ASSESSMENT OF CLIMATE-SMART AGRICULTURE TECHNOLOGIES AND PRACTICES AMONG VADI FARMERS IN KWARA STATE, NIGERIA

[1]Apata, O.M,. [2]Popoola, O.P., [3]Iyiola, O.A., [4]David, E., [5]James-Ojibo, I.U. and [6]Mohammed, A.

[1]Department of Agricultural Economics and Extension Services, Faculty of Agricultural Sciences, Ekiti State University (EKSU), Ado-Ekiti, Nigeria.

[2,3,4,5,6]Department of Rural Development and Gender Issues (RUDEG), Agricultural and Rural Management Training Institute (ARMTI), Ilorin, Kwara State, Nigeria.

Correspondence Author: Popoola, O.P; Email: oluwatokipeter@yahoo.com

ABSTRACT

This paper assessed the Climate Smart Agriculture (CSA) technologies and practices among Village Alive Development Initiative farmers in Kwara State, Nigeria. The specific objectives were to ascertain the level of awareness of VADI farmers on climate-smart agricultural technologies and examine the climate-smart agricultural technologies practised by VADI farmers. A multi-stage random sampling technique was used to select 160 respondents for the study. Data were collected through an interview schedule and analysed using descriptive statistics. Findings show that the age of the respondents had a high frequency (66%) in the 56 years and above category, which signifies that the farmers were adults. Most of the respondents (82.4%) were male, 84.5% were married, 76.4% had formal education, with an average household size of 6 persons and 9 years of farming experience. The majority of the respondents were aware of irrigation practices (98.8%), mulching (92.5%) and ridges (92.4%). The high cost of conservation agriculture equipment was indicated as the most severe constraint to practising climate-smart agriculture technologies. The study concluded that VADI farmers' awareness of climate-smart agriculture technologies was not enough. The study recommends that the dissemination of knowledge on safe climate-smart agriculture technologies should be increased.

Keywords: Climate-smart, agricultural technologies, VADI, farmers

INTRODUCTION

Current agricultural management practices and the associated land use changes account for one-third of total GHG emissions in Africa (IPCC, 2014). Increasing agricultural productivity under the effect of climate change as well as reducing its impact on the environment has a significant political will. Richards et al., (2016) and Wollenberg et al., (2016) reported that increasing resilient productivity and reducing emissions from agriculture are central components of 42 African countries' Nationally Determined Contributions, which outline their intended climate actions under the Paris Agreement. Agriculture in Nigeria is drastically affected by climate change while also being a major source of greenhouse gas emissions exacerbating climate change and land-cover change due to agricultural expansion. Climate-Smart Agriculture (CSA) is an approach to agricultural development that aims to address the intertwined challenges of food security and climate change (Lipper et al., 2014).

Climate-smart agriculture (CSA) is a key concept in the present discourse of climate change mitigation and adaptation (FAO, 2017 & IPCC, 2019). Lipper *et al*., (2014) reported that CSA can be defined as an agricultural activity that mitigates greenhouse gas emissions, increases the adaptive capacity of farmers, and sustainably intensifies agriculture for better livelihoods.

Village Alive Development Initiative (VADI), which originally started in 1995 as women focused programme called Village Alive Women Association (VAWA) in some communities of Kwara state was resuscitated in 2011 to include not only women, but to also allow the involvement of men and youths in the programme. Since its resuscitation, there has been renewed effort and interest by the Institute to ensure the success of the programme for food security, job creation, income generation, community development and poverty alleviation.

Despite the importance of local knowledge in identifying appropriate climate-smart solutions, it is noted that the knowledge interactions on farm and land management practices between farmers and state actors are not clearly defined in the current CSA literature in the study area. Understanding the local knowledge and use of CSA technologies will assist in rendering extension services, formulating agricultural policies, and relevant interventions. Therefore, there is a need for a comprehensive study on the use of climate-smart agriculture technologies among farmers in Kwara state, Nigeria.

However, an understanding of the factors which constraint practicing climate-smart agriculture technologies will assist in promoting high positive use of environmentally safe agricultural practice among the farmers. Knowledge of the constraining factors that could motivate VADI farmers towards climate-smart agriculture will assist in planning and implementation of VADI farmer's agricultural programmes.

It is on the above premise that this study aims to assess the climate-smart agriculture technologies in use by farmers in Kwara State.

Objectives of the Study

The main objective of this study was to assess the climate-smart agriculture technology practiced among VADI farmers in Kwara State, Nigeria. To achieve this main objective, the following specific objectives were considered;

i. describe the socio-economic characteristics of VADI farmers in the study area;
ii. determine farmers' awareness of climate-smart agriculture technologies in the study area;
iii. asssess the climate-smart agriculture technologies practiced by VADI farmers in the study area;
iv. identify the constraints to practicing climate-smart agriculture by VADI farmers in the study area.

METHODOLOGY

Study Area

The study was conducted in Kwara State, which is located in the North Central part of Nigeria and has 16 local government areas. The state's total land area is 36,825 square kilometers. The state borders the Gulf of Guinea between Benin and Cameroon. It lies within the geographical coordinates of longitude 4.5^0E of Greenwich and Latitude 8.5°N of the Equator. The state has River Niger as its natural boundary along its northern and eastern margins and shares a common internal boundary with Niger State in the north, Kogi State in the east; Oyo, Ekiti and Osun States in the South and an international boundary with the Republic of Benin in the West.
The State is characterized by a tropical climate, which ranges from humid to sub-humid at different times in the year. As reported by Joshua 2013, the vegetation of the state is mainly forest and savanna and it constitutes about 47.78% and 35.04%, respectively. The state has a tropical climate with averages rainfall of 1217 mm and an annual average temperature of 26.5 °C.

Agriculture, especially arable cropping and other agro-related activities, are the major occupations of the people despite it being an administrative state. Varieties of food and cash crops are farmed. Thus, it runs an agrarian economy with a vast majority of the populace taking to farming and other enterprises. The major crops grown in the state include cotton, coffee, kolanut, sesame, oil palm, tobacco and Cocoa are the major crops grown in the state. Popular tree species found include; Shea butter, Acacia, Parkia, Afzelia and Terminalia. According to the Nigerian Population and Housing Census (2006), Kwara State has an estimated population of 2,365,353 people with a population density of 65 persons per square kilometer and a GDP of $3.841B (World Bank, 2013).

Sampling Procedure and Sample Size

A multi-stage sampling technique was used in the selection of respondents. Due to the Government's intervention through its agency, Agricultural and Rural Management Training Institute (ARMTI)-on livelihood development through its Village Alive Development Initiative, all the nine participating communities in Kwara state were purposively selected for the study. The list of VADI farmers was obtained from farmers' associations and used as a sample frame. 20% of respondents were randomly selected to give a total of 160 respondents for this study. A pretested and validated interview schedule was used in collecting data base on the objectives of study.

Data Collection

Data were obtained with the means of a structured questionnaire. The data were analyzed using descriptive statistics of frequency count, tables, means, and percentages.

Table 1: Summary of Sampling Procedure and Sample Size

S/N	Communities	Population of Farmers	20% of Farmers
1	Fufu	95	19
2	Elerinjare	97	19
3	Amoyo	85	17
4	Omomere-Oja	81	16
5	Falokun-Oja	93	19
6	Jimba-Oja	91	18
7	Igbo-Owu	79	16
8	Ilota	89	18
9	Apa-Ola	88	18
	Total	**798**	**160**

Source: (VADI Farmers Association, 2023)

RESULT AND DISCUSSION

Socio-Economic Characteristics of VADI Farmers

Figure 1 reveals that 82.4 % of the respondents were male, while 17.6% were female, revealing the dominance of the male gender in farming activities in the study area. This is in line with the study by Adisa and Okunade, (2005), who reported that most farm activities are energy demanding, hence men tend to be more involved than women.

Figure 2 shows that the age distribution of the respondents ranges from 21 to 72 years. The mean age of the respondents was 48 years, which signifies that the respondents are in their active age. Similar studies were conducted by Kurgat *et al.* (2020), who reported that the age of household farmers is, on average, 41 and 48 years, respectively.

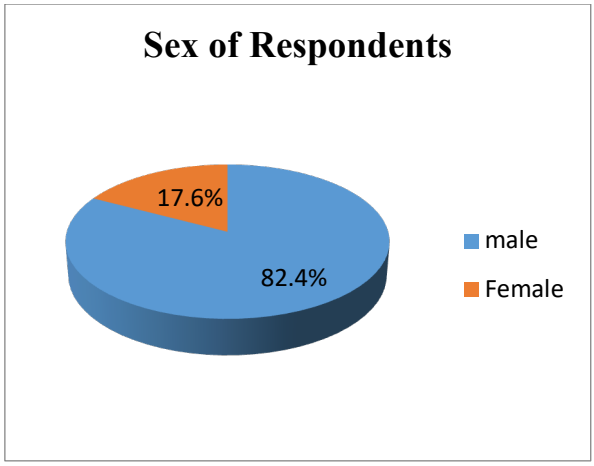

Figure 1: Distribution of VADI farmers according to Gender
(Source: Field Survey, 2023)

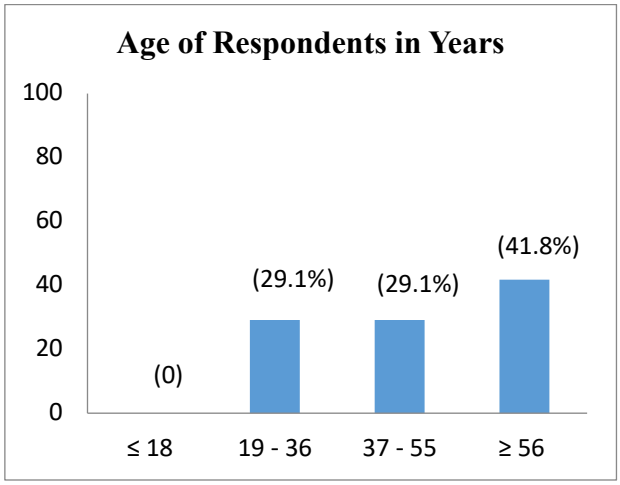

Figure 2: Distribution of the VADI farmers according to Age
Minimum= 21, Maximum= 72 and Mean=48years
(Source: Field Survey, 2023)

Figure 3 shows that 10.5% of the respondents were Christian in religion, while 85% respondents were Islam in religion, and 4.2% practiced traditional religion.

Figure 4 reveals that the majority (84.5 %) of the respondents were married, which implies that the married ones were more involved in farming because of their need to supplement the family's means of livelihood. This is in line with Olaniyi *et al.* (2008), who opined that marital status is one of the factors that affect adoption and new technologies.

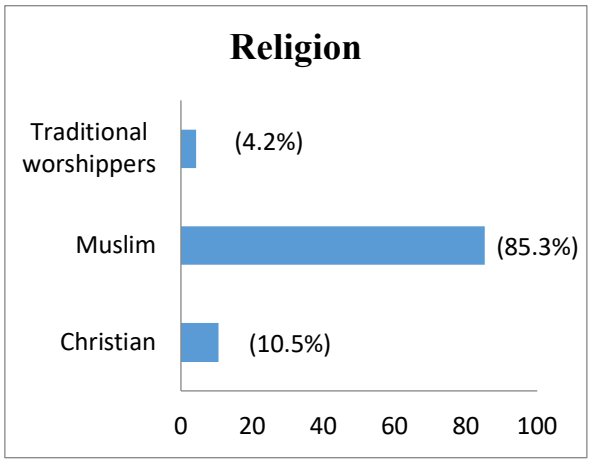

Figure 3: Distribution of the VADI farmers according to their Religion
(Source: Field Survey, 2023)

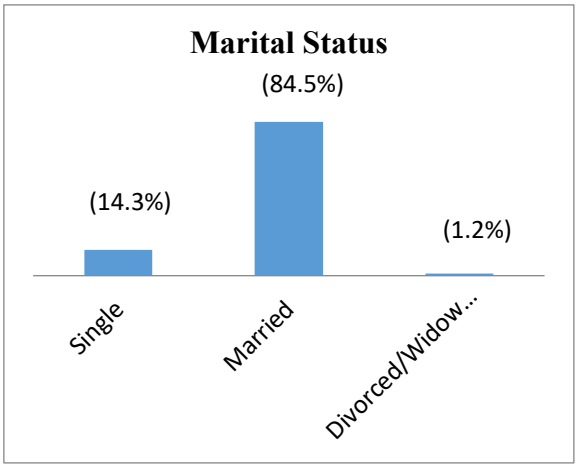

Figure 4: Distribution of the VADI farmers according to marital status (Source: Field Survey, 2023)

Figure 5 show that 76.4% had formal education. Also, Figure 6 reveals that respondents has an average household size of 6 persons

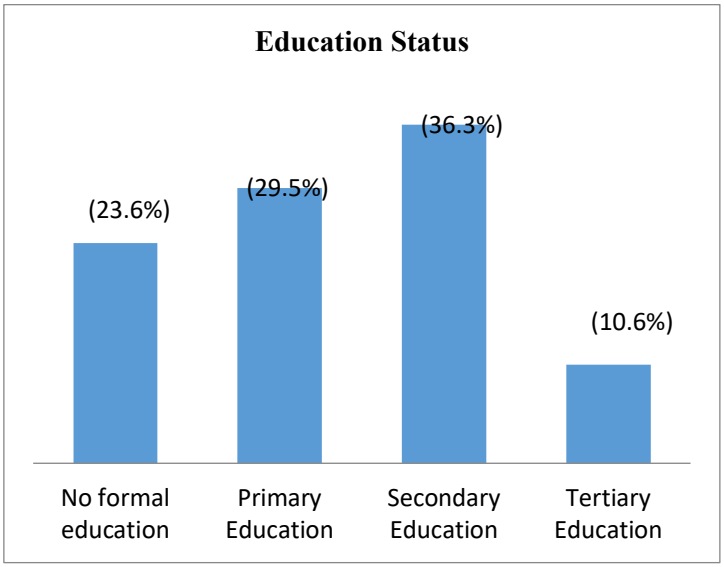

Figure 5: Distribution of the VADI farmers according to Educational Status (Source: Field Survey, 2023)

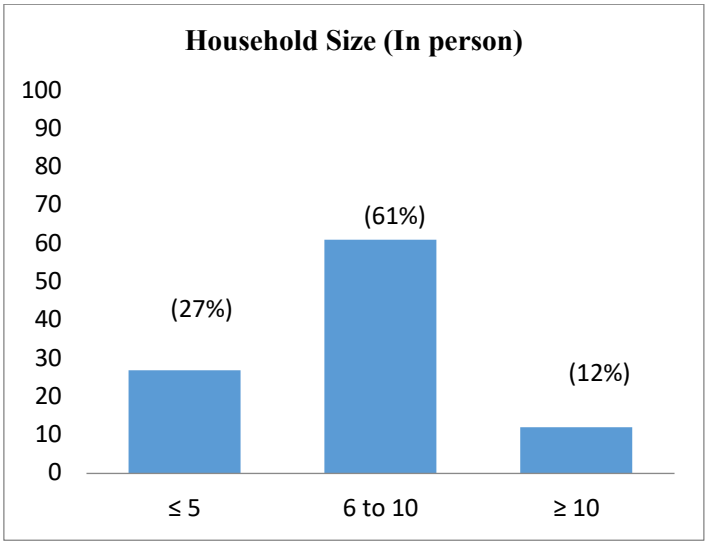

Figure 6: Distribution of the VADI farmers according to the number of the household Mean= 6 persons
(Source: Field Survey, 2023)

Figure 7 reveals that respondents have a mean of 9 years farming experience. Also, Figure 8 shows that most of the farmers (72.3%) do not have formal training on climate-smart agriculture technologies, and only 27.7% of respondents have formal training. This implies that the majority of the respondents do not have training on CSA technologies, which could negatively affect farmers in getting information on the proper ways of practising climate-smart agriculture technologies.

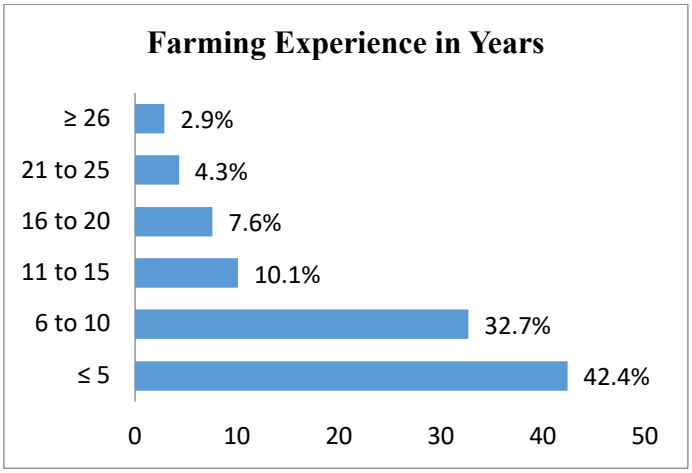

Figure 7: Distribution of the VADI farmers according to farming experience Mean=9years
(Source: Field Survey, 2023)

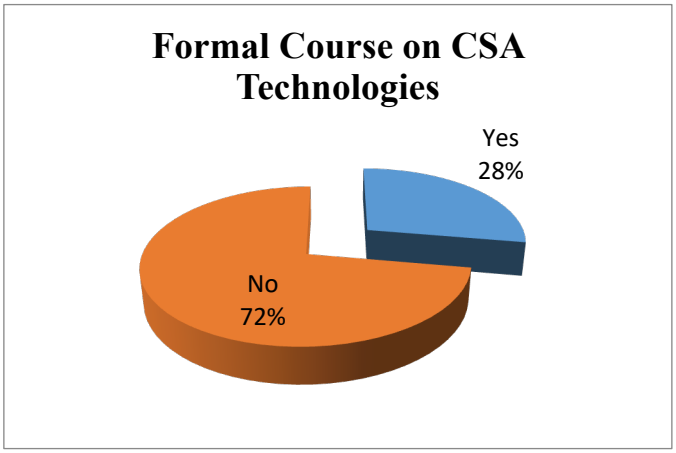

Figure 8: Distribution of the VADI farmers based on the formal training on climate-smart agriculture technologies
(Source: Field Survey, 2023)

Awareness of Climate-Smart Agriculture by VADI Farmers

Results presented in Table 2 show the farmers' level of awareness on climate-smart agriculture technologies. The result reveals a relatively high level of awareness (69.55%) of the farmers on climate-smart agriculture technologies. A similar study was conducted by Autio *et al*., (2021) who reported that lack of awareness on CSA is one of the major factor that constraint the use and practicing of CSA.

Table 2: Distribution of Respondent based on their Awareness on Climate-Smart Agriculture Technologies

Statements	Frequency	Percentage
Irrigation	158	98.8
Mulching	148	92.5
Ridges	148	92.4
Rain water harvesting	144	89.7
Cover cropping	122	76.3
Crop rotation	120	75.2
Fallowing	111	69.2
Agroforestry	111	69.2
Composting	110	69.0
Farm yard manure	94	58.7
Green Manure	81	50.7
Intercropping	80	50.2
Organic agriculture	73	45.7
Contour Ploughing	64	39.8
Terracing	56	35.3
Zero tillage	49	30.5

Average Awareness Level= 69.55%
(Source: Survey, 2023.)

Climate-Smart Agriculture Technologies Practiced by VADI Farmers

Results in Table 3 show the extent to which farmers practiced climate-smart agriculture in the study area. Result reveals that ridge making was the most practiced among the farmers (MS=3.19). This was followed by rain water harvesting while it's raining (MS=3.17), crop rotation (MS=2.99) and agroforestry (MS=2.99). The least climate-smart agriculture technology practiced by farmers in the study area is zero tillage (MS=1.86).

Figure 9 indicates that most of the operators (75.9%) on average practised climate-smart agriculture technologies, which could be a result of their sex, years of formal education or poor extension services. Low farmers (20.5%) practiced climate-smart agriculture technologies, while 3.6% highly used CSA technologies. A mean score of 2.23 implies an overall average climate-smart agriculture technology practiced among VADI farmers in Kwara State, Nigeria. These results show that the level of practicing CSA technologies from the farmers' perspective is not impressive, but there is still an opportunity for improvement.

Table 3: Distribution of Respondents based on Climate Smart-Agriculture Technology Practiced

	NP	RP	OP	AP	
CSA Technologies	**F (%)**	**F (%)**	**F (%)**	**F (%)**	**MS**
Ridges	7(4.7)	32(19.8)	44(27.3)	77(48.2)	3.19
Rain water harvesting	11(6.8)	25(15.8)	50(31.3)	74(46.1)	3.17
Crop rotation	25(15.8)	29(18.0)	29(18.0)	77(48.2)	2.99
Agroforestry	25(15.5)	29(18.1)	29(18.2)	77(48.2)	2.99
Irrigation	16(9.7)	79(49.6)	10(6.5)	55(34.2)	2.65
Mulching	9(5.8)	85(53.2)	32(19.8)	34(21.2)	2.57
Organic agriculture	19(12.1)	88(55.3)	16(9.8)	37(22.8)	2.44
Fallowing	20(12.6)	88(55.0)	16(9.7)	36(22.7)	2.42
Intercropping	12(7.6)	86(53.6)	50(31.3)	12(7.5)	2.39
Cover cropping	77(48.2)	12(7.9)	35(21.6)	36(22.3)	2.19
Composting	13(7.9)	115(71.9)	26(16.2)	6(4.0)	2.16
Contour Ploughing	78(48.6)	20(12.2)	29(18.3)	33(20.9)	2.11
Farm yard manure	89(55.8)	8(4.7)	20(12.5)	43(27.0)	2.11
Green Manure	41(25.9)	81(50.7)	28(17.3)	10(6.1)	2.04
Terracing	77(48.2)	38(23.7)	36(22.7)	9(5.4)	1.86
Zero tillage	89(55.8)	59(37.1)	9(5.5)	3(1.6)	1.54

***NP=Never Practiced *RP=Rarely Practiced *OP= Often Practiced *AP=Always Practiced *MS=Mean Score**

(Source: Survey, 2023.)

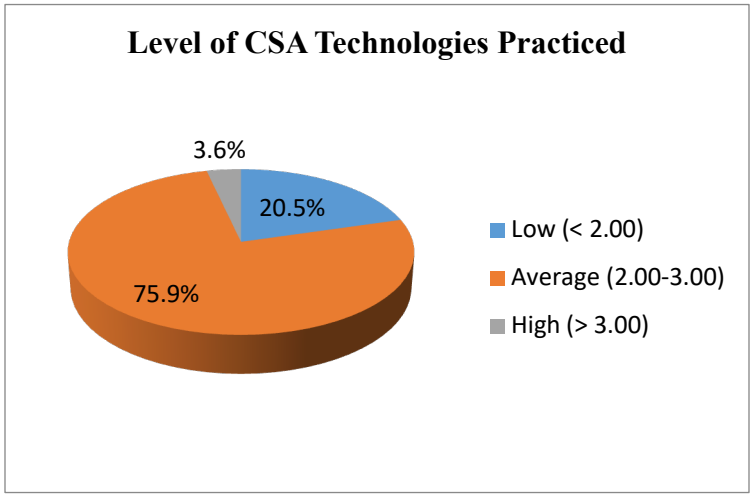

Figure 9: Distribution of the VADI farmers according to level of CSA technologies practiced (Mean ± SD = 2.23 ± 0.24)
(Source: Survey, 2023.)

Constraint to Practicing Climate-Smart Agriculture Practices and Technologies

Table 4 reveals the constraints faced in practicing CSA technologies. The most severe constraint as indicated by the respondents was the high cost of conservation agriculture equipment (M.S=3.18) and lack of technical know-how (M.S=3.04). Practice of CSA technologies is laborious and time-consuming (M.S=2.91) and inadequate resources such as water, land, labour, time, money, knowledge, or training (MS=2.83) were rated 3rd and 4th, respectively. The least constraint is Land size limitations (MS=1.98).

Table 4: Distribution of Respondents based on Constraints to Climate-Smart Agriculture Technology

Constraints	VS	S	LS	N	MS	Rank
	F (%)	F (%)	F (%)	F (%)		
High cost of conservation agriculture equipment	56(35.3)	80(50.0)	20(12.2)	4(2.5)	3.18	1st
lack of technical know-how	33(20.5)	103(64.7)	22(13.7)	2(1.1)	3.04	2nd
Laborious and time consuming	30(19.1)	91(56.8)	34(21.2)	5(2.9)	2.91	3rd
Inadequate resources such as water, land, labour, time, money, knowledge, or training	15(9.7)	107(66.9)	34(21.6)	4(1.8)	2.83	4th
Soil infertility	35(21.9)	47(29.1)	77(48.2)	1(0.8)	2.73	5th
Inadequate extension services	29(18.3)	52(32.4)	75(46.8)	4(2.5)	2.66	6th
Lack of knowledge/ awareness	24(15.1)	44(27.3)	90(56.5)	2(1.1)	2.56	7th
Pest attacks	20(12.2)	30(19.1)	103(64.4)	7(4.3)	2.39	8th
Land size limitations	33(20.5)	20(12.2)	18(11.5)	89(55.8)	1.98	9th

***VS= Very Severe *S=Severe *LS=Less Severe *N=Not a Challenge *MS=Mean Score**
(Source: Survey, 2023).

CONCLUSION AND RECOMMENDATIONS

The study concluded that VADI farmer's level of practicing CSA technologies was average. It also concluded that the farmers' level of awareness was above average. The most severe constraint faced by VADI farmers on practicing CSA technologies was high cost of conservation agriculture equipment, followed by a lack of technical know-how. The results also highlight the need to invest in rural public education to provide farmers with training in CSA practices and technologies. Further research is needed to consider gender in the practice of CSA. The study also recommends that the Government should provide adequate training to increase the knowledge and attitude of farmers for effective practicing of climate-smart agriculture. To disseminate knowledge of climate-smart agriculture, extension services and other stakeholders are to encourage farmers, educating them on climate change and its effects, climate-smart agriculture as well as technologies and practices in mitigating the effects of climate change.

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