Managing climate risks in cropping systems and designing resilient climate-smart farming systems for Senegal

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Introduction

- Agriculture in Senegal is largely subsistence, low input, labour intensive, and sensitive to the prevailing climate, and hence the country is vulnerable to food insecurity.

- Under the AICCRA project, the principal focus is to contribute to the better resilience of production systems in the context of climate change.

- A value chain-based prioritization process identified the production of millet, groundnuts, and cowpeas is being negatively affected by climate change due to soil degradation and poor weather conditions.

- Limited access to agro-advisory services and good quality seed and other agricultural inputs as well as insufficient infrastructure.
Objectives and justification for intervention areas

- Strengthen the capacity of targeted partners and key stakeholders
- Dissemination of climate information services (CIS) to thousands of farmers to improve their decision-making
- Development of public-private partnership business models for the dissemination of CIS
- Large-scale diffusion of validated and uptake of best bet CSA innovations option in dry cereal systems
- Strengthened former Project achievement in Méoune (Tivaoune) and Daga Birame (Kaffrine) by CCAFS
- Extends the knowledge to Thiel (Louga region) which is the transition between the peanut basin and sylvo-pastoral zone.
- Need to carry out actions research that provides solutions to climatic risks.
Farmers’ Perception via Focus Group Discussion (FGD)

Major Constraints Highlighted

- Seed Availability: 95%
- Fertilizer Availability and Costs: 92%
- Agricultural Machinery: 89%
- Climate Variability: 89%
- Pests and Disease: 88%
- Labor: 83%
- Land Availability: 82%
- Market: 82%

Respondents across clusters

CIS use by Farmers

- Weeding: 100%
- Sowing: 100%
- Land Preparation: 100%
- Harvesting: 65%
- Fertilizer Application: 29%
- Storage: 12%
- Cropping Pattern Change: 0%
- Variety Selection: 0%
- Pests Control: 0%

Respondent across Clusters
<table>
<thead>
<tr>
<th>Crop/Cluster</th>
<th>Dagua Birame Without Fertilizer Yield</th>
<th>Dagua Birame With Fertilizer Yield</th>
<th>Thiel Without Fertilizer Yield</th>
<th>Thiel With Fertilizer Yield</th>
<th>Méouane Without Fertilizer Yield</th>
<th>Méouane With Fertilizer Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut</td>
<td>680 kg/ha</td>
<td>1570 kg/ha</td>
<td>670 kg/ha</td>
<td>1480 kg/ha</td>
<td>460 kg/ha</td>
<td>932 kg/ha</td>
</tr>
<tr>
<td>Pearl millet</td>
<td>240 kg/ha</td>
<td>1710 kg/ha</td>
<td>520 kg/ha</td>
<td>1560 kg/ha</td>
<td>300 kg/ha</td>
<td>1152 kg/ha</td>
</tr>
<tr>
<td>Maize</td>
<td>500 kg/ha</td>
<td>1950 kg/ha</td>
<td>550 kg/ha</td>
<td>1640 kg/ha</td>
<td>- kg/ha</td>
<td>- kg/ha</td>
</tr>
<tr>
<td>Sorghum</td>
<td>200 kg/ha</td>
<td>800 kg/ha</td>
<td>- kg/ha</td>
<td>- kg/ha</td>
<td>- kg/ha</td>
<td>- kg/ha</td>
</tr>
<tr>
<td>Cowpea</td>
<td>350 kg/ha</td>
<td>200 kg/ha</td>
<td>200 kg/ha</td>
<td>560 kg/ha</td>
<td>- kg/ha</td>
<td>- kg/ha</td>
</tr>
</tbody>
</table>

**Farmers’ Perception via Focus Group Discussion (FGD)**
Coping with climate risk – tactical?

- **Cropping systems must be smart, and** contributes to climate change adaptation by sustainably increasing productivity & resilience
  - In-season adjustment of inputs or target output
  - Risk-reducing measures - Crop insurance, climate knowledge
  - Forward selling, contracts,
  - Application of IoT’s (Internet of things – connected sensors, drones)

Coping with climate risk – strategic?

- Selection of crop types and varieties
- Timing of planting
- Re-designing farming systems
  - Historical and future climate analyses and modelled scenario analysis
  - Co-design of the farm system for resilience and market opportunities
  - Infrastructure and institutions to enhance adaptive capacity
Our approach.....

- To combine crop model simulation and field experimentation to evaluate crop response to *variable climate risks* (e.g. rainfall amount and distribution), *management practices* (e.g. planting date, fertilization strategies, population etc.), and *soil types* that will inform decisions on appropriate CSA packages and seasonal *yield forecasting*.

- Thus, implementing participatory research and extension approach (PREA) – to accelerate the adoption of CSA & CIS dissemination towards climate risks management.
Integrating CSA & CIS

Brief Description: CSA packages deployed supported with seasonal yield forecasting.

Application domain: 2 AEZ piloted-Decision support tool to evaluate crop response to variable climate risks & farm management practices that will inform decisions on appropriate CSA packages as well seasonal yield forecasting.

Result: 108 demonstration plots in 18 villages combining pearl millet and groundnut cultivars with ISFM approach – 3 Technology parks to promote adapted improved varieties of millet, groundnut, and cowpea compared to local variety as well as different production techniques

Enabling conditions for further scaling/uptake- via organized farmers’ field days across the clusters
Deployment of AgCelerant IoT and manual rain gauge to reduce basis risk, validate downscaled data and support CSA

- **2022 pilot**: 8 *agCelerant* IoT automatic alongside 20 manual rain gauges have been deployed to 20 communities across three clusters

- Supporting CSA advisories on planting dates and farming activities based on in-season rainfall forecasts being implemented by ICRISAT and CERAAS

- Validation from existing infrastructure, downscaled climate data (with ANACIM)

- Immediate beneficiaries are the farmers and thereafter serve as a source of information to insurance companies
Matching crop varieties to agro-ecological zones in Northern Nigeria to determine optimal planting windows toward reducing climatic risk due to crop failure and early terminal drought

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target AEZ</th>
<th>Cultivar</th>
<th>Optimum Planting window</th>
<th>Simulated yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearl Millet</td>
<td>Sudan Savanna</td>
<td>JIRANI</td>
<td>June 5 and 30</td>
<td>2425 - 2935</td>
</tr>
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<td></td>
<td></td>
<td>SOSATC88</td>
<td></td>
<td>2322 - 2832</td>
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<td></td>
<td></td>
<td>SUPERSOSAT</td>
<td></td>
<td>2083 - 2552</td>
</tr>
<tr>
<td></td>
<td>Northern Guinea Savanna</td>
<td>JIRANI</td>
<td></td>
<td>2268 - 2893</td>
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<td>SOSATC88</td>
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<td>2327 - 2917</td>
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<td>SAMNUT-23</td>
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<td>2089 - 2641</td>
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<td></td>
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<td>SAMNUT-24</td>
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<td>1457 - 1798</td>
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<td></td>
<td>SAMNUT-25</td>
<td></td>
<td>1060 - 1200</td>
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<td>SAMNUT-26</td>
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<td>1119 - 1399</td>
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<td>SAMNUT-23</td>
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<td>1395 - 1580</td>
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<td>SAMNUT-24</td>
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<td>992 - 1023</td>
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<tr>
<td></td>
<td></td>
<td>SAMNUT-25</td>
<td>May 25 and June 30</td>
<td>1129 - 1263</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAMNUT-26</td>
<td></td>
<td>1082 - 1246</td>
</tr>
</tbody>
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Akinseye et al., (2020)

Previous Examples......
Thank you for listening
Questions I would like to discuss.

• How can crop-modeling studies inform policies in supporting the development of climate resilience in the cropping systems?

• How does the impact of management on the climate resilience of cropping systems change when information about farm and farmer socio-economic characteristics is included in crop modeling studies?