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Urban Food Production and Climate Variability in Ibadan, Nigeria

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Abstract: *The reality of climate variability is evident across all sectors of the economy including the agricultural sector. Urban farmers in Ibadan, an indigenous city in Africa, carry various perceptions as regards climate variability which trigger their behaviour towards the stress on urban agriculture from climate variability. This study examined urban farmers in Ibadan perception of climate variability and its effect on urban food production making use of cross-sectional survey method. The study was anchored on the concept of climate variability and perception. The study revealed that indigenous knowledge techniques and personal observation (44.3%), radio and television (20.9%), extension workers (20.1%) were the main medium through which the farmers know of climate variability. The study concluded that the farmers are well informed of variation in climate and the perceived changes will influence their decision-making on their farming activities and type of responses to climatic issues. Improved food production process was also encouraged among urban farmers.*

Keywords: Urban farmers; Perception; Climate variability; Ibadan.

Introduction

Urban settlements across the world are being confronted with various environmental problems such as pollution, housing deficit and derelict, and food insecurity as a result of rapid urbanization and increasing urban population. In developing countries like Nigeria, the capacity of governments to manage this urban growth is very low and arriving at the appropriate strategies towards food production, service delivery and other urban issues to city dwellers is a challenge to urban authorities. Urban agriculture (UA) which entails animal rearing and planting of food crops within the cities spaces (Food Agriculture Organisation- FAO, 2014) has been introduced by government and engage upon by city dwellers to mitigate and solve the difficulty of food availability within the city.

Yet, the food production mitigating strategy (UA) has been shaped and negatively impacted by the varying global climate. UNEP (2013) and IPCC (2014) states that no country or continents of the world is left in the event of climate change and variability. Urban agriculture, unlike other sectors, is directly affected by this

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change and variability. Urban farmers' means of livelihood is put into doubt and stress as their main source of income is largely affected by climate variability. Farmers are left redundant by the inability to understand the climate on which their livelihood is based. One of the resultant effects of global warming is flood which is ravaging farmlands along floodplains and wetlands, in rural and urban settlements.

As climatic variability is negatively affecting crop production, the steady increase in human population has led to a rise in the demand for food, consequently putting pressure on viable land for agricultural production. Thus, agricultural practices, especially in urban areas of developing countries, will have to adapt to changes and variability in the climatic conditions to ensure food security for human survival. Farmers still remain the fore bearers of the challenges resulting from climatic variability and urban agriculture. Vedwan and Rhoades (2001) identified that understanding climate variability patterns is integral to understanding ways in which humans and farmers will respond. As understanding perceptions and adaptation strategies of individual households or farmers and farming communities in certain area does not only provide better location specific insights but also helps generate additional information relevant for developing a climate adaptation and mitigation framework (Belaineh et al., 2013).

In order to understand farmers existing knowledge of and how they will respond to climate variability in Ibadan, it is imperative to study their perceptions of climate and their farming environment. This will facilitate informed decisions and sustainable policy towards tackling the challenges posed to farmers by climate variability. There is presently little knowledge on whether and how farmers perceive climate variability in Ibadan, Nigeria. Investigating urban farmers' awareness knowledge therefore becomes imperative. This motivated this study which examined the socio-economic characteristics of urban farmers' in Ibadan, their perception of climate variability and the type of crops and food produced.

Conceptual/Theoretical Discourses and Literature Review

This study is anchored on the concept of climate variability perception. Over the past two decades, scientific consensus about the reality of climate change has generally solidified in recent IPCC report (2001, 2007). Climate change is a change in the state of the climate that can be identified by changes in the mean/or the variability of its properties, and that persists for an extended period, typically decades or longer (IPCC, 2001). Umar et al. (2008) states climate change refers to a change occurring in the climate during a period of time which can range from decades to centuries. AMCEN (2011) observed that climate variability be thought of as a short term fluctuation rather than a long term climate change. The definition of climate variability has been used synonymously with climate change but the defining time frame has been changes that result in climate for typically a decade or more (IPCC, 2001; Agbola & Ojeleye, 2007; Dinse, 2011).

Information about climatic condition is very vital to agricultural productivity. Khan et al. (2009) reinstate that effective climate estimations will help guide farmers short and long range adaptation process and decision

to climate variability. These responses are individually and communally defined and based on past perceptions. Perception is the organization, identification, and interpretation of information inorder to represent and understand the environment' (Schacter, 2011; Fellmann et al., 2018) over time by self (Gibson, 1980). Going by this definition and the assertions of (Khan et al., 2009; Schacter, 2011), responding to climate variability require a longitudinal review and understanding of climate change by a person. The self in this regard is the urban farmers and the world is the urban environment which has been subjected to the shock of climate variability. As the informations or stimuli gathered from the environment subject individuals (urban farmers) is transformed into a psychological awareness which forms their perceptions (Van den Ban & Hwakin, 2000). This is because perception as a system of knowledge born from interest, cultural attachment and social processes and interactions often subject an individual to changes in behaviour. Koshti et al. (2013) operationally defined perception as the "awareness knowledge gained by the farmers" towards the climate change and variability and the changes perceived by them in climate parameters like rainfall and temperature over the period of last 40 years via the senses, based chiefly on memory".

Literature review

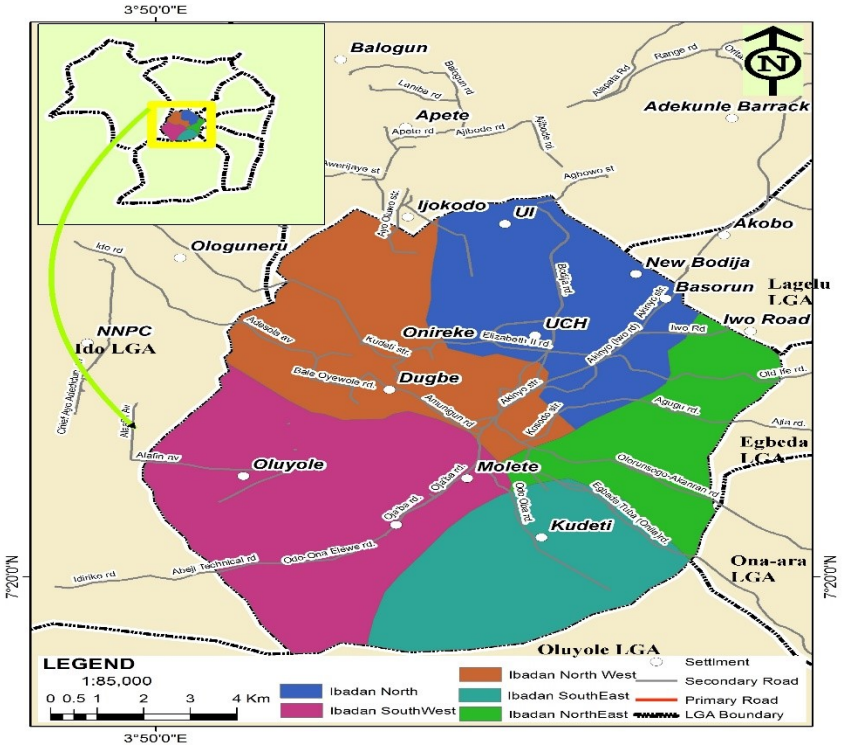
Farmland is an important part of urban settlement landscape and urban farming a means of livelihood for urban farmers. Demand for food within the urban areas has led to increased investment in and practice of urban farming (animal rearing, tree planting, horticultural farming to crop production) in cities of developed and developing countries, thus, making urban agriculture evident within the urban enclaves. Globally, urban farming has been identified to be practised by over 800 million people (Kwasi, 2010) with a 70% employment ratio and 40.07% of Gross Domestic Products (GDP) contribution in Nigeria (National Bureau of Statistics, 2012), thus serving as means of livelihood for urban youths in Nigeria. Despite the high dependence on urban farming in Nigeria, climate variability serves as a constraint to its development. Despite the high dependence on urban farming by urban farmers for livelihood, farming within the urban area faces various shock and stress.

Climate variability remains a major threat to the human environment across the globe. Literatures (Macharia et al., 2010; Wisner et al., 2015; Wahab & Popoola, 2018) have signaled food insecurity as a result of agricultural productivity adversely affected caused by climate variability is eminent in Africa. In Nigeria, climate extremes such as flood led to the loss of over 9000 hectares of cultivable farm lands in Nasarawa state in the middle-belt zone in the year 2012 (Wahab, 2013), farm income negatively affected along the Northern corridors of Nigeria owing to drought (Oyekale, 2006), crop such as maize quantity and quality dropped in Abeokuta Southwest Nigeria (Sowunmi & Akintola, 2010) and land degradation in Southeast zone of Nigeria (Ifeanyi-Obi et al., 2012). Globally, climate variability continues to pose challenge to human environment, while agriculture production and local livelihoods is a major victim of these climate-induced

changes (Wood et al., 2014; Wahab & Popoola, 2018); with the farmers income mainly affected (Sugden et al., 2014).

Research Methods and Materials

Ibadan, opined to be the largest indigenous city in Africa is located in Western Nigeria. Ibadan with total land area of 3,123km² (15% -463.33km² urban and the remaining 85% is in the rural) (Fapojuwomi & Asinwa, 2013) is made up of eleven (11) Local Government Areas (LGA), five (5) of which constitute the Urban Local Government (see Map 1), while the remaining six (6) form the surrounding parts known as the rural or peri-urban local government. The population of Ibadan in 2006 was 2,550,593 (NPC, 2006) with a 6.018 million estimate in 2018 (Dar-Al-Handasah, 2018).



Map 1. Five Urban Local Government Areas LGA in Ibadan

Source: Department of Urban and Regional Planning, University of Ibadan, 2018.

The study was a cross-sectional survey of urban farmers in Ibadan, Oyo state, Nigeria. For this study, primary data through the use of structured questionnaires which was administered to 244 urban farmers, in-depth interview conducted to officials in the agriculture department of the five urban LGAs was used. Sample for the study was drawn using purposive, snowball and accidental sampling technique. Owing to the fore knowledge of the location of some of the urban farm lands in Ibadan, the researchers made use of purposive sampling, there after farmers were asked to identify the location of another farmland within their

environ or LGA, thus snow ball technique. To full arrive at stipulated 244 targeted sampling technique, while some of the urban farmers were interviewed on their farm land, some were interviewed at the local government headquarter during their urban farmers association meeting. The meeting time for the urban farmers across the LGAs was known through discussions with agricultural extension officers attached to urban farmers across the LGAs and also verified by the farmers' association executive. In this instance, accidental sampling method was also adopted to administer questionnaire to the urban farmers.

Secondary data on the population of farmers were sourced from Oyo State Agricultural Development Programme (OYSADEP) office Ibadan. The sample frame for this study was the 4,073 urban farmers registered with the OYSADEP in five LGAs in Ibadan metropolis, which were distributed across 59 wards. A 6% sample size was adopted and a structured questionnaire was administered to 244 (6%) farmers selected within the 59 wards as follows: Ibadan North (75 respondents), Ibadan North-East (36 respondents), Ibadan North-West (28 respondents), Ibadan South-East (56 respondents), and Ibadan South-West (49 respondents). Extension Officers of the Department of Agriculture in the five LGAs in Ibadan urban and two field assistants were used in the data collection process. Farmers were asked to state the differences between the present climate and that of ten years ago according to climate variables of temperature, rainfall pattern and humidity. They were asked if rainfall commencement/end is now early or late. If the numbers of rainfall events, temperature and humidity have decreased, increased or remained unchanged. Interview conducted with extension officers of the Department of Agriculture in the five urban LGAs and some farmers complimented data gotten from the questionnaire.

Findings and Discussion

Socio-demographic Characteristics of Sampled Urban Farmers

Studies by Odewumi et al. (2013); Wahab & Popoola (2018) and Amoatey and Sulaiman (2018) identified the roles played by UA in the household income generation for farmers, revenue generation for government and city dwellers and workers food production in Ibadan metropolitan area. Study revealed that 47.5% of farmers depended on farming as their main source of income and livelihood, 38.6% of the farmers engaged in faming as a means of additional income while 14.0% engaged in farming as a form of leisure. Out of a total of 244 urban farmers sampled, 40.6% had a household size of between 1- 5 people, more than half (50.4%) had households with 6-10 people, while 10% had households more than 10 people. The large household size can be attributed to the need for farm labour to work on the farm, as most farmers averred that farm work was labour intensive.

The study revealed that 65.2% of the respondents were male while 34.8% were females (Table 1). The prevalence of men could be due to the labour-intensive nature of farming activity in the study area. On ages of respondents, 18.5% were below age 30years, 23% were between age 31 and 35years, 11.0% were aged

between 36 to 40years, while 11.9% and 35.6% were aged between 41 and 45years, and 45years and above respectively. The findings on the ages of respondents conforms with the earlier findings that majority of farmers are aged less than 45 years, with youthful strength.

Table 1: Urban farmers Socio-demographic characteristics

Sex of Respondents	**Frequency**	**Percent**
Male	159	65.2
Female	85	34.8
Total	244	100.0
Age of Respondents	**Frequency**	**Percent**
Below 30yrs	45	18.5
31-35yrs	56	23.0
36-40yrs	27	11.0
41-45yrs	29	11.9
Above 45yrs	87	35.6
Total	244	100.0
Marital Status of Respondents	**Frequency**	**Percent**
Single	66	27.1
Married	156	64.0
Divorced	13	5.1
Widowed	9	3.8
Total	244	100.0
Average Monthly Income of Respondents	**Frequency**	**Percent**
Less Than #5000	11	4.5
#5000-#15000	39	16
#16000-#25000	59	24.2
#26000-#35000	61	25.0
#36000-#45000	22	9.0
Above #45000	52	21.3
Total	244	100.0

Source: Author's Field Survey, 2018

More than four-fifth (85.2%) of the farmers resided within the urban interface, while the remaining 14.8% resided within the peri-urban local government areas. It was also observed that majority of the farmers resided along the core areas of Ibadan, areas such as Beere, Oja-oba, Gate, Iwo-road and Yemetu.

On marital status of the respondents, 27.1% were single, 64.0% married, while 5.1% and 3.8% were divorced and widowed respectively (Table 1). This shows that farming in the study area was practised by people of varying marital status, with more than seven-tenth (72.9%) of them being married were at one time or the other married, buttressing the observed importance of being married among the Yoruba's that constitutes the majority in the city (Sanni & Daini, 2014).

Majority of the respondents were low income farmers. About 4.5% of the respondents earned below #5,000 a month, 16% earned between #5, 000 and #15, 000, 24.2% earned between #16000 and #25000, 9% earned between #26000 and #35000, 25% earned between #36000 and #45000, while the remaining 21.3% earned above #45, 000 monthly.

Urban Farmers' Perception of Climate Variability

Findings revealed that 88.1% of the respondents agreed that climate variability existed, while the 11.9% was of a different view that climate variability did not exist or were not sure. When the mental image or history of perception of climate variability of farmers was tested on a ten years timeline, evidence revealed a 16.8% decline in perception of climate variability over the last ten years. Data findings shows that between 2-10 years, 71.3% of the respondents agreed that there was climate variability over the last decade, 20.5% were not sure, while the remaining 8.2% disagreed that there was climate variability over the last decade (Table 2). The researchers hypothesis and argue that factors such as age of farmers, length of farming experience, timing of when farmers or farmland experience climate driven shocks can dictate the longitudinal time based experience or perception of climate variability.

As revealed in Table 2, most of the farmers have been into farming for over a decade. Number of years in farming showed that 40.9% of the respondents had engaged in farming for less than 5 years, 22.5% had been farming for between 6 and 10 years, 7.8% between 11 and 15 years, 10.6% between 16 and 20 years, while 18.8% of the respondents had been into farming for over 20 years.

The study 2 also revealed association between the number of years in farming and farmers' perception of climate variability. For instance, while 43.0% of those who had been into farming for over a decade claimed to have awareness of climate variability, only 33.3% of those that have less than 5 years claimed to be aware of climate variability (Table 2). The study also revealed association between level of education attained by urban farmers and their level of awareness of climate variability. For instance, out of majority (76.5%) had formal education (minimum of primary school) while 23.5% had no formal education. Observed

nexus between level of education and awareness of climatic variation confirms findings of previous studies most especially (Mudombi, 2011).

Table 2: Cross-tabulation of farmers' experience, literacy level and knowledge about climate variability in the past 10yrs

Cross-tabulation between farmers' farming experience and farmers knowledge about climate variability in the last 10 years					
		Knowledge about Climate Variability in the last 10yrs			
		Agree	Not Sure	Disagree	Total
Number of Years in Farming	1-5yrs	58(33.3%)	34(68%)	8(40%)	100(40.9%)
	6-10yrs	41(23.5%)	5(10%)	9(45%)	55(22.5%)
	11-15yrs	15(8.6%)	2(4%)	2(10%)	19(7.8%)
	16-20yrs	20(11.4%)	5(10%)	1(5%)	26(10.6%)
	Above 20yrs	40(23%)	4(8%)	0	46(18.8%)
Total		**174(71.3%)**	**50(20.5%)**	**20(8.2%)**	**244(100%)**
Cross-tabulation between farmers' level of literacy and knowledge about climate variability in the past 10 years					
		Knowledge about Climate Variability in the last 10yrs			
		Agree	Not Sure	Disagree	Total
Educational Qualification of farmers	No Formal Education	39(23.5%)	5(10%)	6(21.4%)	50(20.5%)
	Primary	24(14.5%)	12(24%)	3(10.7%)	39(15.9%)
	Secondary	44(26.5%)	18(36%)	15(53.6%)	77(31.6%)
	Tertiary	59(35.5%)	15(30%)	4(14.3%)	78(31.9%)
Total		**166(70.4%)**	**50(21.2%)**	**28(8.4%)**	**244(100%)**

Source: Authors' Field Survey, 2018

In Ethiopia, Mengistu (2011) identified that climate information is a necessity towards mitigating against the effect of climate variability. Information dissemination on issues relating to urban agricultural activity is the duty of agricultural extension officers and agencies such as The Nigerian Meteorological Agency (NIMET). It was revealed from field observation that dissemination of information regarding the climate and climatic forecast was not undertaken at the local farmers' level, rather a national focus was given to information dissemination. When asked on the medium of climate and other farming related information, a farmer said this:

> "...*I get to know most things* (climate change and farming techniques) *through personal observations, my father's mentoring or sometime we hear when we go for our farmers meeting or on radio…*"

Although this cannot be refuted as the study revealed that 146 (61.8%) respondents had access to agricultural extension workers while 90 (38.2%) respondents did not. It was gathered from field observations and interview with farmers at various locations that four out of the five urban LGAs of Ibadan namely Ibadan North, Ibadan North-East, Ibadan South-West, and Ibadan North-West were accessible to agricultural extension officers. Ibadan South-East farmers complained of not having access what-so-ever to agricultural extension officers in both OYSADEP and the Department of Agriculture in the local government secretariat. At the same time, the Department of Agriculture in Ibadan South-East local government complained about unavailability of land to engage in agricultural practices as the local government area is fully built-up. In the words of the official she said:

> "...*To be candid, where is the land for farming in this LGA* (Ibadan South-East)*, that a side, the political interest is not there, the few open spaces are now converted for commercial shops… We* (department officials) *have just mobilized through various external assistance to acquire land at the rural LGA to support the production of food…*"

Findings also revealed that farmers who farmed along the floodplain areas, unused open spaces and government land such as National Horticultural Research Institute (NIHORT), had no access to agricultural extension workers. The reason for this can be attributed to the nature of the environment and security. The area in which the farmlands are located is a property of NIHORT, thus the land used for farming is just an open space which can be taken-over at any time. This limits farmers' activities and extension workers interaction with farmers in such area. Farmers who engaged in the planting of exotic crops such as green beans and cucumber claimed that they did not have access to the extension workers because the workers had no adequate knowledge about the type of crop they grew. Interview with the Department of agriculture in the local governments and field observations revealed that lack of political will on the part of local government Chairmen or Care-taker Committee of the five urban LGAs was a hinderance to urban agriculture. Inadequate financial allocation to the Department of Agriculture in the LGAs, delay and diversion of such financial allocation were major difficulties facing the Department. Most of the LGAs allocate substantial funds to public lectures and seminars but little for field programmes. Hence, too few financial supports were available for the needing farmers.

Relationship between some selected urban farmers' variables and climate variability

The relationship between the socio-economic characteristics (age, sex, educational qualification, farm size, income, farming history) and farmers' perception of the climate variations was tested using chi-square analysis and presented in Table 3. The analysis finding as presented in Table 3 showed that age, length of farming experience and farmers' educational status influenced the variation in their perceptions of the nature of change in rainfall pattern. With a Pearson Chi-square 2-ways test of confidence level significance value of 0.040 (which is lesser than 0.05%) for relationship between age and farmers perception. This means that there is over 95% confidence level in the prediction. For the number of years in farming and educational status of farmers, there was a significance value of 0.000 respectively. This reveals that as far as all other socio-economic characteristics and farmers perceptions of climate variability were concerned,

there is no significant variation. The study revealed that farmers in Ibadan are more aware of rainfall variability than any of the other measured climate parameters (temperature and humidity).

Table 3: Chi-square test of relationship between socio-economic characteristics and farmers' perception of climate variations.

Socio-economic characteristics of farmers		Perceived change in Humidity		Perceived change in Temperature		Perceived change in Rainfall	
		Increase	Decrease	Increase	Decrease	Increase	Decrease
Age	Below 30yrs	10	35	38	7	23	22
	31-35yrs	15	40	45	10	35	20
	36-40yrs	7	20	25	2	13	14
	41-45yrs	8	20	19	9	20	8
	Above 45yrs	37	52	73	16	65	24
Total		77(31.5%)	167(68.5%)	200(81.9%)	44(18.1%)	156(63.9%)	88(36.1%)
	Chi-square value 6.929[a] *(Significance value 0.140**)*			*Chi-square value* 6.022[a] *(Significance value 0.198**)*		*Chi-square value* 10.007[a] *(Significance value* .040***)*	
		Perceived change in Humidity		Perceived change in Temperature		Perceived change in Rainfall	
		Increase	Decrease	Increase	Decrease	Increase	Decrease
Farm Size	Less Than 1 Hectares	35	90	102	23	76	49
	1-5 Hectares	38	63	84	17	65	36
	6-10 Hectares	3	4	7	0	6	1
	Above 11 Hectares	1	10	7	4	9	2
Total		77(31.5%)	167(68.5%)	200(81.9%)	44(18.1%)	156(63.9%)	88(36.1%)
	Chi-square value 5.438[a] *(Significance value* .142***)*			*Chi-square value* 4.151[a] *(Significance value 0.*246***)*		*Chi-square value 3.*506[a] *(Significance value 0.*320***)*	
		Perceived change in Humidity		Perceived change in Temperature		Perceived change in Rainfall	
		Increase	Decrease	Increase	Decrease	Increase	Decrease
Number Years in Farming	1-5yrs	32	67	82	17	53	46
	6-10yrs	11	46	44	13	38	19
	11-15yrs	5	12	14	3	8	9

	16-20yrs	8	16	18	6	14	10
	Above 20yrs	21	26	42	5	43	4
Total		77(31.5%)	167(68.5%)	200(81.9%)	44(18.1%)	156(63.9%)	88(36.1%)
	Chi-square value 7.812[a] *(Significance value 0*.099***)*			*Chi-square value 3.457*[a] *(Significance value 0*.484***)*		*Chi-square value 22.730*[a] *(Significance value 0*.000***)*	
		Perceived change in Humidity		Perceived change in Temperature		Perceived change in Rainfall	
		Increase	Decrease	Increase	Decrease	Increase	Decrease
Sex	Male	48	114	133	29	100	62
	Female	29	53	67	15	56	26
Total		77(31.5%)	167(68.5%)	200(81.9%)	44(18.1%)	156(63.9%)	88(36.1%)
	Chi-square value 0.829[a] *(Significance value 0*.362***)*			*Chi-square value 0*.006[a] *(Significance value 0*.940***)*		*Chi-square value 1*.017[a] *(Significance value 0*.313***)*	
		Perceived change in Humidity		Perceived change in Temperature		Perceived change in Rainfall	
		Increase	Decrease	Increase	Decrease	Increase	Decrease
Educational Qualification	No Formal Education	23	27	42	8	34	16
	Primary	9	28	31	6	31	6
	Secondary	23	56	64	15	55	24
	Tertiary	22	56	63	15	36	42
Total		77(31.5%)	167(68.5%)	200(81.9%)	44(18.1%)	156(63.9%)	88(36.1%)
	Chi-square value 6.349[a] *(Significance value 0*.096***)*			*Chi-square value 0.347*[a] *(Significance value 0*.951***)*		*Chi-square value 18.483*[a] *(Significance value 0*.000***)*	
		Perceived change in Humidity		Perceived change in Temperature		Perceived change in Rainfall	
		Increase	Decrease	Increase	Decrease	Increase	Decrease
Income	Less Than #5000	1	10	8	3	5	6
	#5000-#15000	12	27	30	9	25	14

Source: Authors' Field Survey, 2018

	#16000-#25000	20	40	51	9	36	24
	#26000-#35000	19	43	51	11	43	19
	#36000-#45000	4	17	19	2	13	8
	Above #45000	21	30	41	10	34	17
Total		77(31.5%)	167(68.5%)	200(81.9%)	44(18.1%)	156(63.9%)	88(36.1%)
	Chi-square value 6.400[a] *(Significance value 0*.269***)*			*Chi-square value 2*.798[a] *(Significance value 0*.731***)*		*Chi-square value 3*.025[a] *(Significance value 0*.696***)*	

Climate Variability its Implication on Urban Food Production

This study conceptualizes food production as a crop entity and the process of production of the food/crop or animals been reared, produced or planted by urban farmers in Ibadan. In Odewumi et al. (2013) and Wahab and Popoola (2018), the effects of climate variability on urban agriculture were extensively identified and the adaptation techniques adopted by farmers discussed. The processes involved on food production were not identified and the effect on the food produced not extensively identified. This study avers that urban food production is shaped by the varying climate.

Based on reconnaissance survey, on-farm field observation and interview with farmers, this study identifies that food production in urban-Ibadan includes vegetable and legume farming, food crop such as maize

Plate 1: On-farm marketing of vegetable at Eleyele Floodplain area of Ibadan

Source: Authors' Field Survey, 2018

farming and animal rearing (chicken, goats and pigs been the most common). Vegetable and legume farming continue to be main type of farming activity practiced within the city centre along the floodplain and open spaces (see Plate 1).

The study also identifies based on picture evidence (Plate 2 and 3) the use of herbicides and irrigation of plants with waste water from adjoining wetland or canal close to the farm locations

Plate 2: Woman trying to fetch water from Dirty canal for irrigation

Source: Authors' Field Survey, 2018

Plate 3: Herbicide Application for legumes

Interview with the woman reveal that urban farmers have resulted into the use of such dirty, unhealthy water for irrigation of their farm crop as a result of short raining season and late rain. When interviewed as to why such dirty water was used for irrigation she said this:

> "*...The rain hasn't been falling well, my vegetables are dying off, I also need money to feed my family. I just need to make use of any water to irrigate it so it can grow and be harvested for sale …*"

Based on this, with the pictorial representation of the on-farm sale of legumes as presented in Plate 1and the extensive use of herbicide to control pest and yield in Plate 3, the study argues that the crop produced might be considered harmful to human health is not properly prepare when about to be ate. When asked of the process of preparing the legumes if washed before sale, a farmer has this to say:

> "*...That is not my duty, mine is to plant and sell, where will I even get the water to be washing it before selling? I think the people should know that they need to boil and prepare well before eating …*"

Further questioning towards the consideration of the use of organic fertilizer as against chemical fertilizer, the farmer responded that the air pollution accompanying organic fertilizer and also the slow rate of controlling stunted growth is an issue. A farmer in his own word said this:

> "*...The odour from the poultry waste when used for manuring is high and community people complain sometimes and even some vegetable buyers claim the can still smell it… but for the chemical fertilizer, no complain and not odour and likewise fast to control pest and disease…*"

While the response of chemical fertilizer is undoubted, the effect on the soil and water body in adjoining area needs to be investigated. The study have identified that the extreme climatic condition will affects crop yield (see Plate 4), the human hazard exposures of this food produced are also needed to be further investigated as the effects of the herbicides on the quality of the farm produce and effects on human health investigated.

Plate 4: Drying up cucumber plant owing to high temperature
Source: Authors' Field Survey, 2018

Interview also reveal that while core and traditional settlements and societies continue to practice animal (goat, chicken, snail, rabbit) farming at subsistence and household level, the future of meeting urban meat demand continues to be limited considering the rate of urbanization into peri-urban space. For example in Nigeria, the climate change driven crisis between Fulani herdsmen and crop farmers continues to subject pressure and shock on animal farming and nomadic lifestyle leading to induced protein scarcity. Lasisi et al. (2017) reported that even the peri-urban areas (areas where animal farming are unconsciously relocated to) are experiencing land pressure owing to urban sprawl. Urban animal farming needs to be well advocated for, especially in LGAs that are rocky and has limited land for crop farming.

Conclusion and Recommendations

For continued human existence, food is a necessity. One of the ways to meet up with the increasing demand for food in an urban settlement is through urban agriculture. Urban farmers are faced with varieties of difficulty of which climate variability is one. Farmers were aware of their environment and climatic influence on agriculture in the past owing to the stability in climatic conditions and based on the indigenous agricultural knowledge systems. This study has revealed the awareness knowledge of urban farmers of climate variability in Ibadan. The farmers have perceived increase in temperature, rainfall and humidity based on their years of farming experiences, traditional farming practices and informations from radio/television,

extension workers and interaction with farmer's cooperatives. The study further concludes that the knowledge of the urban farmers about climate variability will guide their response to the variations including the decision on whether to increase or decrease their farming activities. As environmental decisions are dictated by peoples' perception of it. Thus, updated correct perception as regard climate variability will bring about proper response to the climatic issues. Based on this assertion and identified problems, this study suggests the following:

The urban farmers should be provided with both formal and informal educational training, retraining and extension services so as to broaden their knowledge on relevant aspects of climate variability and change and its relationship to urban agriculture. This is a necessary investment to promote sustainable food security. Also, massive awareness campaigns and community sensitization should be put in place in order to get the farmers informed on the reality of climate variability, its causes and serious consequences on food production. Farmers must be routinely sensitized about the implications of certain activities such as over-grazing, deforestation, and bush burning and be discouraged from further practice. Composting of agricultural waste and afforestation should be encouraged as a way of mitigating the occurrence of climate variability and weather extremes. Nonetheless, the effect of the fertilizer used on food crops and adjoining environment should be examined.

Additional extension personnel who are knowledgeable about climate change and variability should be provided by government to increase the extension-farmer ratio and also make the extension services more accessible to farmers. The Department of Agriculture in all the local governments in Ibadan should be adequately staffed and equipped with transportation and communication facilities to enable them provide adequate outreach/extension services to farmers within their areas of jurisdiction.

The role of indigenous knowledge in weather forecast cannot be totally neglected. Thus, collaboration between the scientist and indigenous farmer as regards weather related information is imperative as this provide a dual way of gathering data. Therefore, the people's indigenous knowledge of weather forecast and farming practices should be encouraged by extension agencies/workers for possible integration with modern techniques to enhance improved farming in local communities in Ibadan and Nigeria in general. Ibadan South-east Local government, which is fully built-up, should consult with the Bureau of Physical Planning and Urban Development to acquire land in any of the six rural local government areas in Ibadan and allocate to its farmers to enable them continue to farm and enhance food production.

This study also identifies the need for improved crop production that reduces the possibility of consuming herbicide and also waste through the irrigation of plant with water from canals along the floodplain area. Investigation on the effect of some selected chemical used by urban farmers to enhance crop yield on human health needs to be established likewise.

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