Sesame Uganda

Climate change risks and opportunities

Sesame in Uganda

Uganda's agricultural sector is an important catalyst for economic growth, poverty alleviation, and food security. Nevertheless, the economic losses from the impacts of climate change on the agricultural sector by 2050 are estimated to be about US$1.5 billion (Zinyengere et al., 2016). 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). In 2010, Uganda was the fifth largest producer of sesame globally, and production peaked at about 216,000 mega tonnes in 2012 (FAOSTAT, 2018). The average yield of sesame is about 700 kilograms per hectare (FAOSTAT, 2018).

Past trends in temperature

The temperature trend (from 1961-2005) for both the short (October, November, December (OND)) and long rain season (March, April, May (MAM)) show that temperature in Uganda has been increasing for the past few decades by more than 0.8°C (Figure 1). In particular, the temperature trend in the short rainy season has significantly increased (by 1°C -1.4°C) in most parts of the country.

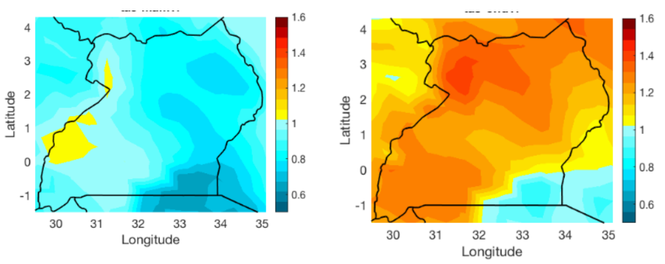

***Figure 1.** Temperature trend from 1961-2005 for the short rainy season (October, November, December) (RIGHT) and the long rainy season (March, April, May) (LEFT) in Uganda. During both the short and long rainy season, temperature has increased by more than 0.8C in the country.*

Climate change in future[1]

Temperature

During both the short and long rainy season, the model projections for mid-century (2050's) show a temperature rise all over Uganda (Figure 2). The temperature is expected to rise by about 3.2°C over southwestern and western Uganda especially during the long rainy season (Figure 2). This rise in temperature during the long rainy season is also anticipated in the rest of the country where temperature will rise by about 2.8°C over central, northern and eastern parts of Uganda. During the short rainy period, the temperature is expected to rise by about 2.8°C over the southwestern part of Uganda, and by more than 2°C over the rest of the country. Figure 2 shows that the expected rate of warming over the southwestern part of Uganda is higher than the rest of the country and the rise in temperature is generally higher in MAM as compared to OND.

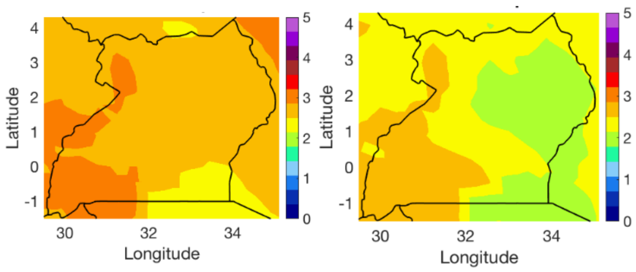

***Figure 2**. Projected seasonal mean changes in temperature for 2050s under the RCP8.5 emission scenario (worst case scenario), relative to the reference period (1961-2005). During both the short (October, November, December; RIGHT) and long (March, April, May; LEFT) rainy season, temperature is likely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

Precipitation

The seasonal mean rainfall in the short rainy season is projected to increase in the dry areas of the north-eastern and northern part of Uganda by as much as 40-50% for mid-century (Figure 3).

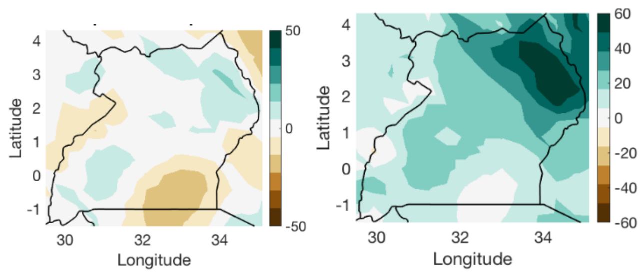

***Figure 3.** Projected seasonal mean changes in rainfall (in percentage) for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005). Note: The seasonal mean rainfall in the short rainy season (RIGHT) is projected to increase over most parts of the country. However, the seasonal rainfall is expected to decrease by 2050s over much of the southern part of Uganda during the long rainy season (LEFT)*

[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) are 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

In the north-eastern and northern part of the country, the increase in the seasonal mean rainfall in the short rainy period accompanied by an increase in the number of consecutive wet days by about 2-3 days (Figure 4) could lead to enhancement of rainfall in the region. However, the length of the longest wet spell in the southern half of the country during both short and long rainy season is expected to decline by about 2-4 days.

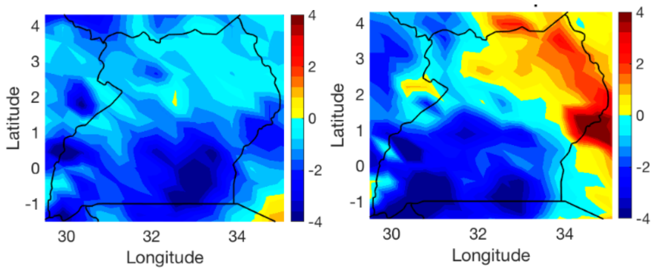

Figure 4. *Projected seasonal mean changes in consecutive wet days for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005). For the north-eastern part of Uganda, the longest wet spell during the short rainy season (RIGHT) is likely to increase by about 2-3 day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

Drought

The projection of the longest consecutive dry days (CDD) for the short rainy season show that dry spells are expected to decrease by about 3-5 days over most parts of the country except the southern tip (Figure 5). The decline in the dry spell coupled with the increase in the wet spell and seasonal rainfall in the north-eastern part of Uganda can reinforce the possibility of increased likelihood of floods in the region. On the other hand, during the long rainy season, the consecutive dry days are expected to slightly increase (~1day) over southern parts of the country. The increase in the consecutive dry days and the decline in the longest consecutive wet days coupled with the decrease in seasonal mean rainfall in the long rainy season (up to 5-10 %) could lead to shortage of rainfall and water scarcity in the region.

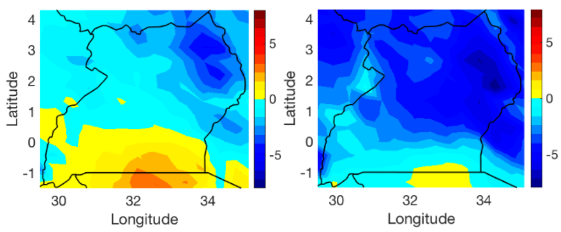

Figure 5*. Projected seasonal mean changes in consecutive dry days for mid-century (2050s) under the RCP8.5 emission scenario, relative to the reference period (1961-2005). Dry spells are expected to decrease by 3--5 days over most parts of the country except the southern tip during the short rainy season (RIGHT). A slight increase (~1day) in the dry spell is expected over the southern part of Uganda for the long rainy season (LEFT).*

In summary, during both the long and short rainy season, the model projections for 2050's show a temperature rise in all parts of Uganda. While rainfall is expected to increase in most parts of Uganda during the short rainy season, the long rainy season is expected to suffer from a long dry spell and a decrease in seasonal rainfall.

Climate change impact (modelling study)

Climate change is likely to considerably erode existing opportunities for yield increases in sesame especially during the short rainy seasons. Currently, the average yield of sesame is about 700kg/ha. Under current climatic conditions farmers can more than triple this with optimum nutrient management practices and biotic control. However, due to climate change impact in future (i.e. 2050s), in the short rainy season, yields under optimum management conditions are likely to decrease by up to 1000kg/ha in Gulu, Apac, Lira, Kitgum and large parts of Pader. In the long rainy season all these areas are likely to experience yield decreases as well. However, the sesame production in Apac and Gulu will be affected the most.

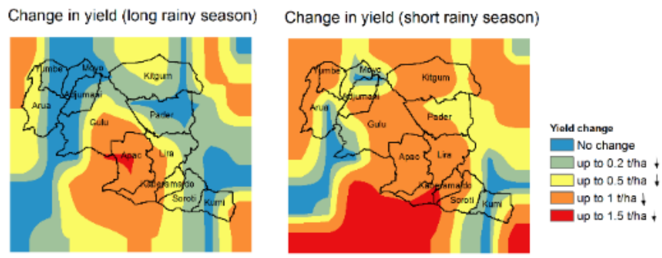

Figure 6*. Change in sesame yield under RCP 8.5 (2050s) compared to current climatic conditions. Yields were simulated under optimum nutrient management conditions and biotic control (Duku, forthcoming)*

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

A field survey on climate change and its impact amongst different stakeholders in the sesame value chain in northern Uganda was carried out in April 2019. The survey showed that 42% of the stakeholders reported a delayed start to the long rainy season compared to ten years ago. Majority of the respondents, however, consider the start of the long rainy season to have become more unpredictable (Figure 7). Over 90 % of all male and female respondents reported a decrease in sesame productivity (Figure 8). In addition to drought, changes in start of the rainy season etc., respondents attributed the reported decrease in productivity to the impact of climate change on the increased incidence of pests and diseases.

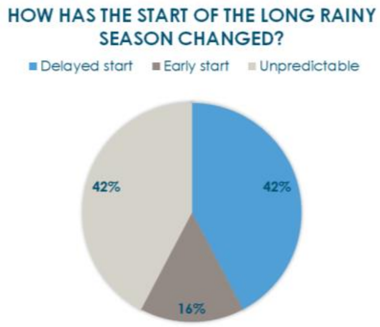

Figure 7. Stakeholders' perception of changes in the start of the long rainy season due to climate change - Climate change field survey, April 2019 (SNV, forthcoming)

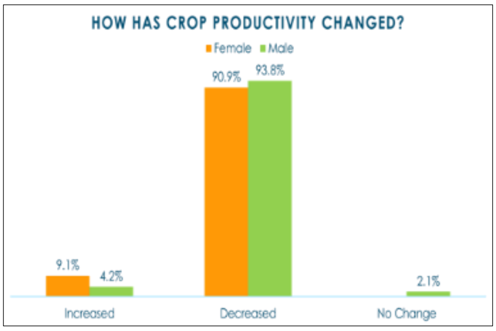

Figure 8. Stakeholders' perception of changes in sesame productivity due to climate change - Climate change field survey, April 2019 (SNV forthcoming)

Climate Risk Assessment workshop (29 - 30 April, 2019)

The Climate Risk Assessment workshop brought together 72 participants representing the different stakeholders of the sesame value chain. The majority of the participants were male and female smallholder farmers. Stepwise they shared and discussed experiences with climate change, its impact on their business and the effectiveness of current coping strategies (Photo 1). 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)

- Water harvesting
- Drought-tolerant seeds
- Plot channels for water drainage
- Irrigation
- Planting trees

Adaptation strategies with potential benefit for the entire value chain were further explored from a business perspective. Climate smart business ideas were discussed to address high climate related risks and to improve the viability of the value chain (Photo2).

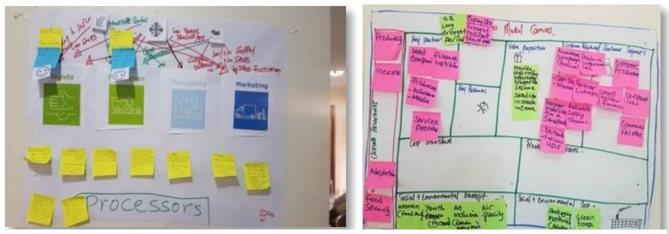

Photo 1 and 2. Results of discussion on impact of climate change on business (LEFT) and (RIGHT) Exploring climate smart business ideas using business canvass model (Source: CRA workshop sesame, 29-30 April 2019)

Climate smart business ideas addressing high-medium climate change risks (examples)

- Bundled services which provide access to drought-tolerant varieties, relevant information, finance and creation of market linkages
- Provide available and affordable water for production
- Provide high yielding varieties to insured farmers

References:

1. CIAT & World Bank. 2017. *Climate-Smart Agriculture in Uganda. CSA Country Profiles for Africa Series*. International Center for Tropical Agriculture (CIAT); World Bank, Washington, D.C.
2. Duku, C. (forthcoming). *Impact of climate change on soybeans in Uganda.*
3. FAOSTAT, 2018. *FAOSTAT Database*. Food and Agriculture Organization of the United Nations, Rome, Italy.
4. SNV (forthcoming) *Climate change field survey on soybeans, Uganda*, April 2019.
5. Zinyengere, N., Araujo, J., Marsham, J. and Rowell, D. (2016). *Africa's climate - helping decision-makers make sense of climate information: Uganda country factsheet.* Future Climate for Africa, Cape Town, South Africa.

Acknowledgement

This document was developed by Confidence Duku, Annemarie Groot, Monserrat Budding-Polo (Wageningen Environmental Research), Teferi Demissie (CCAFS) with contributions from: George Oroma (SNV), the Ugandan SNV team, Agriterra, and Rabobank. It highlights activities and examples of results of a climate risk assessment for the sesame value chain implemented in the period January - April, 2019. The assessment was carried out in the context of the **Climate Resilient Agribusiness for Tomorrow (CRAFT**) project.

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 Project (CCAFS), Agriterra, and Rabo Partnerships in Kenya, Tanzania and Uganda

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