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PERCEIVED EFFECTS OF CLIMATE CHANGE ON VEGETABLE PRODUCTION AMONG WOMEN FARMERS IN KWARA STATE, NIGERIA.

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ABSTRACT

Women are key players in the agricultural sector of most developing countries of the world, with vegetable being a common crop they cultivate. Vegetables are one of the best resources for overcoming micronutrient deficiencies and providing smallholder farmers with much higher income per hectare than other staple crops. A significant change in climate on a global scale will impact vegetable cultivation and agriculture as a whole. This study assessed the perceived effect of climate change on vegetable production among women farmers in Asa Local Government Area of Kwara State that is known predominantly for vegetable production. Five communities were randomly selected while 156 women were randomly selected from a list of registered women farmers in the study area. Structured interview schedule was used to obtain information from the women on their experiences and climate change impacts on vegetable production. Data were analysed using descriptive and inferential statistics such as frequency counts, percentages, Chi-square and Pearson Product Moment Correlation (PPMC). The study revealed that the women are involved in production of various vegetables such as amaranth, cochorus, celosia, bitter leaf, water leaf, tomatoes, pepper, pumpkin and okro. Respondents reported noticeable changes in the rainfall pattern which has resulted in the women adopting various strategies to cope with the situation. Early planting (28.8%), irrigation (50.6%) and planting many vegetables instead of one (16.0%) were some of the coping strategies the women engaged on their vegetable farms. Majority (95%) of the women perceived climate change as a huge challenge and opportunity to learn more about their environment.

Keywords: coping strategies, smallholder farmers, environment, vegetable farms

INTRODUCTION

Agriculture is an important sector in Nigeria as it provides employment for over 60 percent of the entire population. This population operates subsistence agriculture which is almost entirely weather dependent (Sofoluwe et al., 2011). Women play an important role in food production, producing between 60 and 80 per cent of the food in most low-income countries.Women often engage in vegetable production amongst other crops to make ends meet. Moreover, the worsening condition of climate change adversely affect vegetable production yield.The declining productivity of agricultural crops and food wastes had been traced to adverse climatic change and variability.

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Climate change is one of the most serious environmental threats facing mankind worldwide. It affects agriculture in several ways, including its direct impact on food production. Climate change, which is attributable to the natural climate cycle and human activities, has adversely affected agricultural productivity in Africa (Ziervogel et al. 2006). Available evidence shows that climate change is global, likewise its impacts; but the most adverse effects will be felt mainly by developing countries, especially those in Africa, due to their low level of coping capabilities among which Nigeria belong (Nwafor 2007; Jagtap 2007; Odjugo, 2010). As the planet warms, rainfall patterns shift, and extreme events such as droughts, floods, and forest fires become more frequent (Zoellick 2009), which results in poor and unpredictable yields, thereby making farmers more vulnerable, particularly in Africa (UNFCCC, 2007). Farmers, who constitute the bulk of the poor in Africa, face challenges of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases (Zoellick, 2009). It is projected that crop yield in Africa may fall by 10-20% by 2050 or even up to 50% due to climate change (Jones and Thornton, 2003), particularly because African agriculture is predominantly rain-fed and hence fundamentally dependent on the vagaries of weather. As the people of Africa strive to overcome poverty and advance economic growth, this phenomenon threatens to deepen vulnerabilities, erode hard-won gains and seriously undermine prospects for development (Zoellick 2009). There is therefore the need for concerted efforts toward tackling this menace.

Agriculture interventions considered 'climate smart' should be harnessed to address problems of exacerbating climate change. It is important to understand the gender dimensions of climate change when considering appropriate climate smart agriculture. Climate-smart agricultural practices have the potential to increase farmers' productivity and resilience, reduce or remove greenhouse gases, and enhance achievement of food security and development goals. The best technological innovations, management practices and interventions contribute both to climate change adaptation and mitigation (Jost et al, 2013).

Mubaya et al(2010), note that the impact of climate change is two-fold, bio-physical and socio-economic.Bio-physical impacts include rising sea waters, more frequent and intense storms, extinction of species, worsening drought, crop failure,as well as changes in cloud cover and precipitation, melting of polar ice caps and glaciers, and reduced snow cover (Mendelsohn and Dinah, 2005; UNDP, 2004; UNFCCC, 2007). The environmental degradation caused by bio-physical impacts creates socio-economic impacts. This is mainly on the agricultural sector where areas suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas are expected to decrease (Mubaya et al., 2010). This consequently, affects small scale subsistence farmers in terms of productivity, food security and family income. Climate change is therefore expected to have a significant impact on the livelihoods of the rural poor in developing countries.

According to World Bank (2015) women are key players in the agricultural sector, yet compared to men, they own fewer assets and have access to less land, fewer inputs, and fewer financial and extension services and more prone to adverse effects of worsening climate change'. Assessing whether the women vegetable farmers consider change in climate as a threat to their vegetable production, that is, their perception about the effect of climate change on their vegetable production is crucial to understanding intervention approaches to addressing the problem of low

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yield, incidence of pests and diseases, heat and cold stress associated with vegetable production. Understanding coping strategies they employ to survive this critical condition is as well vital. The study, therefore aimed at assessing the perceived effects of climate on vegetable production among women farmers in Kwara state.

1.1 Objectives of the Study:

The main objective of the study is to investigate the perception of women farmers on the effects of climate change on vegetable production in Kwara State, Nigeria.

The specific objectives are to:

1. Describe the socioeconomic characteristics of women vegetable farmers in the study area.
2. Identify coping strategies employed by women vegetables farmers on climate change effects
3. Determine the perception of women about the effect of climate change on vegetable production.

1.2 Research Hypotheses:

1. There is no significant relationship between socioeconomic characteristics of women farmers and perceived effects of climate change on vegetable production.
2. There is no significant relationship between coping strategies employed by women farmers and perceived effects of climate change on vegetable production.

2.0 Methodology:

2.1 The Study Area: The study was conducted in Kwara State, Nigeria. Kwara State is located in the North Central Geographical Zone of Nigeria within latitudes 70 45'N and 90 30'E and 6o 25'E. It covers a total land area of about 36,825 square kilometers. The state comprises of 16 Local Governments Areas (LGA's) which are further grouped by Kwara State Agricultural Development Project (KWADP) into four zones. The topography is mainly plain to slightly gentle rolling lands. The annual rainfall ranges between 1000mm and 1500mm. Average temperature ranges between 300C and 350C. It also has an estimated figure of 203,833 farm families with the majority living in the rural areas.

2.2 Population and Study Sample: The population for this study comprises of all women vegetable farmers in Kwara State. A multi-stage sampling technique was used to select the respondents in the study area. Firsty, Zone C, which fell within Kwara Central Senatorial District and made up of five local government areas namely; Ilorin West, Ilorin East, Ilorin South, Moro and Asa, was purposively selected for the study due to the predominance of women farmers who grow vegetable crops in abundance in Kwara state. Secondly, Asa LGA which has the largest women vegetable farmers in the zone was selected. Thirdly, five communities were randomly selected from Asa local government area, they were; Otte, Lasoju, Idi-Emi, Ogele and Bala. According to information obtained from the extension agents working in the area, the population of women vegetable farmers in the various communities is as shown in Table 1.At the final stage, fifty percent (50%) of women vegetable farmers were randomly selected from each community to give a total sample size of 156 respondents. Data were collected with the use of structured interview schedule between March and April, 2017.

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TABLE 1: STUDY POPULATION AND SAMPLE

Community	Population of women vegetable farmers	Sample (50%)
Otte	63	31
Lasoju	74	37
Idi-Emi	55	28
Ogele	54	27
Bala	66	33
Total	312	156

3.0 RESULTS AND DISCUSSION:

The socioeconomic characteristics of women farmers are presented in Table 2. A high percentage of them (69.2%) are in their productive years (31-50years). Though some are younger (12.8%) and a few of them are old (3.3%). This shows that women of various age categories are involved in vegetable production. Most of the women are married (64.1%) some are widows while few of them are single. Marriage is seen as a stage of responsibility whereby women are expected to have a means of livelihoods to cater for their households. Vegetable production is a major source of livelihood for women in Asa local government area. More than half (51.9%) of the women farmers had no formal education while some of them had primary (31.34%) and secondary (12.2%) education. Many of the women had large families of 4-6 children (43.6%) and 7-9 children (20.5%). This requires that they should have a source of income to support their families and the children too assist their parents on the farm or to market vegetable products. Most of the women (66.1%) have been involved in vegetable production for more than seven years 25.6% have been engaged in vegetable production for 4-6years while 8.3% have been engaged in vegetable production for 1-3years. This is an indication that these women had a wealth of experience in vegetable production practices and adaptation strategies to weather and climate fluctuations in the area.

TABLE 2: SOCIOECONOMIC CHARACTERISTICS OF RESPONDENTS (n=156)

Variables	Frequency	Percentage
Age (years)		
Below 30	20	12.8
31-40	41	26.3
41-50	67	42.9
51-60	23	14.7
61-70	5	3.3
Marital status		
Single	11	7.1
Married	100	64.1
Widow	45	28.8
Education background		

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No formal education	81	51.9
Primary education	49	31.4
Secondary education	19	12.2
Adult education	3	1.9
Quranic education	4	2.6
Number of children		
1-3	56	35.9
4-6	68	43.6
7-9	32	20.5
Years of vegetable production		
1-3years	13	8.3
4-6years	40	25.6
7-9years	61	39.1
10 years and above	42	27.0

Source: Field Survey 2017

Table 3 shows the various type of vegetable grown by women in Asa local government and the number of times each were produced annually. It can be observed that majority of the women (about 80%) produced Amaranthus, Celosia and Chorcorus (leafy vegetables) more than three times in a year. Fruit vegetables such as Okro, Tomatoes,Rodo pepper and Tatase were grown at least twice or three times a year. Other vegetables grown by the women include; water leaf and bitter leaf which are also produced all year round depending on the prevailing situation and individual woman's experience in vegetable production.

TABLE 3: TYPES AND FREQUENCY OF VEGETABLE PRODUCTION BY RESPONDENTS PER GROWING SEASON (n=156)

Variable	Once F (%)	Twice F (%)	Three times F (%)	More than thrice F (%)
Amarantus	7 (4.5)	22 (14.1)	5 (3.2)	122 (78.2)
Celosia	16 (10.3)	11 (7.0)	3 (1.9)	126 (80.8)
Chocorus	9 (5.8)	14 (9.0)	11 (7.0)	122 (78.2)
Okro	5 (3.2)	42 (26.9)	88 (56.4)	21 (13.5)
Tomatoes	3 (1.9)	48 (30.8)	77 (49.4)	28 (17.9)
Bitter leaf	27 (17.3)	29 (18.6)	62 (39.7)	38 (24.4)
Water leaf	15 (9.6)	36 (23.1)	45 (28.8)	60 (38.5)
Rodo pepper	3 (1.9)	43 (27.6)	68 (43.6)	42 (26.9)
Tatase	10 (6.4)	30 (19.2)	72 (46.2)	44 (28.2)

Source: Field Survey 2017

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Table 4 shows the result on noticeable changes over the years as observed by women in Asa local government area in the last ten to fifteen years. Most of the women (70.5%) indicated that every year there is lateness in the onset of rain. This could have a negative influence of vegetable production since Nigeria agriculture is mostly rain fed. Another change in weather condition as observed by the women is that the rain is not enough. This happens every year (34.0%) or once in 2 years (58.9%) which may also affect their level of vegetable production because it is dependent on availability of rain. More than half of the women (53.9%) also observed that once in every 2years the rain is too much than what is expected. This could result in flooding, weed problems and incidence of diseases and pests on their vegetable farms. Some of the women also indicated too much heat/high temperature in the area; every year (41.7%) and once in 3 years (44.2%). This could affect the production of crops that suffer heat stress such as tomatoes.
Other noticeable changes as indicated y the women include; Too much cold (57.7%), Long dryness (53.8%), Strong wind (53.2%), Heavy storm (46.8%) and Flooding (60.9%). All these have their various effects on the women's productivity and vegetable production generally because vegetables are sensitive crops that react to the slightest change in weather conditions.

TABLE 4: NOTICEABLE CHANGES AND HOW OFTEN THE CHANGES OCCUR (n=156)
Source; Field Survey 2017

Noticeable changes in weather	Every year F (%)	Once in 2 years F (%)	Once in 3 years F (%)
Late in the onset of the rain	110 (70.5)	40 (25.6)	6 (3.9)
Not enough rain	53 (34.0)	92 (58.9)	11 (7.1)
Too much rain	52 (33.3)	84 (53.9)	20 (12.8)
Too much heat/high temperature	65 (41.7)	22 (14.1)	69 (44.2)
Too much cold	25 (16.0)	90 (57.7)	41 (26.3)
Long dryness	26 (16.7)	84 (53.8)	46 (29.5)
Strong wind	83 (53.2)	42 (26.9)	31 (19.9)
Heavy storm	38 (24.4)	73 (46.8)	45 (28.8)
Flooding	30 (19.2)	95 (60.9)	31 (19.9)

The effects of changes in weather condition and their level of severity on vegetable production are presented in Table 5. More than half of the women (66.0%) indicated low production as severe while 28.9% said it is very severe. This means that climate has resulted in low production for the women vegetable farmers. This would have affected their income and livelihoods which is in line with Mubaya et al(2010), that climate change has both biophysical and socioeconomic implications that affect small scale subsistence farmers in terms of productivity, food security and family income. Many of the women (62.8%) also indicated inability to grow vegetables at the right time as a severe effect of climate change in the area. As disused earlier in Table 4, lateness in the onset of rain is one the observable changes reported by the women. This would affect their time of planting and it will also shorten the length of growing season thereby

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reducing the women's productivity. Inability to produce round the year as before (61.5%) is another severe effect of climate change as indicated by the women. This could be as a result of dry spells and heat/high temperatures that are sometimes experienced in the area. Another severe effect of climate change as indicated by most the women (69.2%) is scarcity or non-availability of water. This is also a resultant effect of inconsistent/ insufficient rainfall, droughts and dry spells. A high percentage of the women (62.8%) also reported the incidence of insect pests as a severe effect of climate change while 40.4% of them reported diseases as severe. High/too much rain leads to high humidity which favours the breeding of many insect pests and diseases. This can lead to severe losses to vegetable and other crop farmers in the area.

TABLE 5: EFFECTS OF THOSE CHANGES ON VEGETABLE PRODUCTION (n=156)

Effects of climate change	Very severe F (%)	Severe F (%)	Not severe F (%)
Low production	45 (28.9)	103 (66.0)	8 (5.1)
Unable to grow at the right time	35 (22.5)	98 (62.8)	23 (14.7)
Unable to produce round the year as before	34 (21.8)	96 (61.5)	26 (16.7)
Non availability of water	32 (20.5)	108 (69.2)	16 (10.3)
Insect pests	32 (20.5)	98 (62.8)	26 (16.7)
Diseases	16 (10.3)	63 (40.4)	77 (49.3)

Source; Field Survey 2017

Results from Table 6 shows that 28.8% of the women engaged in early planting to minimize the effect of climate change. This could mean that they begin their planting operations immediately after the first rain without waiting for the rains to be fully established. This will enable them to take advantage of the early rains to plant in case there is a dry spell, they will water the crops through irrigation. More than half of the respondents (50.6%) employed irrigation process to minimize the effect of climate change. This involves artificial supply of water to their crops either from wells, boreholes or nearby stream and rivers. Due to inconsistent rainfall, scarcity of water is a major problem indicated by the women in the study area. Other coping strategies employed by the women include; mulching (1.3 %), planting at the onset of rain (3.2 %) and planting many vegetables instead of only one (16.0%). Mulching helps to maintain soil moisture by reducing evaporation thereby keeping the soil moist and making nutrients available to the crops. It also prevents direct contact of sunshine and rain drops to the soil keeping out excess heat and reducing runoff that can cause erosion. Planting different types of vegetables enables the women to identify which ones adapt better to the prevailing weather condition. It also prevents too much loss in case some crops did not do well.

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TABLE 6: WOMEN FARMERS COPING STRATEGIES ON CLIMATE CHANGE (n=156)

Variables	Frequency	Percentage
Early planting	45	28.8
Irrigation	79	50.6
Mulching	2	1.3
Planting at the onset of rain	5	3.3
Planting many vegetables instead of only one	25	16.0

Source; Field Survey 2017

PERCEPTION OF WOMEN FARMERS ON CLIMATE CHANGE EFFECTS

Result on Table 7 reveals that majority of the women (96.2%) were of the opinion that climate change has reduced vegetable production in the study area. This is an indication that climate change has a negative impact on vegetable production of the women farmers. Majority of the women (97.4%) also agreed to the fact that some vegetable are not doing well as a result of climate change. This shows that the women were able to identify crops that are not doing well and those that adapt to prevailing weather conditions. Most of the women (69.8%) were in support of the statement that climate change has enabled them to identify other crops that can grow in this area. As shown in earlier discussion (Table 6) women decided to plant many vegetables in a bid to minimize the effect of climate change and this has enabled them to identify which of them performs better in the area. Majority of the women (93.0%) were of the opinion that they earn more income as a result of growing many types of vegetables. Growing many vegetables prevent the women from losing much as a result of crop failure thereby maintaining/improving their source of income. Most of the women (87.9%) agreed to the fact that climate change has resulted in high incidence of pest on the vegetable farms. A high percentage of the women (77.5%) were also of the opinion that there is increase in disease attack on vegetable farms as a result of climate change. High rainfall and increased temperature which are common features of climate are favourable conditions for the buildup of pests and diseases. Almost half of the women (42.3%) were uncertain about the fact that climate change is favorable to the practices of organic agriculture while 11.5% disagreed. This could mean that women in the area have not been exposed to the practices of organic agriculture. Majority of the women (91.7%) agreed to the fact that climate change has resulted in the reduction of chemical use on the farm in the study area. Most of the women (89.1%) also supported the statement that they gained more knowledge as a result of climate change. The women were able to learn more about their environment and the crops they can grow that will do well. More than half of the women (56.4%) were of the opinion that climate change has made vegetable production more

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interesting/enjoyable to the farmers. This could be due to the fact they were able to experiment with many vegetable crops and observe them learning more about their farming practices.

TABLE 7: PERCEPTIONS OF WOMEN FARMERS ON CLIMATE CHANGE EFFECTS (n=156)

Statement	SA	A	U	D	SD
1. Climate change has reduced my vegetable production	53 (34.0)	97 (62.2)	5 (3.2)	1 (0.6)	
2. Some vegetables are not doing well as a result of climate change	45 (28.8)	107 (68.6)	3 (2.0)	1 (0.6)	
3. Climate change has enabled me to identify other crops that can be grown in this area	35 (22.4)	74 (47.4)	38 (24.4)	7 (4.5)	2 (1.3)
4. My income has increased as a result of growing many types of vegetables	52 (33.4)	93 (59.6)	9 (5.8)	1 (0.6)	1(0.6)
5. Climate change results in high incidence of pests on the vegetables farms	28 (18.0)	109 (69.9)	13 (8.3)	5 (3.2)	1 (0.6)
6. Diseases attack on the vegetables farms has increased as a result of climate change	23 (14.7)	98 (62.8)	25 (16.1)	5 (3.2)	5 (3.2)
7. Climate change is favorable to the practice of organic agriculture	31 (19.9)	41 (26.3)	66 (42.3)	18 (11.5)	
8. Climate change has resulted in the reduction of chemical use on the farm	16 (10.3)	127 (81.4)	10 (6.4)	3 (1.9)	
9. I gained more knowledge on vegetable production as a result of climate change	48 (30.8)	91 (58.3)	11 (7.1)	5 (3.2)	1 (0.6)

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10. Climate change has made vegetable production more interesting/enjoyable to farmers	44 (28.2)	44 (28.2)	15 (9.6)	37 (23.7)	16 (10.3)

Source; Field Survey 2017

3.1 Research hypothesis 1: There is no significant relationship between socioeconomic characteristics of women farmers and perceived effects of climate change on vegetable production.

Chi-square analysis of relationship between women farmers' selected socio-economic characteristics and perceived effects of climate change on vegetable production is shown in Table 8. From the Table, it can be observed that women farmers' marital status was significantly related to their perceived effects of climate change on vegetable production while religion was not significantly related.

Table 8: Chi-square analysis of relationship between women farmers' selected socio-economic characteristics and perceived effects of climate change on vegetable production.

Variables	Chi-square value	Df	P	Contingency Coefficient	Decision
Maritalstatus	16.227	6	0.013*	0.38	S
Religion	3.017	6	0.807	1.167	NS

*Significant at $p<0.05$

Table 9 shows the Pearson Product Moment Correlation analysis of relationship between women farmers' other socio-economic characteristics and perceived effects of climate change on vegetable production. It can be seen from the table that age, academic qualification and farming experience are not significantly related to perceived effects of climate change among women vegetable farmers in Kwara state Nigeria. The result here implies that, age, academic qualification and farming experience do not have significant impact on women farmers' knowledge about the effects of climatic variation on vegetable production, and as a result, they might not likely be able to adapt and cope with these effects of climate change.

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Table 9: PPMC table showing analysis of relationship between women farmers' other socio-economic characteristics and perceived effects of climate change on vegetable production.

Variables	r-value	p-value	Decision
Age	0.050	0.536	NS
Academic qualification	-0.153	0.059	NS
Farming experience	0.050	0.536	NS

*Significant at p<0.05

Research hypothesis 2: There is no significant relationship between coping strategies employed by women farmers and perceived effects of climate change on vegetable production.

Chi-square analysis of relationship between women farmers' coping strategiesand perceived effects of climate change on vegetable production is shown in Table 10. The table reveals a significant relationship between women farmers' coping strategiesand perceived effects of climate change on vegetable production. This is an indication that their level of perception will affect the coping strategies employed by the women.

Table 10:Chi-square analysis of relationship between coping strategies employed by women farmers and perceived effects of climate change on vegetable production.

Variables	Chi-square value	Df	P	Contingency Coefficient	Decision
Copingstrategies	80.739	10	0.000*	1.439	S

*Significant at p<0.05

4.0 CONCLUSION AND RECOMMENDATIONS:

It can be concluded from the findings of this study that women farmers in Kwara state were conscious of climatic changes in their environment. They have also noticed its impact on their vegetable production and have designed ways of coping with the adverse effects of climate change. Some of the coping strategies include; early planting, irrigation and planting many vegetables instead of one.The following recommendations are therefore suggested:

1. Women farmers should be assisted in the procurement of inputs such as improved seeds (pest and diseases resistant varieties, early maturingand climate resilient varieties),irrigation facilities and more reliable credit sources.
2. The women also need more enlightenment on climate smart agricultural practices to enable them cope better with worsening climate change effects.

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