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Research Article

Assessment of the Use of Climate Smart Agricultural Practices among Smallholder Farmers in Ogun State

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Abstract

Climate smart agricultural (CSA) practices are new agricultural approach to guide against the effect of climate change on agriculture. The study assessed the use of climate smart agricultural practices among smallholder farmers in Ogun State. Multistage sampling procedure was used in sampling 149 respondents from 6 villages (Ibara Orile, Orile Joga, Ishaga Orile, Osiele, Olodo, and Kila) in Ogun State. Data were obtained through the use of a structured questionnaire and analyzed using frequency counts, percentages, mean, standard deviation, Chi-square, Pearson Product Moment Correlation (PPMC) and one-way Analysis of Variance (ANOVA). Result showed that 63.1% of the respondents were male, 42.2% had primary and secondary education, 69.8% belong to Yoruba ethnic group while 53.0% were married. The respondents' mean age, faming experience and family size were 42 years, 13 years and 6 persons respectively. More than half (62.4%) had a farm size of less than or equal to 2 hectares. Hired labour (56.4%) was the mostly used type of labour, and the major crops cultivated by the respondents were vegetables (22.5%), cassava (20.3%), maize (15.3%) and yam (13.6%). Information on climate-smart agricultural practices was mostly obtained from fellow farmers (74.5%), family and relatives (64.4%). All the respondents (100%) had received training on CSA practices, and practices often used were minimum tillage (Mean= 3.31), crop rotation (Mean=3.30), use of mulching (Mean=3.26) and use of organic manure (Mean=3.07). The major challenges associated with the use of CSA practices were lack of government support (66.4%), lack of finance (49.7%) and inadequate training (40.3%). PPMC revealed a significant relationship between respondents' source of information and use of CSA practices ($r = 0.478$, $P<0.01$). ANOVA revealed a significant difference ($F = 3.405$, $P<0.05$) in the use of CSA practices across the study locations. In conclusion, the use of CSA practices varies across the 6 villages. It was recommended that extension agents should endeavor to include CSA practices as part of their training for farmers, and also intensify on these practices.

Keywords: Assessment; Use; Climate; Climate Smart Agricultural Practices; Smallholder Farmers

Introduction

Agriculture has been the major occupation of the people and their source of livelihood right from the beginning of creation. There are factors affecting the development and sustainability of agriculture which include social, economic and environmental factors. Climate is an environmental factor with a great impact on agriculture; it influences the types of crops that can be grown as well as the length of growing season of any crops planted. Unfortunately, the world is presently experiencing change in the climate pattern which is now affecting agriculture in a number of ways. These are through changes in average temperatures, rainfall and climate extremes (e.g. heat waves); pests and diseases infestation; changes in atmospheric carbon dioxide and ground level ozone concentration; and changes in the nutritional quality of some foods [1]. Between now and 2050, the world's population will grow from the current 6.7 billion to 9 billion i.e. by one-third of the present population. If current income and consumption growth trends continue, Food and Agriculture Organisation of the United

Nations (FAO) estimates that agricultural production will have to increase by 70 percent by 2050 to satisfy the expected demands for food and feed [2]. Agriculture must therefore transform itself if it is to feed a growing global population and provide the basis for economic growth and poverty alleviation. Climate change will make this task more difficult, due to its adverse impacts on agriculture. As a result of increased prevalence of extreme events and increased unpredictability of weather pattern, it is more likely that this can lead to a reduction in production and lower incomes in vulnerable areas, which may likewise increase global food prices. Developing countries and smallholder farmers are more affected by these changes (FAO, 2013). It is therefore necessary to device a strategic means of achieving a sustainable agricultural development for food security against the influence of climate change without causing depletion to the natural state of the soil. One such intervention is climate-smart agricultural practices. It is not a new agricultural system but a new approach, a way to guide the needed changes of agricultural systems particularly to address food security and climate challenges. Climate-smart agriculture (CSA) may be defined as an approach for transforming and reorienting agricultural development under the new realities of climate change [3]. This study sought to ascertain the assessment of the use of climate smart agricultural practices among smallholder farmers in Ogun State. The specific objectives were to ascertain the socio-economic characteristics of rural farmers in the study area; determine where farmers receive information or training on climate-smart agricultural practices; ascertain the climate-smart agricultural practices farmers have been trained on; determine the climate-smart agricultural practices often used by farmers in the study area; and examine the challenges faced by farmers in using climate-smart agricultural practices.

The hypotheses of the study were: a) There is no significant relationship between selected socio-economic characteristics of smallholder farmers and their use of climate-smart agricultural practices. b) There is no significant relationship between farmers' sources of information and their use of climate-smart agricultural practices. c) There is no significant difference in climate-smart agricultural practices used by famers across the study locations.

Methodology

The study was conducted in Ogun State, Nigeria. The targeted population for the study comprises of smallholder rural farmers producing arable food crops using Ogun State Agricultural Development Project (OGADEP) Structure. Multistage sampling procedure was used to select sample for the study. Out of the four OGADEP operational zones (Ilaro, Ikenne, Ijebu and Abeokuta), Abeokuta zone was randomly selected. "Ilewo and Ilugun" blocks were randomly selected in Abeokuta zone. Three cells were randomly selected from each of the blocks. The cells from "Ilewo" block were Ibara, Isaga Orile and Orile Joga, while the selected cells from "Ilugun" were Kila, Osiele and Olodo. From the six selected cells, a total of 149 respondents were randomly sampled for this study. Data was generated using a well-structured questionnaire. Climate-smart agricultural practices farmers received information or training was measured at nominal level using a rating scale of "Yes" or "No" on a list of CSA practices. A 4-points rating scale of Very often=4, Often=3, Rarely=2, Never=1 on a list of climate-smart agricultural practices was used to determine the usage of CSA practices by the farmers. The challenges faced by farmers in the use of CSA practices was measured at interval level using 3-point rating scale of Major challenge=3, Minor challenge=2, Not a challenge=1. Descriptive statistics such as percentage, frequency table, mean and standard deviation were used. Also, inferential statistics such as chi-square, Pearson Product Moment Correlation (PPMC), and Analysis of Variance (ANOVA) were used to determine the level of association between variables.

Result and Discussion

Socio-economic characteristics of respondents

The result presented in Table 1 shows that majority (63.1%) of the respondents were male while 36.9% were female. This implies that males were engaged in farming activities than females in the study areas. It can be said that male household heads are more involved in agriculture in order to improve the economic conditions of their household. This agrees with Mdoe and Mach [4] who said that in most rural areas, families gain a living by producing both cash and food crops. Table 1 also shows that the mean age of the respondents was 42 years. More than half (51.0%) of the respondents were between the age of 21 - 40 years old. Moreover, the study further reveals that 45.0% of the total respondents were 41 years old and above, while 4.0% were less than or equal to 20 years old. This indicates that larger percentage of the respondents were young adult. The implication could be that agricultural productivity in the study area would be high as younger ones that are more active are engaged in farming activities. The result agrees with the findings of Usman., *et al.* [5] that farmers within the age range of 21-40 years are in their active age of agricultural production.

Furthermore, majority (62.4%) of the respondents were Christians, 24.8% were Muslims while 12.8% practiced traditional religion. This implies that Christianity is the dominant religion among the respondents in the study area. Also, majority (53.0%) of the respondents were married, which agrees with the findings of Onasanya [6] and Soyebo., *et al*. [7] that agriculture is very much practiced by married people to make ends meet and cater for their children. As regards educational qualification, it was observed that 35.6% of the respondents had tertiary education, 22.1% had secondary education, 20.1% had primary education, 13.4% had no formal education and 8.7% only had adult education. This means that more of the respondents had high level of education which could be as a result of underemployment rate in the country or mere engagement in farming activities as a secondary source of income. This result disagrees with the view of Edeoghon., *et al*. [8] that a good number of older people who had low level of education are left to farming activities in Nigeria.

Result in Table 1 further reveals that the mean household size of the respondents consist of 6 persons, where 44.3% had a household size of less than or equals to 5 persons and 49.7% had a household size of between 6-10 persons. This implies that rural farmers give birth to more children in the study area. Farmers have advantage of family labour availability if many household members participate in farm.

The result also shows that majority (69.8%) of the respondents belongs to Yoruba ethnic group, 10.1% are Igbo, and only 2.0% are Hausa. This means that Yoruba is the ethnic group dominating the study area. Result also shows that more than half (63.1%) of the respondents had a farm size of less than or equals to 2.0 hectares, thus, most of them are indeed small-scale farmers. This finding corroborates with that of Omohan [9] that small farm holdings constitute most of the farming activities in Nigeria. The mean years of farming experience is 13 years. A large number (59.7%) of the respondents had an experience of less than or equal to 10 years, 20.1% had an experience of 21 years and above. The study further shows that larger percentage of smallholder farmers were young in the study area.

The findings according to table 1 also reveals that a good number (33.2%) of the respondents are earning between ₦100,000 - ₦139,000 per annum. This result indicates that the estimated earning was a result of total expenditure and cost incurred in the production process which agrees with the finding of Babatunde [10], that farming accounts for half of total household income, the other half is from different off-farm sources.

Variable	Frequency	Percentage	Mean	S.D
Sex				
Male	94	63.1		
Female	55	36.9		
Age (Years)				
Less than or equal to 20	6	4.0	42.77	17.89
21 – 40	76	51.0		
41 – 60	43	28.9		
61 – 80	18	12.1		
81 and above	6	4.0		
Religion				
Islam	37	24.8		
Christianity	92	62.4		
Traditional	19	12.8		
Marital Status				
Single	48	32.2		
Married	79	53.0		

Divorced	11	7.4		
Widow/widower	11	7.4		
Family Size				
Less than or equal to 5	66	44.3	6.05	
6 – 10	74	49.7		
11 – 15	8	5.4		
16 and above	1	0.7		
Ethnic Group				
Hausa	3	2.0		
Igbo	15	10.1		
Yoruba	104	69.8		
Igede	17	11.4		
Ebira	1	0.7		
Egun	7	4.7		
Ighala	1	0.7		
Ohori	1	0.7		
Educational level				
Primary	30	20.1		
Secondary	33	22.1		
Tertiary	53	35.6		
Adult Education	13	8.7		
No Formal Education	20	13.4		
Farm Size				
Less than or equals to 1 hectare	50	33.6		
1.1-2.0 hectares	44	29.5		
2.1 hectares and above	55	36.9		
Farming Experience (Years)				
Less than or equal to 10	89	59.7	13.32	12.025
11 – 20	30	20.1		
21 – 30	14	9.4		
31 – 40	12	8.1		
41 – 50	3	2.0		
51 and above	1	0.7		
Annual Income (₦)				
20-59,000	38	25.5		
60-99,000	25	16.8		
100-139,000	50	33.6	100,000	
140,000+	36	24.2		

Table 1: Socio-economic characteristics of the respondents (n=149).

Source: Field Survey, 2017. S. D=Standard Deviation

Types of labour used by the respondents

Findings in Table 2 show how often the respondents use different types of labour on their farm. The result indicates that 56.4% often used hired labour, 47.0% often used family labour, and 26.2% often used group labour. This reveals that the respondents in the study area frequently used hired labour more than others which may be due to the perceived increase effect of hired labour on agricultural output. This result slightly disagrees with the view of Food and Agriculture Organization [11] which states that family labour is mostly used in Agriculture in the developing countries.

Types of labour	Often	Rarely	Never	Mean	S.D
Hired Labour	84(56.4)	45(30.2)	20(13.4)	2.43	0.719
Family Labour	70(47.0)	51(34.2)	28(18.2)	2.28	0.763
Group Labour	39(26.2)	58(38.9)	52(34.9)	1.91	0.779

Table 2: Types of labour used by the respondents.
Source: Field Survey, 2017.

Types of crops grown by the respondents

The result in Table 3 shows the types of crops grown by the farmers. Cassava, vegetables and maize were the major crops grown by the respondents in the study area. The table reveals that 20.3% of the farmers grow cassava, 24.0% grow vegetables (such as amaranths, jute mallow, pumpkin, cucumber, pepper, and tomato), while 15.3% grow maize. These crops are households' major staple foods or what can be termed as food security crops. This trend is in agreement with the study carried out by Ojo [12] where the size of the farmland invariably influenced the type of crops and enterprise combination opened to the farmers.

S/N	Types of crops	Frequency	Percent
1	Vegetables	*117	22.5
2	Cassava	106	20.3
3	Maize	80	15.3
4	Yam	71	13.6
5	Fruits	33	6.4
6	Cocoa	22	4.2
7	Rice	21	4.0
8	Beans	17	3.2
9	Banana	15	2.8
10	Melon	11	2.1
11	Cocoyam	11	2.1
12	Potato	10	1.9
13	Kolanut	4	0.8
14	Oil Palm	4	0.8

Table 3: Types of crops grown by the respondents.
Source: Field Survey, 2017. *Multiple Responses

Respondents' sources of training or information on climate-smart agricultural practices (CSA)

Table 4 shows the information or training sources of the respondents on climate-smart agricultural practices. The result indicates that fellow farmers (Mean=2.67), friends and relatives (Mean=2.52), and radio (Mean=2.48) were the most significant sources used by the respondents to receive information or training on CSA practices. This finding supported the view of Anholt (1994) that the rise in farmers preferring other fellow farmers as a firsthand information source may be due to the apparent ineffectiveness in the public extension services in developing countries. Ajayi [13] also found that radio was the most frequently used media by farmers in South-West Nigeria to obtain agricultural information. Bulletin (Mean=1.78) and NGOs (Mean=1.60) happens to be less important source of information used by the respondents which may be due to inconsistency in circulation of information by the Nongovernmental organizations (NGOs) and use of bulletin in the study area.

Source	Often	Rarely	Never	Mean	S.D
Fellow farmers	111(74.5)	27(18.1)	11(7.4)	2.67	0.609
Friends and relatives	96(64.4)	34(22.8)	19(12.8)	2.52	0.713
Radio	85(57.0)	51(34.2)	13(8.7)	2.48	0.654
Farmers organisation	67(45.0)	58(38.9)	24(12.7)	2.29	0.729
Extension agents	62(41.6)	59(39.6)	28(18.8)	2.23	0.745
Television	55(36.9)	55(36.9)	39(26.6)	2.11	0.790
Bulletin	35(23.5)	46(30.9)	68(45.6)	1.78	0.804
NGO's	20(13.4)	50(33.6)	79(53.0)	1.60	0.715

Table 4: Respondents' sources of training or information on climate-smart agricultural practices (n= 149).
Source: Field Survey, 2017.

Climate-smart agricultural practices farmers received information or training on

Findings in Table 5 shows the CSA practices farmers have received information or training on. Result shows that 87.2% of the respondents indicated they had received information/training on the use of organic fertilizer, 86.6% on shifting cultivation, and 81.9% on the use of improved seed variety and integrated pest management. These major practices the respondents received information or training on is due to the fact it has been promoted globally that farmers endeavor to use more of organic fertilizer in improving their crop yield. This agrees with the findings of Yusuf and Ukoje [14] that application of organic fertilizer enhances soil quality, improve soil structure and increase crop yield. Use of improved seed variety and integrated pest management is another widely spread information to farmers in developing countries. Improved seeds can improve the yield potential of crops significantly and thus, is one of the most economic and efficient inputs to agricultural development [15].

S/N	Climate-smart agricultural practices	Frequency	Percentage	Ranking
1	Use of organic fertilizer	130	*87.2	1st
2	Shifting cultivation	129	86.6	2nd
3	Use of improved seed variety	122	81.9	3rd
4	Integrated pest management	122	81.9	3rd
5	Crop rotation	120	80.5	5th
6	Minimum or zero tillage practice	119	79.9	6th
7	Irrigation management	108	72.5	7th
8	Control of soil erosion and run-offs	102	68.5	8th
9	Different methods of crop establishment	101	67.8	9th
10	On farm diversification practices	89	59.7	10th
11	Agroforestry	86	57.7	11th
12	Rain water harvesting techniques	55	36.9	12th

Table 5: Climate-smart agricultural practices farmers received information/training on (n = 149).
Source: Field Survey, 2017. *Multiple responses

Climate-smart agricultural practices often used by the respondents

Table 6 shows the extent of the use of climate-smart agricultural practices by the respondents. The result indicates that minimum or zero tillage practice (Mean=3.31), crop rotation practices (Mean=3.30), use of mulching (Mean=3.26), and application of organic manure are the most frequently used CSA practices by the respondents. This implies that the practice of minimum tillage operation by the farmers will have lesser disruptive effect on soil structure. Thereby, helps to maintain soil physical properties and fertility as a mitigating strategy against climate change, rather than the practice of conventional tillage operation involving the use of heavy duty machines such as bulldozer which may expose the soil to adverse effect of climate change. Likewise crop rotation practice will allow the land to remain fertile, helps to improve stability, battle against

S/N	CSA Practices	Very often	Often	Rarely	Never	Mean	Ranking
1	Minimum or zero tillage practice	82(55.0)	39(26.2)	20(13.4)	8(5.4)	3.31	1st
2	Crop rotation practice	67(45.0)	47(31.5)	27(18.1)	8(5.4)	3.30	2nd
3	Use of mulching	79(53.0)	40(26.8)	19(12.8)	11(7.4)	3.26	3rd
4	Application of organic manure	63(42.3)	47(31.5)	25(16.8)	14(9.4)	3.07	4th
5	Other farming activities	58(38.9)	53(35.6)	26(17.4)	12(8.1)	3.05	5th
6	Planting across sloppy areas	56(37.6)	51(34.2)	31(20.8)	11(7.4)	3.02	6th
7	Planting of improved seed	52(34.9)	54(36.2)	33(22.1)	10(6.7)	2.99	7th
8	Use of pesticide	46(30.9)	67(45.0)	23(15.4)	13(8.7)	2.98	8th
9	Avoiding felling of trees	47(31.5)	48(32.2)	41(27.5)	13(8.7)	2.87	9th
10	Artificial water supply	38(25.5)	44(29.5)	47(31.5)	20(13.4)	2.67	10th
11	Use of pre-emergence herbicide	33(22.1)	54(36.2)	35(23.5)	27(18.1)	2.62	11th
12	Fumigation of the store house	25(16.8)	57(38.3)	43(28.9)	24(16.1)	2.56	12th
13	Seed treatment	32(21.5)	37(24.8)	38(25.5)	42(28.2)	2.40	13th
14	Planting of trees and shrubs	24(16.1)	29(19.5)	46(30.5)	50(33.6)	2.18	14th
15	Planting without seed bed	17(11.4)	37(24.8)	51(34.2)	44(29.5)	2.18	15th
16	Harvesting of rain water	10(6.7)	42(28.2)	58(38.9)	39(26.2)	2.15	16th

Table 6: Climate-smart agricultural practices often used by farmers (n = 149).
Source: Field Survey, 2017.

soil erosion and helps control pest attack. Use of mulching and application of organic manure will help to increase the soil buffering capacity.

However, the result shows that rain water harvesting (Mean=2.15) was the least used climate-smart agricultural practice which is not unexpected, as many of the respondents do not receive information or training on this practice.

Level of utilization of climate-smart agricultural practices by the respondents

The result presented in Table 7 shows that the level of respondents' utilization of climate-smart agricultural practices is high. Majority (94.6%) of the respondents had mean score above the average score (32), while 5.4% had mean score below the average (32). This implies that respondents in the study area highly utilized climate-smart agricultural practices.

Rank	Score	Frequency	Percent
High	33 – 64	141	94.6
Low	0 – 32	8	5.4

Table 7: Farmers' level of utilization of climate-smart agricultural practices (n = 149).
Source: Field Survey, 2017.

Challenges faced by the respondents in using climate-smart agricultural practices

The result in Table 8 shows the major challenges in using climate-smart agricultural practices. The major challenges identified by the respondents were lack of government's support (x^2=2.56), expensive cost of implementing the practices (Mean=2.28), lack of finance (Mean=2.26), and inadequate training on the practices (Mean=2.33).

S/N	Challenges	Major Challenge	Minor Challenge	Not a challenge	Mean	S.D
1	No government support	99(66.4)	34(22.8)	16(10.7)	2.56	0.691
2	Expensive cost	74(49.7)	43(28.9)	32(21.5)	2.28	0.798
3	Lack of finance	74(49.7)	40(26.8)	35(23.5)	2.26	0.817
4	No proper training	60(40.3)	41(27.5)	48(32.2)	2.08	0.850
5	Unavailability of improved seed	47(31.5)	45(30.2)	57(38.3)	1.93	0.836
6	Division of labour	35(23.5)	67(45.0)	47(31.5)	1.92	0.740
7	Lack of knowledge	41(27.5)	49(32.9)	59(39.6)	1.88	0.813
8	Inability to understand	39(26.2)	45(30.2)	65(43.6)	1.83	0.820
9	Lack of skills	29(19.5)	59(39.6)	61(40.9)	1.79	0.749
10	Difficulty in application	23(15.4)	54(36.2)	72(48.3)	1.67	0.730

Table 8: Challenges faced by farmers in using climate-smart agricultural practices. (n = 149).
Source: Field Survey, 2017.

The result implies that the government has not been paying much attention to smallholder farmers in the study area. It further shows that extension agents also need to keep themselves updated about what constitute climate-smart agricultural practices, thus, using the appropriate instructional aids and methodology in teaching the farmers. These agree with the report of Telecommons Development Group [16], that timely and up-to-date information on achieving optimal yield is highly desired by farmers, and can only be made available by extension workers, community libraries, and state and local government agricultural agencies.

The result of this findings also agree with that of Drost., *et al*. [17] that rural farmers experience financial barriers to the use of sustainable agricultural practices.

Test of hypothesis

The hypothesis that "there is no significant relationship between socio-economic characteristics of the farmers and their use of CSA practices was tested using Chi-square (x^2). The socio-economic characteristics considered were sex, age, religion, marital status, family size, ethnic group, educational level, farm size, and farming experience. The significance of the relationship was determined at 0.05 level. The chi-square statistical analysis shows that there was no significant relationship (P>0.05) between ethnic group and the respondents' use of CSA practices (x^2=15.147, P=0.05). This implies that the respondents' socio-economic characteristics do not influence their use of CSA practices in the study locations. The result of no significant relationship (P>0.05) between respondents' educational qualification and use of climate-smart agricultural practices (x^2=4.087, df = 4) is surprising because it is expected that the higher the respondents' educational qualification, the higher will be their use of CSA practices and vice versa. Similarly, non-significant association between farmers experience and CSA practices contradicts the findings of Edeoghon (2008) that respondents' farming experience has significant relationship with their use of sustainable agricultural practices in Edo State.

Variables	Chi-square test	Df	Contingency coefficient	P-value	Decision
Sex	0.003	1	0.004	0.959	Not significant
Age	58.836	4	0.532	0.240	Not significant
Religion	0.891	2	0.077	0.640	Not significant
Marital status	1.743	4	0.108	0.783	Not significant
Family size	15.126	3	0.304	0.300	Not significant
Ethnic group	15.147	7	0.304	0.050	Not Significant
Educational level	4.087	4	0.163	0.394	Not significant
Farm size	0.009	2	0.008	0.996	Not significant
Farming experience	26.483	5	0.388	0.492	Not significant

Table 9: Chi-square result of relationship between socio-economic characteristics and the use CSA practices.

Source: Field Survey, 2017.

Df (Degree of freedom) = n-1

P-value < 0.05 Significant

P-value > 0.05 Not significant

Variables	Correlation (r) value	P-value	Decision
Sources of information and utilization of climate-smart agricultural practices.	0.478**	0.001	Significant

Table 10: PPMC result of relationship between farmers' sources of information and use of climate-smart agricultural practices.

Source: Field Survey, 2017. **. Correlation is significant at the 0.01 level (2-tailed).

The hypothesis that "there is no significant difference in climate-smart agricultural practices used by farmers across the study locations" was tested using one-way Analysis of Variance (ANOVA) and results are as presented in Table 11 and 12. Findings in Table 11 reveal that there is a significant difference in the use of climate-smart agricultural practices across the study locations. ($F = 3.405$, $P<0.05$). This result therefore indicates that the use of CSA practices varies from one study location to another.

	Sum of square	Df	Mean Square	F	P-value	Decision
Between Groups	720.637	5	144.127	3.405	0.006	Significant
Within Groups	6053.000	143	42.329			
Total	6773.638	148				

Table 11: Test of significant difference of farmers' use of climate-smart agricultural practices across the study locations**.**

Source: Field Survey, 2017.

Study Locations	N	Mean	S.D
Ishaga Orile	20	45.25	8.097
Orile joga	25	48.32	8.240
Ibara Orile	23	44.83	5.382
Olodo	28	42.39	5.152
Osiele	32	45.19	5.486
Kila	21	41.38	6.674
Total	149	44.60	6.765

Table 12: Post-Hoc (LSD) showing the mean values across the locations

Source: Field Survey, 2017.

Result in Table 12 shows that farmers in Orile Joga had the highest mean value of using CSA practices. The findings in this Table reveal that the number of questionnaires administered to farmers in each study location does not determine the location that had the highest mean value. For example, farmers in Osiele (Mean = 45.19) were administered 32 questionnaires, while farmers in Orile Joga (Mean = 48.32) were administered 25 questionnaire.

Conclusion and Recommendations

Achieving a sustainable agricultural development for food security requires the adoption of climate smart agricultural practices. Based on this research objectives and findings, it can be concluded that smallholder farmers' sources of information on climate-smart agricultural practices in the study area are majorly from fellow farmers, family and relatives. It was discovered that the major climate-smart agricultural practices farmers have been trained on include the use of organic fertilizer, shifting cultivation practices, use of improved seed variety and integrated pest management. The climate-smart agricultural practices often used by the farmers include; the use of organic fertilizer, use of mulching, minimum tillage practice, and crop rotation practice. The findings revealed that the major challenges in using climate-smart agricultural practices are: lack of government support, and lack of financial assistance from lending agencies and institutions. Notably farmers who belong to the same ethnic group conveniently engage in the use of climate-smart agricultural practices. However, farmers across the six study locations do not engage in climate-smart agricultural practices at the same level.

Based on these findings, the following recommendations are therefore proposed; (i) Extension agents should endeavor to include Climate-smart agricultural practices as part of their trainings for farmers, and also intensify on these practices; (ii) The government should consider granting incentives and assistance to smallholder farmers in form of credit; (iii) The benefits of using CSA practices should be more publicized to farmers, especially on radio (iv) Extension agents should endeavor to pay farmers regular visit to ascertain their utilization of CSA practices, assess the challenges facing its use, and proffer useful solution.

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