Agricultural sustainability and food security in the 21st century: a review of Climate-Smart Agriculture (CSA) in Africa

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Abstract

There are suggestions that the adoption of climate-smart agriculture in many African countries will not only help farmers adapt to climate change but also bring about increased productivity. This study, therefore, investigated the climate-smart agricultural practices in different African countries and examined the effect on their agricultural productivity and food security. Findings reveal practices like agroforestry and conservation agriculture, and climate-smart agriculture are improving agricultural productivity and food security in countries like Kenya, Uganda, Tanzania and some Western African countries.

Keywords: *Africa, Agricultural sustainability, Climate-smart agriculture, Food security*

Introduction

Agricultural activities in Africa are more susceptible to climate change than activities from other sectors due to the level of dependence of the agricultural sector on climate and climate-sensitive resources (Bryan et al., 2011). The vulnerability of African agriculture to climate change is of great concern and there is an increasing need for prompt and effective responses to the pressing challenge of climate change. As a response measure, the Food and Agriculture Organisation of the United Nations (FAO) designed the concept of Climate-Smart Agriculture (CSA) to achieve agricultural sustainability, adaptation and resilience to climate change, and reduction of greenhouse gas emissions simultaneously (FAO, 2013).

The concept of CSA operates on three major pillars; sustainability in increased agricultural productivity, adaptation to changes in climatic conditions and reduction or removal of greenhouse gas emissions (FAO, 2013). The concept jointly handles food security issues, ecosystems management and the problem of climate change, as "*an approach for transforming and reorienting agricultural development under the new realities of climate change*" (Lipper et al., 2014).

While there are suggestions that the adoption of CSA in many African countries will result in increased productivity (Dooley and Chapman, 2014), there are few studies supporting this assertion (Bryan et al. 2011; Dooley and Chapman, 2014). The dearth of study on CSA as an adaptation measure against the challenge of food security makes it difficult to evaluate the impact of climate-smart agriculture on food security. It is due to this lack that this research investigated the nature of

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CSA practices in different African countries and examined the effect of climate-smart agriculture on agricultural productivity and food security of these countries.

Methodology

This study was carried out through a systematic review of peer-reviewed literature related to climate change, climate-smart agriculture (CSA) and food security. A realist review method was used. The realist method focuses on explanation rather than on empirical findings (Pawson, 2005), and often includes tighter inclusion criteria and a smaller number of documents than other review approaches, with an emphasis on 'depth' rather than 'width' (Thompson, 2010) of research. This method provides a suitable tool to understand agricultural productivity and food security as they are rooted in complex social, cultural, and ecological systems, which will affect vulnerability and adaptive capacity of the communities that depend on agriculture.

Findings and Discussion

This study identified CSA practices such as intercropping with nitrogen-fixing legumes, composting, agroforestry, conservation agriculture, and use of resilient varieties of crops (Bryan et al., 2011; Dooley and Chapman, 2014) as intensive farming practices which boost productivity. The findings also revealed that the adoption of CSA practices limits the expansion of cultivated areas into forests and enables new agricultural production systems that can restore ecosystem services and values to be established (Wollenberg et al., 2012). The need for CSA opportunities in African countries arose from a growing but food-insecure population, for whom increasing agricultural productivity does not only enhance food security but also preserves scarce forest resources (Dooley and Chapman, 2014).

In Nyando, West Kenya, the establishment of climate-smart villages reduced the proportion of households experiencing hunger months from 81% in 2011 to 23% in 2014, while the proportion of those that could boast of food all year-round increased from 1% in 2011 to 3% in 2015 (World Bank, 2016). In Uganda, the use of shade trees is helping Ugandan farmers in their coffee production. Shade trees help reduce the temperature in coffee growing areas, while simultaneously addressing the Ugandan drought problem. The crop losses that are averted in Uganda because of the use of shade trees could exceed more than US$100 million per annum (Jassogne et al., 2013).

A CSA Project in Tanzania supports small-scale irrigation to boost productivity and help farmers become more climate resilient. About 228,000 farmers have benefited from the project, and it has led to increased rice productivity from 4.5 metric tons to 5.8 metric tons (World Bank 2016). Further, the West Africa Agricultural Productivity Programme funded by the World Bank is making agriculture more climate-smart across 13 countries in West Africa, among which are Mali, Benin and Cote d'Ivoire (World Bank, 2016). The programme has developed and distributed 160 climate-smart crop varieties and trained farmers on climate-smart practices such as agroforestry and composting. Assistance from the programme has helped over 7 million farmers to be more productive, climate resilient, and lower greenhouse gas emissions. There has been an increase in productivity by about 150%, food production has increased by more than 3 million tons and hunger period has reduced by 50%. Incomes of beneficiaries of the programme have grown by an average of 34%, while staple food and nutrition standard has increased.

Conclusion

This study will serve as a reference for researchers and policy makers. With respect to policy implications, understanding the adaptation mechanisms (Climate-Smart Agricultural practices) employed by farmers and its impact on food security by policy makers and non-governmental organisations would aid the development of programmes that would strengthen farmers' resilience to climate change.

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