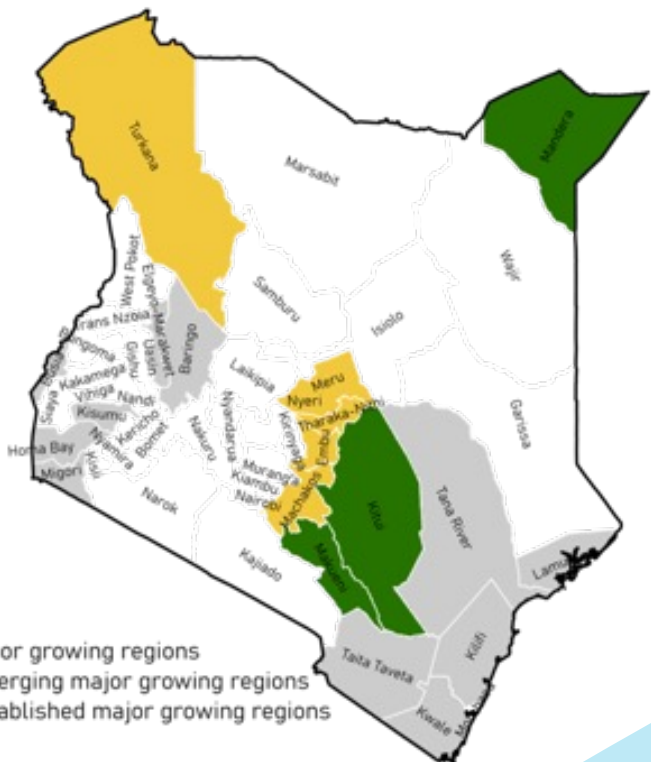




Climate Risk and Opportunities Greengrams in Kenya

Green gram, also known as mungbean, maash or moong (*Vigna radiata* L.), is an important food and cash crop in Kenya. Green gram is drought tolerant with rainfall requirements ranging between 350-700 mm per year. The major green gram growing areas include Kitui, Makueni, Mandera, Tharaka-Nithi, Turkana, Embu, and Machakos. The productivity ranges from > 600 kg/acre in Bungoma, and Embu counties to > 320kg/acre in Kiambu, Homa Bay, and Kisumu, against a global average yield of 730kg per acre.

An economic review of the agriculture sector carried out by the Ministry of Agriculture between 2014 and 2016 indicates that Kenya produces 103,234 metric tons of green grams annually, significantly below the average national consumption of 130,000 metric tons. Kenya has been importing over 6,000 metric tons of green grams from neighboring countries annually to cover the supply deficit. .



Data source: Ensembled CORDEX data.

Note: RCP 8.5 emission scenario has been used to assess the climate change events and impacts. For future analysis, the 2050s (2006-2050) timesteps were used. For the current, the period 1981-2005 had been used. MAM refers to March, April, and May. OND refers to October, November, and December.

Future climate under climate change

Rainfall: Comparing current rainfall with what is expected in future (2050s), the amount of rainfall is likely to change. The change varies across different regions and seasons.

In the MAM season, most of the green gram-growing counties are expected to face a slight increase in rainfall. The largest increase is expected in Turkana.

In the OND season, a larger increase in rainfall is expected over much of the growing areas.

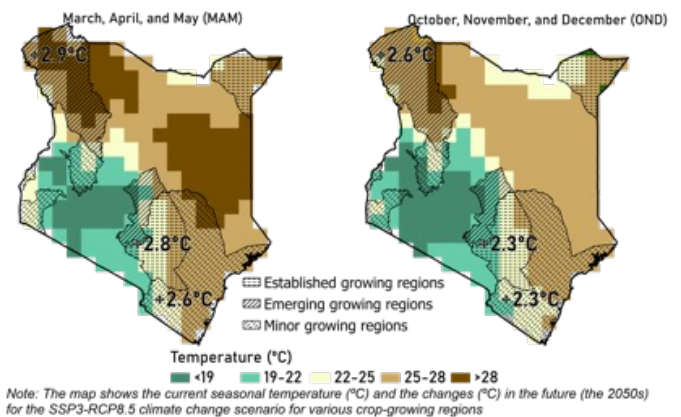
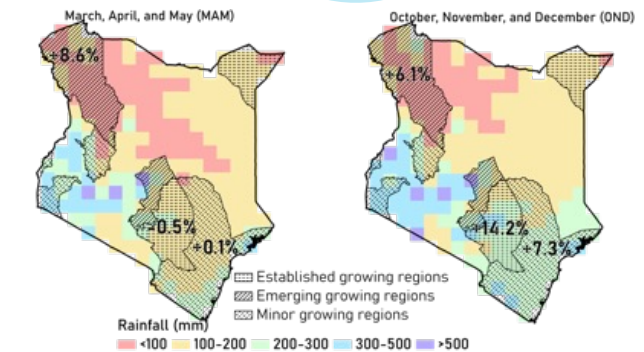
More dry spells with an implication of more frequent droughts are especially expected in the Western sunflower growing areas in Tanzania, during the March, April, May season.

Temperature: In future (2050), temperature is expected to rise in all green gram growing areas, especially in the MAM season (from 2.6°C in the Southeastern region to 2.9°C in the Northwestern region).

Dry periods: In the Western and Southwestern (minor) green gram growing areas, dry periods become shorter in both seasons.

The frequency of dry periods is expected not to change in the MAM season. In the OND season, the frequency of dry periods will probably slightly decrease.

Flood risks: The Southwestern and Western green gram growing areas face higher flood risk due to an increase in rainfall and consecutive wet days in the OND season.

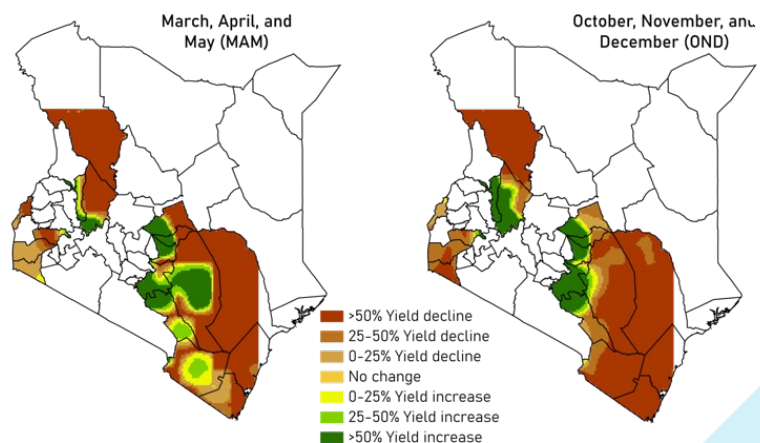


Green gram crop productivity changes (%) in the future

In future (2050), overall, green gram yield in the country is projected to decrease (up to 70-90%) in both seasons compared with the current situation, except for a few counties from the major growing counties.

Compared to MAM, OND yields are projected to have mild negative impacts and a few areas are expected to have a slight yield increase in the future due to an increase in seasonal rainfall.

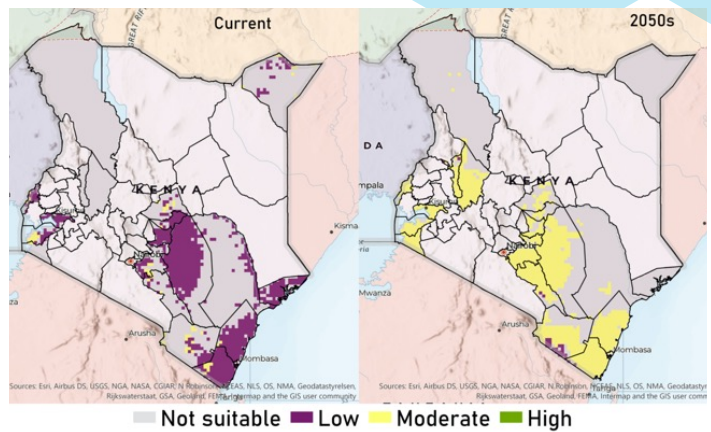
Major yield losses (up to 90%) are expected in Kilifi, Kwale and Turkana counties in both seasons.



Green gram crop-growth suitability

Overall, the suitability for green gram production is likely to increase in future. Most of the green gram growing area that currently have a low suitability or are considered not suitable at all become moderately suitable for green gram production.

In the northern region, a few areas that currently have a low suitability will not be suitable for green gram production in future.



The probability of drought risks

In March, a few areas from Meru and Turkana counties are projected to face high drought risk.

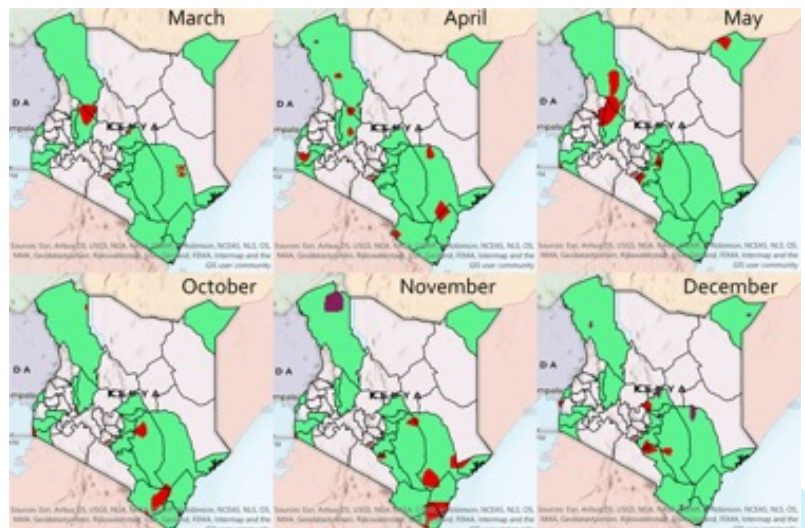
In April, small areas in Baringo, Kilifi, Machakos and Turkana counties are expected to face a high risk of drought.

In May, Embu, Machakos, Mandera, and Turkana counties are projected to have part of the area under high drought risk.

In October, a minimal area from major green gram-growing counties except for Kitui is expected to face high drought risk.

In November, a significant amount of areas from Kilifi and Kwale are expected to face high drought risk.

In December, a substantial part of Machakos, Makueni and Meru counties are likely to experience high risk of drought.








The probability of drought risks has been analyzed based on the Standardized Precipitation Index (SPI). The calculation of SPI is done based on the record of long-term precipitation for 45 years (2006-2050). To assess the risk, we calculated the occurrence of droughts over 45 years (2006-2050) for each month in rainy seasons (MAM and OND) and then calculated the probability by applying the following formula:

$$\text{Probability of drought risks} = \frac{\text{No. of droughts}}{\text{Total years (45)}} \times 100$$

Note: In drought analysis, more than 30% of drought occurrence are classified as high-risk region, 10 to 30% of occurrences are classified as Moderate risk, and less than 10% of occurrences has been classified as Lower Risk.

Climate change adaptation strategies

Adaptation measures are listed based on the discussion with the CRAFT team from Kenya under the following objective, *“To establish suitable adaptation strategies that will increase the adaptive capacity and resilience of the actors within the value chains.”* The listed adaptation measures mainly focused on the green gram value chain in Kenya.

Climate risks	Impacts	Adaptation measures	Impacts of adaptation measures
 Drought	Flower abortion, crop stress, reduced quality and yield of products, late land preparation, and less area ploughed.	Drought/pest & disease tolerant varieties, early maturing varieties, soil water measures (terraces, zero/minimum tillage, mulching, ripping, sub soiling, planting basins, zai pits), and crop diversification.	<ul style="list-style-type: none"> • Increased resilience • Enhanced water retention • Reduction in soil erosion and nutrient losses • Improved soil structure and fertility • Increased yields
 Intense rainfall (Floods)	Delay in planting, Reduced vegetative growth, flower abortion, an early shattering of pods, and crop failure	Conservation tillage, terracing, ripping, and subsoiling.	<ul style="list-style-type: none"> • Increased resilience • Reduction in risk of water logging • Reduction in soil erosion • Reduction in risk of yield loss
 Increase in Temperature	Crop stress, flower abortion, poor filling of the pod, reduced quality and yield, and crops susceptible to pests and diseases.	Mulching, cover crops, use of heat-tolerant varieties, and conservation tillage.	<ul style="list-style-type: none"> • Increased resilience • Reduction in risk of yield losses • Improved soil fertility • Enhanced soil moisture retention
 Soil degradation	Crop stress, reduced quality, and reduced yield	Pesticide application, crop rotation, intercropping, management practices (i.e., roguing, uprooting)	Pesticide application, crop rotation, intercropping, management practices (i.e., roguing, uprooting)
 Pest and diseases	Crop stress, reduced quality, and reduced yield	Pesticide application, crop rotation, intercropping, management practices (i.e., roguing, uprooting)	Pesticide application, crop rotation, intercropping, management practices (i.e., roguing, uprooting)

Acknowledgment

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