Climate change impacts and adaptation options for cereal production in Sub-Saharan Africa: Insights from Ethiopia

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1. INTRODUCTION

Most Sub-Saharan African countries are vulnerable due to dependence on rain fed agriculture, low level of socio-economic development, and limited disaster management skills. Thus, anticipated climate change is expected to aggravate some of the existing challenges and impose new risks beyond the range of current experiences.

2. OBJECTIVES

Understanding current climate variability and future climate change impacts and providing insights on current climate risk management strategies and future adaptation options for adapting agriculture, in particular maize production.

3. MATERIALS AND METHODS

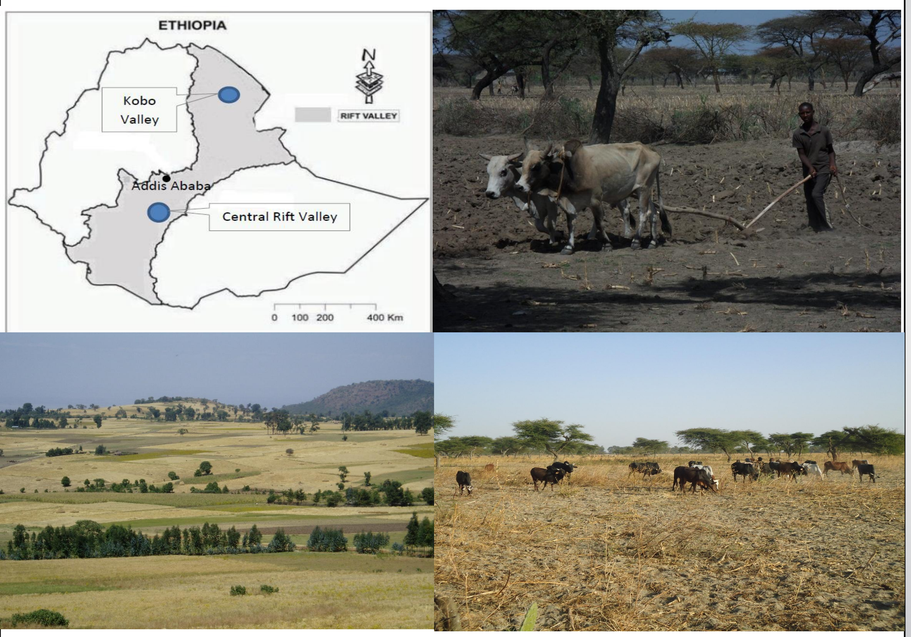

Fig 1. Farming systems of the study area: representative for cereal-based mixed farming

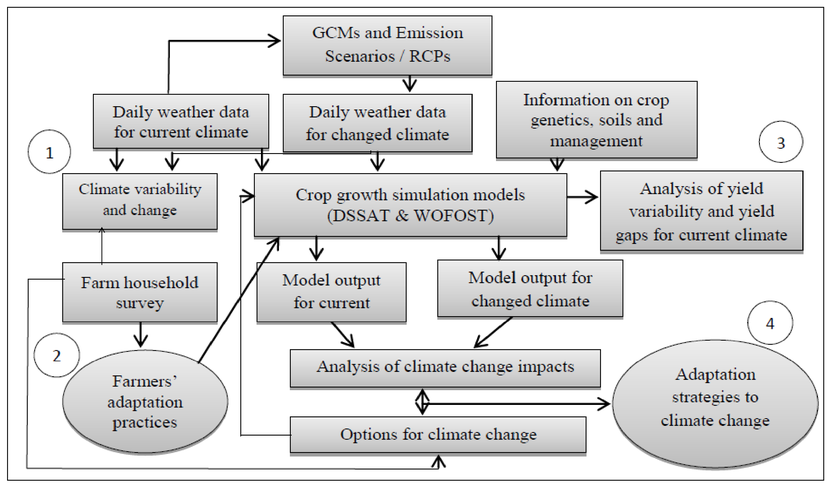

Fig 2. Analytical steps in assessing climate change impacts and adaptation options using crop growth simulation in combination with farm household survey approaches

4. RESULTS

4.1 Climate change and impacts

- Rainfall exhibited high inter-annual variability (CV:15-40%) and the mean annual temperature significantly increased with 0.12 to 0.54 ^{o}C per decade during 1977-2007.
- The annual rainfall will change by -40 to +10% and temperature is expected to increase in the range of 1.4 to 4.1 ^{o}C by 2080s
- Rain-fed yields are characterized by high inter-annual variability (CV: 36%) and is explained mainly by the variation in rainfall
- Actual yields of maize in the CRV are only 28-30% of model simulated rain-fed yield
- Analysis of climate change scenarios showed that maize yield will decrease on average by 20% in the 2050s relative to a baseline climate due to an increase in temperature and a decrease in growing season rainfall.
- The negative impact of climate change is very likely, however, the extent of the negative impact has some uncertainties ranging from -2 to -29% depending on crop model and climate change scenario.

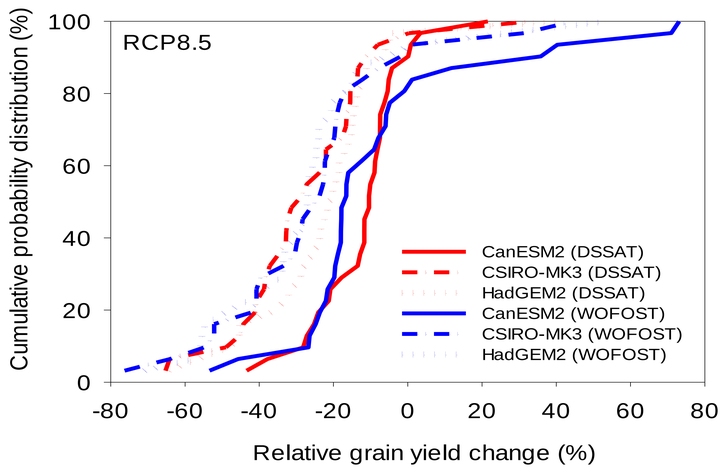

Fig.3 Probability distribution of maize yield change by 2050s (2040-2069) relative to a base line period (1980-2009) as simulated with two crop models

4.2 Current adaptation strategies:

- Crop /cultivar selection
- Changing planting time
- In-situ moisture conservation
- Flood diversion (spate irrigation)
- Income diversification
- Social safety-nets

Fig 4. Strips of furrows on maize field: indigenous in situ moisture conservation technique, locally called "*Shilshalo*"

4.3. Adaptation options for future climate

- shifting planting dates reduced negative impacts of climate change
- increasing nitrogen fertilizer use from 20 kg /ha (baseline) to 80 kg/ha increased yield by 78-89% under climate change scenarios
- use of irrigation (provided that resource is available) increased yield by 12-39% compared to rain-fed under climate change scenarios

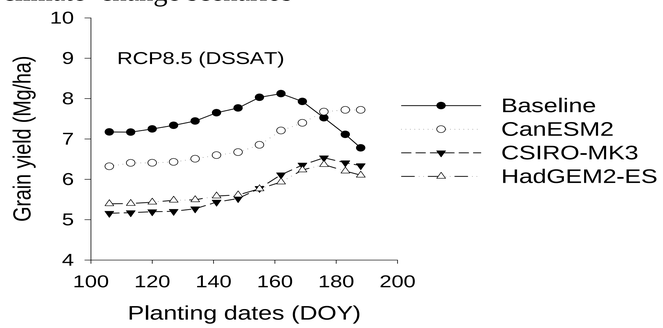

Fig 5. Effects of planting dates on maize yield under baseline and climate change scenarios

4.4. Barriers for adaptation

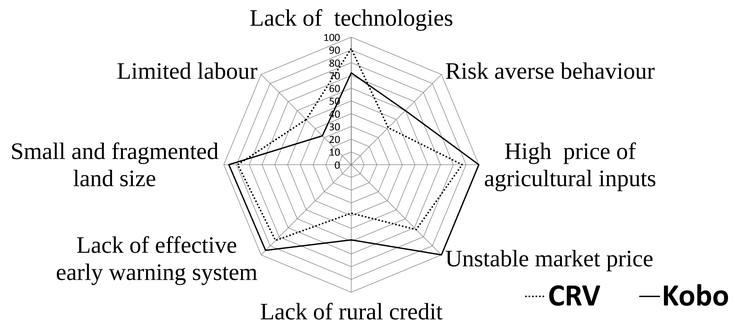

Fig 6. Barriers for successful adaptation

5. CONCLUSION

- Crop production has already been challenged with climate variability, and climate change is projected to affect it negatively.
- Investment in more appropriate adaptation options (e.g. fertilizer, irrigation, improved cultivars) is highly needed.
- Climate change modeling has uncertainties which need to be considered in adaptation planning

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Acknowledgments

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