ISSN 1819-1894

Asian Journal of Agricultural Research

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Asian Journal of Agricultural Research 6 (2): 52-59, 2012
ISSN 1819-1894 / DOI: 10.3923/ajar.2012.52.59

Climate Change and Food Security in Africa

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ABSTRACT

Globally, agriculture is widely accepted as one of the sectors at most risk from climate change challenges. Due to impacts of increased temperatures, reduced rainfall and increased frequency of variation in extreme events especially in the tropics. Agriculture is central to the food security and economic growth of developing nations, providing the main source of livelihood for the world's poor. Climate change will impact significantly on food security. It will affect food production and availability, the stability of food supplies, access to food and food utilization. However, the poorest farmers are the most vulnerable and the most challenged to the impacts of climate change. Africa is the region with greatest risk of increased hunger and threatened livelihoods due to climate change. This study briefly reviews the potential impact of climate change on food security in reducing by half the proportion of people suffering from hunger by 2015.

Key words: Agriculture, food security, climate change, livelihood, farmers, hunger

INTRODUCTION

Studies and issues on climate change have assumed great significance within the last few years since the Villack meeting in Austria, 1985. Global warming is likely to reduce agricultural production in the tropics, where many developing countries are located (Darwin, 2001). However, Africa is the region with the greatest risk of increased hunger due to climate change (Parry *et al*., 2009) and there is a looming food crisis in many countries in Africa (IIED, 2011) in addition to hardcore poverty, public health problems and changes in human settlement pattern across the region (Begum *et al*., 2011; Mia *et al*., 2012). In Africa, food production per capita has however failed to keep up with the population growth rate, with rural population almost trebling in sub-Saharan Africa. In a few mega cities within the continent, rapid urbanization and the shift in consumption patterns that come with increasing income further compounds this problem. Given this scenario, one can appreciate the enormity of the food crisis facing the continent.

Food security is an increasingly important issue. This is because in a world where competition for land, coupled with climate change, providing sufficient food for the current global population of 6.9 billion is difficult to contemplate, let alone for a projected 9.0 billion people in 2050. Globally,

925 million people are undernourished and 16,000 children die from malnutrition each day particularly in developing countries (FAO, 2010) while many (in millions) have livelihood threatened due to climate change especially in Africa's drylands (Begum *et al*., 2011; Mwangombe *et al*., 2011). Agriculture is central to the food security and economic growth of developing countries and is the main source of livelihood for the world's poor especially in sub-Saharan Africa (Ogundari and Ojo, 2005; Wheeler and Kay, 2010; Ogundari and Brummer, 2011). Global food demand is expected to increase by 50% by 2030 and by almost 70% in 2050 (FAO, 2006). Energy demand too will increase, as well as the demand for water for people, agriculture and the environment. Climate change will affect food production and availability, the stability of food supplies, accessibility to food and food utilization (Schmidhuber and Tubiello, 2007). Experts predict that climate change could make between 500,000-1 million km^2 of land unsuitable for food crops in the next decade. This will definitely affect the livelihood of the 20-35 million people who currently live and survive on agriculture in Africa. Increases in mean global temperature will have numerous effects on agricultural production, prominent among them being changes in growing season-the length of time that soil temperature and soil moisture conditions are suitable for crop growth. The earth bodies of water will expand, raising sea levels and reducing the amount of land available for agriculture while extreme weather events such as storms and floods may increase in frequency as well as numerous public health problems will be brought to the fore (Darwin, 2001; Amiri and Eslamian, 2010). These effects and others mean that national agricultural yields in the continent are likely to fall over the next decade (Fig. 1).

In Africa, food security has been fragile, the smallholder resource poor farmers are relying on low yielding varieties and species poorly suited to local conditions with limited opportunities to change cropping patterns; the impact of climate change further exacerbates this problem. Climate change (global warming) shortens growing seasons in the tropics and lengthens growing seasons at high altitudes while mid-latitude impacts are mixed. Food insecurity in Africa is extensive due to low crop yields, lack of income, drought, underdeveloped markets and many civil unrest.

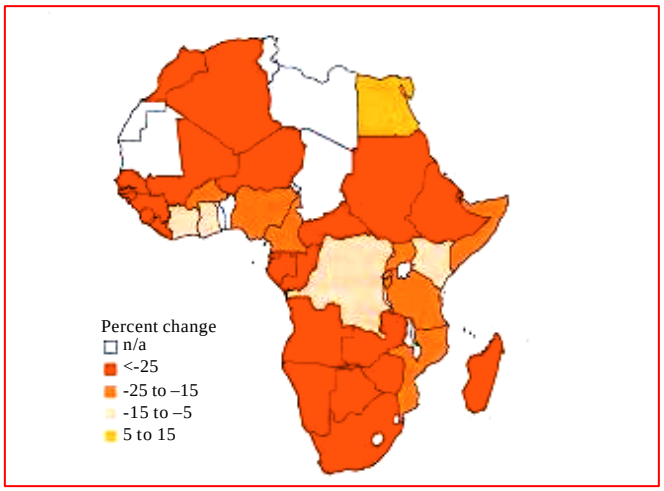

Fig. 1: Impact of climate change (without carbon fertilization effects) on African agricultural productivity by 2080

Before 2000, declining food prices had provided livelihood and allowed millions of people in Africa to escape from poverty and hunger. However, since the turn of the millennium, rapid population growth and urbanization in the continent have forced prices of basic food commodities to climb steadily. Between 2007 and 2009, price increases of staple foods reached alarming proportions, triggering concerns of numerous riots and global food crisis that has been widely reported (Ewing and Msangi, 2009). The underlying causes of rising food prices are many and complex. More important are structural factors that include rising energy costs, stagnation in crop productivity, policy inadequacies or failures that constrain agricultural development, climate change, rising demand for higher value and grain-intensive foods (meat) and diversion of crops or croplands to biofuel production. Among these factors, climate change has borne the brunt because of adverse weather conditions and extreme events that affect crop and livestock productivity that are directly linked to livelihood and food security.

Climate change impact on the physical asset base: Widespread drought in recent years in both the northern and southern hemispheres, combined with increasing awareness that climate change is likely to make such extreme conditions more frequent, is starting to draw a wider attention to farming and food security (ACIAR, 2008). The landscape on which agriculture produces food and materials is a resource under pressure particularly in Africa. Generally, global land suffers severe constraints for crop and livestock production: 13.2% is too cold, 26.5% is too dry, 4.6% is too steep, 2.0% is too wet and 19.8% has impoverished soils (Slater *et al*., 2007). In Africa about 8% of the soil is found on fertile lands while 92% is found on marginal lands. The United Nations Environmental Programme (UNEP) has estimated that the area which is prone to desertification worldwide is approximately 30 million km^2, of which 6.9 million km^2 (or 23%) are in Africa, south of the Sahara (ALF, 1989). It is estimated that in Africa by 2050, climate change would have made an additional 10-15% (742 million hectares) of total land area severely constrained for crop/livestock production. However, increased frequency of extreme weather events could depress yield by damaging crops at key growth stages (Rosenzweig *et al*., 2002) particularly in tropical regions as opposed to temperate environments. In no future, crops will be grown in more variable climates and these will also have direct impacts on crop yields (Wheeler and Kay, 2010). Such impacts will mean that crop and livestock production will become riskier under climate change with grave consequences on future food supplies (Omolehin *et al*., 2007). Agriculture currently accounts for 24% of world output and uses 40% of land area (FAO, 2003). The vast majority of the continent's agriculture is rain fed. It is highly dependent on the climate and human dependence on agricultural livelihoods, particularly by the poor, is high in Africa and other developing countries. Climate change will thus increase competition and access to land as some regions become marginal or even unsuitable for food crop and livestock production.

Compared with 1990 economic conditions, modeling shows that land resource or the physical asset base changes due to climate change which reduces agricultural land in tropical regions where many developing countries are located (Darwin, 2001). In general, diseases are expected in low altitudes and developing countries, reflecting both declining potential land available for crop and livestock production reported above and changes in productivity due to climate change. Despite recent advances in analyzing and modeling the economic effects of global warming, information about climate change and food security in Africa remains extremely limited.

Climate change impact on food security: There is an awakening to the fact that the world's food crops are vulnerable to rapid changes in environmental parameters and this combined with diminishing and degrading land and water resources particularly in the tropics (Africa) has placed

food supplies in a precarious position. Africa and other developing countries are net food importers, where food accounts for 70% of the household expenditure. The rising cost of food has made it harder for those living close to the poverty line to survive, with their real income falling as they absorb rising food prices.

Climate change may slow down rates of improvement in food security (Slater *et al*., 2007). Although the projections are highly uncertain due partly to the simplification of the definition of food security narrowly to mean food availability. More recently, however, the concept of food security is generally accepted as entailing not only food availability but perhaps more importantly food accessibility through production, purchase in the market or food transfers (ALF, 1989). Most models suggest that climate change will slow or reverse the poverty reducing impact of agriculture, with, by one estimate, some 600 million additional people are at risk of hunger if temperature increases by over 3°C (Warren *et al*., 2006) especially in developing countries. Within sub-Saharan Africa, the negative impacts of climate change are likely to be strongest in north and south, possibly with some unlikely positive impacts in Central African countries (Slater *et al*., 2007).

When the United Nations Millennium Development Goals (MDGs) were first announced in September 2000, a deadline of 2015 was set to half global hunger and poverty. At that time, 15 years seemed long enough. Today we are past the half way mark, while progress has been substantial, there is still a way to go in Africa. The twin global crises - dramatic food price rises in 2008 and financial collapses and recession in 2008/2009 coupled with climate change have made the task of meeting MDGs more urgent. The recent global food crisis hit the developing world hard and the poor the hardest (ACIAR, 2009).

It is now generally accepted that increases in food and agricultural production will not by themselves guarantee food security for the people of Africa. Africa's food production systems are generally resource constrained, organisationally complex and ecologically vulnerable (ALF, 1989). Thus, food production and increase must come from sustainable and well managed food production systems.

Climate change impact on storage, trade and food transfers: Access to food encompasses both physical and economic aspects. Physical access to food relates both to the adequacy of supply and to the efficiency of the distribution system including storage, preservation, transport, marketing and processing. Economic access to food relates to the ability of individuals, households or communities to establish entitlement over a requisite amount of food. In Africa, climate change affects seasonal variations in food supply and consumption patterns particularly among poorer families or in remote areas where the community is less integrated into wider markets. The challenge of improving food security in Africa would therefore include actions aimed at improving the procurement system and the food marketing system as well as actions aimed at providing the people at risk of hunger with income which will permit them to purchase their required food.

In Africa, considerable efforts are currently being made to rehabilitate regional and cross border roads and a number of international agencies have assisted rural feeder road rehabilitation and construction. The transport network is still comparatively weak which impact on food trade and transfers (Jothilakshmi *et al*., 2011). Moreso, the smallholder farmer that produces all the bulk of agricultural products have received little protection as they normally receive little or no subsidies while supporting heavy taxes on their exports. This discrimination coupled with climate change has had consequences for both agricultural production and income generation and contributed to much of the rural poverty and hunger which affects livelihood and food security in the continent.

Africa is primarily an agricultural commodity exporter and food importer. The trade relationship of the continent with other regions will necessarily affect the continent's food policy since food security does not depend solely on domestic food production. Presently, the reduced demand for Africa's primary commodities coupled with the depressed prices of exports-the direct result of the global economic meltdown and climate change have seriously increased the costs of providing food security to Africans. With the burden of indebtedness, many countries in the continent can hardly cope with investing in increasing domestic food production or paying for commercial imports. Therefore, many of these countries are more and more dependent on massive food aid to offset domestic deficit. The problem, however, is that food aid which was originally seen as an emergency measure due to extreme weather events (climate change) has become an essential component of the food security schemes of these countries which is not in any way sustainable.

Adaptation strategies: Climate change is already being felt and its effect is expected to continue and to increase especially in the tropics. For different reasons, poor rural communities, small businesses and family farms with limited capacity to adapt seem particularly vulnerable to climate change, requiring support in order to successfully adapt to the quick changes they are experiencing. Farmers' first priority is to seek opportunities to make their existing livelihoods, like agriculture more resilient.

In Africa, most national governments are concerned not only with the food security of individuals or households but also with national food security, that is, the extent to which the national food system can function without excessive reliance on external food aid. Farmers and African governments have several options to counter continued, long run global warming that affects food security. Farmer adaptations, such as switching crop varieties or introducing more suitable crops. Such crops require adaptation to more prolonged and frequent droughts, changes in rainfall distribution, more storms and other extreme weather events, increased and changing pest loads and changes in soil water balances can often be undertaken by individual farmers (Darwin, 2001; Knox *et al*., 2010). Thus, the essence of crop diversification is emphasized as an adaptation strategy (Ghosh, 2011). The challenge is therefore to squeeze more productivity from biodiversity and agronomy to cover for diminishing resource base due to climate change to improve livelihood.

Climate change affects all aspects of human life, this means taking the ecosystem into account, as well as the social and economic aspects that shape local livelihoods.

In emergencies (droughts, floods etc.) donor countries willingly provide food supplies but this provides only short-term relief, what is needed is long-term relief. The time to act is now, where selective breeding that creates crops and animals specifically adapted to Africa's agro-climatic conditions, with idiosyncrasies in soil, pest, disease and rainfall profiles, in addition to differences in farming practices.

Without this in-built adaptation to local conditions and climate change variables, introduced crop/ animal species tend to perform poorly with grave consequences on food security and livelihoods. Adaptation does not guarantee that farming will be able to continue in an area, or if it does, that farm incomes will remain unchanged. Some adaptation will involve shifting agricultural production from one location to another or complete change in agronomic practices (Brahim *et al*., 2009). In some situations, high yielding varieties that withstand the impact may be the most suitable (Srivani *et al*., 2007). However, farming must adapt to and contribute to counteracting climate change.

The challenge of climate change and food security in Africa would therefore include actions aimed at improving the procurement and food marketing systems as well as actions aimed at providing those at risk of hunger with income that will permit them to purchase their required food. Drawing up multi-year food requirement plans, establishment of food security stocks, prevention of post-harvest food losses and an early warning system are very necessary. Thus, developing countries must be helped to build capacity through structural reforms to rebuild run-down or destroyed farming infrastructure following man made and natural calamities to address food security and climate change issues. The distribution system requires the development of adequate infrastructure such as markets, roads, transport and storage. The establishment of market intelligence information units and the provision of incentives/subsidies to both producers and traders.

However, it is not surprising that there will be no one programme of action or policy initiative that will solve the challenge of climate change and food security. This challenge involves complex interactions with natural resources, social and political systems, economics, trade and policy. Small farms that combine stable and diverse production, that generate and sustain their inputs and those that have favourable energy ratios and good links to markets, comprise an effective approach to achieving food security, income generation and environmental conservation. However, multifaceted response adapting the agricultural system and climatic changes to sustainable food security is needed, if Africa is to be part of the global efforts to eradicate extreme hunger and poverty. However, boosting agricultural productivity and food security in Africa, especially in the face of climate change challenges cannot be achieved without the benefits of cutting edge science (IIED, 2011). Advances in technology development and transfer, capacity building and policy research must be harnessed and linked to indigenous knowledge systems.

CONCLUSION

Food has become one of the most important items of discussion in any agenda on African development during the last two decades. The focus on poverty reduction in the past three years has drawn attention to the challenge of achieving lasting food security. The wish has been to find effective and sustainable ways of ensuring that all Africans have access and can afford at all times the minimum quantities and quality of food necessary to lead an active and healthy life in line with the MDGs. A number of global studies on climate change and crop production have combined crop impacts with changes in trade and food demand in order to estimate changes in the number of people at risk of hunger. In Africa, high population growth and regional disparity in income, numbers of persons at risk of hunger due to climate change would be 10-20% greater by 2050.

Many of the expected impacts of climate change on food security will put more pressure on sustainable growth. Climate change however, is likely to exacerbate many of the current challenges already facing the agri-food sector. Adapting local farming practices through a long-term multifaceted approach could reduce the risk of hunger and improve livelihood in line with the MDGs. The broad conclusion is simply that farming, agricultural knowledge and technology need drastic changes. Business as usual is clearly not an option if Africa is to eradicate extreme hunger and poverty in the face of changing climatic conditions.

REFERENCES

ACIAR, 2008. Australian Centre for International Agricultural Research. Partners: In Research for Development. Gene Revolution. Australian Centre for International Agricultural Research July -October, 2008, pp: 2-28.

ACIAR, 2009. Australian Centre for International Agricultural Research. Partners: In: Research for Development. Millennium Development Goals. Australian Centre for International Agricultural Research, July - October, 2009, pp: 2-4.

ALF, 1989. The challenges of agricultural production and food security in Africa. Proceedings of the an International Conference by the Africa Leadership Forum (ALF). July 27-30, 1989, Otta, Nigeria, pp: 65-97.

Amiri, M.J. and S.S. Eslamian, 2010. Investigation of climate change in Iran. J. Environ. Sci. Technol., 4: 208-216.

Begum, R.A., C. Siwar, R.D.Z.R.Z. Abidin and J.J. Pereira, 2011. Vulnerability of climate change and hardcore poverty in Malaysia. J. Environ. Sci. Technol., 4: 112-117.

Brahim, N., T. Gallali and M. Bernoux, 2009. Effects of agronomic practices on the soil carbon storage potential in Northern Tunisia. Asian J. Agric. Res., 3: 55-66.

Darwin, R., 2001. Climate change and food security. Economic Research Service Agricultural Information Bulletin No. 765-8. US Department of Agriculture, Washington, DC., USA.

Ewing, M. and S. Msangi, 2009. Biofuel production in developing countries: assessing tradeoffs in welfare and food security. Environ. Sci. Policy. 12: 520-528.

FAO, 2003. World Agriculture towards 2015/2030: An FAO Perspective. Rome: Food and Agriculture, Organization of the United Nations. http://www.fao.org/ docrep/005/y4252e/ y4252e06.htm

FAO, 2006. World agriculture towards 2030/2050 Prospects for food, nutrition, agriculture and major commodity groups. Interim report, Global Perspectives studies unit, Food and Agriculture Organization of the United Nations, Rome.

FAO, 2010. The State of Food and Agriculture 2010 -11. Global Information and Early Warning System (GIEWS). Food and Agriculture Organization of the United Nations, Rome. www.Foodsecurityportal.org

Ghosh, B.K., 2011. Essence of crop diversification: A study of West Bengal agriculture. Asian J. Agric. Res., 5: 28-44.

IIED, 2011. International Institute for Environment and Development. Integrating climate change into agricultural research and development in Africa. IIED briefing, September, 2011.

Jothilakshmi, M., D. Thirunavukkarasu and N.K. Sudeepkumar, 2011. Structural changes in livestock service delivery system: A case study of India. Asian J. Agric. Res., 5: 98-108.

Knox, J., J. Morris and T. Hess, 2010. Identifying future risks to UK agricultural crop production. Putting climate change in context. Outlook Agric., 39: 249-256.

Mia, M.S., R.A. Begum, A.C. Er, R.D.Z.R.Z. Abidin and J.J. Pereira, 2012. Burden of malaria at household level: A baseline review in the advent of climate change. J. Environ. Sci. Technol., 5: 1-15.

Mwangombe, A.W., W.N. Ekaya, W.M. Muiru, V.O. Wasonga, W.M. Mnene, P.N. Mongare and S.W. Chege, 2011. Livelihoods under climate variability and change: An analysis of the adaptive capacity of rural poor to water scarcity in Kenya's drylands. J. Environ. Sci. Technol., 4: 403-410.

Ogundari, K. and S.O. Ojo, 2005. Determinants of technical efficiency in a mixed crop food production in Nigeria, a stochastic parametric approach. East. Afr. J. R. Dev., 21: 15-22.

Ogundari, K. and B. Brummer, 2011. Technical efficiency of Nigerian agriculture: A meta-regression analysis. Outlook Agric., 40: 171-180.

Omolehin, R.A., E.A. Nuppenau, J. Steinbach and I. Hoffmann, 2007. Determinants of crop-livestock enterprise combination adoption and its impact on crop productivity among resource-poor rural farmers in Zamfara grazing reserve. Asian J. Agric. Res., 1: 35-49.

Parry, M., C. Rosenzweig and M. Livermore, 2009. Climate change, global food supply and risk of hunger. Phil. Trans. R. Soc. B, 360: 2125-2138.

Rosenzweig, C., F.N. Tubiello, R. Goldberg, E. Mills and J. Bloomfield, 2002. Increased crop damage in the U.S from excess precipitation under climate change. Global Environ. Change, 12: 197-202.

Schmidhuber, J. and F.N. Tubiello, 2007. Global food security under climate change. Proc. National Acad. Sci., 104: 19703-19708.

Slater, R., L. Peskett, E. Ludi and D. Brown, 2007. Climate change, agricultural policy and poverty reduction-how much do we know. Natural Resource Perspectives No. 109. Overseas Development Institute, pp: 1-6. http://www.fanrpan.org/documents/d00417/

Srivani, O., V. Geethalakshmi, R. Jagannathan, K. Bhuvaneswari and L. Guruswamy, 2007. Impact of future climate change on growth and productivity of rice crop in Tamil Nadu. Asian J. Agric. Res., 1: 119-124.

Warren, R., N.W. Arnell, R.J. Nicholls, P.E. Levy and J. Price, 2006. Understanding the regional impacts of climate change: Research report. Tyndall Centre Working Paper 90. Norwich: Tyndall Centre. http://www.tyndall.ac.uk/content/understanding-regional-impacts-climate-change-research-report-prepared-stern-review-economic

Wheeler, T. and M. Kay, 2010. Food crop production, water and climate change in the developing world. Outlook Agric., 39: 239-243.