academicJournals

Vol. 6(6), pp. 209-217, August, 2013
DOI: 10.5897/JGRP2013.0370
ISSN 2070-1845 © 2013 Academic Journals
http://www.academicjournals.org/JGRP

Journal of Geography and Regional Planning

Full Length Research Paper

Farmer's perception on the effect of climate change and variation on urban agriculture in Ibadan Metropolis, South-western Nigeria

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Accepted 15 August, 2013

Agricultural activities mostly food crop production are climate dependent, as change in the ideal plant requirement may affect the overall yield and productive capacity of the crop. The study examined farmers' perception on the effect of climate change and variations on urban agriculture in Ibadan Metropolis. Data were obtained through the administration of 145 copies of structured questionnaire to farmers in two prominent urban agricultural communities of Odogbo Barracks and Eleyele. The data obtained were analyzed using descriptive and inferential statistical methods. The result showed that 89.6% of the respondents held the opinion that climate is changing and that variability in climatic conditions had become more pronounced in the past five years. The perceived effects of climate variations were increase in temperature, reduction in number of rain days, increase in rain storms and occurrence of floods. The multiple regression result revealed that farmers' socio-economic characteristics (education, sex, age, income and length of farming experience) had no significant influence on their perception of the effect of climate variations on urban agriculture. The study further showed that farmers' perception of climate change significantly influenced the way they responded to variations in climate. The study therefore suggested the immediate adoption of irrigation and mulching as mitigating measures to cope with the phenomenon instead of the complete reliance on rain-fed agriculture.

Key words: Farmers' perception, coping strategies, perceived effects, climate variations, mitigating measures, ibadan, multiple regression analysis.

INTRODUCTION

Globally, agricultural activities mostly food crop production are climate dependent, as any change in the ideal plant requirement may affect the overall yield and productive capacity of the crop. In cities and urbanized areas, agricultural activities are practised by people as a means of food supply to the urban populace to complement rural supply in addition to income generation. However, variation in climate in recent times has caused drastic changes on agricultural production. The United Nations Development Program (1996) defines urban agriculture "as an activity that produces, processes and markets food and other products in urban areas, applying intensive production methods and re-using natural resources and urban wastes, to yield a diversity of crops and livestock". Urban agriculture is not only limited to the growing of food crops and fruit trees in cities but

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also includes the rearing of livestock as well as the planting of medicinal and ornamental plants. Mougeot (2000) reported that the activity is known to bolster food supplies while also increasing the incomes of the urban poor.

Apart from climate variability, urban agriculture in Nigeria like in many other developing countries is constrained by a number of factors. These factors, according to Okunmadewa (2006) and Adekanye (2004), are primarily man-made which include inadequate finance, poor pricing of urban produce, prohibitive cost of farm inputs, and competition from other land uses and inadequate access to land. However, over the past few years, climatic factors have played a more important role than the man-made factors. This problem, according to Egbuna (2001), is compounded by the heavy reliance on rain-fed agriculture in most developing countries particularly among the rural and urban peasant farmers. The change in climate has nevertheless forced farmers to adopt new practices in response to altered conditions. Higher temperature and changes in precipitation and increased climate variations affect agriculture, forestry and urban areas (Bryant, 1997).

Earlier studies by scholars in diverse fields of human endeavours have heralded the effects of climate change and variability on agricultural production. Ayoade (2005) observed that climate change will affect crop yield directly because of alterations in temperature and rainfall and indirectly through changes in soil quality, pests and diseases. Yaro (2010) indicated that climate variability may be the leading cause of the decline in food crop production amongst other constraints of urban agriculture, and that farmer's adaptive behaviour and coping strategies revolve around the knowledge of climate rather than human environmental variables. Ajadi et al. (2011) showed that variation in some climatic parameters suggests variation in crop yield. Others noted that farmers are aware of climate change and its impacts on their livelihood and their perceptions greatly influence the coping strategies employed. For instance, Ayanwuyi (2011) revealed that arable farmers were more aware of climate change and its impacts on their livelihood, but the techniques of coping and mitigating the impact of the scourge is still crude owing to poverty and ignorance. Similarly, Apata et al. (2009) revealed that fall in temperature influences the probability of changing from monocropping to mixed cropping systems other than increases in temperature. It is apparent from the above that a lot of research has been carried out to investigate the perception and impact of climate variability and change on food crop production in Nigeria. This is not surprising considering the importance of food for man's survival. However, many of these studies focused on crop production or arable farming in rural areas. This is certainly true considering the fact that the rural areas provide most of the agricultural needs of the urban populace.

At this juncture, it is important to differentiate between climate change and climate variability. Climate change and climate variability are generic terms that are often wrongly used to imply the same thing. The two terms mean different things. The former relates to long term change (many decades) in climatic condition say 25 – 30 yrs., while the latter tells us of the yearly or seasonal changes in climatic conditions. Dinse (2011) sees climate variability as the way climate fluctuates yearly above or below a long-term average value, and climate change as a long-term continuous change (increase or decrease) to average weather conditions (e.g. average temperature). However, the obvious difference is the fact that climate change is slow and gradual, and unlike year-to-year variability, is very difficult to perceive without scientific records (Dinse, 2011). Perhaps, the knowledge and perceptions of farmers about climate change would influence the way they respond to variations in the climate.

It has been recognized that people make decisions in their environment not the way the environment is but the way they perceive it. In addition, the perceptions of farmers have the tendency of influencing their coping strategies which ultimately determine the extent to which climate impacts agriculture (Ajadi et al., 2011). The issue of perception of climate change is particularly important considering the fact that agriculture constitutes the mainstay of about 60-70% of the Nigerian populace (Apata et al., 2009). It is perhaps, the level of perception that determines the strategies to be employed in minimising the impacts of climate variations. Therefore, the need to examine the perception of farmers on the effects of climate variations on urban agriculture and the strategies employed by farmers to reduce the threat of climate variations on urban agriculture is therefore pertinent to the study.

MATERIALS AND METHODS

Study area

Ibadan, the Capital City of Oyo State is located on latitude $7^0 23'$ and $7^0 39'$ North and longitude $3^0 55'$and $3^0 91'$ East. Spatially, the study area has a tropical wet and dry climate and is strongly influenced by the West African monsoon climate, marked by a distinct seasonal shift in the wind pattern. Between March and October, the area is under the influence of the moist maritime South-west monsoon winds, while the dry season occurs normally from November to February when the dry dust-laden winds blow from the Sahara desert. The annual rainfall of Ibadan ranges from 788 to 1884 mm within a twenty year period (Moormann et al., 1975). The mean annual temperature is 26.6^0C. Relative humidity is constantly high throughout the year with annual average greater than 80%, and the period of highest relative humidity coincides with the rainy season. The soils of Ibadan metropolis belong to the major soil group of ferruginous tropical soils. Generally, the soils have low nutrient-holding capacities. The natural vegetation is moist deciduous rainforest (Hopkins, 1974) which characterizes the drier Northern

Figure 1. A cross section of farmers involved in vegetable farming at Eleyele

Figure 2. A section of vegetable farmland at Odogbo barracks.

edge of the rainforest zone in South western Nigeria.

Agricultural activities in Ibadan metropolis are characterized by mostly secondary and quaternary services; there are still features of primary functions such as farming in the metropolis. In most of the urban periphery where there is availability of large expanse of land areas, farming activities are usually practised in form of settlement farm, livestock rearing or plantation agriculture. These areas include Olubokun farm settlement at Iddo Local Government, cassava and banana plantation at Moniya and Laniba in Akinyele Local Government. Other subsistence and commercial farming practices are spread all over the six local government outside Ibadan. These include Iddo, Akinyele, Egbeda, Lalupon and Iyana Offa where maize, cassava, yam and potatoes are usually produced. However, within the Ibadan metropolis, lots of farming activities such as vegetable farming and leguminous plantation are also practised. Usually, the vegetable farming is practised along river catchment areas for easy accessibility to water to irrigate the land. Also, around most areas in Ibadan such as Eleyele, Ojoo, Sango, Dugbe, Apete, Ologuneru, vegetable farming is usually practised due to its high demand by urban residents. Unfortunately, due to the increase in climatic variations especially over the past five years, many of the urban farmers have been confronted by the challenges of increased drought, increased temperature, over-utilization of land and the deleterious global warming. However, with the recent prediction of increase in rainfall by climate experts, there is the possibility of floods which could render damaging effect on crop yield.

Data collection

The study employed the descriptive research survey design. The design was used to sample urban farmers. Primary and secondary data were used. The primary data types included: data on the socio-economic characteristics of respondents; data on the type of farming system practised by urban farmers; data on the coping strategies adopted by urban farmers in dealing with climatic variations; data on the knowledge of farmers towards climatic variations and change. The secondary set of data was information on the impact of climatic elements such as rainfall, temperature and humidity on the crop yield and farming practices. The sets of primary data were obtained through administration of copies of structured questionnaire to urban farmers, while the secondary data were collected from the Ministry of Agriculture, International Institute for Tropical Agriculture (IITA) on some of the resultant effect of climate change on farm products. Other information was sourced from the internet where related works were used

Due to the nature of farming in Ibadan metropolis, a reconnaissance survey was carried out in order to ascertain areas in Ibadan where urban farming is practised. The survey revealed that most of the farming activities within Ibadan metropolis were dominated by vegetable and subsistence farming where different types of food crops were grown. The areas where vegetables are grown include Ojoo, Sango, Odogbo, Eleyele, Apete, and other swampy areas usually called 'AKURO' amongst the Ibadan indigenes. Hence, Adekunle Fajuyi Military Cantonment, Ojoo (Odogbo barracks) and Eleyele were purposefully selected due to the large number of people involved in farming in these two areas (Figures 1-2). A total of 145 copies of questionnaire were administered using the cluster sampling method. Permission to conduct the research was sought from the farmers after the purpose of the survey had been explained. On this note, ninety copies of questionnaire were administered to farmers in Adekunle Fajuyi Military Cantonment, Ojoo (Odogbo barracks) due to the large expanse of land and number of farmers involved in the occupation, while fifty-five copies were administered to farmers in Eleyele.

Data analysis

Both descriptive and inferential statistics were used for the analysis of data. Information obtained from the administered questionnaire was analysed using tables, percentage, chi square and multiple regression analyses. In order to effectively carryout this test, items in the questionnaire coded for descriptive analysis were transformed or re-coded into dummy variables. For instance, questions like sex of respondents were coded as 1 if the respondent was a female and 0 if the respondent was a male; education was re-coded to primary education and above as 1 and no education as 0; monthly income of respondents with 6 options was re-coded to low income as 0 (N<5, 000 – N25, 000) and high income re-coded as 1 (>N25, 000); length of farming experience was re-coded to inexperienced farmers as 0 (1 – 5 yrs) and experienced farmers as 1 (>5 yrs), while farmers' perception was recoded into awareness of change as 1 and unawareness of

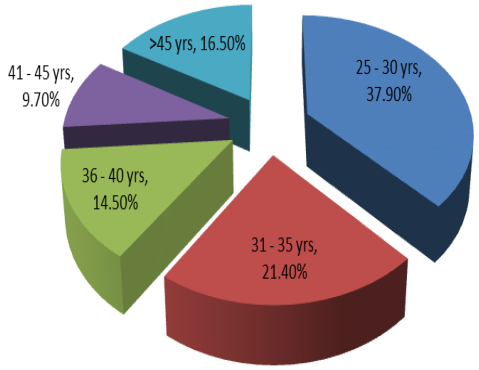

Figure 3. Age pattern of respondents.

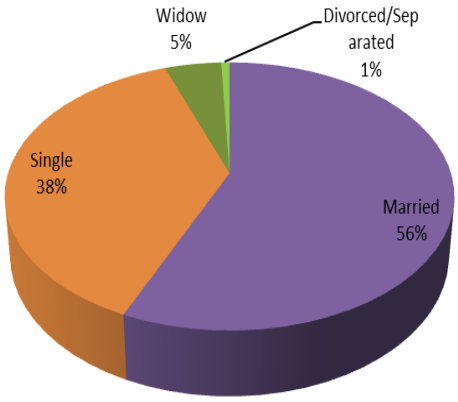

Figure 4. Marital status of the respondents.

change as 0. Statistical computation was done with the aid of SPSS 17.0 for Windows.

RESULTS

Socio-demographic characteristics of respondents

Information on the socio-demographic characteristics of respondents shows that 66.9% were females, while 33.1% were males. This implies that females are more involved in urban agriculture than their male counterpart. This is true as women use it to support their families nutritionally and income wise. The age pattern of the respondents reveals that majority are adults and elderly. This is however, not surprising considering the nature of the occupation. The result further shows majority of the urban farmers are married (Figures 3-6).

In addition, the education of respondents indicated that majority (41.1%) had post primary education, 29.0% had primary education, and 27.6% had post secondary education; while 2.3% had no education. The length of farming or number of farming years is an important characteristic that enable farmers to appreciate and give good account of the impacts of climate variations in their environment. The study reveals that a large percentage of farmers (42.1%) had farming experience that ranged between 6 - 10 years, 29.0 and 13.8% had 1 - 5 and 11-15 years of farming experience, 4.1% had 16 - 20 years farming experience; while 11.0% had farming experience of above 20 years.

Farmer's perception of climate variability and change

The way farmers perceive climate variations in their environment is quite important because it significantly influence the capacity of urban farmers to develop appropriate coping strategies. On the perception of farmers on climate variations and change, 89.6% of the respondents were of the opinion that the climate is changing and the variability in the climatic conditions has become more pronounced in recent years, while 10.4% held the opinion that climate was not changing. The breakdown indicates that 27.6% of the respondents mainly perceived climate variations in terms of an increase in the occurrence of floods after rainfall. The fact that most of the respondents (49.7%) perceived changes in the climatic conditions in terms of increased rain storms, temperature and occurrence of flood after heavy downpour might be due to the importance or widespread prevalence of rain-fed agriculture in tropical countries in which Nigeria is no exception (Figure 7). This is a confirmation of weather experts' prediction of heavy rainfall and intense floods for the year in which case Ibadan was flagged an area to be seriously affected by the floods.

Perceived problems encountered by urban farmers in the area

Information in Table 1 shows that farmers face a number of problems in their pursuit of food production and income generation. The table therefore gives information on the differences in problems as perceived by the farmers between the two locations. Increase in the cost of fertilizer (32.4%), poor crop yield (22.8%) and water scarcity (20.8%) were affirmed as the primary perceived problems faced by urban farmers in the area. Other perceived problems caused by the impact of climate variation on urban agriculture in Ibadan were outbreak of pest and disease (13.8%) and delay in harvesting or change in harvesting period (10.3%). The chi square result further indicates that the alleged or perceived problems do not differ between the two sampled locations ($X^2 = 20.00$; $p>0.05$).

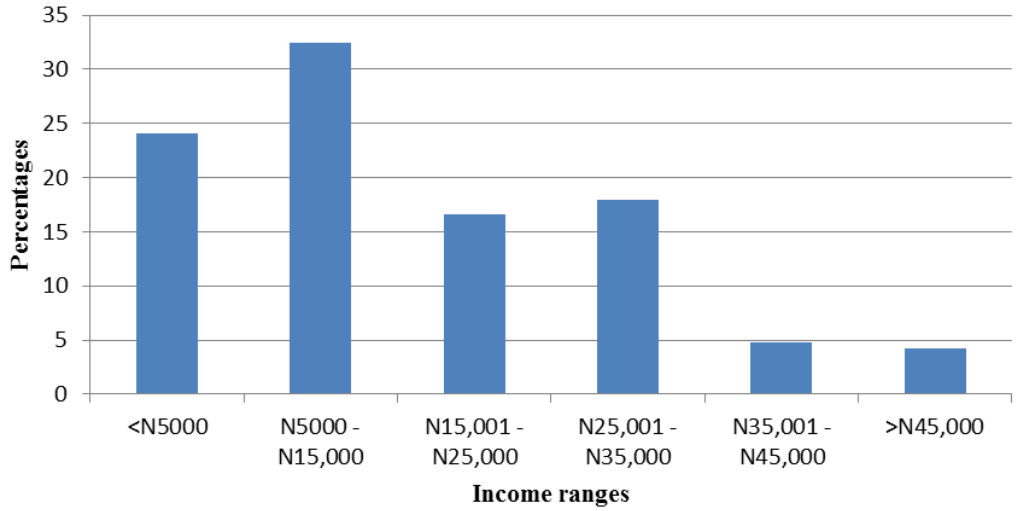

Figure 5. Monthly income of urban farmers.

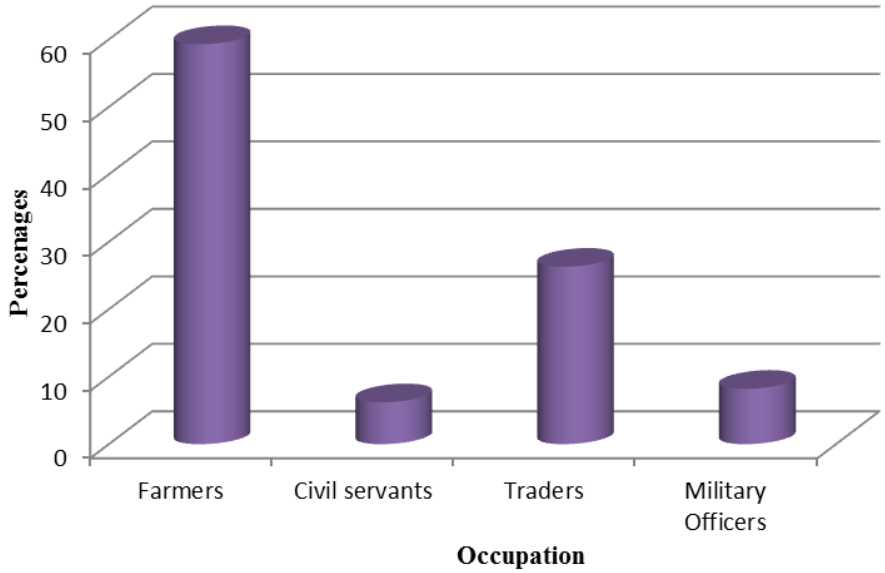

Figure 6. Nature of occupation of urban farmers.

Strategies adopted by farmers to cope with climate variations

Urban farming activities have been widely acclaimed to be the means by which urban residents ensure food security and augment their income. It is therefore expected that changes in the climatic conditions may affect this activity. However, urban farmers have long devised coping strategies to minimise these impacts on their farmland. The study identified four major strategies (Table 2) usually adopted by urban farmers in the study locations to include use of irrigation, application of fertilizers to improve and enhance crop yield, practice of dry mulching and application of chemicals. The information depicts that 29.6% of the respondents in both Odogbo barracks and Eleyele alleged they adopt irrigation to make up for the deficiencies in rainfall amount or late onset of rainfall, 42.8% used fertilizer or manure as their coping strategies to improve crop yield against unfavourable climatic conditions.

The practice of dry mulching was used by 19.3% to minimise the impact of extreme climatic conditions especially warmer temperature conditions, while 6.2% of the respondents in Odogbo barracks and Eleyele applied

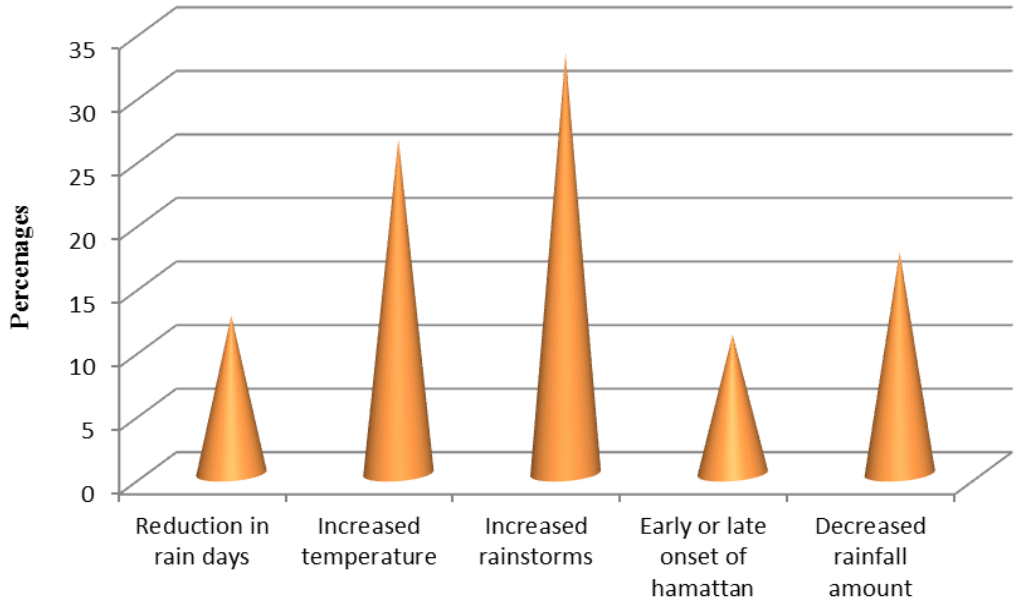

Figure 7. Farmers' perception of climatic changes.

Table 1. Alleged problems resulting from climate variations.

Identified problems	Location		Total
	Odogbo Barracks	Eleyele	
Water scarcity	18 (20)	12 (32.7)	30 (20.7)
Poor crop yield	22 (24.4)	11 (41.8)	33 (22.8)
Delay in harvesting	10 (11.1)	5 (18.2)	15 (10.3)
Increased cost of fertilizer	29 (32.2)	18 (7.3)	47 (32.4)
Outbreak of pest and disease	11 (12.2)	9 (0.0)	20 (13.8)
Total	90 (100)	55 (100)	145 (100)

Source: Author's Field Survey, 2011; [X^2=20.00; df =16, p>0.05] [Figures in bracket are percentages].

Table 2. Coping strategies adopted by urban farmers across locations of study.

Coping Strategies	Location		Total
	Odogbo Barracks	Eleyele	
Irrigation	25 (27.8)	18 (32.7)	43 (29.6)
Application of fertilizer	39 (43.3)	23 (41.8)	62 (42.8)
Mulching	18 (20)	10 (18.2)	28 (19.3)
Application of chemicals	5 (5.6)	4 (7.3)	9 (6.2)
Use of hybrid seedlings	3 (3.3)	0 (0.0)	3 (2.1)
Total	90 (100)	55 (100)	145 (100)

Source: Author's Field Survey, 2011.[X^2=21.00; df=16, p>0.05], [Figures in bracket are percentages].

chemicals especially pesticides and insecticides to ward off pests and diseases associated with the onset of rainy season due to increased humidity conditions. The result reveals that the use of hybrid seedlings in order to shorten the growing season of planted crop is an uncommon practice employed by urban farmers in the

Table 3. Summary of multiple regression result.

Variables	Coefficients		
	B	β	t-value
Length of farming experience	0.155	0.223	2.656*
Farmer's monthly income	0.069	0.107	1.206
Sex of farmers	0.083	0.128	1.485
Ages of farmers	0.011	0.054	0.604
Education of farmers	-0.128	-0.049	-0.587
Test results			
F- value	0.115		
R	0.25		
R^2	0.061		
Constant	1.026		4.562*
DF	5/108		

*Significant at 1% significance level. Source: SPSS Window Output Version 17.0.

area (2.1%). The chi-square analysis revealed that the coping strategies adopted by urban farmers do not vary across the study locations (x^2=0.884; p>0.05). This can be attributed to the fact that most of the urban farmers practice the same methods of farm production which invariably do not have any significant effect on their locations (X^2=21.00, p>0.05).

Analysis of the effect of sex, age, education, income and length of farming experience on farmer's perception of climate variation

In the course of this study, the researchers sought to find out if the socio-economic characteristics (sex, age, education, income and length of farming experience) of farmers have any significant influence on their perception of the effect of climate variations on urban agriculture. In order to achieve this, the multiple regression model was employed. Results obtained are presented in Table 3. The result shows there is a weak association (0.25) between sex, age, education, income and length of farming experience of farmers and their perception of the effect of climate variations on urban agriculture. The ANOVA result further reveals that sex, age, education, income and length of farming experience of farmers do not have significant influence on their perception of the effect of climate variations on urban agriculture (F = 0.115, p>0.05). This shows that the selected socio-economic variables do not account for or in any way influence farmer's perception of climate change. Further-more, the significance of the predictor variables in influencing farmer's perception of the effect of climate variations on urban agriculture indicated that among the variables, only length of farming happens to be significant (t = 2.656, p<0.01). This means that length of farming directly influences farmer's perception of the effect of climate variations on urban agriculture.

The remaining variables are individually insignificant in influencing farmer's awareness of the effect of climate variations on urban agriculture. The t-values for these set of variables were monthly income (t = 1.206, p>0.05), sex (t = 1.485, p>0.05), ages of farmers (t = 0.604, p>0.05) and education level of farmers (t = 0.587, p>0.05) (Table 3). The strength of contribution of each selected factors using the product of unstandardized regression co-efficients indicates that length of farming had the greatest contribution (0.155) to farmer's perception of the effect of climate variations on urban agriculture, followed by sex (0.083) and income (0.069). Education has an inverse effect on farmer's perception as the advancement in education increases farmers' understanding of climate change thereby influencing their perception on what constitutes climate variability (Table 3). This implies that with education, farmers can logically distinguish between climate change and climate variability. This is because education enables the farmers to understand the indicators of climate change and variability, which would help them to carry out necessary actions to mitigate any inherent effect and to improve crop yield. The study therefore reveals that the perception of climate variation issues increases with increasing length of farming experience amongst the urban farmers.

DISCUSSION

Urban agriculture in Ibadan is still largely climate-dependent especially for the urban residents. The result reveals an increased awareness and perception of farmers on the impact of climate extremes on crop production. For instance, majority of the farmers in the area reported the climate variability in terms of reduced rainstorms, late onset of rainfall and changes in rainfall and temperature pattern. Similar result was reported by Manyatsi et al. (2010) in their study that majority of the members of communities were aware of climate variability. The reported signs of climate variability included drought, poor rains, and change in rainfall pattern and increase in temperature. Rainfall, for instance, is seen as the major determinant of the planting season of most crops as its early or late onset could affect the time of the year when crops are planted. This finding is consistent with the findings of Ekpoh (2010) that crop yields are very sensitive to rainfall and its amounts and distribution may have significant impact on crops. He argued also that temperature is quite useful during germination, maturity and harvesting. In a similar manner, Agbola and Ojeleye (2007) noted that in crop production, rainfall and temperature affect the types of crops grown, the farming system practiced, the growing season and

the farm operation. In addition, the farmers submitted that the onsets of rains are now delayed which has consequently led to the shortening of the wet season to between four and six month instead of the average period of seven months recorded in past years. It was also revealed that in spite of the decrease in the amount of rainfall in recent years, the set time of occurrence of rainfall in the year is now between April and June in contrast to the past where rainfall started in early March. This has led to the reduction in the growing season of most crops as many farmers alleged they hardly get two to three planting seasons for maize which is considered an important staple food crop for consumption. This corroborates the works of Adelekan and Bolarinwa (2001), when they observed changes in planting seasons in Southwestern Nigeria.

Perhaps, the outbreak of insect pests and diseases has been associated with the onset of rainy season. This is because at this period, relative humidity is higher than other periods of the year which creates room for the thriving of insects that eat up crops and cause considerable damage to crops planted. This is in line with the works of Ayoade (2005) that climate change affects crop yield directly because of alterations in temperature and rainfall and indirectly through changes in soil quality, pests and diseases.

Furthermore, the combination of sex, age, education, income and length of farming experience of farmers do not significantly influence their perception of the effect of climate variations on urban agriculture. But, the test of significance of each variable identifies length of farming experience of farmers to exert substantial influence on farmer's perception. This is true as the years of farming enable a farmer to understand changes in crop behaviour and the possible reasons for the observed changes. This could be done through the comparison of yearly harvest and rainfall duration among other variables. This is also consistent with the study by Nhemachena and Hassan (2007) that farming experience increases the probability of uptake of all adaptation options because experienced farmers have better knowledge and information on changes in climatic conditions and crop and livestock management practices. However, farmers in the study area have long devised coping techniques in adapting to climate variations. Farmers in the study area adopt similar coping techniques as it does not vary across locations and there is a favourable disposition to irrigation, emphasizing the importance of rainfall to agriculture in the urban centres. This however confirmed the works of Jones and Thornton (2003) who noted that shifting to an irrigated farming system could be seen as a coping strategy in the face of climatic variability across the developing world. Other forms of agricultural coping techniques adopted in this study include: application of fertilizer or manure to enhance plant growth, the use of chemicals especially insecticides and pesticides to ward off insect/pests and diseases, the use of dry mulching to artificially create micro-climate conditions necessary for crops in their nursery and of the use of hybrid seedlings in order to stimulate speedy growth of cultivated crops.

CONCLUSION AND RECOMMENDATIONS

The impact of variations in climate on urban agriculture is assuming increasing trends by the day. In the past, many urban farmers were not aware of the nature of their climatic environment and it could be said that the farming practices revolved around the farmers' perception about the climate. However, majority of the farmers are now aware of variations in the climatic conditions and how it affects their farm produce especially vegetable. The study shows therefore, that the knowledge and perception of farmers about climate change influences their coping strategies. Hence, there must be a need to sensitize the farmers on the effect of climatic changes and global warming and how it could affect food production.

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