Agricultural Journal 7 (5): 339-342, 2012
ISSN: 1816-9155

Climate Change and Cropping Techniques among Farmers in Oyo State: Implications for Extension Systems

R.G. Adeola, F.A. Kuponiyi and O.O. Adebayo
Department of Agricultural Economics and Extension,
Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State, Nigeria

Abstract: Many developing countries Nigeria inclusive remain heavily dependent on agriculture for food production. However, the coping capacity of the peasant farmers that produce the bulk of the food for the teaming population of Nigeria is limited by both resources and lack of knowledge. Any effort that helps to reduce the vulnerability of this sector to climate related risks is likely to result in considerable economic and social benefits for the entire population. This study investigated the cropping techniques adapted by farmers to mitigate risks associated with seasonal climate change in Oyo state. Shifting planting dates, changing crop varieties and other cultural practices were among the various techniques used to cope with seasonal climate change by farmers. The study therefore recommended that deliberate efforts be taken to first document what farmers are doing and work towards their improvement. Hence, the need for extension to develop an integrated programme that includes strategies which are technically sound and affordable.

Key words: Climate change, cropping techniques, extension systems, implications, strategies, Nigeria

INTRODUCTION

Nigerian agricultural sector is vulnerable to climate change and thus the need for farmers to adjust their practices to either mitigate the deleterious effects of climate change or take full advantage of the change and adapt it to crop growth. The developing countries are likely to be worst hit by the impacts of climate change considering the current degradation of natural resources; poor access to technologies and low investments in production. According to the Intergovernmental Panel on Climate Change (IPCC, 2001), billions of people in developing countries will face changes in rainfall patterns that will contribute to severe water shortages or flooding and rising temperatures that will cause shifts in crop growing seasons. Climate change is likely to result in food insecurities, especially for the resource poor who cannot meet their food requirements through market access in developing countries (FAO, 2008).

Extreme weather events, such as spells of high temperature, heavy storms or droughts can severely disrupt crop production. The resulting effects depend on current climatic and soil conditions, the direction of change, availability of resources and infrastructure to cope with change (Olesen and Bindi, 2002). Rain fed agriculture has been the norm in many developing countries where a good rainy season means good crop production, enhanced food security and a healthy economy. However, failure of rains could lead to crop failures, food insecurity, famine and negative national economic growth (Sivakumar and Motha, 2007). Agriculture has to find new balances between producing food, managing natural resources and providing a livelihood base for the rural population. To meet this challenge, farmers need to integrate vast amount of information on externalities that are constantly changing. The information needs to be understood well enough to take advantage of the situations in which externalities interact. For example, farmers' choice of appropriate crop that will take full advantage of abundant or deficient) soil water (Tanaka *et al*., 2007). Farmers should possess the ability to reduce the negative effects of climate change and exploit possible positive effects using several agronomic adaptation strategies. Different agronomic strategies for agriculture have been suggested in order to reduce the negative effects and exploit the positive effects of climate change. These strategies include both short term adjustments and long term adaptations.

Example of short term adjustments are changes in planting dates, fertilizer use and varieties while long term adaptations refer to major structural changes to overcome adversity caused by climate change. This involves changes of land use to stabilize production and crop substitution for the conservation of soil moisture.

Corresponding Author: R.G. Adeola, Department of Agricultural Economics and Extension,
Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State, Nigeria

The development and dissemination of management practices that are best adapted to seasonal climate change should be the focus of research and extension. It is imperative for extension to understand farmers' perceptions, attitudes, cropping systems and decision-making information with respect to climate change for the development of appropriate adaptations and mitigation strategies. The overall objective of this study was to address the vast array of information on potential adaptive responses of cropping techniques to climate change and provide necessary information for extension to design programmes that will enable farmers to remain sustainable in ever changing environment. The specific objectives were to:

- Identify the existing cropping techniques adapted by the farmers to cope with climate change in the study area
- Identify crop mixtures grown in the study area
- Examine the existing interactions of climate change with cropping techniques
- Identify the challenges and opportunities for the development of climate change extension programme

MATERIALS AND METHODS

The study was carried out in Oyo state, Nigeria. It is in latitude 6°55'-8°45'N and longitude 2°50'-3°56'E in South-Western Nigeria. The climate is equatorial characterised with both dry and rainy seasons. Rainy season is from April to October while the dry season starts from November to March. The mean annual temperature is 21°C while the annual rainfall ranges from 1000-1500 mm. The wet season is between 230-260 days year^{-1}. However, available data showed that rainfall in Saki zone had decreased by 3.1% in the last 2 decades while the temperature also decreased by 65% within the same period (FAO, 2008).

The state share boundaries with Kwara state in the North, Ogun state in the South, Osun state in the East and Benin Republic in the West. The state has a vegetation pattern of rain forest in the South and Guinea savannah in the North. Maize, yam, cassava, sorghum, pepper and tomato are the popular food crops grown in the area. The cash crops include cocoa, oil palm, cashew and kola nut. Oyo state is divided into 4 agricultural zones namely, Ibadan/Ibarapa, Oyo, Saki and Ogbomoso zones by the Oyo State Agricultural Development Programme (OYSADEP). Each zone is divided into blocks which correspond to local government areas demarcation. A multi-stage sampling technique was used in selecting respondents for this study. Two agricultural zones; Ibadan/Ibarapa (Rain forest) and Saki (Guinea savannah) representing different agro-ecological zones were purposively selected for the study. Three blocks were selected from each zone representing about thirty percent of the total blocks in the two zones. From each of the six blocks, two cells were randomly selected making a total of twelve cells and one village (cell headquarters) from each cell were further selected. The list of registered crop farmers was collected from the OYSADEP and 30 farmers were randomly selected from each village to arrive at a total of 360 respondents. Descriptive statistics were used to describe the data

RESULTS AND DISCUSSION

The mean age of the farmers was 43.7 years with majority (79%) ranges between 31 and 50 years indicating that most of the farmers were young and active. Majority (85%) of the respondents are married and 60% of them completed primary education. The percentage of illiterate farmers was 25%. The high literacy level is likely to make them more responsive to adaptation strategies against climate change. About 85% of the farmers were male while only 15.3% were female reflecting the predominant role of male farmers in farm decision making (Table 1). Farmers in the study area cultivated 2.8 ha on the average showing that they were small scale farmers. The mean years of farming experience was 15.4 years.

Table 1: Demographic characteristics of the respondents (N = 360)

Variables	Frequency	Percentage
Age		
<30	54	15.0
31-40	162	45.0
41-50	122	34.0
>50	22	6.0
Marital status		
Single	48	13.3
Married	306	85.0
Widowed	6	1.7
Educational level		
No formal education	90	25.0
Adult education	24	6.7
Primary	216	60.0
Secondary	24	6.7
Tertiary	6	1.6
Gender		
Male	305	84.7
Female	55	15.3
Farm size (ha)		
<1	12	3.3
1-2	84	23.4
3-4	252	70.0
>5	12	3.3
Farming experience (years)		
<5	36	10.0
5-10	96	26.7
11-15	102	28.3
16-20	42	11.7
>20	84	23.3

Field survey: 2008

Sources of information on climate change: Radio was a popular source of information on climate change as claimed by 78.9% of the respondents in Ibadan/Ibarapa zone while 58.9% in Saki zone also claimed the similar source (Table 2). Almost equal and low proportions of the respondents obtained information relating to climate change from the extension agency in the two zones. This indicates that little attention was paid by the extension agency regarding the information on climate change in the study area. A larger percentage (43.3%) of the respondents in Ibadan/Ibarapa zone compared to 21.1% in Saki zone obtained their information through the television. This may be due to the proximity of the respondents in Ibadan/Ibarapa zone to the urban centres. Table 3 shows the various crop mixtures grown in the two zones depending on the biophysical (soil, climate and availability of water) conditions. Yam, cassava and maize based crop mixtures were cultivated across the two zones. Sorghum, soybean and pigeon pea were included in crop mixtures in the Guinea savannah of Saki zone. Cassava had continuously been included in the mixtures probably due to its hardy characteristics of being able to thrive under unfavourable weather conditions.

Table 2: Distribution of respondents by sources of information on climate change (N = 180)

Sources of information	Ibadan/Ibarapa zone Frequency	Ibadan/Ibarapa zone Percentage	Saki zone Frequency	Saki zone Percentage
Extension agency	67	37.5	63	34.7
Radio	142	78.9	106	58.9
Television	78	43.3	38	21.1

Table 3: Distribution of respondents by common crop mixtures found in the study area (N = 180)

Mixture	Ibadan/Ibarapa zone Frequency	Ibadan/Ibarapa zone Percentage	Saki zone Frequency	Saki zone Percentage
Yam/maize/okra	62	34.4	97	53.9
Cassava/maize/ melon	12	6.7	102	86.1
Maize/yam/ cocoyam/spinach	116	64.4	155	79.2
Maize/cassava/pepper	65	36.2	124	68.9
Maize/yam/ cassava/okra	42	23.4	131	72.8
Maize/cassava/ spinach	145	80.6	86	47.8
Maize/cassava/	34	18.8	106	58.9
Sorghum/yam/pepper	-	-	165	91.7
Maize/cassava/ groundnut	-	-	156	86.7
Maize/soybean	-	-	145	80.6
Maize/ pigeon pea	-	-	172	95.6
Maize/cowpea	-	-	157	87.2
Maize/cassava/cowpea	-	-	64	35.6
Cassava/ tomato/pepper	-	-	87	48.3

Field survey: 2008

Cropping techniques: The study also show that mulching was a prominent cropping technique employed for coping with climate change in Saki zone as claimed by 91% of the respondents while only 13.9% adopted the same technique in Ibadan/Ibarapa zone (Table 4). This trend may be due to wide disparity in the time of commencement of rain between the two zones. Delayed planting is another technique that is common among farmers in Saki zone. This implies that time of rain commencement is a determining factor in choosing this cropping technique. For example in Saki zone, farmers have substituted maize with crops like cowpea and groundnut which they normally plant twice in a year and resulted to planting of late season maize.

Crop rotation and planting of improved varieties were cropping techniques common among farmers in the two zones. However, planting of cover crops is a cropping technique that was more prominent in Saki zone probably due to inadequate natural vegetative cover. Use of fertilizers was a common cropping technique adopted by farmers in Saki zone compared to Ibadan/Ibarapa zone. Use of pesticides was employed by a large percentage of farmers in Ibadan/Ibarapa zone probably due to the effect of greater precipitation and higher temperature that favour the germination of spores and proliferation of fungi and bacteria (Rosenzweig and Hillel, 2000).

Irrigation was the only cropping technique adopted only by the farmers in Saki zone indicating the insufficient amount of rainfall for cropping in that zone. Attention of the farmers in Saki zone had also been shifted toward planting of crops (sorghum, cowpea and groundnut) with less rainfall demand and this was corroborated with the perception of the farmers concerning the rainfall pattern and warmer temperatures observed during the past 2 decades.

Table 4: Distribution of respondents by cropping techniques adopted (N = 180)

Cropping techniques	Ibadan/Ibarapa zone Frequency	Ibadan/Ibarapa zone Percentage	Saki zone Frequency	Saki zone Percentage
Mulching	25	13.9	91	50.6
Mixed cropping systems	35	19.4	96	53.3
Delayed planting	11	6.1	87	48.3
Crop substitution	28	15.5	128	71.1
Varieties	78	43.3	64	35.6
Crop rotation	86	47.8	93	51.7
Planting of cover crop	12	6.7	97	53.9
Use of fertilizers	31	17.2	67	37.2
Use of pesticides	78	43.3	65	36.1
Irrigation system	-	-	52	28.9

Field survey: 2008

Table 5: Distribution of respondents by their perception of climate change (N = 360)

Statements on climate change	Strongly agree*	Agree*	Undecided	Disagree	Strongly disagree
Climate change is a threat to crop production	216 (60.0)	84 (23.4)	54 (15.0)	6 (1.7)	-
Extremes weather events can disrupt crop production	106 (29.4)	254 (70.6)	-	-	-
Rainfall pattern had been erratic in the last 2 decades	156 (43.3)	194 (53.9)	10 (2.7)	-	-
Prolonged spells of high temperature is a common occurrence in the last 2 decades	204 (56.7)	108 (30.0)	28 (7.8)	6 (1.7)	4 (1.1)
Farmers should be adapt strategies to reduce the negative effects of climate change	158 (43.9)	138 (38.3)	40 (11.1)	24 (6.7)	-
Farmers should exploit the possible positive effects of climate change using agronomic strategies	52 (14.4)	18 (5.0)	20 (5.6)	164 (45.6)	106 (29.4)

*Multiple responses figures in brackets are in percentages; Field survey: 2008

Farmers' perception of climate change on crop production: Majority (83.4%) of the farmers agreed that climate change is a threat to crop production, 15% were undecided while 1.7% disagreed with the statement. All the respondents agreed that extremes weather events could disrupt crop production while 97.2% of the farmers observed that rainfall pattern had been erratic in the past 2 decades. Prolonged dry spells of high temperature had been a common occurrence in the past 2 decades as observed by 86.7% of the farmers while 7.8% were undecided about this. About 82% of the farmers believed that they could adapt agronomic strategies to reduce the negative effects of climate change. However, majority (75%) of the farmers disagreed that farmers should possess the ability to exploit the possible positive effects of climate change using agronomic strategies (Table 5).

CONCLUSION

This study reported here, documents the cropping techniques adapted to mitigate risks associated with seasonal climate change. The adoption of these techniques was influenced by the agro-ecological zones and associated level of indigenous knowledge available in the study area. However, adapting to climate change might require improved cropping techniques that are beyond the existing practices. Hence, the need for extension to play proactive role by collaborating with research in generating necessary responses and technologies needed by the farmers to handle future challenges. The cropping techniques followed in agro-ecological zone should be thoroughly understood by research and extension to ensure the development and promotion of appropriate and sustainable technologies.

The extension programmes to be designed should aim at providing farmers with the tools they need to implement economically viable and environmentally acceptable crop production practices and thus creating a more sustainable agriculture.

REFERENCES

FAO, 2008. Climate change adaptation and mitigation the food and agriculture sector. Proceedings of the Technical Background Document from the Expert Consultation, March 5-7, 2008, Rome, Italy, pp: 17.

IPCC, 2001. Climate Change 2001: Impacts, Adaptation Vulnerability. Cambridge University Press, Cambridge, UK., Pages: 1032.

Olesen, J.E. and M. Bindi, 2002. Consequences of climate change for European agricultural productivity, land use and policy. Eur. J. Agron., 16: 239-262.

Rosenzweig, C. and D. Hillel, 2000. Soils and global climate change: Challenges and opportunities. Soil Sci., 165: 47-56.

Sivakumar, M.V.K. and R. Motha, 2007. Managing Weather and Climate Risks in Agriculture. Springer, Berlin, Germany, pp: 503.

Tanaka, D.L., J.M. Krupinsky, S.D. Merrill, M.A. Liebig and J.D. Hanson, 2007. Dynamic cropping systems for sustainable crop production in the Northern Great Plains. Agron. J., 99: 904-911.