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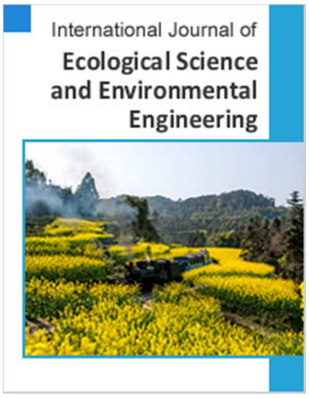

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Farmers Perception of Climate Variability in Three Urban Fringe Communities of Ilorin, Nigeria

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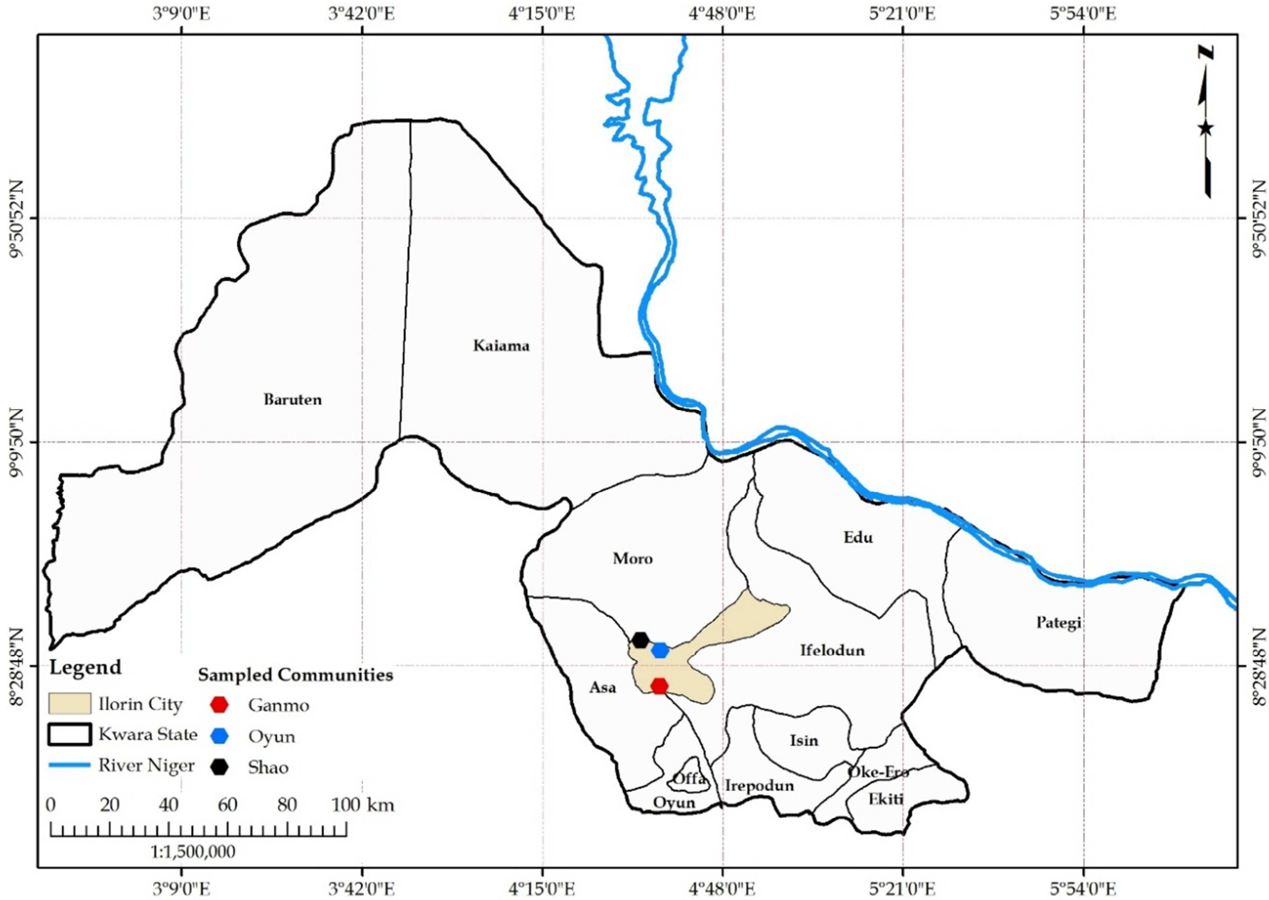
Abstract
Change in climate and consequent global warming are posing threats to food security in many developing nations including Nigeria because of the climate-dependent nature of agricultural systems and lack of coping capabilities. This paper assessed farmer perceptions of climate variability in three urban fringe communities of Ilorin with a view to understanding farmers' knowledge, opinion and response as regards the issue. Using systematic random sampling techniques, one hundred and fifty questionnaires were administered on arable farmers in the study areas. A cross-sectional questionnaires were administered, Focus Group Discussion (FGD) was used to appraise farmers' predictability of rainfall as rainfall is the most important climatic variable in agricultural production. It was observed that the farmers are aware of the changes in climate and generally agreed that it was easy to predict the coming season and the seasons were distinct but now the rains have become more and more unpredictable. The study found that Climate variability has affected their crop yield and farm income. Rainfall, raining days, maximum temperature, minimum temperature and average relative humidity, were found to be significant determinants of crop outputs. Farmers had adopted some coping strategies such as, planting of different varieties of crops, changing the expanse of land put into crop production, use of chemical fertilizers, planting short gestation crops, believing these will go a long way reducing the effect of climate variability.

1. Study Area

The study areas for this research are; Ganmo, Oyun and Shao communities (figure 1). Ganmo is located on latitude 8°25'N and longitude 4°36'E, it is 11.33km from Ilorin, Shao is located on latitude 8°35'N and longitude 4°33'E, it is 10.65km from Ilorin and Oyun got its name from River Oyun located in the area [4]. The climate of Ilorin is tropical under the influence of the two trade winds prevailing over the country hence two climatic seasons i.e. rainy and dry season. The rainy season is between March and November and the annual rainfall varies from 1000mm to 1500mm, with the peak between September and early October. Also, the mean monthly temperature is generally high throughout the year with 25°C in January, May 27.5°C and September 22.5°C Ajibade, 2002 adapted from [8].

Ilorin is composed by ferruginous tropical soils on crystalline acid rocks. The landscape consists of a relatively flat and undulating land with interspersed hills and valleys in parts of Baruten, Kaiama and Moro Local Government areas [2]. Ilorin is located in the transition zone between the deciduous forest (rainforest) of the southern and the savannah grasslands of the north. The vegetation of Ilorin composed of species of plants such as locust beans trees, shear butter trees, elephant grasses, shrubs and herbaceous plants among others are common in this area [3].

The population census of 1991 put the population of Ilorin at 532,088. The figure was projected with the annual growth rate of 2.84 percent to be 606,533 in 1996 [5]. The 2006 census put the population at 766,000 (NPC, 2006).



Source: Generated from Map Library, 2013 [10]

Figure 1. *Kwara State Showing the Sixteen Local Government Areas.*

2. Results and Discussion

2.1. Personal Characteristics of Sampled Arable Farmers

The personal characteristics of arable farmers like sex, age, marital status, farming experience, size of household, size of farmland, other occupation apart from farming and level of education were discussed in this section.

Table 1 shows the percentage sex distribution of arable farmers in the study areas. The result of analysis shows that all the sampled 150 respondents were males, there were no females. This shows the peculiarity of the study areas, where the female gender is disallowed to engage in laborious work and obligated to attend to milder activities like trading among others. The age of the farmers revealed that majority (64%) were above 60 years of age. This means that the arable farmers sampled are relatively old. This goes to buttress the fact that agriculture is seen as an occupation for the aged while the young look for white-collar jobs in the urban areas.

All the farmers (100%) were married and this means more mouth to be fed and possibility of getting family labour. In respect to their farming experience, 94% have been farming for over 20years. The table also shows that 12.67%, 49.33%, and 38% of the respondents have household size of 4-6 persons, 7-9persons, and 10-12 persons respectively. The mean household size stood at approximately 9 persons per household in the study areas. Having large household size as in this case is sometimes advantageous because it substitutes for labour input.

Table 1 further revealed that 71.33% of the respondents had farm size less than 2.00ha. The percentage distribution according to the farmers engagement in off-farm job include; artisans (59.33%), traders (2%), retired (4%) while the remaining 34.67% did not have off-farm job as at the time of carrying out this research (See Table 1). From the data obtained from the field, larger proportion of the farmers had no formal education and this constitutes 61.33% of the respondents while the rest had formal education.

Table 1. *Personal Characteristics of Sampled Arable Farmers.*

Characteristics	Frequency	Percentage Frequency	Cumulative Frequency
a. Sex			
Male	150	100	100
Female	-	-	100
TOTAL	150		
b. Age			
30-40	5	3.33	3.33
41-50	16	10.67	14.00
51-60	33	22.00	36.00
Above 60	96	64	100
TOTAL	150		
c. Marital Status			
Single	-	-	-
Married	150	100	100
Widowed	-	-	100
Divorced	-	-	100
Separated	-	-	100
TOTAL	150		
d. Farming Experience			
1-5	-	-	-
6-10	-	-	-
11-15	7	4.67	4.67
16-20	2	1.33	6.00
21+	141	94.00	100
TOTAL	150		
e. Size of Household			
1-3	-	-	-
4-6	19	12.67	12.67
7-9	74	49.33	62.00
10-12	57	38.00	100
12+	-	-	100
TOTAL	150		
f. Size of Farmland			
0.01-1.00ha	12	8	8.00
1.01-2.00ha	47	31.33	39.33
2.01-3.00ha	48	32	71.33
3.01-4.00ha	10	6.67	78.00
Above 4.01ha	33	22	100
TOTAL	150		
g. Other Farm Occupation			
Artisan	89	59.33	59.33
Trader	3	2.00	61.33
Civil Servant	-	-	61.33
Retired	6	4.00	65.33
Non	52	34.67	100
TOTAL	150		
h. Educational Qualification			
No Formal Education	92	61.33	61.33
Primary Education	41	27.33	88.66
Secondary Education	13	8.67	97.33
Tertiary Education	4	2.67	100
TOTAL	150		

Source: Field Survey, 2013.

2.2. Farmers Perception of Climate Variability

One of the objectives of this research is to appraise farmers' perception of climate variability in three communities in urban fringe of Ilorin. Table 2, 3 and 4 show their perception about rainfall, temperature and length of rainy season respectively.

Majority (78%) of the sampled farmers (Ganmo 16.67%, Shao 29.33% and Oyun 32%) perceived that the amount of rainfall is decreasing, 12.67% increasing, while the remaining 9.33% don't know whether it is increasing or decreasing (See Table 2).

Table 2. *Farmers Perception of Rainfall.*

Farmer's Perception	Ganmo	Shao	Oyun	Total
Increasing	13 (8.67)	6 (4)	0 (0)	19 (12.67)
Decreasing	25 (16.67)	44 (29.33)	48 (32)	117 (78)
I don't know	12 (8)	0 (0)	2 (1.33)	14 (9.33)

Percentages are in parentheses
Source: Field Survey, 2013.

Table 3 shows that almost all the respondents in the study areas (92%) perceived that temperature is increasing, 4.67% perceived it is decreasing and 3.33% from Ganmo don't know whether it is increasing or decreasing.

Table 3. *Farmers Perception of Temperature.*

Farmer's Perception	Ganmo	Shao	Oyun	Total
Increasing	45 (30)	43 (28.67)	50 (33.33)	138 (92)
Decreasing	0 (0)	7 (4.67)	0 (0)	7 (4.67)
I don't know	5 (3.33)	0 (0)	0 (0)	5 (3.33)

Percentages are in parentheses
Source: Field Survey, 2013.

The result of the analysis from table 4 indicates that 75.33% (Ganmo 18.67%, Shao 26% and Oyun 30.67%) of the sampled farmers perceived that the length of rainy seasons is decreasing. From the remaining 24.66%, 17.33% perceived that there is no changes, increasing 4% and 3.33% don't know whether it is decreasing, increasing or there is no changes.

Table 4. *Farmers Perception of Length of Rainy Seasons.*

Farmer's Perception	Ganmo	Shao	Oyun	Total
Increasing	0 (0)	6 (4)	0 (0)	6 (4)
Decreasing	28 (18.67)	39 (26)	46 (30.67)	113 (75.33)
No changes	21 (14)	5 (3.33)	0 (0)	26 (17.33)
I don't know	1 (0.67)	0 (0)	4 (2.67)	5 (3.33)

Percentages are in parentheses
Source: Field Survey, 2013.

Summarily, it can be deduced from table 2, 3 and 4 that the amount of rainfall and length of rainy seasons is decreasing, while temperature is decreasing. This shows that the farmers in the study areas not only perceived, but are also aware of the variations in these key elements (i.e. rainfall and temperature) of climate.

2.2.1. Farmers' Predictability of Rainfall

Table 5 reveals farmers' predictability of rainfall. Majority (120 i.e. 80%) of the sampled farmers (Ganmo 26.67%, Shao 23.33% and Oyun 30%) generally agreed that it was easy to predict the coming season and the seasons were distinct but now the rains have become more and more unpredictable.

However 27 (18%) of the respondents believed that rainfall is still predictable while 3 (2%) respondents believed that it is highly predictable.

Table 5. *Farmers' Predictability of Rainfall.*

Farmer's Opinion	Ganmo	Shao	Oyun	Total
Highly predictable	3 (2)	0 (0)	0 (0)	3 (2)
Predictable	7 (4.67)	15 (10)	5 (3.33)	27 (18)
Unpredictable	40 (26.67)	35 (23.33)	45 (30)	120 (80)
Highly unpredictable	0 (0)	0 (0)	0 (0)	0 (0)

Percentages are in parentheses
Source: Field Survey, 2013.

2.2.2. Result of the Focus Group Discussion (FGDs)

According to [1], rainfall is the most important climatic variable in agricultural production. In respect to this Focus Group Discussion (FGD) was used to appraise farmers' predictability of rainfall in term of its amount and the length of rainy seasons.

One of the farmers in the Focus Group Discussion at Ganmo admitted

"it is now difficult for us to predict the length of rainy seasons (say between March and November)".

Another farmer added,

"there is now higher incidence of dry spells, which have also increased in intensity".

In Shao one farmer in the Focus Group Discussion highlighted,

"we are now experiencing shorter rainy seasons than before".

Another man in the Focus Group Discussion at Oyun remark,

"it is now difficult us to predict amount of rainfall in a season", he added "there are some trained personnel (weather forecasters) who do predict the amount of rainfall and its length".

2.3. Causes of Climate Variability

This study further assessed farmers' perception about the causes of climate variability as one of the objectives 76% of the sampled farmers (Ganmo 26.67%, Shao 18% and Oyun 31.33%) perceived climate variability purely as God's work. They believed that God meted out punishment on human beings because of our wicked ways. In addition, there is an indication that farmers in Ganmo and Oyun seriously disregard the role played by anthropogenic activities in the increase of climate variability as 6% of the sampled farmers in Shao believed that human beings are the cause of climate variability (See Table 6).

Also from table 6, 12.67% of the sampled farmers (Ganmo 5.33%, Shao 5.33% and Oyun 2%) associated the cause of climate variability to angers of gods. The remaining 5.33% (Ganmo 1.33% and Shao 4%) believed that it is a natural phenomenon. These natural causes were cited as natural changes in winters, low or high temperatures and changes in wind movement, among others.

Table 6. *Causes of Climate Variability.*

Causes	Ganmo	Shao	Oyun	Total
Natural phenomenon	2 (1.33)	6 (4)	0 (0)	8 (5.33)
Human activity	0 (0)	9 (6)	0 (0)	9 (6)
Angers of gods	8 (5.33)	8 (5.33)	3 (2)	19 (12.67)
God's work	40 (26.67)	27 (18)	47 (31.33)	114 (76)

Percentages are in parentheses
Source: Field Survey, 2013.

2.3.1. Effects of Climate Variability on Crop Yield and Farm Income

This section assessed the effects of climate variability on crop yield and farm income. The four major crops produce by the sampled farmers are; Maize, Yam, Cassava and Cowpea. The result of the analysis revealed that 82.67% of the sampled farmers (Ganmo 18%, Shao 31.33% and Oyun 33.33%) are now having low yield despite the fact that all other factors (amount of land cultivated, type of crops grown, type of farming practices etc.) remains constant (See Table 7). This decrease in crop yield was associated to climate variability and this invariably leads to lower income compared to some years back. In addition to this, it can also lead to food scarcity and increase in prices of food. Also from table 7, 15.33% (from Ganmo) admitted that they are still having normal yield because climate variability is not really affecting them, but rather the Fulani's who use their cows to graze on their farmland.

Table 7. *Effect of Climate Variability on Crop Yield and Farm Income.*

Effect	Ganmo	Shao	Oyun	Total
High	0 (0)	3 (2)	0 (0)	3 (2)
Low	27 (18)	47 (31.33)	50 (33.33)	124 (82.67)
Normal	23 (15.33)	0 (0)	0 (0)	23 (15.33)

Percentages are in parentheses
Source: Field Survey, 2013.

2.3.2. Extreme Weather Event on Farm

The extreme weather events noticed by the sampled farmers on their farm is analyzed in this section. The cause of these noticed weather events - flooding, drought and destructive winds is linked to climate variability. The result of the analysis revealed that 48% of the sampled farmers (Ganmo 10.67%, Shao 16.67% and Oyun 20.67%) had experienced drought on their farm, 15 farmers in Shao (this accounted for 10% of the total sampled farmers) experienced destructive winds breaking their cowpea at flowering stage and invariably reducing their crop yield and farm income. 4.67% (Ganmo 2% and Shao 2.67) experienced flooding, while the remaining 29.33% have not noticed anything of such (See Table 8).

Table 8. *Extreme Weather Event on Farm.*

Weather event	Ganmo	Shao	Oyun	Total
Flooding	3 (2)	4 (2.67)	0 (0)	7 (4.67)
Drought	16 (10.67)	25 (16.67)	31 (20.67)	72 (48)
Destructive winds	0 (0)	15 (10)	0 (0)	15 (10)
I don't know	31 (20.67)	6 (4)	9 (6)	44 (29.33)

Percentages are in parentheses
Source: Field Survey, 2013.

2.4. Agricultural Extension Officers and Improved Agricultural Techniques

Agricultural extension officers are intermediaries between research and farmers. They operate as facilitators and communicators, helping farmers in their decision making and ensuring that appropriate knowledge is implemented to obtain the best result. Agricultural extension officers need to communicate to farmers' agricultural information on crops, on how best to utilize the farmland, how to adapt to climate variability, etc. Each agricultural extension officer is linked to one of the agricultural development centres for example Agricultural Development Project Board, Ministry of Agriculture, International Institute of Tropical Agriculture, etc.

Larger percentage of the sampled farmers 58% especially in Ganmo (28%) and Oyun (26%) Agricultural Extension Officers have not been to their community, not to say that they will train them on improved agricultural techniques to adapt to climate variability. 28.67% (Ganmo 2.67%, Shao 18.67% and Oyun 7.33%) admitted that they have been trained once and 11.33% two times majorly on fertilizer application – technique of application, time to apply, type of fertilizer that suite each crops etc. to obtain the best result (See Table 9).

Table 9. *Agricultural Extension Officers and Improved Agricultural Techniques.*

No of times	Ganmo	Shao	Oyun	Total
0	42 (28)	6 (4)	39 (26)	87 (58)
1	4 (2.67)	28 (18.67)	11 (7.33)	43 (28.67)
2	4 (2.67)	13 (8.67)	0 (0)	17 (11.33)
3	0 (0)	3 (2)	0 (0)	3 (2)

Percentages are in parentheses
Source: Field Survey, 2013.

2.5. Improved Agricultural Techniques

Table 10 shows that 19.33% of the total sampled farmers (Ganmo 2.67%, Shao 18% and Oyun 4.67%) have been trained on fertilizer application as a means of adapting to climate variability. It is believed that fertilizer will haste plant growth and increase its productivity if properly applied. 78.67% (Ganmo 30%, Shao 20% and Oyun 28.67%) professed that Agricultural Extension Officers have not trained them any improved agricultural techniques to adapt to climate variability. Some of those farmers added that Agricultural Extension Officers have not been to their community before.

Table 10. *Agricultural Techniques.*

Improved Agricultural Techniques	Ganmo	Shao	Oyun	Total
No technique	45 (30)	30 (20)	43 (28.67)	118 (78.67)
Application of fertilizers	4 (2.67)	18 (12)	7 (4.67)	29 (19.33)
Planting different varieties of crops	1 (0.67)	0 (0)	0 (0)	1 (0.67)
Planting improved seedlings	0 (0)	2 (1.33)	0 (0)	2 (1.33)

Percentages are in parentheses
Source: Field Survey, 2013.

2.6. Coping Strategies to Climate Variability

Climate variability and its impacts have led communities to develop coping strategies such as crop rotation, mulching, increase hectares of land cultivated among others. These coping strategies have been passed from generation to generation through traditional and cultural practices. However these could be improved by agricultural extension officers disseminating current knowledge on adaptation methods to them.

Figure 3 demonstrates strategies adopted by the sampled farmers to cushion the effect of climate variability in their area. 28% of the total sampled farmers adopted planting of different varieties of crops, 7% changed the expanse of land put into crop production and 8% used chemical fertilizers because of the believe that it will go a long way in reducing the effect of climate variability. 5% adopted planting short gestation crops, 7% adopted different planting date, while 18% no adaptation method because some of them lack current knowledge of adapting to climate variability (because of their low level of education) and those that are informed about the modern techniques of coping with climate variability lack the money to acquire these techniques. The remaining 27% believed that nothing can be done by human beings than to pray to God for favourable seasons, they lamented about the rate at which temperature is increasing nowadays and the significant reduction in the amount of rainfall and length of raining seasons.

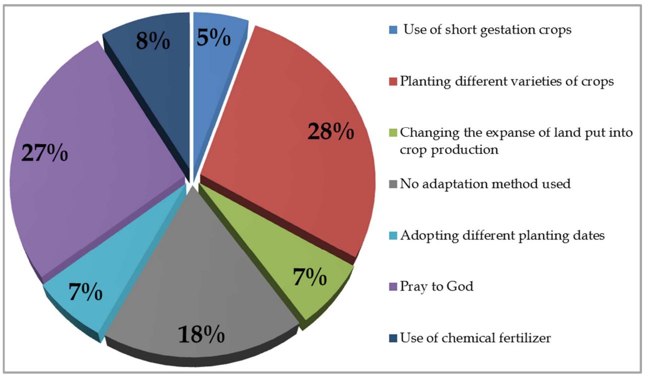


Figure 2. *Coping Strategies to Climate Variability.*

2.7. Pattern of Climatic Variables and Crop Yield for a Period of Ten Years (2002-2011)

This subsection examines the data obtained from Kwara State Agricultural Development Board (KWADP) on pattern of climatic variables and crop yield for 2002 - 2011. Line graphs was used to shows the variation in the climatic variables – rainfall, number of raining days, minimum temperature, maximum temperature and average relative humidity. Production yield of maize, yam, cassava and cowpea under the years reviewed was also represented.

Table 11. *Climatic Data for 2002 – 2011.*

Year	Rainfall (mm)	No of raining days	Temperature (°C) (max)	Temperature (°C) (min)	AVG. Relative Humidity (%)
2002	1028.50	66	36.44	20.30	77.00
2003	811.75	50	31.17	17.50	83.00
2004	1597.40	56	33.33	20.15	82.00
2005	1144.50	55	35.90	23.90	82.50
2006	1236.99	78	36.47	22.79	81.00
2007	1481.63	78	37.08	22.50	78.60
2008	1381.90	60	36.00	22.00	84.00
2009	1526.57	72	38.00	23.40	87.10
2010	1165.70	62	36.00	23.30	87.40
2011	1253.40	59	36.10	22.91	84.42

Source: Kwara State Agricultural Development Project (KWADP)[9]

Table 11 shows the climatic data over a period of ten years while Figures 3 and 4 show the trends of these climatic variables. According to [1], rainfall is the most important climatic variable in agricultural production so rainfall graph was plotted separately.

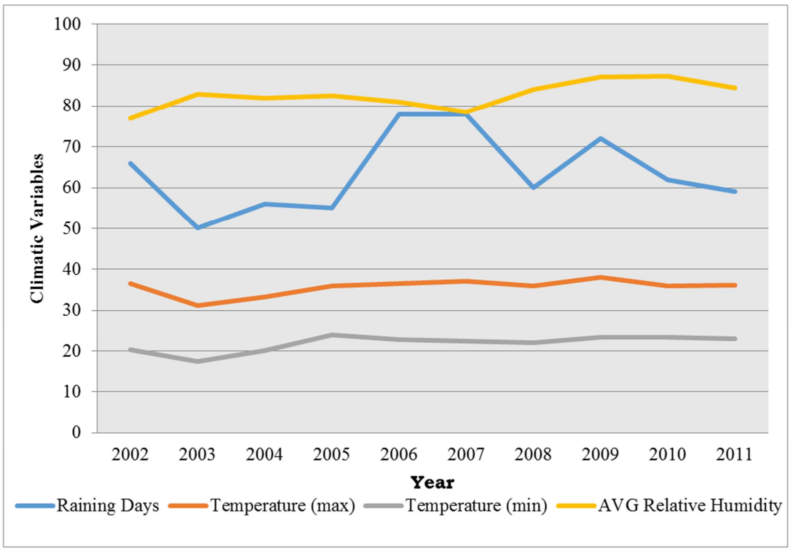


Figure 3. *Line graph for climatic variables.*

Figure 3 reveals that there are variations in the climatic variables tested, but that of raining days is more glaring. 2003 has the minimum number (50) of raining days while 2006 and 2007 has the highest, it falls in 2008 (60) and increased again in 2009 (72). The trends of minimum and maximum temperature are somehow stable between 2004 and 2011. Average relative humidity experienced slight variation between 2003 and 2007 and rise from 2008 to 2010.

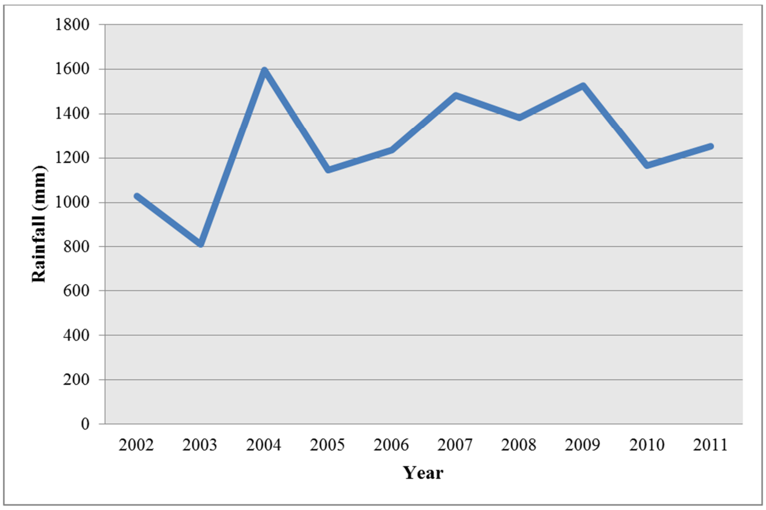


Figure 4. *Line graph for rainfall.*

The amount of rainfall from 2002 to 2011 varies from 811.5mm to 1597.40mm. It dropped from 1028.50mm in 2002 to 811.5mm in 2003 (the lowest in the period), it reached its peak 2004 (1597.40mm) and starts to fluctuate from 2005 (1144.50mm), 2008 (1381.90mm), 2010 (1165.70mm) and 2011 (1253.40mm) See Figure 4.

Table 12 reveals that there are variations in the yield of the sampled crops, while Figure 5 shows the trend of the yield. Cassava which is the leading crop has the highest yield in the year 2008 (17.14), decreased in 2009 (15.97), increase steadily in 2010 and 2011. Yam has its highest output in 2011 (16.80) and lowest output in 2004 (12.21), while there is no much variation in the output of maize and cowpea. The changes were attributed to variations in the climate of the study area. These are illustrated in figure 5.

Table 12. *Crop Production Yield (Tons/Ha) in '000 (2002 – 2011).*

Year	Maize	Yam	Cassava	Cowpea
2002	1.30	12.33	12.94	0.14
2003	1.47	10.86	12.56	0.17
2004	1.25	11.70	12.21	0.13
2005	1.35	11.63	12.46	0.25
2006	1.58	11.85	15.28	0.26
2007	1.37	11.66	16.99	0.44
2008	1.43	12.46	17.14	0.40
2009	1.50	12.46	15.97	0.45
2010	1.47	12.53	16.48	0.43
2011	1.49	13.14	16.80	0.46

Source: Kwara State Agricultural Development Project (KWADP)[9]

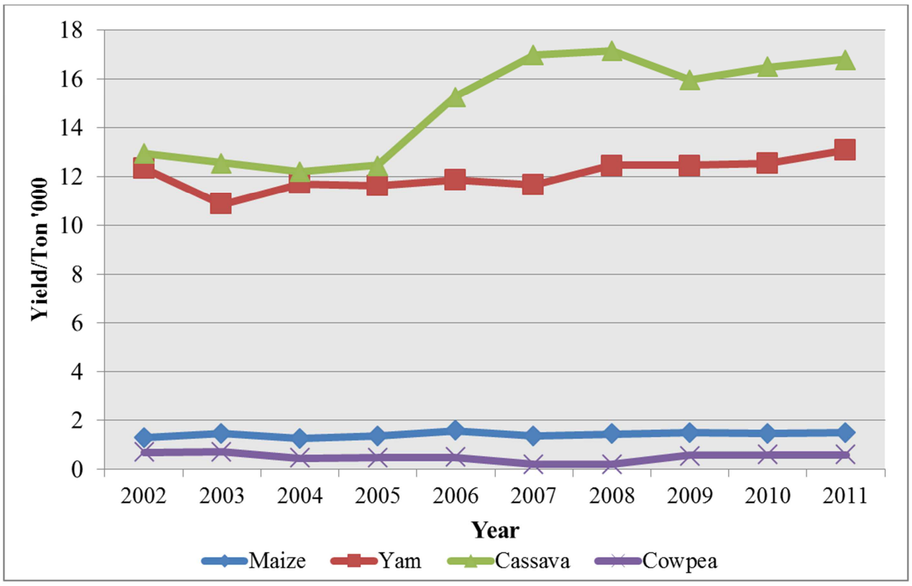


Figure 5. *Line graph showing crop yield (2002 - 2011).*

2.8. Multiple Regression Analysis for Crop Yield and Climatic Variables

Multiple Regression analysis was employed to determine the percentage contribution of each of the climatic variables to crop yield.

The regression equation is: $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + e$

Where Y = Crop yield, X_1 = Rainfall, X_2 = Raining Days, X_3 = Maximum Temperature, X_4 = Minimum Temperature, X_5 = Relative Humidity, X_6 = Number of raining days, e = error term, a = intercept i.e. the value of 'y' when $x_1x_2 \text{-----} x_n$ are zero $b_1b_2 \text{-----} b_n$ = gradient of the multiple regression line.

Correlation analysis is use to assess the relationship between climatic data and crop yield. The correlation coefficient analysis (Table 13) employed for the study reveals that maximum temperature is positively and highly correlated with yam (0.640) and cassava (0.610), minimum temperature is highly and positively correlated with yam (0.572) and cassava (0.558). This means that increase in maximum and minimum temperature will of the study area may lead to a higher yield for yam and cassava. Number of raining days is positively correlated with cassava (0.515), this means that increase in the number of raining days may lead to a higher yield for cassava. Relatively humidity is correlated with maize, this shows that there is a strong positive correlation between relative humidity and maize yield i.e. increase in relative humidity of the study area may lead to a higher yield for maize.

Other climatic variables are positively but weakly correlated with the crops under study except rainfall and maize (-0.187) and cowpea (-0.636) which are negatively correlated. This means that the higher the rainfall, the lower the yield of maize and cowpea i.e. excessive rainfall is not good for maize and cowpea. Raining days and cowpea (-0.328), maximum temperature and cowpea (-0.328) and minimum temperature and cowpea (-0.363) are negatively correlated. This means that the more the raining days and the higher the maximum and minimum temperature, the lower the yield of cowpea i.e. raining days, maximum and minimum temperature are not good for cowpea.

Table 13. *Correlation Analysis of Climatic Variables and Crops.*

Crop	Rainfall (mm)	Raining Days	Temperature (max)	Temperature (min)	AVG Relative Humidity
Maize	-0.187	0.310	0.199	0.278	0.515
Yam	0.302	0.193	0.640	0.572	0.350
Cassava	0.380	0.515	0.610	0.558	0.357
Cowpea	-0.636	-0.328	-0.328	-0.363	0.134

Source: Researchers' computation. Correlation is significant at the 0.05 level (2-tailed).

The regression analysis computed for the crops revealed that maize, yam, cassava and cowpea have coefficient of determination of Table 0.80, 0.66, 0.55 and 0.52 respectively. This means that 80, 66, 55 and 52% of the variance in maize, yam, cassava and cowpea can be respectively explained by the climatic parameters investigated (Table 14). The implication of this is that 20, 34, 45 and 48% of the variance in maize, yam, cassava and cowpea can be respectively explained by other factors such amount of land cultivated, type of farming practices, soil fertility, etc. This is in support of [6] and [7] findings.

Table 14. *Regression Analysis.*

Crop	R	R^2	Standard Error	F	P-Value
Maize	0.892	0.796	68.78785	3.118	0.147
Yam	0.813	0.661	562.59044	1.563	0.343
Cassava	0.744	0.554	2094.01789	0.992	0.518
Cowpea	0.721	0.520	180.80840	0.867	0.571

Source: Researchers' computation.

3. Summary

The study found a positive relationship between rainfall, raining days, maximum temperature, minimum temperature and average relative humidity and output of yam and cassava. Maize is inversely related to rainfall, but has positive relationship with other elements of climate aforementioned while cowpea is inversely related to rainfall, raining days, maximum temperature and minimum temperature but positively related with average relative humidity. However, the sampled climatic elements; rainfall, raining days, maximum temperature, minimum temperature and average relative humidity, were found to be significant determinants of crop outputs.

It was also observed that climate variability and its impacts have led communities to develop coping strategies such as farmers planting of different varieties of crops, changing the expanse of land put into crop production, use of chemical fertilizers, planting short gestation crops etc. because of the believe that it will go a long way in reducing the effect of climate variability.

4. Conclusion

Climate variability has been seen to have significant effect on crop production based on farmers' perception. This is because their agricultural yield has decreased from what it used to be some ten years ago. This has also affected their income because agriculture is climate dependent. The effect of which is more pronounced whenever there are variations in these climatic elements – rainfall, raining days, minimum temperature, maximum temperature and average relative humidity. It can therefore be concluded that the effect of climate variability can be reduced if farmers are been educated on the causes and current methods of adaptation.

Recommendations

The knowledge and information gap concerning the causes of climate variability, effect, information dissemination, awareness programmes and training programmes calls for immediate action. Therefore, the following recommendations are made based on the findings of the study:

a) Farmer should be more enlightened about the causes of climate variability, most especially on the human induced ones such as - industrial and agricultural practices including animal husbandry, forest and grassland clearing and burning, lumbering, fuel wood and charcoal extraction, oil extraction, burning of fossil fuel, etc.
b) Policies must aim at promoting farm-level adaptation through emphasis on the early warning systems and disaster risk management and also, effective participation of farmers in adopting better agricultural and land use practices.
c) There is an urgent need for meteorological reports and alerts to be made accessible when necessary to farmers in an understandable form.
d) Massive campaign on the reality of climate variability, its impacts on food crop production and modern adaptation measures is highly recommended. This could be achieved by organizing seminars on climate variability regularly for them.
e) Extension services should be more improved in the study area. This is with the aim of educating the farmers on the suitable coping strategies on climate variability.

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