POLICY BRIEF
UNU-INRA
December, 2013
Volume 1 No. 1

REDUCING CLIMATE CHANGE IMPACT ON FOOD PRODUCTION IN GHANA

By Benedicta Y. Fosu-Mensah

INTRODUCTION

Ghana's agriculture in all its agro-ecological zones depends heavily on rainfall. However, the year-to-year and within-season variability in rainfall is a significant constraint to the sustainability of the rainfed farming system being practiced. This system already faces the challenge of low soil fertility resulting in low crop yields, insufficient domestic production, food insecurity and poverty, all of which constitute major constraints to national development. As farmers strive to improve food productivity under these conditions, climatic effects also present other challenges. Studies show that climate change will have a significant impact on Ghana's agriculture since farmers rely heavily on rainfall as a source of moisture for crop production. The increase in temperature and decrease in rainfall will result in a decrease in crop yields which will adversely affect food security and the livelihoods of the rural poor.

This policy brief reports on a study carried out in Ejura in the Ashanti Region of Ghana. It assesses the impact of climate change on two maize cultivars (Obatanpa and Dorke) under two scenarios: (A1B: an integrated future world that puts a balanced emphasis on all energy sources, and B1: a more integrated and ecologically friendly future world), by demonstrating their nutrient use efficiency under rainfed conditions in sub-humid Ghana.

Figure. 1: Maize Field in the Northern Region of Ghana

Impact of Climate Change

The major contributors of Greenhouse gas (GHG) emissions are the developed countries but the impact of climate change will be greater in the developing countries of Sub-Saharan Africa, including Ghana, although these nations are low emitters of GHGs. Climate change is projected to have serious impacts on different sectors of Ghana's economy, particularly the agricultural sector, with smallholder farmers being the most affected, since their agrarian livelihoods are largely dependent on the rains as the main source of moisture.

UNITED NATIONS UNIVERSITY
UNU-INRA
Institute for Natural Resources in Africa
www.inra.unu.edu

CHANGING TEMPERATURE AND PRECIPITATION

Climate change is already manifesting in Ghana through increasing temperatures, decreasing rainfall, increasing variability in the intensity and pattern of rainfall, an increase in the occurrence of floods and droughts in some parts of the Northern Region of Ghana and rising sea levels in coastal areas. The risk of climate change impacts on Ghana suggests that urgent action is needed to adapt to this phenomenon. The rise in temperature and decrease in precipitation will directly affect natural ecosystems, food production, human health and the national economy as a whole.

Figure 2: Drought stricken field

The United Nations Framework Convention on Climate Change (UNFCCC) specifies two main policy approaches to addressing climate change and its associated shocks. These are mitigation, by reducing greenhouse gas (GHG) emissions into the atmosphere and enhancing carbon sinks, and adaptation to reduce the impacts of climate change (Klein et al., 2005). An Intergovernmental Panel on Climate Change (IPCC) report shows that without adaptation, climate change will have a detrimental effect on all sectors of most nations across the globe.

Food Production in Sub-Humid Ghana

The sub-humid region is one of the high food producing areas in the country, with maize being one of the most cultivated cereal crops. Over the years, there has been a decreasing trend in yield due to a decline in soil fertility, especially of nitrogen and phosphorus. As farmers battle to increase crop productivity under low soil fertility conditions, climate variability and change present further challenges to farmers. A study by Kunstmann and Jung (2005) indicates changing precipitation and temperatures in the Volta Basin as presented in Figures 3 and 4.

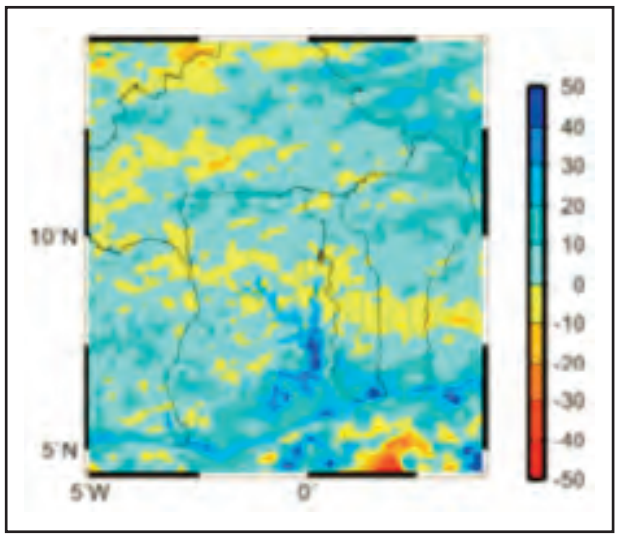

Figure 3: Change in annual mean precipitation (%) in the Volta basin (2030–2039 vs. 1991–2000)

Source: Kunstmann and Jung 2005

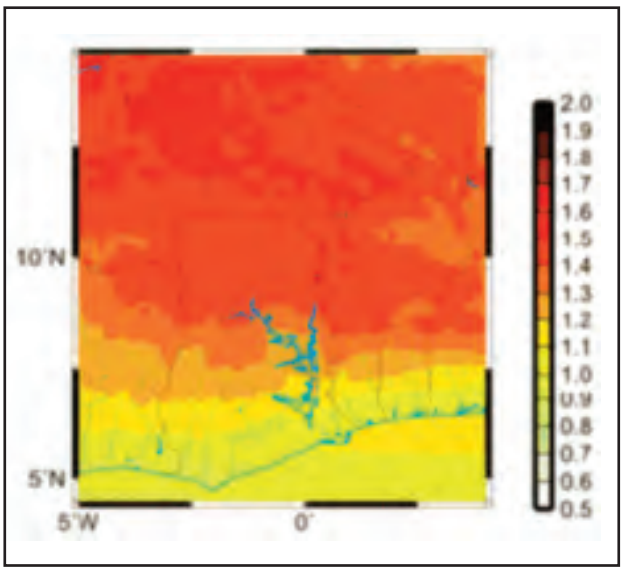

Figure 4: Change in annual mean temperature (°C) in the Volta basin (2030–2039 vs. 1991–2000)

Source: Kunstmann and Jung 2005

RESEARCH FINDINGS

Findings from the study suggest that by the year 2050 precipitation is likely to decrease by 20 % with an increase in temperature between 1.3°C – 1.6°C. This finding is in line with a report by Sagoe (2006) who carried out research in the six ecological zones of Ghana and reported that by the year 2050, the mean temperature in the country will increase by 2.0°C. In effect, an increase in temperature and a decrease in precipitation (-20 %) are likely to result in a delay in the onset of the rainy season, and consequently delay and/or narrow the sowing period under rainfed agriculture. Hence when long season cultivars are planted in the minor season, they will interfere with harvesting operations of major season crops on the farm. This delay is likely to impact maize yield. As shown in Figure 5 climate change will result in a significant increase in variability of rainfall, thereby impacting maize yields. There were, however, higher variability in yields (error bars) for earlier sowing under climate change, representing a higher risk of crop loss compared to late sowing (2nd Week of May) for Obatanpa.

Climate change also reduces the nutrient utilisation efficiency of crops. From Figure 5, the application of 40 kg N ha-1 gave a similar yield as that of 80 kg N ha-1 under both scenarios. This is attributed to water stress conditions, as plant nutrients are transported through soil moisture. Moisture stress will directly result in nitrogen stress as water is needed for nutrient uptake.

The combination of delayed sowing under increased temperature conditions and declining precipitation is likely to reduce maize yield to about 28 % - 35 %. This reduction could have serious implications for food security in the country. To mitigate this, farmers will have to appreciate the potential impacts of climate change and strive to adapt to them.

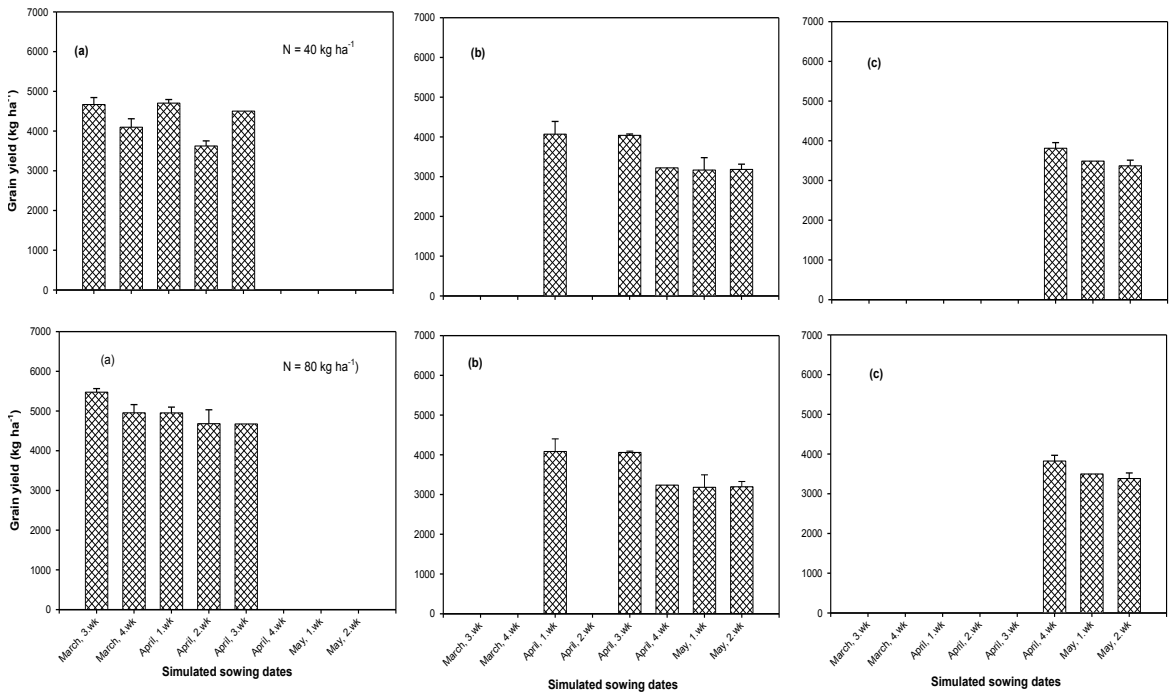

Figure 5: ***Simulated maize (var Obatanpa)- cowpea (Malam yaya) grain yield (kg/ha^{-1}) rotation on Haplic Lixisol at Ejura, Ghana, from historical weather data (1980-2000) (a), projected climate change (2030-2050) for scenarios A1B (b) and B1(c) with 40 and 80 kg N ha^{-1} and 30 kg P ha^{-1}***

POLICY RECOMMENDATIONS AND CONCLUSION

The key strategy to adapt and manage the risk and vulnerability associated with climate change is to consciously consider its immediate and long-term effects on food security and formulate policies and programmes to address it.

To equip the public on climate change issues, there is the need for stakeholders in the agriculture value chain to facilitate widespread education on climate change and the adaptation measures that are available.

It is also necessary to build the needed infrastructure to adapt to climate change. Below are some suggested measures that should be considered by stakeholders in addressing the impact of climate change on crop yields:

1) Building of irrigation schemes using local materials or improving on existing ones as well as providing infrastructure (e.g. storage facilities) to help improve on food production and availability.

2) Increasing funds for agricultural research, including studies on climate change to inform policies.

3) Developing improved technologies (breeding of high-yielding and drought-resistant cultivars).

4) Increasing the extension-farmer ratio, and making extension services more accessible to farmers.

5) Enforcing policies on afforestation to serve as a sink for CO_2. Studies indicate that reducing emissions from deforestation in developing countries is a cost-effective option relative to GHG mitigation. Policy options and attractive incentives like payment for ecosystem services should be put in place to reduce deforestation and emissions.

REFERENCES

IPCC (2007). Fourth Assessment Report. Working Group II. Impacts, Adaptation and Vulnerability on Agriculture.

Klein, R.J.T., E.L. Schipper and S. Dessai, 2005: Integrating mitigation and adaptation into climate and development policy: three research questions. Environ. Sci. Policy, 8, 579-588.

Kunstmann and Jung (2005). Impact of regional climate change on water availability in the Volta Basin of West Africa. Proceedings of symposium 56 held during the Seventh IAHS Scientific Assembly at Foz do Iguaçu, Brazil, April 2005). IAHS Publication, 295.

Sagoe, R. (2006). Climate change and root crop production in Ghana. Crops Research Institute, Kumasi. A report prepared for the Environmental Protection Agency (EPA).

ABOUT THE AUTHOR

Dr. Benedicta Y. Fosu Mensah is currently a research fellow at the Institute of Environment and Sanitation Studies, University of Ghana. She produced this policy brief during her Visiting Scholarship at the United Nations University - Institute for Natural Resources in Africa

This Policy Brief is prepared from a UNU-INRA Working Paper No.1:

Modelling the Impact of Climate Change on Maize (*Zea Mays L.*) Yield under Rainfed Conditions in Sub-Humid Ghana

by Benedicta Y. Fosu-Mensah as part of UNU-INRA's Visiting Scholars Programme.

CONTACT DETAILS

The United Nations University - Institute for Natural Resources in Africa

Second Floor, International House, Annie Jiagge Road, University of Ghana, Legon, Accra, Ghana

Address: PMB, KIA, Accra, Ghana
Tel: +233 302 500396
Email: inra@unu.edu
Website: www.inra.unu.edu