Food Security in Ghana

October, 2021

AgMIP The Agricultural Model Intercomparison and Improvement Project

Climate Change Impact on Farmers' Livelihood; The Case for Navrongo, Ghana.

Photo Credit: Samuel Adiku

Key Messages

Projected changes in agricultural production systems, in response to developmental goals as well as commodity prices, if adopted will lessen the negative impact of climate change on farmers' livelihoods under future production system even though a significant proportion of farmers will remain vulnerable.

Using heat tolerant crop varieties has the potential to further reduce the proportion of farmers vulnerable to climate change.

Climate

- **Temperature increases are projected for Navrongo**. High and moderate emission scenarios would result in up to 1.9 and 2.7 °C respectively by the 2050s
- **Changes in rainfall are projected to be variable:** An increase of up to 10% in total amounts is expected while the number of rainy days would reduce by 13%.

Vulnerability

- **Peanut,** as it is cultivated today, is not vulnerable to climate change and would almost always benefit from it. **Maize** is highly vulnerable, while **Sorghum** is moderately vulnerable to climate change and could either slightly benefit or suffer from it.
- **In tomorrow's production system**, **maize** continues to suffer from climate change, while **sorghum** remains relatively unaffected and could slightly benefit or suffer from it. **Peanut** still almost always benefits from climate change.

Adaptation

- A long crop life cycle is sufficient to reduced the negative impacts of climate change on the cereals, especially maize, while peanut only benefits marginally

Vulnerability to climate change under current and future production systems in Navrongo, Ghana

Current Production System

Continuation of the current agricultural system under future climate conditions (2050) would lead to reductions in maize yield by 12 to 20%. On the other hand, sorghum yields would largely be unaffected by climate change, apparently due to its relatively higher tolerance to higher temperatures and drought stress. Peanut, unlike the cereals, will benefit from climate change due to projected CO_2 fertilization. The practice of the current agricultural production system under future climate conditions would result in between 48 to 59% of households becoming vulnerable to climate change. This translates into a reduction in net farm returns and up to 7% increase in poverty.

Future Production System

In the future, agricultural production systems at Navrongo are expected to use improved seeds, planting density, and fertilizer applications. Further, it is also expected that advancements in socio-economic, institutional, biophysical and technological systems would improve overall productivity. For this future production system, two scenarios of productions were assessed; sustainable, and fossil fueled, development pathways. Under these future systems, climate change impact on maize would still be negative compared to sorghum. In both cases, however, the impacts would be more severe in the future production systems compared with current production system. Peanut would continue to be positively impacted by climate change. The magnitude of impact, however, reduced under the fossil fuel development pathway.

Changes in the production system, if adopted, will mitigate the increased future climate impacts to result in a reduction in the proportion of households vulnerable to 36% - 48% and a reduction in poverty by up to 5% and 3% under the sustainable and fossil fuel pathways respectively.

Adaptation

A longer crop life cycle is sufficient to reduce the negative impacts of climate change on the cereals, especially maize. Peanut yield would also increases but at lower magnitude. At least 50% of households may adopt use of heat tolerant variety resulting a reduction in poverty rate by 25% under both sustainable and fossil fuel driven agricultural development pathway pursued.

Authors: ***MacCarthy D.S., Valdivia R., Anaglo J., Madajewicz M., Clottey J., Adiku S., Amoah A.B., Amoako K.K., Quist E., Botchway V.A, Klutse N.A.B., Mutter C. & Rosenzweig C.***

2050s Climate Projections

Climate in Navrongo is likely to be variable with reduced rainfall events and higher temperatures

+1.9 to 2.7°C

Variable Rainfall: An increase of up to 10% in total amounts is expected while the number of rainy days would reduce by 13%.

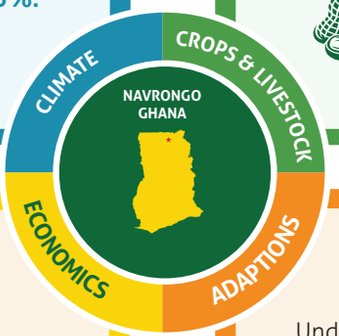
2050s Productivity Projections

Changes in climate could lead to:

Maize
In future farming systems characterized by higher input levels, maize continuous to be negatively affected by climate change.

Sorghum
Remains relatively less negatively impacted by climate change

Peanut
Always benefits from climate change



2050s Economic Projections

Under current production systems, between 48 and 59% of households are vulnerable to climate change

Under current production system, poor households could increase by up to 7% due to climate change.

With sustainable development, about 40% of households will be vulnerable to climate change in the future

With sustainable development poverty rate could **decline** by **up to 5%**

2050s Adaptation Projections

Under future production systems, between 30 and 47% of households are vulnerable to climate change

Cereal Productivity
Using maize and sorghum with longer life cycle will improve yield and reduce negative impact of climate change

Peanut Productivity
Peanut also benefits from heat tolerant varieties but at a lower magnitude.

Improved Livelihoods
Adaptation will increase net farm income and reduce poverty in Navrongo.

48 - 56% of households could possibly **benefit** from adaptation to climate change.

Acknowledgment: This work was carried out with financial support from the UK Government's Department for International Development and Foreign, Commonwealth & Development Office, as well as the International Development Research Centre, Ottawa, Canada Climate and Resilience (CLARE) Program; via the Agricultural Model Intercomparison and Improvement (AgMIP) 'A-Teams' project award #109204-001 to Columbia University, including support of seven additional AgMIP partners. This publication has not been peer reviewed. Any opinions stated in this publication are those of the author(s) and are not necessarily representative of or endorsed by the partners.

For more information on the AgMIP-CLARE Project, visit http://agmipimpactsexplorer.
Contact: dsmaccarthy@gmail.com/dmaccarthy@ug.edu.gh