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PERCEIVED EFFECT OF CLIMATE CHANGE ON QUALITY PRESERVATION OF PLANTING MATERIALS USED IN CROP FARMING IN ONA-ARA COMMUNITY, OYO STATE

***ABEGUNRIN, O.O.,[1] ADEKOLA P.J.,[2] ALUKO, A.K.[3] AND KEHINDE, B.R.[4]**
[1]Agricultural Extension and Management Department, Federal College of Forestry, Ibadan, Nigeria
[2]Forestry and Environmental Technology Department, Federal College of Forestry Ibadan, Nigeria
[3]Horticulture Department, Federal College of Forestry Ibadan, Nigeria
[4]Library and documentation Department, Federal College of Forestry Ibadan, Nigeria
*Corresponding author: abegunrinopeyemi52@gmail.com

Abstract
The study was carried out to examine the perceived effect of climate change on quality preservation of planting materials and coping strategies used by arable crop farmers in Ona Ara Local Government Area of Oyo state, Nigeria. A multi-stage sampling technique was used to select 103 respondents and data were collected through a well-structured questionnaire. The data was analyzed through descriptive statistics and inferential statistics (Chi-square and Pearson Product Moment Correlation). The study showed that most (66.0%) of the respondents were male, 40.4% were between 46-55 years, 63.1% were married and had secondary education (56.3%). The study also showed that most of the respondents accessed information frequently through farmers' cooperative society (74.8%), friends and neighbors (69.9%) and farmers association (61.2%). Result further revealed that planting materials are vulnerable to adverse effect of climate change (77.7%), higher temperature causes pollen sterility (76.7%), lead to poor farm economy (70.6%) and reduce planting material weight (68.0%). The coping strategies used included timely harvesting (95.2%), timely planting of quality seeds (87.4%) and purchase of planting materials from reputable sources (58.3%). Chi square analysis revealed that secondary occupation (χ^2 = 18.293, p= 0.026), education (χ^2 = 24.450, p= 0.004) and religion (χ^2 = 20.901, p= 0.002) had significant relationship with coping strategy used. Also, PPMC analysis revealed that significant relationship existed between sources of information (r= 0.059, p= 0.05), knowledge (r=0.385, p=0.000) and coping strategies used. Therefore, it is recommended that farmers should be given the opportunity to build their adaptive capacity against the effect of climate change affecting planting material quality.

Keywords: *Perceived effect, Preservation, Climate change, Planting materials*

Introduction

Climate change presents several challenges to production of high-quality planting material (Apata, 2016). In this process, temperature is often the main factor, although time and amount of rainfall are also important. Higher temperatures often affect crop phenology, pollen germination, and pollen sterility, which results in less planting material set (Baek *et al*., 2018). The rising temperatures are predicted to reduce potential seed harvests in several tropical and subtropical locations. This influence can be caused by changes in normal weather patterns, but short bursts of exceptionally high or low temperatures or precipitation are also important when they happen during crucial stages.

In an effort to mitigate the impact of climate change on crops, farmers have implemented a number of coping techniques, including altering irrigation plans, diversifying cropping patterns and intensities, and changing harvesting and planting schedules (Kezar *et al*., 2021). The methods for reducing abiotic anomalies are affordable and simple to use in the field. To prevent environmental stress from adversely influencing planting material output and quality, planting material production must be moved to a favorable ecological niche, either in latitude or altitude. Potential mitigation techniques include planting climate-resilient cultivars, developing new crops to lessen the impact of climatic variability, and working to expand the cultivation of small or neglected species to ensure food and nutritional security (Hampton *et al,* 2016).

As a climate change adaptation method, it has been proposed to alter the seeding date to avoid the negative effects of high temperatures during the planting material setup. The timing of wheat sowing in northwest India would need to be moved forward by six days for every degree Celsius if the temperature rose. The impacts of other factors, such as soil temperature, day length, etc., must also be taken into account, even if altering the date of sowing may be a useful management technique to minimize the effects of heat stress on the amount and quality of planting material (Duku *et al.*, 2018).

Crop adaptation and management are proven to benefit from these strategies. According to Marcinkowski *et al.* (2018), crop management techniques such as irrigation timing, optimal planting density, situation-specific fertilizer scheduling, precise pesticide administration, and routine crop scouting must be adapted to local cropping systems under particular environmental stressors. However, pre-harvest weather has a bigger impact on seed quality. Excessive vegetative growth is encouraged by high humidity and rainfall during the season, which lowers yield and seed quality (Liu *et al*., 2019). Due to the sensitivity of seed to heat and drought, exposure to these circumstances during crop growth and storage results in a significant yield drop. High temperatures during field seed growth have been shown to significantly impair the quality of planting materials (Moore *et al*., 2021). According to Settele *et al.* (2016), climate change effects can also affect pollinator behavior, modify crop suitability areas, increase the spread of novel seed-borne illnesses, and reduce seed yields, storability, and lifespan.

It is against this background that this study focused on the perceived effect of climate change on quality preservation of planting materials and coping strategies used by arable crop farmers in Ona Ara local government Oyo state. Specific objectives include; the socioeconomic characteristics of respondents, access to sources of information on quality preservation of planting materials among the respondents, perceived effect of climate change on quality preservation of planting materials among the respondents and coping strategies used by respondents for quality preservation of planting materials in the study area.

Methodology

Area of Study

The study was carried out in Ona-Ara Local Government Area of Oyo State with the administrative headquarters located at Akanran which was created in 1989. It has a total landmass of $3,570km^2$and a population of 265,059 as at the 2006 census (NPC, 2006) with geographic coordinate 7.2212°N, 4.0261°E. The LGA is highly endowed with a fertile agricultural land suitable for the farming activities. The people are predominantly farmers who grow varieties of arable crops, food crops, cash crops and edible fruits. They also engage in other income generating activities like livestock production. The Population of this study comprises of people within Ona-Ara Local Government Area, Oyo state.

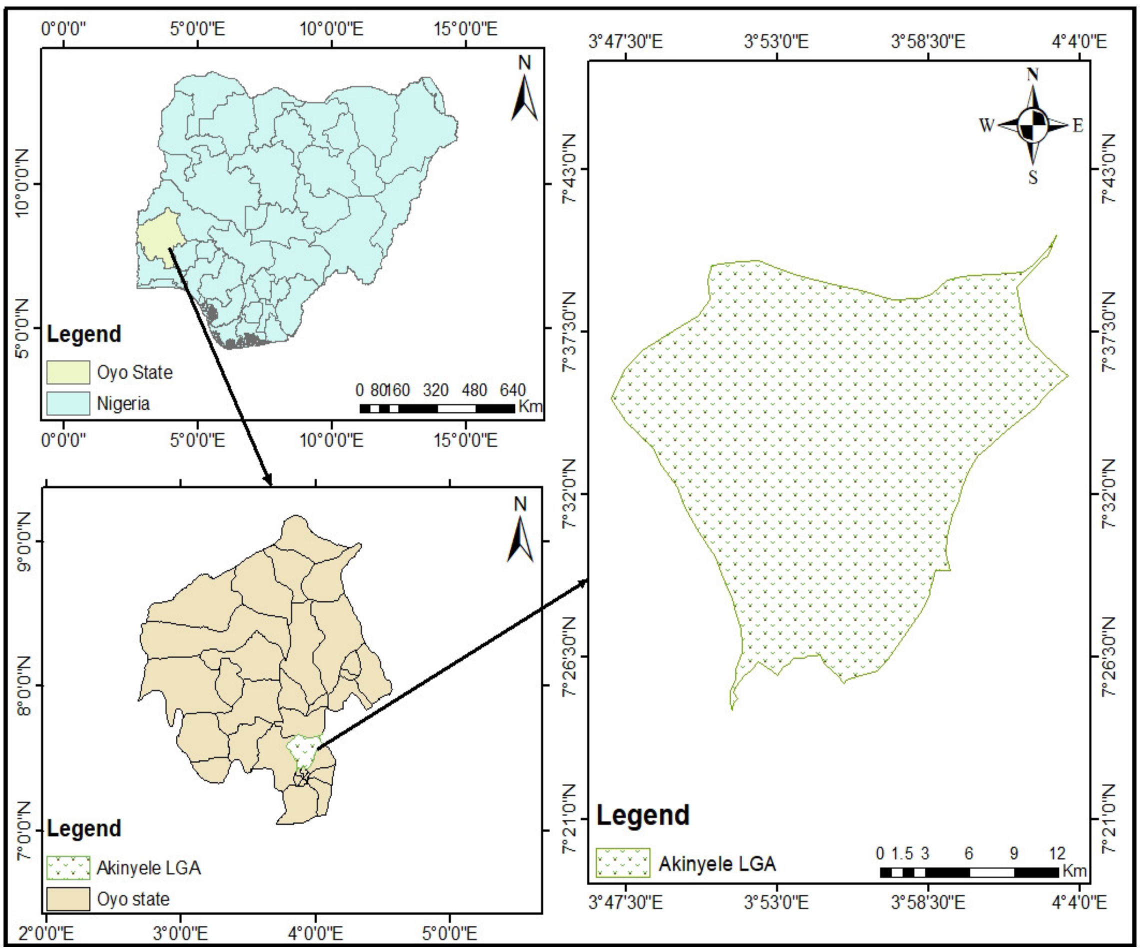

Fig. 1: Map of Ona-Ara LGA showing the study area

Sampling Procedure

Multi stage sampling procedure was used to select respondents for the study.

Stage 1: Identification of Wards in Ona-Ara Local Government area: WARD 1- Akanran/Olorunda, WARD 2- Araromi/Aperin, WARD 3- Badeku, WARD 4- GbadaEfon, WARD 5- Odi-Odeyale/Odi-Aperin, WARD 6- Ogbere, WARD 7- Ogbere-Tioya, WARD 8-Ojoku/Ajia, WARD 9-Olode/Gbedun/Ojebode, WARD 10-Olorunsogo, WARD 11- Oremeji/Agugu

Step 2- Selection of Wards

Five wards were randomly selected from the identified wards in Ona-Ara Local Government. They are: Akanran, Araromi, Ojoku, Gbada-Efon and Gbedun,

Step 3: Selection of villages

Furthermore, two villages were purposively selected from the each of the five wards to give total number of ten villages selected based on the predominance of arable crop farmers in the area. Also, systematic sampling was used to selected 120 respondents from the ten villages.

Data were collected with the use of a well-structured questionnaire**.** Descriptive statistics such as frequency table and percentage were used to analyse the objectives while inferential statistics such as Chi-square and Pearson Product Moment Correlation (PPMC) were used to analyze the hypotheses.

Results and Discussion

Table 1 above shows the socio economic characteristics of the respondents in the study area. It shows 66% of respondents are male and 34% are female and this might be attributed to the laborious nature of all the activities involved in arable crop production/farming in the study area which agreed with the findings of Ibitoye *et al.* (2014) who reported that the males dominated agricultural production in a study on climate variability adaption among arable crop farmers. Also, the study reveals that 40.4% are between the ages of 46-55years, 39% are between 35-45 years and only 20.6% were between 56-66 years and this implies that most of the respondents are in their active age and could therefore make active decisions on climate change and adaptation strategies and this agreed with the findings of Oluwasusi and Tijani (2013).

The distribution according to educational background showed that 56.3% of the respondents had secondary education, which implies that most of the respondents have the ability to read and write and therefore will influence their decision making and perception to climate change and coping strategies against climate change. This support the result of Stanturf, *et al.* (2011) that revealed that enhancing education is a determinant the decision of farmers in natural resource management initiatives and various developments. Furthermore, table 1 showed that 38.8% of the respondents generated a monthly income of ₦30,000-₦60,000, 34% generate between ₦90,001– ₦120,000 and only 27.2% generate ₦60,001-₦90,000 which shows low income earned by the arable crop farmers and might equally be due to low output that usually occurs as a result of the adverse effects of climate change. This is in agreement with the findings of Falola *et al.* (2012) that low income earned by the arable crop farmers may also be as a result of extra costs incurred by the arable crop farmers in an attempt to mitigate the adverse effects of climate change.

Table 1: Socioeconomic characteristics of the respondents

Variable	Frequency	Percentage
Sex		
Male	68	66.0
Female	35	34.0
Age (years)		
35-45	38	39.0
46-55	45	40.4
56-66	14	20.6
Marital Status		
Single	21	20.4
Married	65	63.1
Widowed	14	13.6
Separate	3	2.9
Religion		
Christianity	59	57.3
Islam	40	38.8
Traditional	4	3.9
Education		
No formal education	10	9.7
Primary education	20	19.4
Secondary education	58	56.3
Tertiary education	15	14.6
Secondary occupation		
Livestock Farming	13	12.6
Artisans	48	46.6
Government worker	7	6.8
Trading	35	34.0
Monthly income		
30,000-60,000	40	38.8
60,001-90,000	28	27.2
90,001-120,000	35	34.0
Household Size		
1-4	28	27.2
5-7	71	68.9
8-10	4	3.9
Membership to an association		
Yes	89	86.4
No	14	13.6

In addition, the table above shows that 68.9% have a household size of about 5-7 members, 27.2% have between 2-4 members and only 3.9% have 8-10 members and this shows that a larger percentage is having a fairly large number of respondents and this could be used for labour on the farmland which support George, *et al.,*(2021) who reported average household size of about 7 people implied that the household size among farming households in the study area is fairly large and is expected to be a very good source of labor (family labor) for their farming activities and enhance their level of productivity. Majority (86.4%) of the respondents belong to a membership association and only 13.6% do not belong to any association and this implies that those that belong to an association have an advantage of information and help such as credit against the effect of climate change and this relate with Balew *et al.* (2014) who reported belonging to an association influence access to agricultural information, credit, and farm assets on coping strategies towards climate change.

Table 2: Access to sources of information on planting material qualities

Source of information	Very frequent	Frequent	Not frequent	Not at all
Radio	70(68.0)	27(26.2)	6(5.8)	0(0.0)
Television	0(0.0)	23(22.3)	77(74.8)	3(2.9)
NGOs Program	0(0.0)	0(0.0)	39(37.9)	64(62.1)
Extension Agents	0(0.0)	0(0.0)	53(51.5)	50(48.5)
Weather Forecast Stations	0(0.0)	0(0.0)	27(26.2)	76(73.8)
Research Institutes	0(0.0)	7(6.8)	37(35.9)	59(57.3)
Farmers Association	6(5.8)	63(61.2)	14(13.6)	20(19.4)
Friends / neighbours	17(16.5)	72(69.9)	11(10.7)	3(2.9)
Internet	0(0.0)	31(30.1)	25(24.3)	47(45.6)
NIMET	0(0.0)	0(0.0)	67(65.0)	36(35.0)
National seed service	0(0.0)	0(0.0)	59(57.3)	44(42.7)
Agro-input dealers	0(0.0)	3(2.9)	85(82.5)	15(14.6)
Farmers' cooperative societies	0(0.0)	77(74.8)	26(25.2)	0(0.0)

Table 2 shows the sources of information on planting material qualities among respondents in the study area. It shows 68% use radio very frequently, 26.2% frequently and only 5.8% which do not use it frequently. This result indicates that most of the respondents make use of radio and this could be attributed to the fact that radio is widely used in rural areas due to its easy accessibility and affordability and this support Oyesola *et al.* (2011) who reported that about 93% of respondents used radios as an information source because it was the common electronic media used successfully in rural areas. In addition, 74.8% of the respondents frequently get information from farmer's cooperative societies, 25.2% do not get frequently, in the same vein 69.0% frequently obtain information from friends/neighbours, 16.5% very frequently and also 61.2% obtain information frequently from farmers association and 5.8% obtain very frequently. This finding implies that most of the farmers prefer to obtain information from sources such as association, cooperative societies and friends and neighbors as they attribute that to the trust and reliability they have in each other and it could encourage collectiveness in fighting against effect of climate change. This result is according to the findings of Adeogun (2010) who shows that farmers belonging to a group enjoy a lot of benefits from information gathered and are able to accomplish a lot collectively than individually.

Furthermore, the table above shows that the use of television was frequently used among 22.3% and not frequently used among 74.8% of the farmers and this shows that a large percentage of the respondents do not use television frequently which could be due to the erratic power supply experienced by the respondents in the study area. This supports finding by Acheampong *et al.,* (2017) which states that lack of constant supply of electricity have limited the accessibility of information services in rural area.

However, the table also shows that 73.8% did not access information from weather forecast stations. This could be due to the kind of information obtained from the source which is sophisticated and require good technical knowhow to understand the information. This agrees with George *et al.,* (2021) that inadequate knowledge and technical know-how in operating some information source will to a greater extent limit the farmer's use of such source towards the effect of climate change in the study area. Finally, 57.3% of the respondents do not use information from research institutes and only 35.9% which use it but not frequently and this could be attributed to the limited extension agent or services which serve as intermediary between farmers and research institutes. This finding is in line with Sanni (2019) who reported that respondents were not able to access information through services of extension workers due to poor or low availability of extension agents

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Table 3: Perceived effect of climate change on quality preservation of planting materials

Statements	**SA**	**A**	**U**	**D**	**SD**
Planting materials are vulnerable to adverse effect of climate change	80(77.7)	20(19.4)	0(0.0)	0(0.0)	3(2.9)
Postharvest processing leading to seed production is affect by climate change effect	61(59.2)	39(37.9)	0(0.0)	3(2.9)	0(0.0)
Seed setting is affected by unfavourable effect of climate change	62(60.2)	27(26.2)	4(3.9)	10(9.7)	0(0.0)
Storage of planting materials/ seeds is affected by climate change effect	61(59.2)	17(16.5)	18(17.5)	3(2.9)	4(3.9)
High temperature as a primary determinant affect the quality of planting materials	61(59.2)	38(36.9)	0(0.0)	0(0.0)	4(3.9)
Higher temperature causes pollen sterility during seed formation	79(76.7)	21(20.4)	0(0.0)	0(0.0)	3(2.9)
Pollen during seed formation is affected by high temperature	60(58.3)	33(32.0)	7(32.0)	0(0.0)	3(2.9)
Climate change effect leads to poor farm economy	73(70.9)	21(20.4)	6(5.8)	0(0.0)	3(2.9)
It lowers the planting values of the crops	62(60.2)	41(39.8)	0(0.0)	0(0.0)	0(0.0)
Climate change effects yields of the crops	57(55.3)	29(28.2)	17(16.5)	0(0.0)	0(0.0)
It causes reduction in planting materials/ seeds weight	70(68.0)	23(22.3)	4(3.9)	3(2.9)	3(2.9)
It increases the seed germination time	64(62.1)	28(27.2)	8(7.8)	3(2.9)	0(0.0)
It reduces seed vigour	63(61.2)	31(30.1)	3(2.9)	0(0.0)	6(5.8)
It causes delay in seed emergence	35(34.0)	56(54.4)	9(8.7)	0(0.0)	3(2.9)
It affects reproductive growth of the crops	30(29.1)	55(52.4)	12(11.7)	0(0.0)	6(5.8)

The Table 3 above shows the perceived effect of climate change on the preservation of planting material quality. It shows that 77.7% strongly agree that planting materials are vulnerable to adverse effect of climate change. This could be attributed to the fact that weather factor such as temperature, relative humidity, precipitation, etc. can influence seed production and quality from an early stage, especially with the onset of reproductive growth in plant. In the same vein, 60.2% also strongly agree that seed setting is affected by unfavourable effect of climate change. This finding is according to (Singh, *et al.,* 2013) who reported numerous obstacles to the continuous production of high-quality seeds are brought on by climate change. Majority (70.9%) strongly agree that climate change leads to poor farm economy and 20.4% agree with that, in the same vein 55.3% strongly agree that climate change affect the yield of crops. The result further shows that 59.2% strongly agree that postharvest processing leading to seed production is affect by climate change effect. This has an impact on the farmers' seed especially where a farmer grows own-saved seed as change of weather can delay the processing period of the planting material (Shii, 2014). In addition, 59.2% also strongly agree that storage of planting materials/seed is affected by climate change effect. Maity *et al.,* (2016) reported planting material quality parameters like size and weight also get changed when environmental conditions are not favorable during storage. The table also shows that 60.2% strongly agree that climate change lowers the planting values of crop. Reproductive cycle of plant is highly sensitive to environmental stresses, as the elevated temperature and CO_2 can alter the physiological steps involved in flowering, ultimately leading to failure in seed set and timely development (Jagadish *et al.,* 2016).

In addition, it was revealed that 76.7% strongly agree that higher temperature causes pollen sterility during seed formation. This implies that a larger percentage of the respondents are affected. Also, 58.3% strongly agree that pollen during seed formation is affected by high temperature This findings could be attributed to the fact that Pollen is highly sensitive to heat stress throughout its developmental stages and also short exposure to high temperature leads to loss of pollen viability, seed setting and grain mass, which support Jagadish *et al.* (2016) that the morphology, total pollen produced, the pollen wall architecture, pollen viability, germinability and pollen tube growth are often found to be negatively affected by heat stress.

Table 4: Preservation strategies used

Strategies	Larger extent	Lesser extent	Rarely used	Not used
Timely planting of quality planting materials/seeds	90(87.4)	13(12.6)	0(0.0)	0(0.0)
Ensure good seed developments	32(31.1)	36(35.0)	35(34.0)	0(0.0)
Application of fertilizer to boost soil nutrition	11(10.7)	23(22.3)	14(13.6)	55(53.4)
Timely harvest	95(95.2)	8(7.8)	0(0.0)	0(0.0)
Allow seed maturation before harvesting	34(33.0)	62(60.2)	7(6.8)	0(0.0)
Use of good threshing methods to reduce seed damage	8(7.8)	26(25.2)	38(36.9)	31(30.1)
Use of good seed drying methods	14(13.6)	54(52.4)	35(34.0)	0(0.0)
Use of good planting materials/seed storage facilities	41(39.8)	31(30.1)	18(17.5)	13(12.6)
Purchase of planting materials/ seed from reputable sources	60(58.3)	40(38.8)	0(0.0)	3(2.9)

Table 4 above shows the strategies used by arable crop farmers against the effect of climate change on the quality of planting material in the study area. It shows timely harvest was used at a larger extent among 95.2%, of the respondents. In addition, 87.4% also practice timely planting of quality planting material/seeds. These findings suggest the fact that farmers make use of agronomic activities such as timely planting and timely harvesting which are easy to practice and give optimum yield. Farmers have tried to tackle the effect of climate change on crops by shifting harvesting and planting times, diversification of cropping pattern and intensity which are cost-effective and easy to use in the field for mitigating abiotic abnormalities (Duku *et al.,* 2018). The result further shows 58.3% practiced the purchase of planting materials/seeds from reputable sources as a coping strategy used at a larger extent. This could be attributed to farmer's belief that such sources have undergone proper seed test and the quality has been ascertained for planting. Quality standards and practices are used in commercial seed production to maintain high levels of seed quality for seed production contracts, certification, marketing and import (Hampton, 2015).

Hypothesis Testing

Table 5: Chi square analysis of socio-economic characteristics of respondents

Variables	**Chi-Square Value**	**P-Value**	**Decision**
Sex	4.214	0.239	N.S
Marital status	16.304	0.061	N.S
Religion	20.901	0.002	S
Education level	24.450	0.004	S
Secondary occupation	18.295	0.026	S

The Chi square analysis shows that there is significant relationship between some of the socio-economic characteristics of respondents and the coping strategies used to preserve planting material quality in the study area except sex and marital status which was significant at 5% level of significance as indicated in the table above. This implies that religion, education level and secondary occupation of the respondents have a significant influence on the perception of effect of climate change.

Table 6: Relationship between knowledge level on preservation of planting material quality and strategies used

Variables	**r -value**	**P-Value**	**Decision**
Knowledge level and Strategies used	0.385	0.000	S

The Table 6 above shows that there is no significant relationship between respondent's knowledge level on quality of planting material and the preservation strategies used by the respondents. This implies that the respondent's knowledge on preservation of planting material quality does not influence the respondent's coping strategies used against the effects of climate change.

Conclusion

The study concludes that arable crop production is predominantly practiced by males, young and active with good formal education, and is engaged in non-agricultural activities as secondary occupation. It revealed that respondents have access to information from sources such as radio, farmers association and friends mostly with sources such as weather forecast station, research institution and extension agent having low usage among the respondents. The respondent's knowledge on preservation and storage of seeds and the importance of weather forecast information in preservation was high in the study area. There were several effects of climate change on the preservation of planting material quality from the storage to the developmental stages of crop and the post planting (harvesting and processing of crops). However, the farmers made use of some coping strategies like timely harvesting, timely planting of quality materials/seeds, use of good planting materials/seed storage facilities and purchase of planting materials/seeds from reputable sources

Recommendations

Based on the findings of the study, it is therefore recommended that:

1. There is a need for the government through extension agents and concerned NGOs to sensitize farmers more on the possible causes of climate change and the importance of good seed quality.
2. Government and other relevant stakeholders should revisit the traditional seed production and storage practices in developing new technologies tailored to the needs of small-scale seed producers.
3. Farmers should be helped through financial means and other support option in accessing drought-tolerant, flood and disease resistant planting materials to enable them cope with these effects of climate change

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