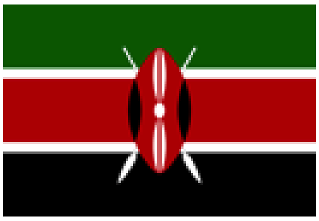
Green Grams Kenya



Climate change risks and opportunities

Green grams in Kenya

Agriculture in Kenya contributes to the national economy, food security, and employment of rural households. Climate change and weather variability affect agricultural production negatively and it is expected to worsen in the future. Climate-smart agriculture (CSA) practices present an opportunity to reduce such losses, build resilience in the agriculture sector, improve productivity and farmer incomes, and contribute to climate change mitigation (CIAT & World Bank, 2017). Green gram, also known as mungbean, maash or moong (*Vigna radiata* L.), is a potential food and cash crop in Kenya and grows well in arid regions, playing a key role in local food security. In the regions where stakeholders of the green grams value chain have been interviewed (Makueni, Kitui, Tharaka, Nithi), the area under production typically varies from 1-10 acres per household.

Past trends in temperature

The temperature trend (from 1961-2005) for both the short (October, November, December, (OND)) and long rainy season (March, April, May, (MAM)) show that temperature in Kenya has been increasing by more than 0.8°C (Figure 1). In particular, the rate of increase has been by more than 1°C over north-eastern and north-western parts of the country during the long and short rainy season respectively.

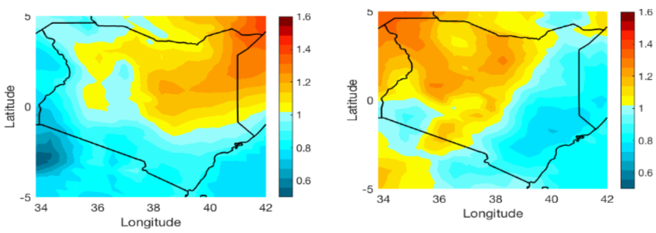


Figure 1. *Temperature trends (1961-2005), March, April, May (MAM) (long rains, LEFT) and temperature trends (1961-2005) – October, November, December (OND) (short rains, RIGHT)*

Climate change in future[1]

Temperature

During both the long and short rainy seasons, the model projection for mid-century (2050's) shows a temperature rise all over Kenya (Figure 2). The temperature is expected to rise by about 2.8°C - 3°C over western, southwestern, central, northern and north-eastern parts of Kenya during MAM (Figure 2). The temperature is also expected to rise over south-eastern part of Kenya by about 2.5°C during the same long rainy season. During the short rainy period, the temperature is expected to rise by about 2.5°C and 2°C in the western and eastern half of the country respectively.

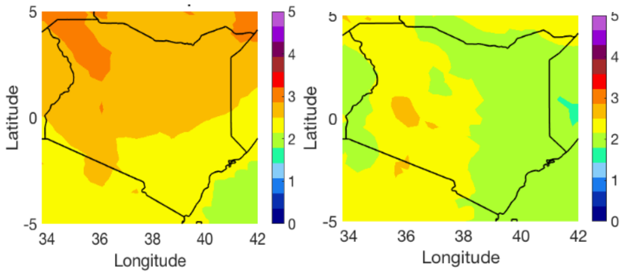


Figure 2*. Projected seasonal mean changes in temperature for 2050s under the RCP8.5 emission scenario (worst case scenario), relative to the reference period (1961-2005). During both the short (October, November, December; RIGHT) and long (March, April, May; LEFT) rainy season, temperature is likely to rise by more than 2°C with the highest increase of 3°C over north-western Kenya during the long rainy season (MAM).*

Precipitation

The seasonal mean rainfall in the short rainy season is projected to significantly increase in the north-western part of Kenya by as much as 50% for mid-century (Figure 3). In the north-eastern, central and eastern parts of the country, the seasonal mean rainfall is also expected to increase by up to 30-40% during the short rainy season.

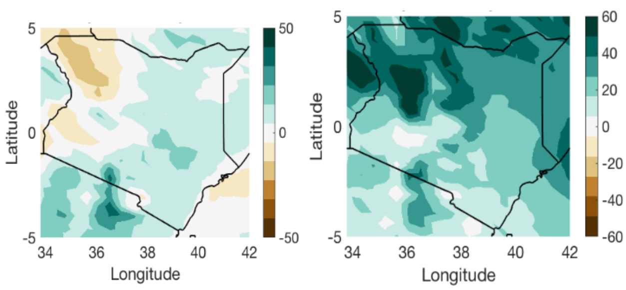


Figure 3. *Projected seasonal mean changes in rainfall (in percentage) for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005). The mean rainfall during the short rainy season (RIGHT) is projected to significantly increase in the northern part of Kenya by 40-50% for the 2050s. However, during the long rainy season (LEFT), the seasonal mean rainfall is expected to decrease by 10-20% over north-western and western parts of Kenya.*

[1] For this work on climate change projections, dynamically downscaled daily rainfall, maximum, minimum and mean temperature from the Rossby Center (SMHI) regional climate model (RCA4) was used. The regional model (RCA4; Dieterich et al., 2013) was used to downscale four Global Circulation Models (CanESM2, EC-EARTH, MPI-ESM-LR, GFDL-ESM2M) from the Coupled Model Inter-comparison Project Phase 5 (CMIP5). The regional model was run at a grid resolution of 0.44 x 0.44 over the African domain and all other details about the simulation can be found in Dieterich et al. (2013). The global models (GCMs) projections were forced by the Representative Concentration Pathways (RCPs), which are prescribed greenhouse-gas concentration pathways (emissions trajectory) and subsequent radiative forcing by 2100. In this study, we used RCP4.5 and RCP8.5, which are representatives of mid-and high-level of emission scenarios respectively

western and north-eastern part of the country (Figure 4) can translate into enhancement of extreme rainfall and resultant extreme events of flooding in the region. However, in the long rainy season, the seasonal mean rainfall decreases by about 10-20% in the north-western and western part of Kenya. Similarly, the consecutive wet days are expected to decrease by 1-2 days in the western and north-western parts of the country.

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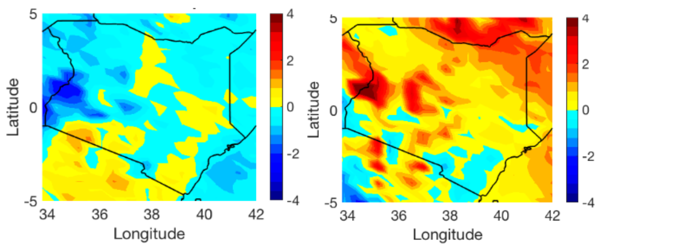

Figure 4. *Projected seasonal mean changes in consecutive wet days for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005). For the northern part of Kenya, the longest wet spell is likely to increase by about 2-3 days in the 2050s during the short rainy season (RIGHT). However, the length of the longest wet spell is expected to decrease by 1-2 days in the north-western and western part of the country during the long rainy season (LEFT).*

The projection of the longest consecutive dry days (CDD) for both the short and long rainy season show that dry spells will decrease for mid-and-end of the century in most parts of Kenya. Specifically, the reduction in the longest dry spell is about 4-5 days in the northern part of the country for OND, 1-2 days for MAM (Figure 5). The fact that the decrease in consecutive dry days combined with the previous findings of an increase in seasonal mean rainfall and consecutive wet days in OND reinforces the probability of extreme flooding events.

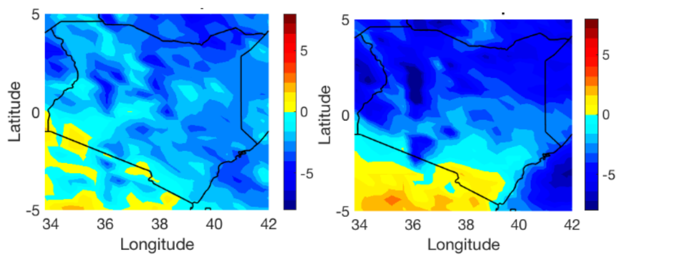

Figure 5*. Projected seasonal mean changes in consecutive dry days (in percentage) for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005). Dry spells are expected to decrease for the 2050s in most parts of Kenya, with the maximum decrease in the northern half of the country by about 4-5 days during the short rainy season (RIGHT). Dry spells are also expected to decrease in the north-eastern and eastern part of the country by about 1-2 days in the long rainy period (LEFT).*

In Summary, during both the short (OND) and long (MAM) rainy seasons, the model projections for 2050s show that a high temperature rise (particularly during MAM) is expected in all parts of Kenya ranging from 2.0°C to 3°C. An increase in seasonal rainfall and consecutive wet days in the short rainy season could reinforce the probability of extreme events of flooding in the north-eastern and north-western part of the country. However, a decrease in seasonal rainfall and a likelihood of more dry days in western Kenya during the long rainy season could have an implication of more incidences of agricultural drought in the region by 2050s.

Climate change impact (modelling study)

Unlike other crops, yields of green gram are likely to increase substantially in the future as a result of climate change during both the long and short rainy seasons. In both future long and short rainy seasons, green gram yields under optimum management conditions are likely to increase by about 2 tonnes per hectare in most areas. In Meru, yields are likely to increase by up to 6 tonnes per hectare in the future long rainy season. However, in Embu, yields are likely to decrease especially in the short rainy season when yield decreases of up to 2 tonnes per hectare are expected.

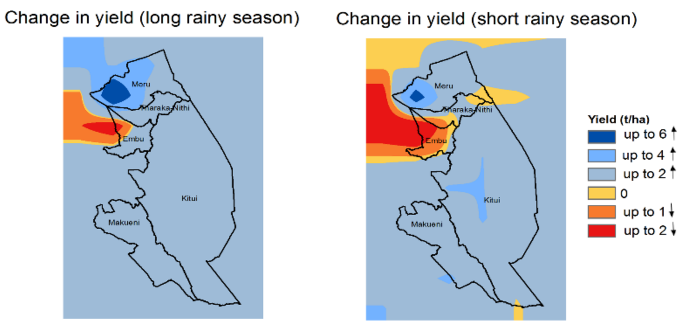

Figure 6*. Change in green gram yield under RCP 8.5 (2050s) compared to current climatic conditions. Red/orange areas indicate where yields are likely to decrease in the future and blue areas indicate where yields are likely to increase (Duku, forthcoming)*

Stakeholders' perceptions of climate change and its impact (climate change field survey results)

Approximately 70% of both female and male interviewed farmers have not experienced a difference in rainfall over the past ten years. Those that did experience change, mentioned that extreme rainfall had decreased. Concerning drought and temperature, 84.5% of all interviewed farmers mentioned an increase in drought and 92.7% of farmers felt that extreme high temperatures had increased. Striking difference is that most of the interviewed female farmers felt that the occurrence of extreme low temperatures had increased whereas most of the male farmers mentioned that it had decreased. 64% of the interviewed farmers reported that the start of the long rainy season had become more unpredictable (Figure 7).

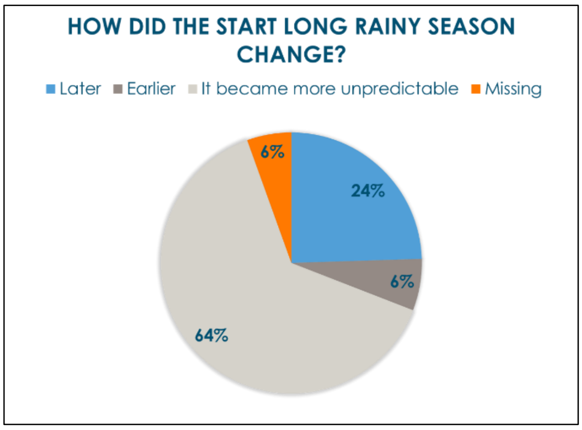

Figure 7. Smallholder farmers' perceptions of changes in the start of the long rainy season due to climate change (Climate change field survey green grams, 2019 (SNV, forthcoming)

A majority of all stakeholders cited a perceived decrease in crop productivity due to climate change (Figure 8).

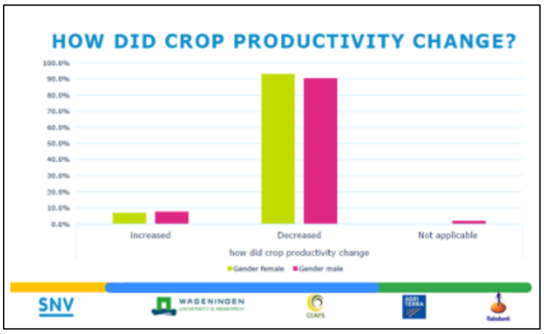

Figure 8. Stakeholder perceptions of the effect of climate change on crop productivity - Climate change field survey green grams 2019 (SNV, forthcoming)

Climate Risk Assessment workshop (24 -25 April, 2019)

The Climate Risk Assessment workshop brought together 60 participants representing the different stakeholders of the green grams value chain. The majority of the participants were male and female smallholder farmers (Figure 9).

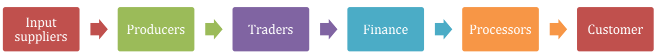

Figure 9. Value Chain Actors present at the Climate Risk Assessment Workshop

Stakeholders shared and discussed experiences with climate change, its impact on their business and the effectiveness of current coping strategies (Photo1).

Photo 1. Workflow day 1 - discussing climate change, impact on business, coping strategies and their effectiveness (processor, bank, traders) (Source: CRA workshop green grams, 24 & 25 April 2019)

Based on insights into climate change projections and participants' adaptive capacity, different adaptive strategies were discussed to anticipate and prepare for future conditions.

Adaptation strategies (examples)

- Biological pesticides
- Policy statements against emissions enhancing projects
- Conservation agriculture practices (e.g. zero tillage, mulching)
- Adoption of warehouse receipting system
- Diversification of factory raw materials to accommodate climate smart crops

Adaptation strategies with potential benefit for the entire value chain were further explored from a business perspective.

Figure 10. Template of the Climate Smart Business model canvas used to explore business opportunities

Climate smart business ideas were discussed to address high climate related risks and to improve the viability of the value chain.

Climate smart business ideas addressing climate change risks (examples)

- Finance: Providing green loans for CSA initiatives
- Input suppliers: Setting up weather information systems
- Farmers: Engaging in conservation agriculture and selling
- Trainings
- Processor: making use of waste materials for packaging and use of biogas

References

1. CIAT & World Bank. 2017. Climate-Smart Agriculture in Kenya. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture; World Bank, Washington, D.C. 25 p.
2. Duku, C. (forthcoming). Impact of climate change on green grams production in Kenya.
3. Climate change field survey on green grams value chain, Kenya, April 2019 (forthcoming).

Acknowledgement

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Project Information

The Climate Resilient Agribusiness for Tomorrow (CRAFT) project (2018 - 2022), funded by the Ministry of Foreign Affairs of the Netherlands will increase the availability of climate smart foods for the growing population in Kenya, Tanzania and Uganda. The CRAFT project is implemented by SNV (lead) in partnership with Wageningen University and Research (WUR), CGIAR's Climate Change Agriculture and Food Security Programme (CCAFS), Agriterra and Rabo Partnerships in Kenya, Tanzania and Uganda

For More Information:

Contact Susan Cantella (Project Manager) scantella@snv.org or
Dorah Egunyu (Communications Officer) degunyu@snv.or