ISSN: 3029-0724

Research Article

Journal of Environmental Science and Agricultural Research

Rural Farmers' Use of Indigenous Crop Management Practices for Climate Variability Adaptation in Imo State, Nigeria

Godson-Ibeji CC, Aminu GO, and Chikaire JU*

Department of Agricultural Extension, School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri, Imo State, Nigeria

Corresponding author
Chikaire JU, Department of Agricultural Extension, School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri, Imo State, Nigeria.

Received: May 31, 2023; **Accepted:** June 08, 2023; **Published:** June 12, 2023

ABSTRACT
The study analyzed indigenous crop management practices employed by farmers to ensure adaptation in the face of climate variability in Imo State, Nigeria. A total of 360 farmers were randomly selected from the three agricultural zones of the State. Interview schedule was used to elicit information from the respondents. Percentage, mean and Standard deviation were used to describe data collected. Results showed that the farmers were fully aware of climate variability as indicated by a high percentage score of the various prediction signs; erratic rainfall pattern (86.1%), heavy flooding (94.4%), long rainfall (88.8%) among others. Climate variability affects crop production in the following ways ; crop infestation by pests and diseases (M=3.26), leads to death of farmers (M-3.01), heavy presence of armyworms (M=2.76) among others effects. The farmers used the following indigenous crop management practices use of indigenous grains (94.4%), crop rotation (91.6%), multiple cropping (93.1%) among others. The following are benefits of indigenous crop management practices-practices are cheap and cost free (M=3.32), not harmful to human health (M=3.95), practices have no side effects (M=3.27), readily available domestically (M=3.75), and practices have no expiry date. The above practices are safe and have proved successful for centuries and we recommend that they should be integrated into the modern practices of agriculture.

Keywords: Indigenous Knowledge, Agriculture, Crops, Climate Variability, Food Security

Introduction

In most countries of the world, Nigeria inclusive, the lives of rural farmers depend largely on climate-sensitive natural resources. Similarly, household food security is broadly determined by crop yields and animal stocks which also rely on climatic conditions especially, rainfall. Therefore any alteration in the rainfall pattern for example, implies shifting growing periods for crops and possible tensions that may arise between farmers and herders as they struggle over scarce resources [1].

Looking at the African continent in general, the agricultural sector plays an important role in economies of all countries within the region. It is the largest employer in Sub-Saharan Africa and contributes more than 50 percent to household income [1]. Consequently, it is imperative to assess how farmers within the study communities are maintaining or improving levels of production and ensuring food security locally despite the changing trends in climatic conditions. In addition, it is equally useful to know first and foremost if perception of climate change is engendering behavioral change and lastly to identify best practices which have made some communities better off than others for replication throughout the sub-region to improve food crop production [1].

The impact of climate variability on food security (food availability, accessibility, utilization and stability) will ultimately be experienced differently, depending on location. According to IPCC, the consequences of climate change are far-reaching for agriculture and will disproportionately affect the poor and marginalized groups in society who have a lower capacity to adapt to changing climate and who depend on agriculture for their livelihoods. For instance, an increase in temperature of 1 to 3ºC (moderate warming) is expected to benefit crop and pasture yields in temperate regions, while in tropical and seasonally dry regions such as Africa, it is likely to have negative impacts, particularly for cereal crops [2].

Most developing countries are identified as being vulnerable to climate change. Indigenous communities have long been recognized as particularly vulnerable to the impacts of climate change due to the close connections between their livelihoods, culture, spirituality, social systems and their environment [3]. Local people, including farmers, local artisans, and animal keepers in the study area are the custodians of indigenous knowledge (IK) systems. IK is dynamic and it changes through creativity and innovativeness as well as through contact with other local and international knowledge systems [4]. These knowledge systems represent mechanisms to ensure minimal livelihoods for local people. IK systems often are elaborate and adapted to local culture and environmental conditions tuned to

Citation: Godson-Ibeji CC, Aminu GO, Chikaire JU. Rural Farmers' Use of Indigenous Crop Management Practices for Climate Variability Adaptation in Imo State, Nigeria. J Envi Sci Agri Res. 2023. 1(1): 1-4. DOI: doi.org/10.61440/JESAR.2023.v1.01

the needs of local people and quality and quantity of available resources [5].

Objective of the Study

The general objective of this study was to examine the rural farmers' use of Indigenous crop management practices for improving household food security and climate change adaptations in Imo State, Nigeria.

Specific objectives are to:

i. examine farmers perceived awareness of climate variability in the study area;
ii. determine perceived effects of climate variability on agricultural production in the study area
iii. identify the indigenous crop management practices used by the respondents in responding to climate variability; and
iv. ascertain the benefits of use of indigenous crop management practices by respondents.

Materials and Methods

The study was carried out in Imo State, Southeast Nigeria. The State has 27 Local Government Areas and three agricultural Development Projects zones. The ADP zones are Owerri, Okigwe and Orlu respectively. This study employed multistage sampling technique. The first stage involved the selection of all three agricultural zones in the State. The second stage, involves the purposive selection of two predominant farming Local Government Areas from each of the zones, giving a total of six Local Government Areas. The third stage involved the purposive selection of two farming communities from each Local Government Area, giving a total of twelve communities. In the fourth stage, a random selection of 360 rural farmers (10%) was done out of 3600 farmers contained in the farmers list obtained from the village heads of the affected communities. This was achieved by the selection of thirty household heads who are farmer from each of the selected communities Primary data were collected with the use of a structured interview schedule, complimented with Focus Group Discussions (FGD). The result of the FGD provided more insight to the study and validated the responses from the interview. Data generated were descriptively analyzed.

Measurement of Variables

Climate variability awareness (objective 1) was measured descriptively using percentage. Signs observed in the environment were listed on a table and farmers indicated by saying Yes/No against each sign. Mean was also computed on a 4-point Likert type rating scale of strongly agree, agree, disagree and strongly disagree assigned weight of 4, 3, 2, 1 to achieve objective 2 (perceived effects of climate change), objective 3 (indigenous crop management practices used for mitigating climate variability was achieved using percentage. The practices were listed in a table and the farmers indicated by marking the once they used While objective 4 (perceived benefits of use of indigenous crop management practices was achieved on a 4point likert type scale rating scale of strongly agree, agree, disagree and strongly disagree assigned weight of 4, 3, 2, 1 The values were added and divided by 4 to get the discriminating mean value of 2.50. Any mean value equal to or above 2.50 was accepted as effects, indigenous crop management practices and perceived benefits.

Results and Discussion

Farmers' Awareness of Climate Variability in the Study Area

Table 1 revealed that the selected farmers were fully aware of climate change menace. With a high percentage response the following signs were seen by the respondents - unsteady and erratic rainfall pattern with a mean response of 86.1%, long period of dry spell (77.7%), heavy and long period of rainfall (88.8%), very high temperature (100%), abnormal and unusual heavy winds (81.6%), occurrence of floods (94.4%), loss of forest resources (80.55%), occurrence of soil erosion (90.2%), drying up of streams (88.6%) and overflowing of streams/river (91.65%). These were indicators showing that the phenomenon of climate change variability is real. Awareness of climate change variability help the farmers identify sustainable indigenous farm practices. This enables them to implement adaptation for higher resilience. The above findings agree with La Trober who opined that floods and droughts have been observed to increase in recent years [6]. Many rural farmers in developing countries are already seeing the effects of climate change daily in the reduced availability of water for their agriculture.

Table 1: Farmers Awareness of Climate Change

Climatic Signs	% Yes	% No
Unsteady and erratic rainfall pattern	86.1	13.8
Long period of dry spell	77.7	22.2
Heavy and long period of rainfall	88.8	11.1
Very high temperature	100	-
Abnormal/Unusual heavy winds	81.6	18.3
Occurrence of floods	94.4	5.5
Loss of forest resources	80.5	19.4
Soil erosion occurrences	90.2	9.7
Drying up of streams/rivers	88.6	11.3
Overflowing of streams/rivers	91.6	8.3

Perceived Effects of Climate Variability on Agricultural Production

Table 2 showed the numerous effects of climate change on the respondents based on an acceptable mean response (M) of 2.50. It was revealed that crops were infested withpests and diseases (M=3.26) more often due to climate variability. Farm produce shortages/low yield (M=2.95), farms overtaken by floods (M=3.37), increase d cost of food items (M=2.75), andcrop failures (M=2.85). Adverse change in weather conditions lead to food shortages as demand will increase and available food will not be sufficient for consumers. This situation affects prices of commodities. Other effects include death of livestock/farm animals (M=2.68), increase food insecurity (M=2.52), heavy presence of armyworms (M=2.76), destruction of cereal crops (M=2.78), appearance of locusts (M-2.68), damage to trunk and rural roads (M=3.02), this is occasioned by heavy flooding, and physical infrastructure destruction (M=2.88). The above situations poses threat to household food security.

In a study by Pentsilet al. on effect of climate change on household food security and livelihood in Ghana, it was observed that45% of farmers reported to have insufficient crop produce for household consumption. This shortfall in production was attributed mainly to changes in rainfall pattern, inability to purchase fertilizers and lack of funds to expand the size of farms [1].

Table 2: Perceived Climate Change Effects on Agricultural Production

Perceived Effects of Climate Variability	Mean	SD
Crop infestation by pests and diseases	3.26	0.48
Farm produce shortages/low yields	2.95	0.87
Farms overtaken by floods	3.37	1.64
Increased Cost of food items	2.75	1.55
Reduction in vegetation/forest reserves	3.40	0.83
Displacement of farm workers	2.66	0.54
Leads to death of farmers	3.01	0.77
Crop failures	2.85	0.88
Death of livestock/farm animals	2.68	0.56
Increased food insecurity	2.52	0.66
Heavy presence of armyworms	2.76	0.87
Destruction of all cereal crops	2.78	1.63
Damage to trunk and rural roads	3.02	0.99
Physical infrastructure destruction	2.88	0.78
Appearance of locusts	2.68	0.98

Mean 2.50 and above accepted SD- Standard Deviation

Indigenous Crop Management Practices of Respondents

Table 3 showed the indigenous crop management practices used by the farmers for adaptation to climate variability. These practices identified were: **crop diversification (80.5%), crop rotation (91.6%), and mixed farming (88.8%)**. These are perceived as the most ecologically feasible, cost effective, and rational ways of reducing uncertainties in agriculture especially among smallholder farmers [7]. Also, crop diversification increases resilience and brings higher spatial and temporal biodiversity on the farm [7]. According to Lin, crop diversification does the following: improves soil fertility, controls pests and diseases, yield stability, nutrition diversity, and health. Truscott et al. says crop diversification is an environmentally sound alternative to the control of parasites and the maintenance of soil fertility in agriculture [8, 9]. These practices also sequester carbon. Farmers also practice **use/selection of clean planting materials (74.4%)** as in the case of formal research to control pests and diseases. For the case of cassava, they ensure that the cuttings are not damaged prior to planting and that nodes face downwards to encourage effective sprouting and root growth. Farmers relied on crop rotation to rejuvenate the soil.

Changing time of planting (82.5%): Early planting is one of the pillars for both indigenous and improved farming methods practiced. This is especially important in this agroecological zone where agriculture is rain-fed. Farmers take advantage of the early rains and plant their crops leading to high yields. Early plating is also preferred to allow crops receive enough rainfall and reduce pests and diseases incidences.

Seed Selection by colour (84.7%): The respondents reported that, subsequent to harvesting, the crops are threshed and carefully stored for use. The seeds are carefully selected for planting in the next season. Good seeds are selected by colour. Olatokun and Ayanbode observe that Nigerian women cull the seeds and preserve them for the next planting season [10].

Multiple Cropping (93.1%): Sowing of seeds is done haphazardly by hand. All seed varieties are sown simultaneously in the same field. This practice maximises the growth of all crops at the same time in the same field and it allows cropping systems to reuse their own stored nutrients, productivity per unit area is higher than in mono-cropping systems with the same level of management.

Storage of Seeds and Crops (85.5%) after harvesting and threshing, the crops are stored and prevented from attack by weevils. The most common preservation practice mentioned by the participants is by hanging the maize cobs from the hut roof. Sometimes the seeds are mixed with the ash and stored into clay-pots and baskets. The seeds could last for more than five seasons. Chili pepper (Capsicum annum.) is used to preserve harvested cowpea in storage [11,12].

Use of indigenous grain crops (94.4%) Many farmers prefer the use of indigenous grains such as millet and sorghum that are more drought-resistant than maize and also produce high yields with very little rain [11,12]. Farmers also prefer specific crop varieties for drought seasons, such as an indigenous finger millet variety as it ripens fast, and an early maturing cowpea (Vigna unguiculata) variety.

Hand weeding of crops (88.1%), it was reported that subsequent to planting, when the crops are about four weeks old, weeding commences. Weeds are removed by hand or hand-hoe to avoid competition for moisture with the crops, thus disturbing the growth of crops.

Cultural pest control (86.6%): The respondents said that the traditional techniques used for pest control include use of hoe for weeding, intercropping and rotation patterns and pest resistant seed varieties. At germination stages, indigenous techniques such as hoe-weeding are applied while at later stages is complemented by the use of pest control chemicals as the crop grows.

Crop fermentation (82.25), mounds/heap making (98.65) and burying tubers of crops in moist soils (86.1%) are indigenous crop management practices for food security and climate variability adaptation. During oral discussions with the farmers, it was said that farmers use rudimentary post harvest handling techniques. When farmers harvest cassava and not all of it is consumed or sold, the fresh tubers are buried in moist soil, the tubers stay fresh for up to seven days. Fermentation was reported to reduce the cyanide level in or the bitterness of the cassava, a process also recommended by conventional research. Farmers use various means to cope with the problems of soil fertility loss. These include making mounds by collecting and heaping trash in preparation for planting sweet potatoes, cassava, maize etc which are preferably planted on raised seed bed

Table 3: Indigenous Crop Management Practices Used

Crop Management Practices	* Frequency	Percentage
Use of indigenous grains	340	94.4
Crop diversification	290	80.5
Crop rotation	330	91.6
Mixed farming	320	88.8
Cultural pest control	312	86.6
Changing time of planting/early planting	297	82.5
Seed selection by colour	305	84.7
Multiple cropping	335	93.1
Hand weeding of crops	317	88.1
Storage of seeds	308	85.5
Use of clean planting material	268	74.4
Burying tubers of crops in moist soil	310	86.1
Mounds/heap making	355	98.6
Crop fermentation	296	82.2

Multiple Response

Perceived Benefits of use of Indigenous Crop Management Practices for Mitigating Climate Variability

In table 4, we see many benefits of indigenous crop management practices usage as perceived by the farmers. These include practices is cheap and cost free (M=3.32), not harmful to human health (M=3.95), practices have no side effects (M=3.27), readily available domestically (M=3.75), practices have no expiry date (M=3.20), no specialist attention needed (M=2.86), practices are easy to handle and apply (M=3.21), practices work on almost all soil types (M=2.75), leads to higher crop yields (M=3.34), and its tolerance to bad weather conditions (M=2.62).

Table 4: Benefits of use of Indigenous Crop Management Practices for Mitigating Climate Variability

Perceived Benefits	Mean	SD
Practices are cheap and cost free	3.32	0.98
Not harmful to human health	3.95	1.07
Practices have no side effects	3.27	1.78
Readily available domestically	3.75	1.05
Practices have no expiry date	3.20	0.73
No specialist attention is needed	2.86	0.64
Practices are easy to handle and apply	3.21	0.47
Practices work on almost all soil types	2.75	1.08
Leads to higher crop yields	3.34	0.85
Tolerance to bad weather condition	2.62	0.96

Mean 2.50 accepted **SD - Standard Deviation**

Conclusion

Climate change variability is real. It is seen in erratic rainfall pattern, high temperature, heavy winds, flooding and many more. These have affected crop production adversely leading to food shortages, crop failures, displacement of farming population, damages to rural roads and infrastructures. Farmers practice crop rotation, mixed farming, multiple cropping, cultural pest control among many others. The benefits are numerous such as increase yield, tolerant to bad weather, not harmful to humans, no side effects, easy to handle among others [13-15].

References

1. Pentsil S, Mensah JK, Sparkler SB, Appiah-Kubi E, Essien C, et al. Effect of climate change on household food security and livelihood, Ghana. Technical report, African-Asian Rural Development Organisation and CSIR-Forestry Research Institute of Ghana. 2017. 44.
2. Intergovernmental Panel on Climate Change (IPCC). Climate Change 2007: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. United Nations. Cambridge. 2007.
3. Warrick CO. Local Voice Local Choice? Vulnerability to Climate Change and Community-Based Adaptation in Rural Vanuatu. PhD Thesis. University of Waikato, New Zealand. 2011.
4. Warren DM. Indigenous knowledge systems. Implication for agriculture and International development. The academy for Educational Development, Inc, Washington, DC. 1989.
5. Niang I, Ruppel OC, Abdrabo MA, Essel A, Lennard C, et al. Climate Change Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: University of Cambridge Press. 2014. 1199-1265.
6. La Trober S. Climate change and Poverty. A Discussion Paper of TEARFUND. Christian Actionwith the World's Poor. Tear fund Office, London. 2002.
7. Joshi P. Crop diversification in India: nature, pattern and drivers. In: New Delhi India: Asian Development Bank. 2005.
8. Lin BB. Resilience in agriculture through crop diversification: adaptive management for environmental change. Bioscience. 2011. 61: 183-193.
9. Truscott L, Aranda D. A snapshot of crop diversification in organic cotton farms. In: Discussion paper. Soil Association. 2009.
10. Olatokun WM, Ayanbode OF. Use of indigenous knowledge by rural women in the development of Ogun State. Indilinga. 2010. 20: 47-63.
11. Altieri MA. Traditional farming in Latin America. Ecologist. 1991. 21: 93-96.
12. Altieri MA, Nicholls CI. Biodiversity and Pest Management Agroecosystems. 2nd edition. Haworth Press, New York. 2004.
13. Mafongoya PL, Ajayi OC. Indigenous Knowledge Systems and Climate Change Management in Africa, CTA, Wageningen, The Netherlands. 2017. 316.
14. Simonelli MT. Climate Change and Indigenous Knowledge. Higher Educational Handbook Series. Keynote Publishers Limited, Ilesa, Nigeria. 2008.
15. Yanda P, Mubaya PC. Managing a Changing Climate in Africa: Local Level Vulnerabilities and Adaptation Experiences. Dar es Salaam: Mkukina Nyota Publishers Ltd. 2011.