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Assessment of Climate Smart Farming System in Federal Capital Territory (FCT) Abuja

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Abstract

Climate-Smart Agriculture (CSA) is one key agricultural development approach aimed at sustainably increasing productivity. Worldwide emphasis has been placed on designing approaches with regard to the needs of sustainable development. This study entails the assessment of Climate Smart Farming System (CSFS) in the Federal Capital Territory (FCT) Abuja. Data was collected using an informed questionnaire to determine the extent of farmers' adoption of Climate Smart Farming System in Gwagwalada (GWA), Kwali (KWA) and Abuja Municipal (AMAC) Area Councils in the Federal Capital Territory (FCT) Abuja. The result showed that a large proportion of respondents (82%) did not know about Climate Change although about 94.7% of them noticed changes in rainfall pattern and rise in temperature over a long period. All these farmers (94.7%) were not aware of most of the CSFS practices and so, adoption of Climate Smart practices is very low (5.3%) in these areas. Farmers, due to changes in temperature and rainfall, made changes to their farming systems by practicing crop rotation, early planting, mixed cropping, planting of trees, cover cropping to mitigate the effects. Sustainable agriculture will require a wider societal change towards appreciating the balance between agriculture and environmental change. Based on these findings, it is recommended that efforts such as sensitization campaigns, training and supportive programs on Climate-Smart Agriculture (CSA) be made to encourage farmers in the study area to adopt Climate Smart agricultural practices as a whole.

Keywords: Climate, Smart Farming System, Climate Smart Agriculture, Abuja

INTRODUCTION

Climate change refers to long term shifts in temperature and weather patterns which could be natural or human activities driven. Climate change can result to an increase in global temperature, causing sea levels to rise and change the amount and pattern of precipitation and an expansion of subtropical deserts (Oyerinde *et al*., 2013). Other effects of the warming includes more frequent occurrence of extreme weather events including heat waves, droughts heavy rainfall, species extinctions due to shifting temperature regimes and changes in crop yields (Oyerinde *et al*., 2013).

Climate-Smart Agriculture (CSA) is one key agricultural development approach aimed at sustainably increasing productivity. Climate Smart Agriculture (CSA) appeared as a concept on the policy agenda in 2009 and comes from an increased concern within the global development community in general. FAO in particular emphasized issues regarding the impacts of Climate Change on global food security, in combination with a steadily growing population, urbanization and consumption growth trends (FAO, 2013). The definition of CSA, as agreed upon by many international institutions such as the UN, IFAD, the World Bank and CGIAR, is that it integrates the three dimensions of sustainable development (i.e. economic, social and environmental) by jointly addressing food security as well as climate challenges and is as such composed of three main pillars or goals namely:

i. Sustainability in increasing agricultural productivity to support equitable increases in incomes, food security and development;
ii. Adapting and building resilience to Climate Change from the farm to national levels;
iii. Reducing and/or removing greenhouse gases emissions (GHG), where possible.

In order to make agriculture more productive and sustainable, the FAO has suggested five interconnected principles for the transition towards sustainable food and agriculture (FAO, 2010). They have the ambition to balance the social, economic and environmental dimensions of sustainability in agriculture, and provide a basis for developing policies, strategies, regulations and incentives to guide the transition to sustainability, while promoting resilience through an adaptive response to shocks and impact on crop productivity (FAO, 2010). Agriculture is significantly affected by temperature variability and changes in the other climatic factors all over the world including Nigeria (Oyerinde *et al*., 2013, 2014). Farmers are feeling the worst impacts of Climate Change on crop production, return on investment and sustainable livelihood (Oyerinde *et al*., 2013, 2014). All stakeholders in crop production must ensure nutritious food for all, through increasing production up to 60% in 2050 (Alexandratos and Bruinsma, 2012), while fighting changes in climate in the world. Climate resilience improvement is in common use nowadays to inform crop management options. In view of the current and future Climate Change and variability, interest among researchers to apply such technique is increasing to strengthen the climate resilience in crops of hot and dry areas (Ullah *et al*., 2017). Climate resilience is quite a resemblance to vulnerability and commonly defined as “the ability to bounce back after an external shock or stress”. Resilience of a system can also be illustrated through its components (Ahmad *et al*., 2018; Chuixiang and Nathan, 2021).

Agriculture system is affected by extreme weather events associated with Climate Change, therefore adaptive measures are needed to mitigate the negative impacts of Climate Change. The recent study was designed to x ray impact of Climate Change by bringing about Climate Smart practices for sustaining the productivity of crop and animal in the Federal Capital Territory, Abuja, Nigeria. This research focused on assessing the Climate Smart Farming System such as climate resilience method of land preparation, planting and other farm practices. Therefore, the aim of the research is to establish the impact of Climate Change on farming within the FCT, Abuja system at Federal Capital Territory (FCT), Abuja

2.0 MATERIALS AND METHODS

2.1 Description of Study Area

The study was carried out in the Federal Capital Territory, Nigeria. The Federal Capital Territory (FCT) is lying between Latitude 8.25° and 9.20° North of the equator and Longitude 6.45° and 7.39° East of Greenwich Meridian. The FCT has a landmass of approximately 7,315 km^2, of which the central city occupies 275.3 km^2. It is situated within the Savannah region with moderate climatic conditions (Ishaya and Hassan, 2013). It is under climate classification features classified as a tropical wet and dry climate, it experiences three weather conditions annually. This includes a warm, humid rainy season and a blistering dry season. In between the two, there is a brief interlude of harmattan occasioned by the northeast trade wind, with the main feature of dust haze and dryness. The rainy season begins from April and ends in October, when daytime temperatures reach 28°C to 30°C and night time temperature is around 22°C to 23°C. In the dry season, daytime temperatures can soar as high as 40°C and nighttime temperatures can dip to 12°C . Even the chilliest nights can be followed by daytime temperatures well above 30°C. The high altitudes and undulating terrain of the FCT act as a moderating influence on the weather of the territory. Rainfall in the FCT reflects the territory's location on the windward side of the Jos Plateau and the zone of rising air masses with the city receiving frequent rainfall during the rainy season from March to November every year (Ishaya and Hassan, 2013).

2.2 Descriptive Survey

Questionnaire was designed to obtain information on Climate Smart Farming Systems (CSFS) used in agricultural production in the Federal Capital Territory, Abuja, Nigeria. The questionnaire comprises of questions on environmental factors such as droughts, floods, new pests, pathogens and weed problems as well as their advantage and disadvantage in agricultural production in the selected areas. The questionnaires were administered by one hundred and fifty (150) farmers in rural communities in three Area Councils (AC) in the Federal Capital Territory (FCT), Abuja, namely: Gwagwalada (GWA), Kwali (KWA) and Abuja Municipal (AMAC). Responses obtained from all AC were collated and analyzed base on location of the farm and GPs record was also taken. Data on CSFS, as well as, factors aiding their occurrence were retrieved from the administered questionnaires. Also, an on-spot assessment of the situation was done on farms to authenticate information earlier collected.

Data collected from the respondents were analyzed using non-parametric and parametric statistical tools. These involve the use of descriptive and inferential analytical tools such as percentages, bar charts and correlation of factors associated with impact of Climate Change on farm productivity in the study area. The Data were analyzed using Excel 2020 and SPSS Version 22 Software.

3.0 RESULTS

3.1 Sex of farmers surveyed

The study was carried out to get information about climate smart agriculture. The survey involved 150 farmers in three randomly selected Area Councils in FCT with 109 males and 41 females which account for 72.7 % and 27.3% respectively (Figure 1).

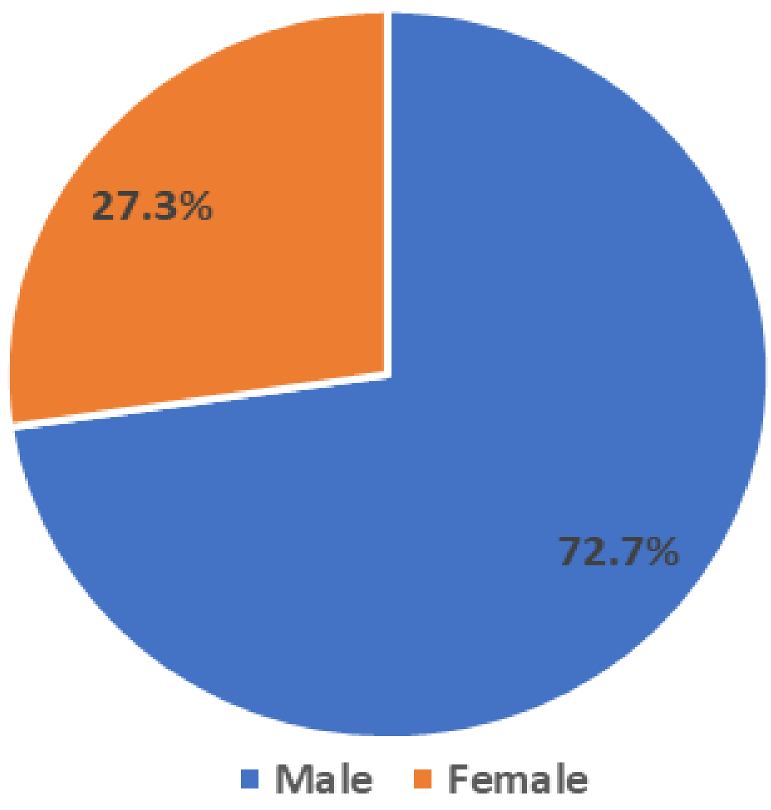

Figure 1: Sex Distribution of Respondents

3.2 Age Distribution of Respondent

The highest number of farmers in the selected Area Councils for the survey was within the ages of 21-30 accounting for 35.3% of the population surveyed. The least number (4.0%) of farmers was recorded within the age of 1-20 (Figure 2). Farmers between the ages of 31-40 were 31.3%, ages 41-50 were 16.7%, ages 51-60 were 6.7% and ages 60 above were only 6%.

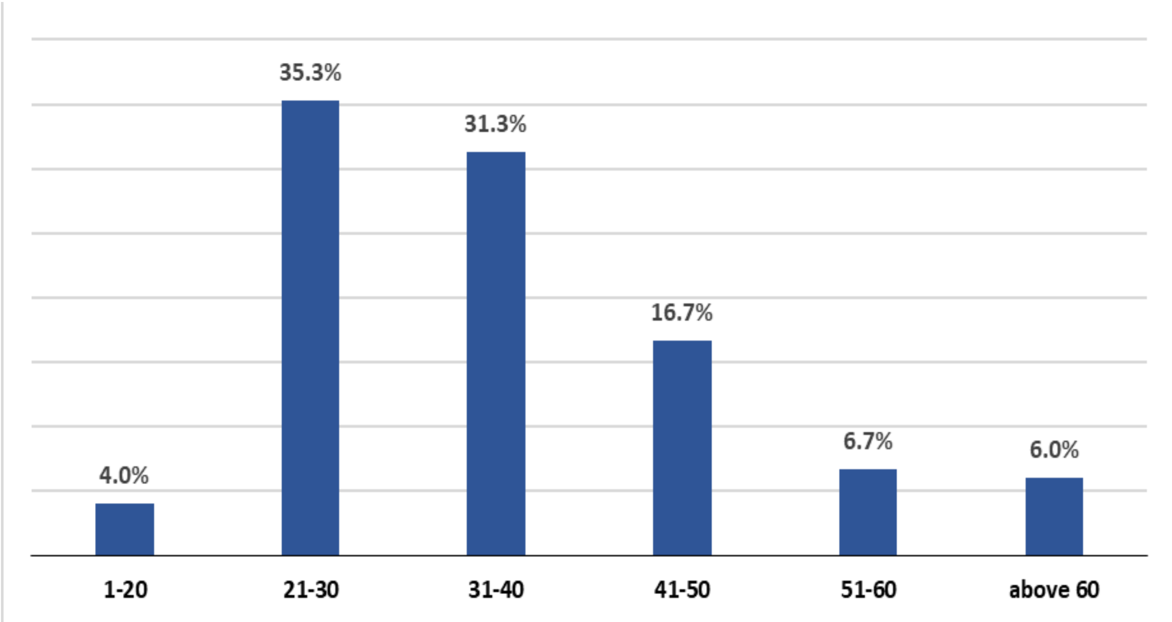

Figure 2: Age Distribution of Respondents

3.3 Educational Status of Farmers surveyed

A total of 61 farmers accounting for 40.7% of the farmers surveyed had Secondary school/vocational qualifications. 10% of the farmers, that is 15 of them, had no formal education. The percentage of farmers with M.Sc., College Education and Business study were 0.7% each, which were the least percentage (Figure 3).

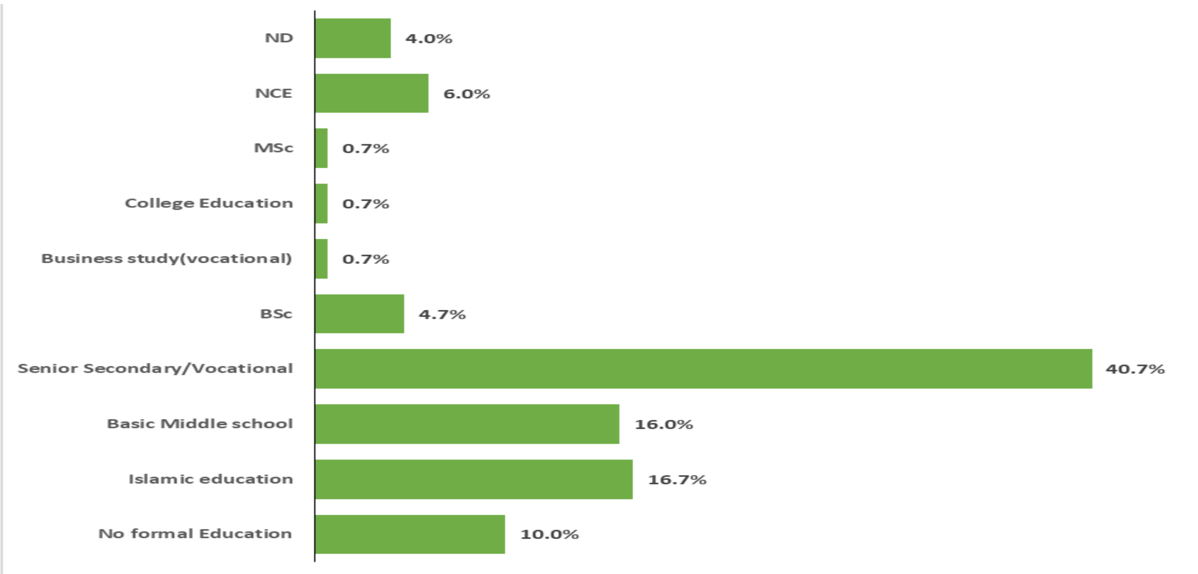

Figure 3: Educational Status of Respondents

3.4 Occupation of Respondents

Figure 4 shows the farmers that were surveyed practice different occupations such as crop farming, fish farming, livestock farm or combination of some of the farming system. Majority of the respondents 64% practice crop farming, while the minority of the respondents 0.7% practice crop and fish farming. 33.3% and 2% of the respondents practice crop and livestock farming and livestock farming alone, respectively.

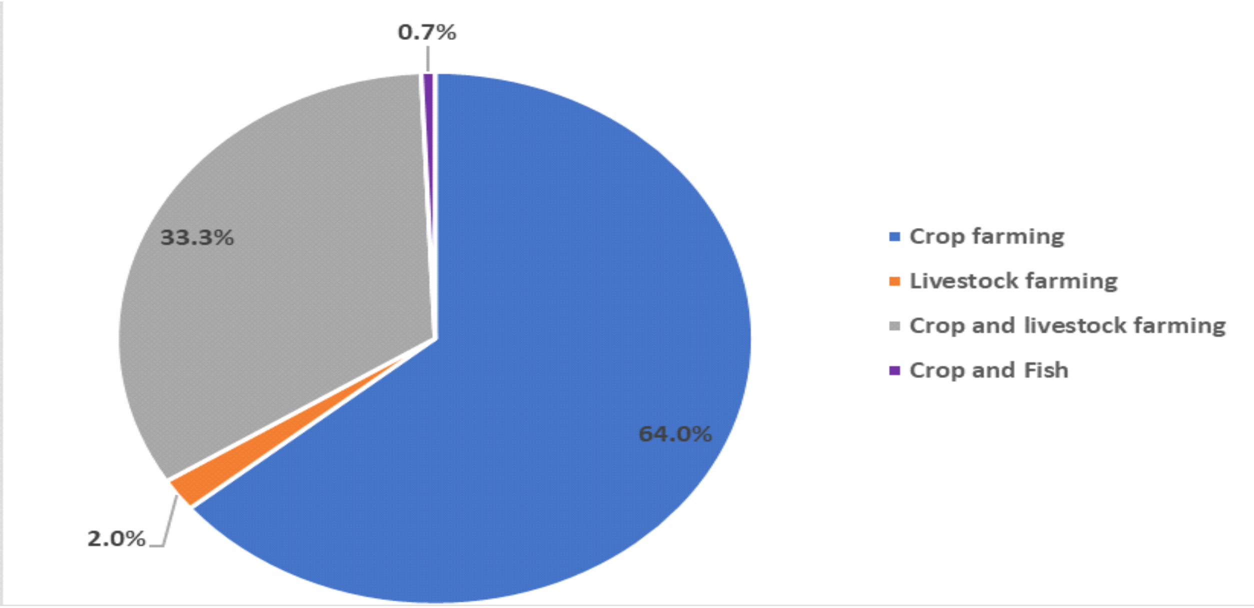

Figure 4: Type of Farming Occupation

3.5 Farming experience of participants

During the field survey, it was recorded that most of the farmers, 48.7% have been practicing farming for about 1-20 years ago. The least percentage was those that had been practicing for above 60 years. There was a gradual decrease in percentage as the years increase, but there was more percentage for respondents with 51-60 years of experience (4.0%), than 41-0 years of experience (2.7%) (Figure 5).

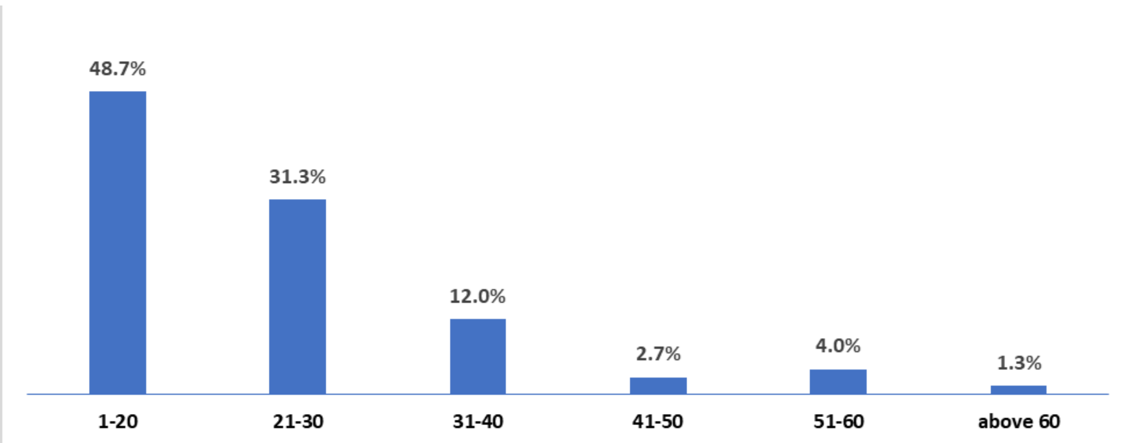

Figure 5: Farming Experience of Respondents

3.6 Topography of Farm Location

The highest frequency was recorded on farms located on lowland with the total number of 77 farms, accounting for 51% and the lowest frequency was recorded on farms located on hill (4%), which accounted for 6 farms. The farms near rivers was 45%, accounting for 67 farms (Figure

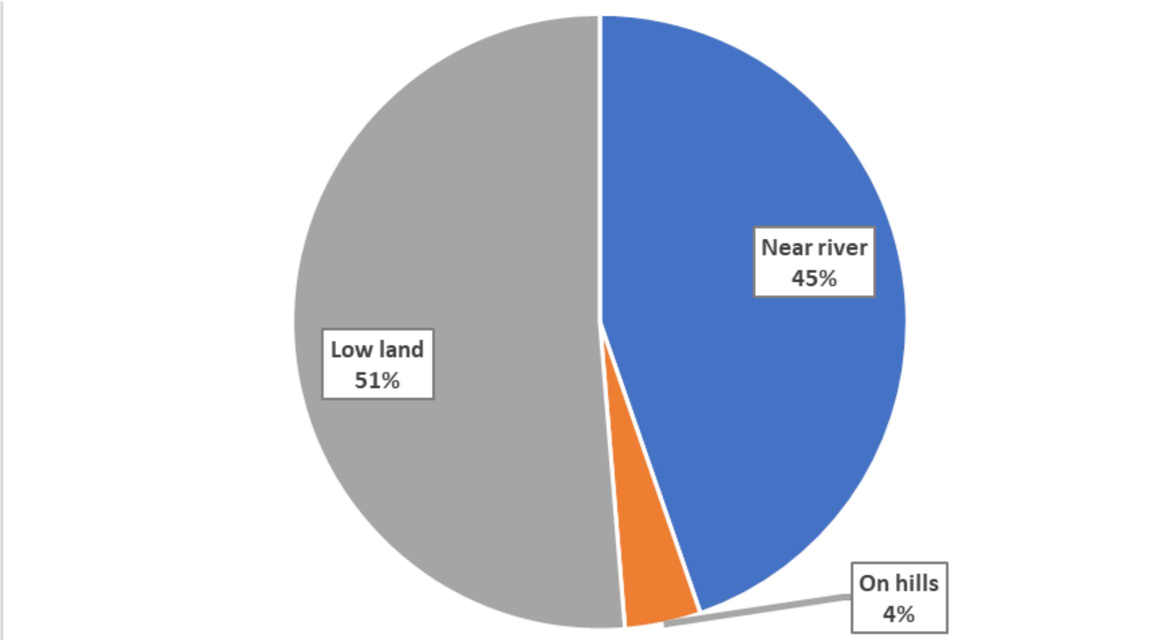

Figure 6: Topography of Farm Locations

3.7 Cropping System Practiced by Respondents

Figure 7 illustrate the various cropping systems practiced by farmers on their farms which are rainfed or irrigation. The highest number of 134 farmers accounting for 89.3% practice rainfed cropping. Only 1.3% practice irrigation farming. 9.3% of the farmers practice rainfed and irrigation together.

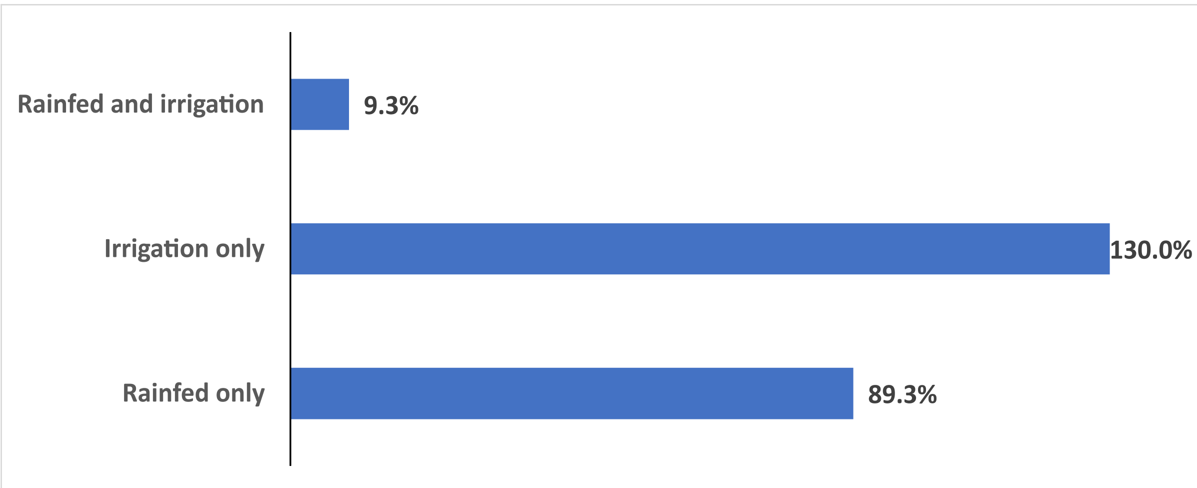

Figure 7: Cropping System Practiced by Respondents

3.8 Farmers Knowledge about Climate Changes and Global warming

Majority (123) representing 82% of the respondents does not know about Climate Change and Global Warming. 27 of the farmers, making up only 18% have knowledge on Climate Change and Global Warming (Figure 8).

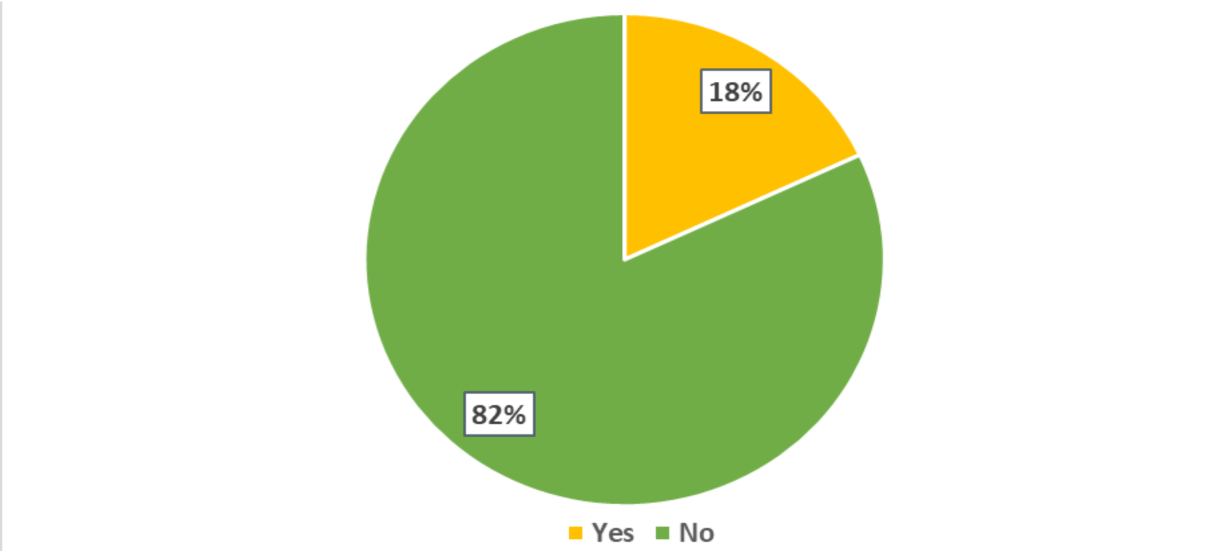

Figure 8: Farmers Knowledge on Climate Change and Global Warming

Medium of Information on Climate Change

The few numbers of farmers who were aware of Climate Change and Global Warming, majorly got the information on the Television programs or news. 1.3% of them got their information from the internet and another 1.3% from theirs friends (Figure 9).

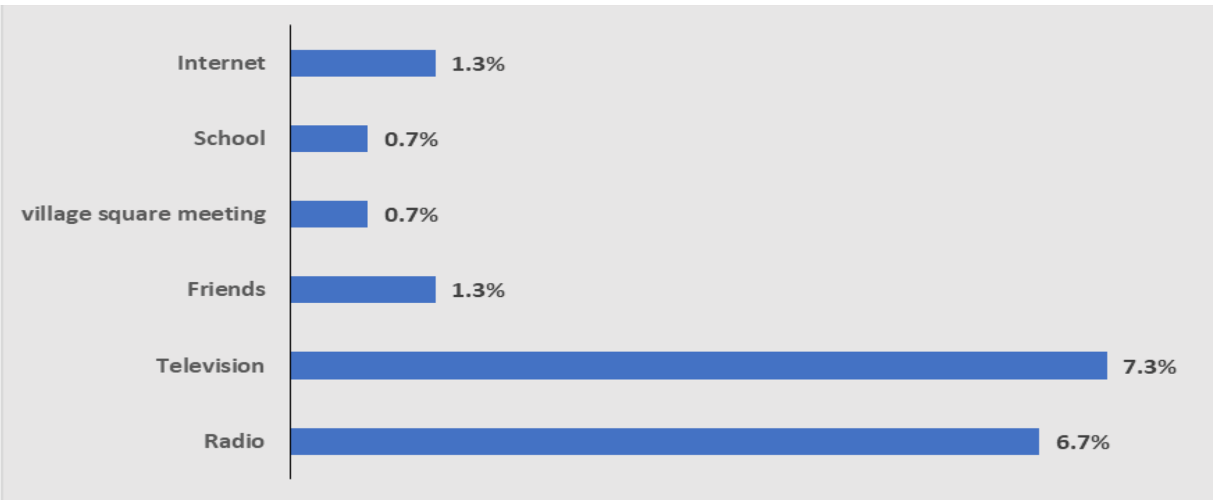

Figure 9: Medium of Information on Climate Change

3.9 Changes observed by the respondents

A total number of 142 farmers which made up 94.7% noticed changes in rainfall and temperature for the past 30years and others with which made up 5.3% noticed no change (Figure 10).

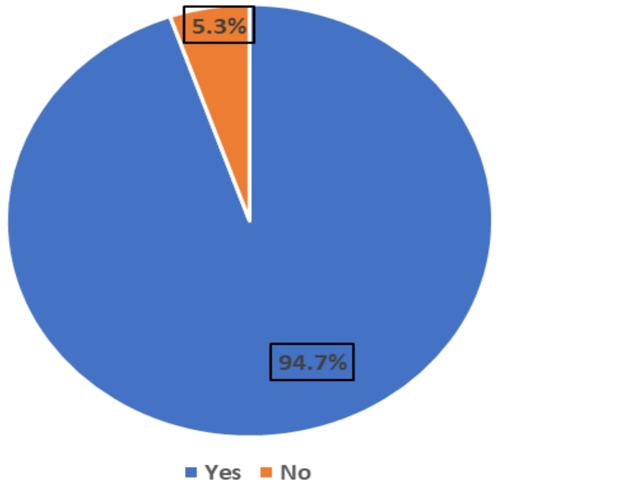

Figure 10: Observation of change in temperature and rainfall

Changes noticed by majority of the farmers includes short rainfall over the past years which accounts for 42% of the responses (Figure 11). 27.3% of them noticed excessive heat or high temperature, 24% noticed flooding and excessive rainfall. Only 1.3% noticed the long duration of dry season.

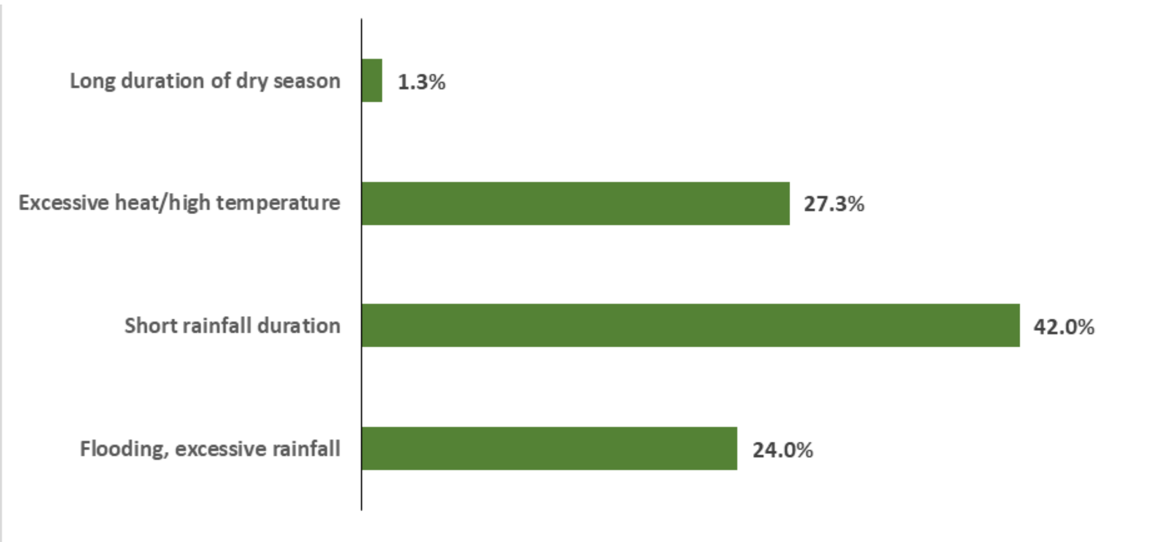

Figure 11: Changes observed by the respondents

3.10 Main opportunities (positive impact) created by the long-term changes in the mean of climates over 30years

As showed in Figure 12 below, we ask the farmers what have been the main opportunities in change in climate variables, which total number of 81farmers with 54.4% said it improved the groundwater and 31 farmers with 20.7% that floods increase fish harvest during the data collection.

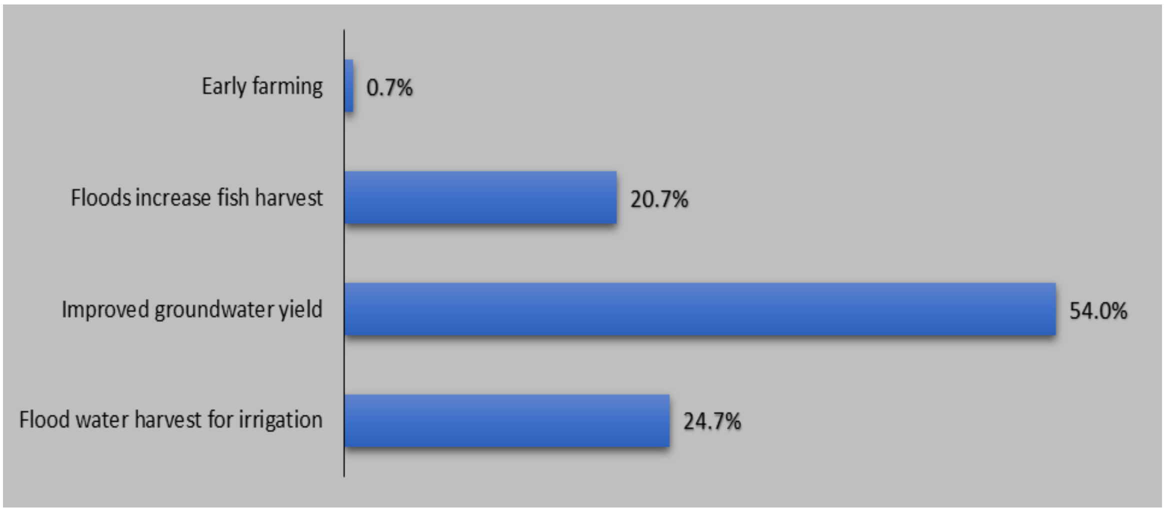

Figure 12: Main opportunities (positive impact) created by the long-term changes in the mean of climates over 30years

3.11 Means by which farmers capitalize on these opportunities or positive effects in future for better farm productivity

The highest frequencies for the opportunities or positive effects in future for better farm productivity is irrigate more which 75 farmers with 50% sees great opportunity in that while about 45 farmers with 30% Adopt irrigation practice as their own way of better farm productivity during the surveyed-on farmers.

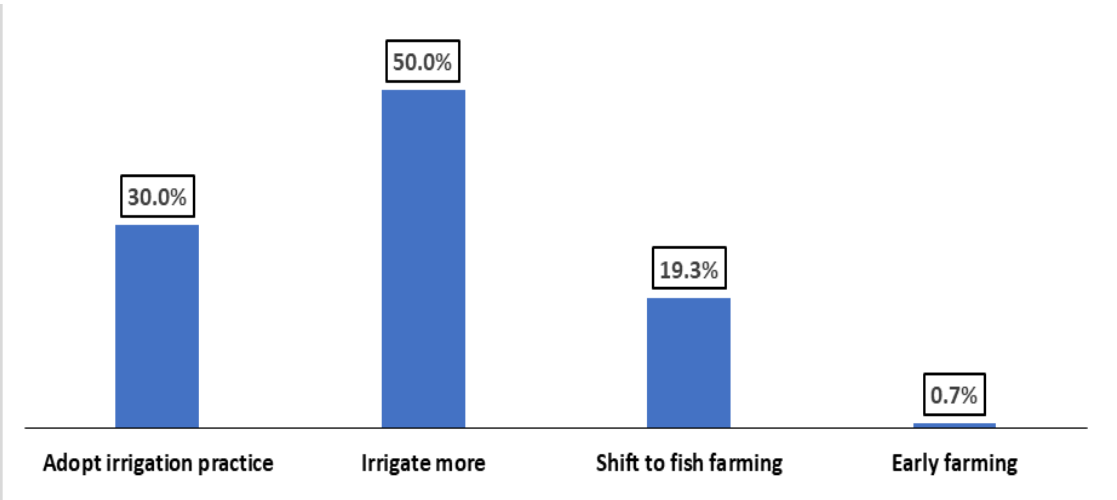

Figure 13: Means by which farmers capitalize on these opportunities or positive effects in future for better farm productivity

3.12 Changes in vegetation noticed over the last 30 years

The highest number of farmers with 99.3% noticed changes due to deforestation and grazing which is one of the factors which affect climate change and only 7% noticed with no changes.

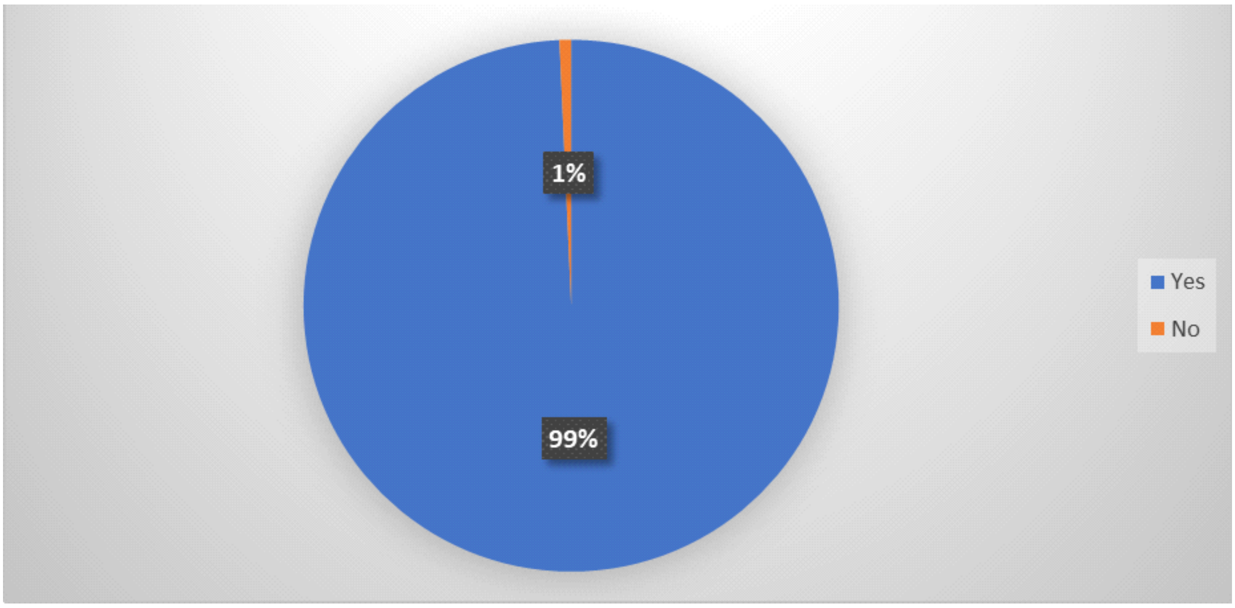

Figure 14: Changes in vegetation noticed over the last 30 years

3.13 Vegetation changes farmers noticed in the last 30 years

The frequency shows that there is decrease in vegetation cover in the last 30 years. A total number of 133 farmers with 88.7% said there is high decrease in vegetation cover and 16 farmers with 10.7% observed increase.

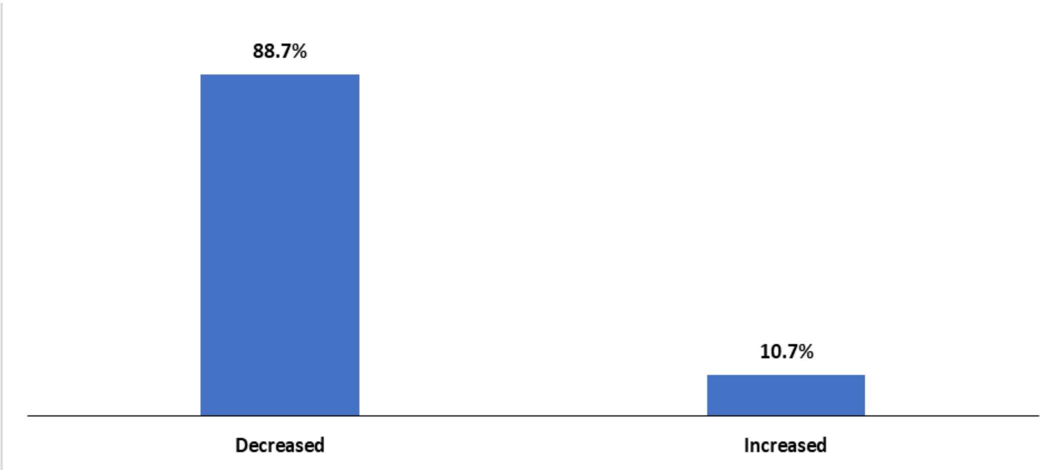

Figure 15: Vegetation changes farmers have noticed in the last 30 years

3.14 Changes in vegetation type over 30 years

The frequency showed decrease in vegetation type over 30 years, 88% respondents observed decreased while 11.3% noticed increase for the past 30years.

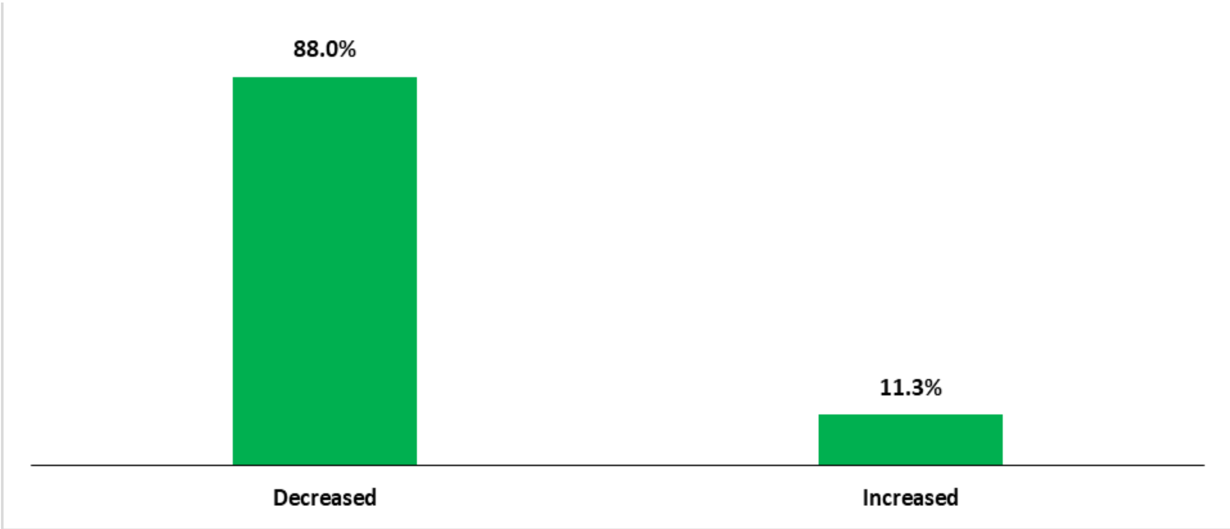

Figure 16: Changes in vegetation type over 30 years

3.15 Farmers use of fuel in home/farm

During the surveyed result analyzed showed that 96% farmers use fuel in their respective house and about 4% don't make use of fuel in their house or farm.

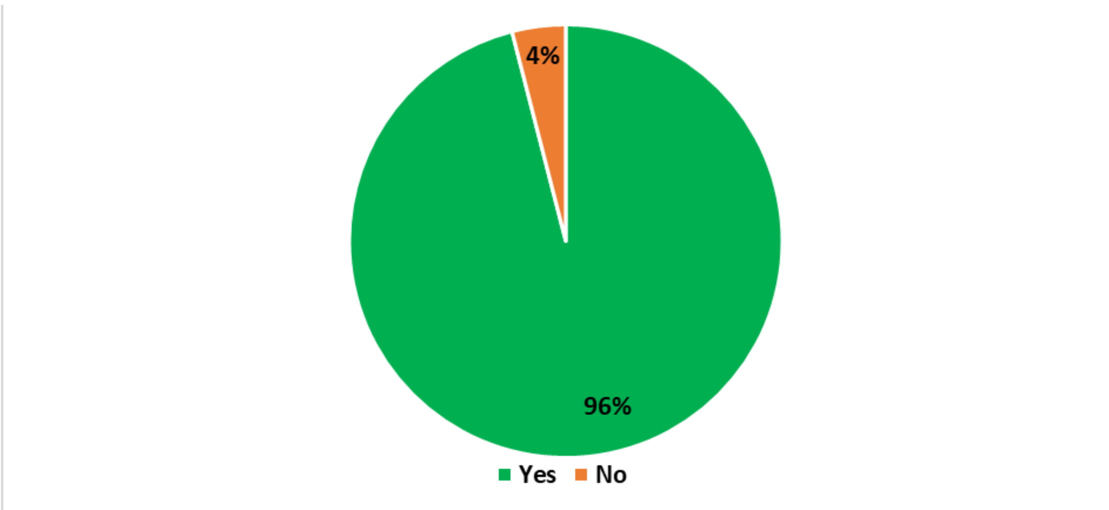

Figure 17: Farmers use of fuel in home/farm

3.17 Type of fuel used by farmers

Frequencies shows various type of fuel farmers use in their home or farm as shown in the Figure 18 below, 69.3% use firewood,10% use gas and 9% use kerosene in their farm or home.

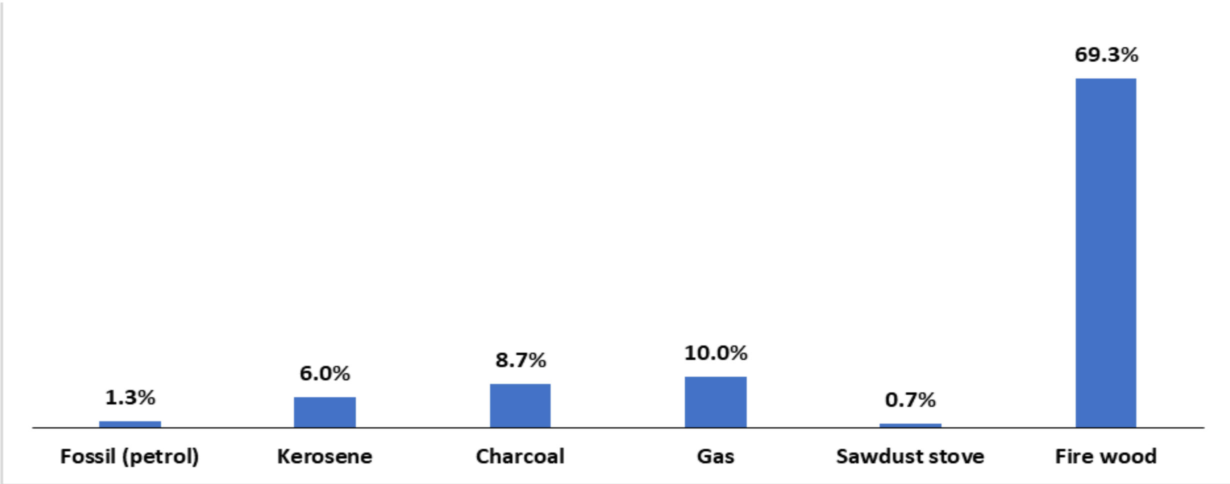

Figure 18: Type of fuel used by farmers

3.17 Farmer's knowledge on climate smart farming

The aim of carrying out this surveyed is to know the farmers who practice and know about climate smart cropping and during the surveyed a total higher number of 142 farmers with 94.7% the higher frequency didn't know about climate smart cropping 8 farmers with 5.3% know about it and practice it in the farm.

Figure 19: Farmer's knowledge on climate smart farming

3.18 Farmers adaptability to Climate change in over 10years

The highest number of 142 farmers with 94.7% has not made any changes in their farming because they don't know about climate smart cropping the little farmers with 5.3% have made change with their farming with the information.

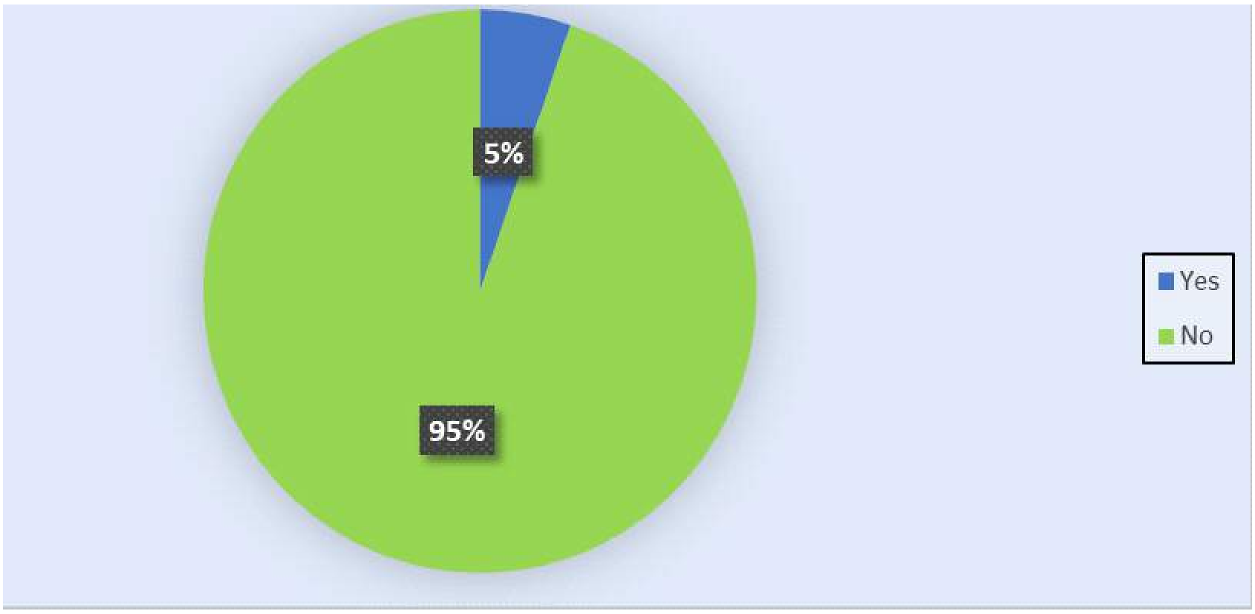

Figure 20: Percentage of farmers that made changes or adjustments in their farming ways in response to climate change and variability over 10years

3.19 Farmers adjustments in farming ways due to long terms shifts in temperature

Frequency shows that most farmers practices climate smart cropping but don't have much knowledge on it which we have about 34% practicing crop rotation, 24% mixed cropping 12.7 practicing mixed farming in the surveyed area during research.

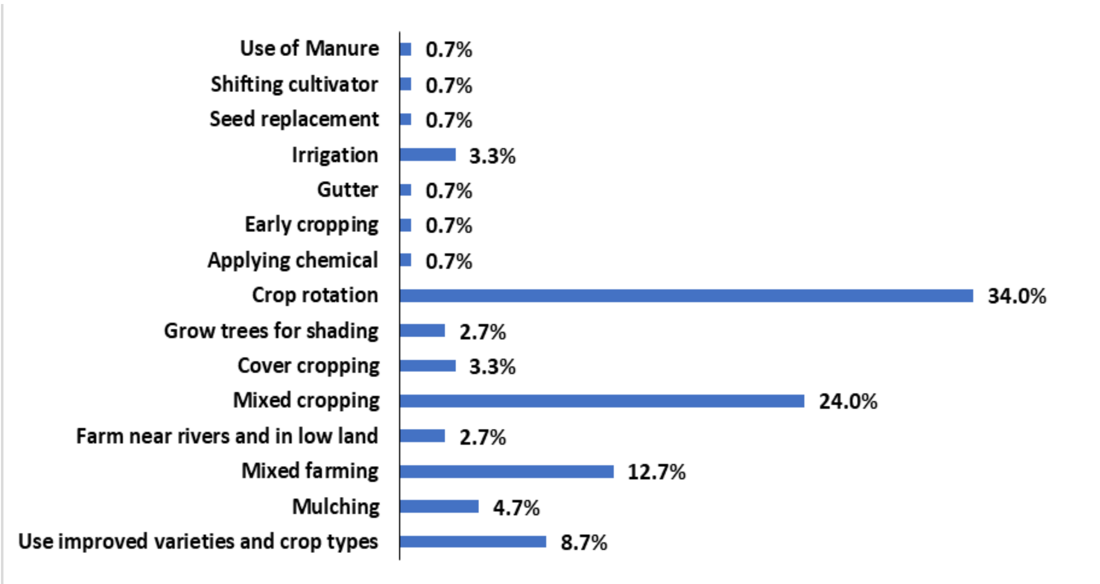

Figure 21: Farmer's adjustments in farming ways due to long terms shifts in temperature

3.20 Receive of support by farmers for climate Adaptation

Frequencies shows that a lot of farmers never receive support for climate adaptation in the area council covered. The highest numbers of 139 farmers with 92.7% don't receive support, only 11farmers accounting for 7.3% receives support for climate adaptation (Figure 22).

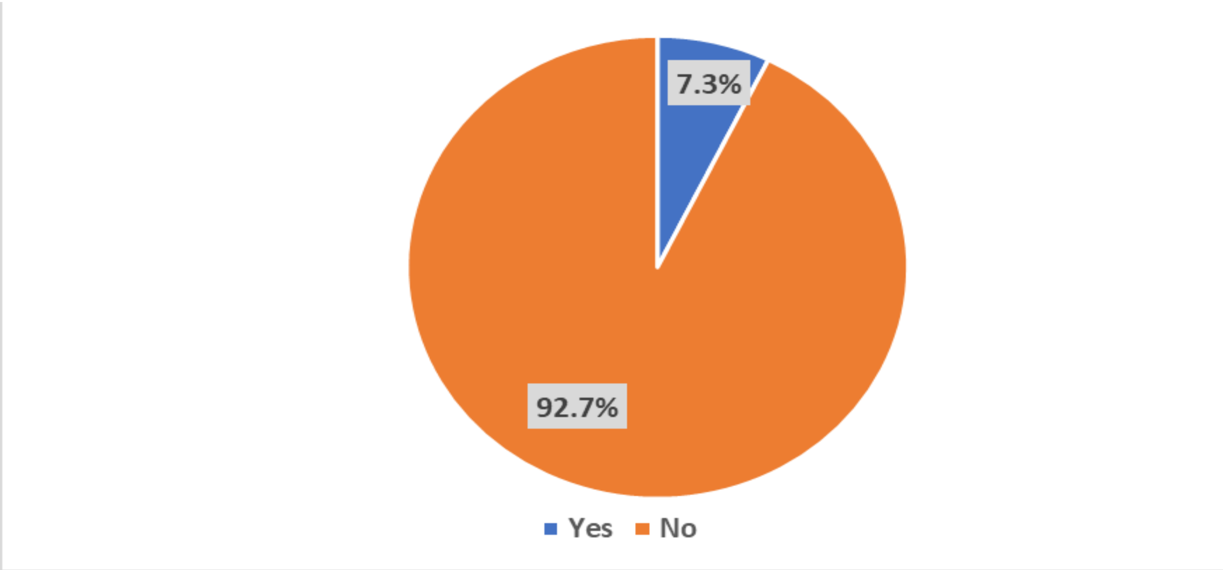

Figure 22: Receive of support y farmers for climate Adaptation

3.21 Form of support received by farmers

The farmers who got support for climate adaptation is also surveyed to know the form which the support come from to the. Most farmers accounting for3.3% gets their support from subsidized farm input while 2.0% gets supports from material support and 92.6 of the farmers do not get support at all in climate adaptation.

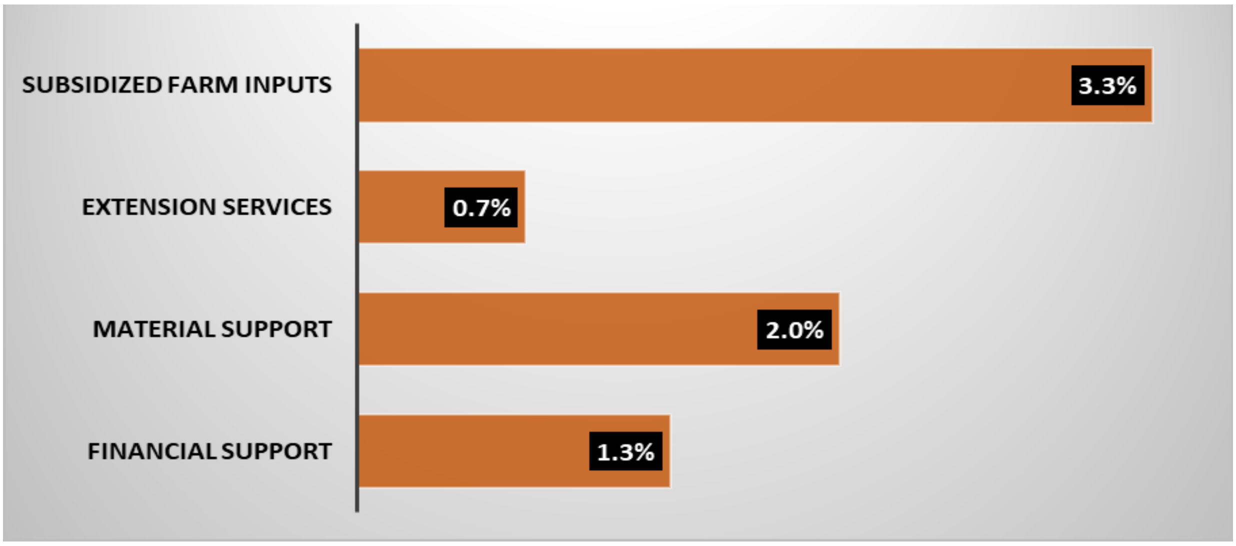

Figure 23: Form of support received by farmers

3.22 Source of support received by farmers

Frequencies shows that highest number of farmers accounting for 4% get their support from Area council 3% gets support from FCT Donor and large number of 96.2% do not receive any support.

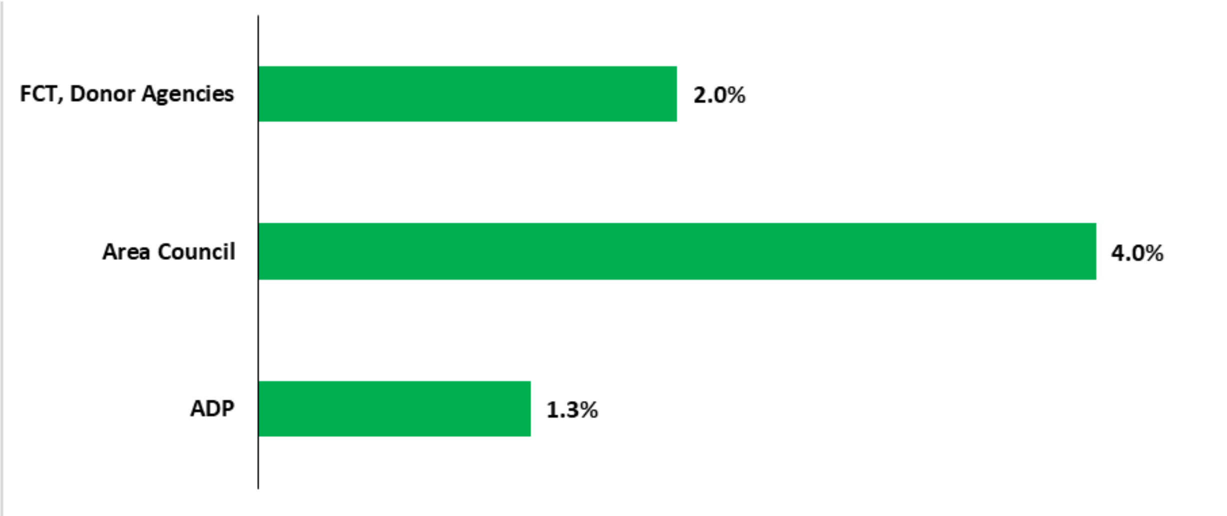

Figure 24: Source of support received by farmers

DISCUSSION

This survey covering three Area Councils of the Federal Capital Territory, Abuja helped highlight climate smart farming systems and methods employed in the adjustments to climate changes over time. the farmers are not aware and have no understanding of climate change, global warming and climate smart cropping but some farmers noticed long term changes in climate such as flooding, short rainfall duration, excessive heat and high temperature, long duration of dry season. This is in the support of IPCC (2014) reports that the earth surface has been warmer in the past three successive decades. The aforementioned climatic elements have been reported to influence crop production (Sowunmi and Akintola, 2010). According to Sowunmi and Akintola, 2010, the overall predictability of these climatic elements is imperative for day-to-day and medium term planning of farmers' operations.

The results of survey revealed that the majority of farmers employ few methods of climate smart farming in response to climate change over time. Some of the climate farming responses observed by the farmers in these Area Councils surveyed includes Early cropping, farming near rivers and in low lands, irrigation, seed replacements, crop rotation, cover cropping, use of resistant varieties, growing trees for shading, mulching etc. Adaptation and awareness of climate smart farming is very poor, this result agrees with **Saliu *et al.* (2018). Large percentage of the farmers use fire wood as fuels which could also contribute to the problem of deforestation observed by the farmers.**

CONCLUSION

The study determined the extent of farmers' adoption of Climate Smart Farming System practices in the FCT. The findings indicated that a large proportion of respondents were not aware of most of the practices and so, adoption of most of the practices was very low. Agronomic practices in term of cultivation of high yielding, drought tolerant, disease and pest resistant seed varieties was the most adopted practice due to long time of research and extension activities on seed varieties as well as favorable government policy and support prograrmme on seed production and utilization in the country. Adoption of Integrated Pest Management (IPM), water management, integrated soil fertility management and agro-forestry were very low. Effort should be made to encourage farmers in the study area to adopt climate smart agricultural practices.

6.0 RECOMMENDATIONS

i. Sensitization campaign on reality of climate change and the need to adopt climate smart practices towards reduction of adverse effect of climate change should be intensified.
ii. Policy and supportive programmes towards climate change mitigation and adaptation in the study area should focus on adoption of all Climate Smart Agricultural practices especially those climate smart practices that were not highly adopted by farmers.
iii. Efforts should be made by research institution to train extension staff properly about all the components of climate smart agricultural practices.
iv. Extension staff should in turn disseminate extensively accurate information on Climate-Smart Agricultural practices to cover a larger proportion of farmers in the study area. Government should provide incentives and enabling policy environment towards adoption of good CSA practices in general and specifically those ones that were not highly adopted.
v. Credit facilities should be provided in order to enhance the capacity of farmers in procuring the necessary climate smart inputs.

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