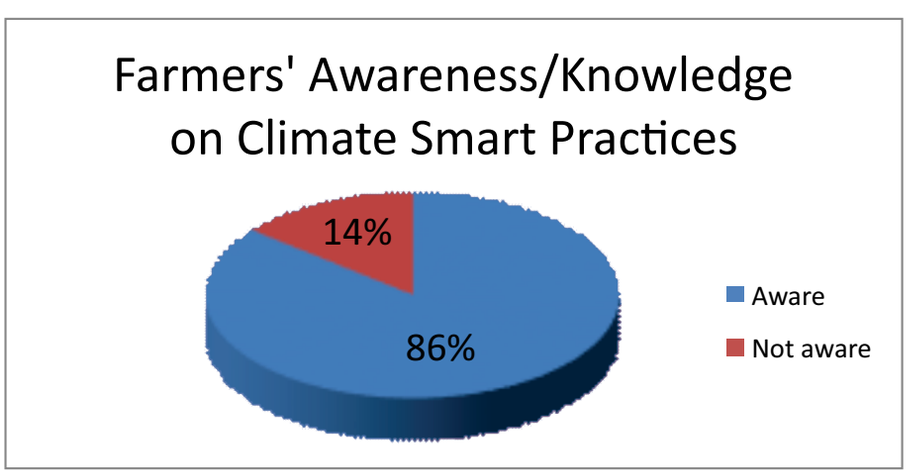
Variables	Frequency	Percentage	Mean (?̄)
Sex			
Male	79	65.8	
Female	41	34.2	
Age (years)			42.8
<40	47	39.1	
41-50	59	49.2	
51-60	13	10.8	
>61	1	1.0	
Educational Qualification			
Primary	16	13.3	
Secondary	49	40.8	
Tertiary	26	21.7	
No formal	29	24.2	
Marital Status			
Single	17	14.2	
Married	81	67.5	
Divorced	05	4.2	
Widowed	17	14.2	
Farming Experience (years)			12.05
<10	25	20.8	
11-20	68	56.7	
21-30	20	16.7	
>31	**7**	**5.8**	
Household Size (No)			4.64
<5	29	24.2	
6-10	90	75.0	
>11	**1**	**0.8**	
Farm Size (hectares)			3.26
<5	99	82.5	
6-10	19	15.8	
>11	**2**	**1.7**	

Source: Field Survey, 2021

The Respondents' Socio-economic Characteristics

Table 1 shows the result of the socio-economic characteristics of the farmers in the study area. Majority of the arable crop farmers were males (65.8%), while the remaining were females (34.2%). This implies that males are mostly involved in climate smart agricultural practices than their female counterparts in the study area. It implies that men were more involved in CSAPs than women which might be as a result of cultural and religious norms of the people which negate females from engaging in more farming activities. This is in line with the assertion of Thompson and Aturamu (2018) who opined that only about a quarter of the farmers sampled in the study area on agricultural practices were female. The mean age of the respondents is 43 years (83.3%). This implies that the respondents are in their active and productive age range where energy is highly needed for arable crop farming activities. This is in line with the work of Obisesan, et.al., (2013), who pointed out that the active age is regarded as agile with more energy to dissipate and concentrate on productive efforts. Greater proportion of the respondents were with secondary education (40.8%), to none formal education (24.2%) and tertiary education (21.7%). This implies that the respondents were not really educated judging from their educational levels. This implies that majority of the respondents were moderately literate and hence stands the chance of understanding the accruing benefits of patronizing climate smart agricultural practices and this would assist their information seeking habits as asserted by Ogunlade, et.al, (2010). Majority were married (67.5%) with average farming experience of 12 years (77.5%). This corroborates the ascertain of Bello, et al., (2017) that, the higher the farming experience the more the farmers would have gained more knowledge and technological ideas on how to tackle climatic variability in the arable crop production and the higher would be their output and income on the long run. Mean household size of 5 persons (99.2%) and farm size of 3 hectares (82.5%). House size implies available manpower for labour which in turn translated to lesser money spent on hired labour.

Distribution of the Respondents based on Awareness of Climate Smart Agricultural Practices



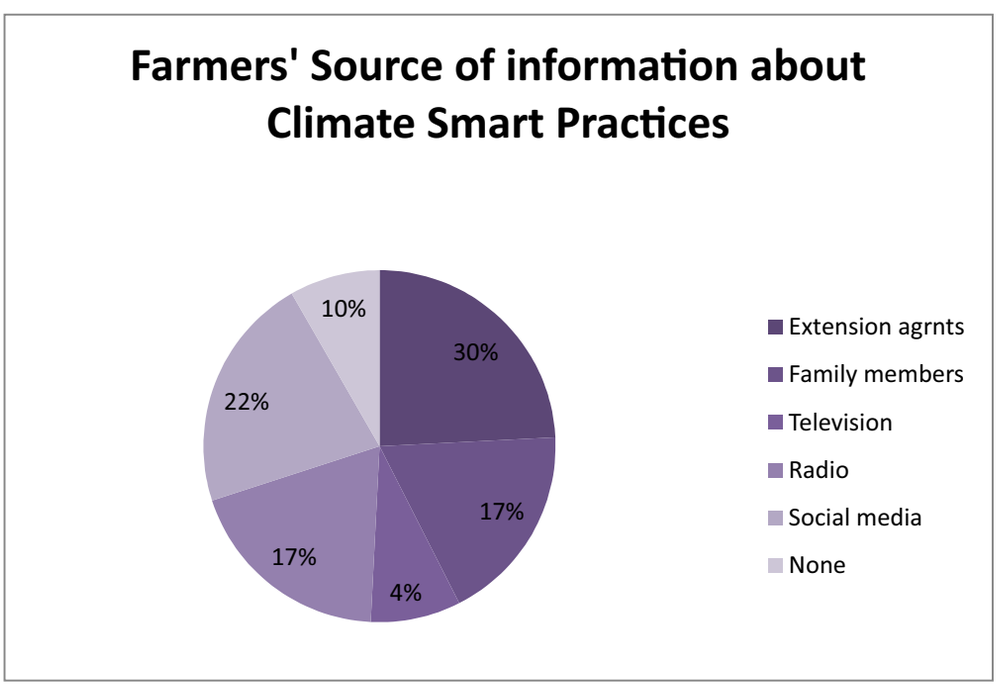
Source: Field Survey, 2021

Figure 1: Awareness of Climate Smart Agricultural Practices

Awareness of Climate Smart Agricultural Practices among Respondents

The awareness of climate smart agricultural practices among the arable crop farmers is shown in figure 1 above. As depicted in the figure, majority (86.0%) of the respondents were aware of the climate smart agricultural practices in coping with climate change and variations on their farming activities. This is in line with the work of Opeyemi, et al (2021) who agreed that majority of the households were aware of climate smart agricultural practices in Delta State, Nigeria. Climate change is global issue throughout the world and there is need for more awareness and better understanding of the best the agricultural practices in mitigating the results of the change. This is only possible if the clienteles in agriculture are aware of the effects of the climate change in order to device some smart practices in handling the conditions. This is in line with the work of Fawole and Aderinoye-Abdulwahab (2021) on climate smart agricultural practices to improve productivity in Nigeria.

Distribution of the Respondents based on Sources of Information on Climate Smart Agricultural Practices



Source: Field Survey, 2021

Figure 2: Farmers' Sources of Information on Climate Smart Agricultural Practices

Sources of Information of the Respondents on Climate Smart Agricultural Practices

Figure 2, shows the distribution of the respondents based on sources of information on climate smart agricultural practices in the study area. the main source of knowledge of the respondents on climate smart agricultural practices is extension agents (30.0%). This implies that the extension component of the Agricultural Development Programme (ADP) of the state that is saddled with the responsibility of disseminating useful practices, innovation and improved technologies from the research to the farmers who are the end users is

very proactive in the study area. This is in consonance with the work of Eta, et al (2022) who agreed that extensions agent are proactive in the dissemination of climate smart agricultural information to farmers in Cross River State, Nigeria. This was followed by Social Media (22.0%). It implies that most of the respondents in the study area uses social media in getting information on agricultural best practices on climate change process. Next to this are family members and Radio program (17.0%). That mean there is information flow from the informal channel of individual contacts within the study area. Also radio is the cheapest means by which farmers receive information on agricultural best practices. This is in line with the work of Aidoo and Freeman (2016) who posited that there is information flow in informal communication networks among farmers. Television was the least in getting agricultural information on climate smart practices to farmers probably because of its affordability, infrastructural problems like electricity, better signals amongst others. This is in line with Olorunfemi et al (2020) on climate change information among farmers.

Respondents Knowledge-Adoption Index on Climate Smart Agricultural Practices

The knowledge adoption index of the respondents is shown in Table 2. The knowledge adoption index is very important as this will give us the clear picture of the proportion of the respondents who adopted the available climate smart agricultural practices to boost food security status of the study area. Hence, the Knowledge-Adoption Index (KAI) is used in the study to understand the knowledge and adoption level of respondents under different Climate Smart Agricultural Practices (CSAPs) at a glance. In this wise the Lebesques's Dominant Convergence Theorem was used to find the sequence converges point (otherwise called mean value). The KAI for each CSAPs practice (variables under consideration) was calculated based on the knowledge and adoption of the practice by the respondents. The calculation was done from the below relationship. The grand total of the average value of the CSAPs represents the KAI value for decision making on the adopted CSAPs on climate smart agricultural practices.

$$KAI = \frac{fk + 2\,fa}{2N}$$

Where:

KAI=Knowledge-Adoption Index

fk= Number of respondents who only know but not adopt the smart agricultural practices

fa = Number of respondents who have adopted the climate smart agricultural practices

N= Total number of respondents under consideration in the study

Table 2 : Distribution of the Respondents based on Adoption of Climate Smart Agricultural Practices

Variables	Adopted	Not Adopted	Don't Know	KAI (?̄)
Minimum to zero tillage	38	75	7	0.62
Crop rotation	109	11	0	0.95
Cover cropping	113	7	0	0.93
Mulching	70	41	9	0.75
Solar-powered greenhouses	0	81	39	0.33
Composting	21	72	27	0.47
Short-duration crop varieties	62	35	23	0.66
Integrated farming	45	55	20	0.60
Drought tolerant crops	35	84	26	0.55
Organic farming	10	84	26	0.43
Mean score				**0.63**

Source: Field Survey, 2021

Adoption of Climate Smart Agricultural Practices

It can be deduced from the Table 2 that the grand total of all the knowledge adoption index (¯) which is the adoption index to be used for judgement is 0.63. Therefore, values above the index value implies adopted smart agricultural practices while values below represent not adopted climate smart practices. The lowest to KAI value (0.33 to 0.63) were found in solar-powered greenhouses, organic farming, composting, drought tolerant crops, integrated farming; and minimum to zero tillage. These practices were not adopted by the respondents while the adopted practices were cultivating short-duration crop varieties, mulching, cover cropping, and crop rotation with KAI value more than the grand index value (0.66 to 0.95). Those none adopted climate smart agricultural practices may probably be because the respondents were not aware of those practices. Hence they don't have knowledge of them and without knowledge there can be no adoption. Those practices adopted might be due to their awareness of those practices on climate smart agricultural practices probably from the zonal extension agent in charge of the study area. This is in congruent with the work of Fawole and Aderinoye-Abdulwahab (2021) on climate change on agricultural practices.

Table 3: Distribution of the respondents based on Perception of Climate Smart Agricultural Practices

Variables	Mean (?̄)	SD	Rank
CSAPs is not only for the educated farmers	1.98	1.33	6th
Compatibility of CSAPs with culture, belief and norms	2.84	1.58	2nd
CSAPs are not too complex to handle	2.24	1.22	4th
Use of CSAPs can lead to higher yield	2.08	0.95	5th
CSAPs are not expensive and affordable	2.46	0.96	3rd
The yield from CSAPs are better than regular farming	3.33	1.02	1st
Farmers need training for adopting CSAPs	1.54	0.71	7th

Source: Field Survey, 2021

Respondents' Perception on Climate Smart Agricultural Practices

Table 3 shows the respondents' perception on climate smart agricultural practices. The perception of the respondents on climate smart agricultural practices was measured on a 5 point likert type scale of Strongly Agreed (4), Agreed (3), Undecided (0), Disagreed (1) and Strongly Disagreed (2) against some perception statements on climate smart agricultural practices. Perception index was generated which represented the Mean value ( ) was obtained and used for making inference on the respondents' perception on climate smart agricultural practices. That is 4+3+2+1+0/5=2.00. Therefore, favourable perceptions are 2.00+0.5=2.50 while unfavourable perception are 2.00-0.5=1.50 at an interval of 0.5. The clienteles have favourable positive perception towards climate smart agricultural practices judging from the mean values. They have the highest perception for the fact that yield from CSAPs are better than regular farming (=3.33), followed by compatibility of CSAPs with culture, belief and norms (=2.84), and the fact that CSAPs are not expensive and affordable (=2.46) as well as CSAPs are not too complex to handle (=2.24). They have optimum perception on the fact that it leads to higher yield (=2.08) and it is not only for the educated arable crop farmers only) =1.98) while they have less perception on the fact that farmers need training to adopt CSAPs (=1.54). This agreed with the assertion of Ali and Erenstein, (2017) that farmers have favourable perception of climate change.

Table 4: Distribution of the Respondents based on Constraints to Adoption of Climate Smart Agricultural Practices

Constraints	Mean (?)	SD	Rank
Socio-economic constraints	0.24	0.43	4th
Inadequate credit and funding to adopt CSAPs	0.28	0.45	3rd
Lack of technical know-how on CSAPs	0.28	0.45	3rd
Inadequate information on CSAPs	0.28	0.45	3rd
Lack of institutional support on CSAPs	0.28	0.45	3rd
High cost of implementation of CSAPs	0.23	0.42	5th
Inadequate training on CSAPs	0.29	0.46	2nd
Inadequate extension services	0.34	0.48	1st

Source: Field Survey, 2021

Respondents based on Constraints to Adoption of Climate Smart Agricultural Practices

The respondents' constraints to adoption of climate smart agricultural practices is shown in Table 4. It can be seen that the most severe constraints of the respondent on climate change in the study area is inadequate extension services (0.34±0.48). This implies that extension services with its responsibility of disseminating agricultural information to farmers is not living to expectation in the study area. This was followed by Inadequate training on climate smart agricultural practices (0.29±0.46) probably because farmers felt there is need for on the job training on climate smart practices. There are also limitations in the areas of credit and funding, technical know-how on CSAPs, information shortage and lack of institutional supports on CSAPs (0.28±0.45). Socio-economic constraints which related to farmers' personal variations is not left out as constraint (0.24±0.43) as well as high cost of implementation of CSAPs (0.23±0.42). this is

in agreement with the work of Olorunfemi et al (2020) who posited that the most severe constraints of farmers on information dissemination on smart practices is extension contact

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CONCLUSION AND RECOMMENDATIONS:

It can be summarized from the study that:

1. Majority of the arable crop farmers are males (65.8%), aged 43 years, with secondary education (40.8%). Greater proportion are married (67.5%), with average farming experience of 12 years, household size of 5 persons and farming size of 3 hectares.
2. Majority (86.0%) were not aware of climate smart practices and main sources of awareness/knowledge of is extension agent (30.0%).
3. The adopted climate smart practices are; cultivation of short duration crops, mulching, planting of cover crops and practicing crop rotation ($\bar{}$=0.66-0.95).
4. The respondents have high perception for the fact that yield from CSAPs are better ($\bar{}$=3.33), compatibility with culture, belief and norms ($\bar{}$=2.46) and its affordability ($\bar{}$=2.84).
5. Main constraints to adoption of climate smart practices are inadequate extension services ($\bar{}$=0.34), inadequate training on CSAPs ($\bar{}$=0.29) among others.

Based on the summary of the study, the following conclusions can be drawn.

1. Main source of knowledge on climate smart practices is extension services (30.0%).
2. Majority of the respondents were aware (86.0%) of climate smart practices.
3. They have favourable positive perception towards climate smart practices
4. Major constraints are inadequate extension services (0.34) and training on climate smart practices (0.29) amongst others.

It was recommended that:

1. Other sources of awareness with wider spread should be used for information dissemination on climate smart practices
2. Extension services should be strengthened and made proactive to be able to live to expectation of spreading information smart agricultural practices.
3. Socio-economic factors that will foster positive perception of climate smart practices should be done.
4. Periodic capacity building and advisory services should be done to assist the clienteles to be abreast of current information on climate smart practices.

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