Improving Soil Quality and Crop Productivity through Farmers Tested and Recommended Conservation Agricultural Practices in Cropping Systems of West Africa

Sustainable Agricultural and Natural Resource Management – Collaborative Research Support Program (SANREM – CRSP)

Lead Institution: Kansas State University

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W. Africa: Mali and Ghana
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Multi-disciplinary: integrated for research, extension and graduate training
W. Africa: Problems: Climate Change

Projected Water Resources

Projected Temperatures

West Africa is going to experience more heat and drought stress.
Problems: Soil Erosion and Soil Quality

Soil Erosion: Wind

Soil Erosion: Water

Wild Fires: Burning

Poor Soil Fertility
Sub-Saharan African countries use less than 10 kg/ha of fertilizer (versus an average of 100-200 kg/ha in Asia)

Cost of fertilizer for West African farmer is similar or higher than US farmers cost. But his income is 0.10% compared to US farmers.

Wages per day is about <$5.
Problems: Cultivar Adoption and Genetics

New Variety Adoption by Region

Our Project: Goal

Our overall goal is to provide food security by increasing economic returns to smallholder farming households dependent on rain-fed agriculture.

This will be achieved through gender-sensitive farmer participatory development, discovery and dissemination of sustainable CAPS that improve soil quality, water capture, water use efficiency, crop productivity, and efficient use of inputs and labor.
Region – Ghana – Upper West - Villages

Districts: Municipal, Wa West, Nadowli and Lawra.

Lawra District: Brutu, Bo and Puffiu. (NGO, LACERD).

Nadowli District: Sombo (NGO, Upper West Agro-Industries)

Wa Municipal: Busa, and Busa Tangzu. (NGO Upper West Agro-Industries)

Wa West District: Nyoli, Siyiri, Dorny, and Kpongri. (NGO responsible is Lassia Tuolu Agric. Project).
Region – Ghana – Upper West

Lead Country PI:

Dr. Jesse B. Naab
Soil Scientist and Cropping Systems
Savanna Agricultural Research Institute
Upper West Region, Wa
Ghana

Providing Leadership in the Region – Passionate about Development
Upper West region is food insecure and vulnerable.
Available crop growing season is about 180 – 210 days. Soil are mostly light textured with poor fertility.

Average soil fertility status of upper west region

Source: Soil Research Institute (SRI) CSIR - Kumasi.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Upper West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil pH</td>
<td>6.0 – 6.8</td>
</tr>
<tr>
<td>Organic matter (%)</td>
<td>0.5 – 1.3</td>
</tr>
<tr>
<td>Total nitrogen (%)</td>
<td>0.01 – 0.07</td>
</tr>
<tr>
<td>Available P (mg /kg soil)</td>
<td>2.0 – 7.4</td>
</tr>
<tr>
<td>Available Ca (mg / kg soil)</td>
<td>52 - 152</td>
</tr>
</tbody>
</table>
Main crops include sorghum, millet, maize, peanut, cowpea and bambara nuts

<table>
<thead>
<tr>
<th>Group</th>
<th>Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>Maize, millet, sorghum, rice</td>
</tr>
<tr>
<td>Industrial crops</td>
<td>Cotton, sheanut</td>
</tr>
<tr>
<td>Legumes</td>
<td>Cowpea, bambara nut, groundnut, soybean</td>
</tr>
<tr>
<td>Fruits</td>
<td>Papaya, mango, cashew,</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Tomato, pepper, okra,</td>
</tr>
<tr>
<td>Roots and tubers</td>
<td>Yam, cassava, sweet potato</td>
</tr>
</tbody>
</table>
Region – Ghana – Upper West - Partners

NGOs:

1. Lassia Tuolu Agricultural Project
2. Langmaal Centre for Rural Development Initiatives
3. Upper West Agro-Industries Limited
1. **Lassia Tuolo Agricultural Project (LAP)**

   The Lassia Tuolu Agricultural Project is an NGO under the Catholic Diocese of Wa. The operational areas of LAP are Wa West and Wa East Districts. The core functions of LAP are:

   - **Formation of farmer groups and nurturing them into viable farmer based organizations;**
   - **Training of farmers in group dynamics, livelihoods, credit and savings;**
   - **Extension services mainly agronomic training;** and
   - **Linking of the FBOs to other players in the value chain (input dealers, markets and processors).**

   The LAP currently works with 30 Farmers Based Organizations with a total of 600 members.
2. Langmaal Centre for Rural Development Initiatives

The Langmaal Centre for Rural Development Initiatives (LACERD) is an NGO operating in the Nandom traditional area of the Lawra district (see map) in the Upper West Region. The core businesses of LACERD are:

- Formation of farmer groups and training;
- Agriculture is the main focus;
- Concerns about environmental issues; and
- Gender issues and training

3. Upper West Agro-Industries Limited (UWAgI)

The Upper West AgroIndustries Limited is a local NGO established 10 years ago with the goal of contributing to food security and poverty reduction. The UWAgI works with about 120 farmer groups by providing inputs (land preparation, seeds and fertilizers) to produce soybean which is then purchased by the company. The farmer groups own shares in the company.
Region – Mali

Lead Country PI:

Dr. Mamdou Doumbia
Soil Scientist
Institute of Economic and Rural Development
Mali

Passionate Researchers
## Region – Mali – Mid and North Districts

Most northern regions are food insecure and vulnerable.

<table>
<thead>
<tr>
<th>Villages</th>
<th>Region</th>
<th>Rain (mm)</th>
<th>Cropping System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koporopin</td>
<td>Mopti</td>
<td>500</td>
<td>Millet</td>
</tr>
<tr>
<td>Lagassagou</td>
<td>Mopti</td>
<td>500</td>
<td>Millet</td>
</tr>
<tr>
<td>Fambougou</td>
<td>Segou</td>
<td>700</td>
<td>Millet / Sorghum</td>
</tr>
<tr>
<td>Bouawere</td>
<td>Segou</td>
<td>700</td>
<td>Millet / Sorghum</td>
</tr>
<tr>
<td>Siguidolo</td>
<td>Segou</td>
<td>800</td>
<td>Sorghum</td>
</tr>
<tr>
<td>Oumarbougou</td>
<td>Sikasso</td>
<td>800</td>
<td>Maize</td>
</tr>
<tr>
<td>Fansirakoro</td>
<td>Koulikoro</td>
<td>900</td>
<td>Maize</td>
</tr>
<tr>
<td>Noyeradougou</td>
<td>Sikasso</td>
<td>1000</td>
<td>Maize</td>
</tr>
</tbody>
</table>

Legend:
- Green: Generally Food Secure
- Yellow: Moderately Food Insecure
- Orange: Highly Food Insecure
- Red: Extremely Food Insecure
- Filled Black: Famine
- Gray: No Data
Most central and northern regions are dry and south is wet. Important crops include sorghum, millet and cotton in north.
**Region – Mali – Partners**

**Extension Service:**
National Department of Agriculture
Regional Department of Agriculture

**NGO:**
1. PRECAD: Syngenta foundation (agricultural development)
2. AMADE: Malian Association for Development (socio-economic development of rural population)
3. AMEDD: Association of Malian Development (sustainable rural development)
Conservation Agricultural Practices (CAPS)

Can CAPS help small farmers improve productivity and help adapt to climate change?

- Crop Residue
- Cover Crop
- Minimum Tillage
- Crop Rotation
- Water Harvesting
- Nutrient Management
Our Project: Critical Questions

Critical questions associated with CAPs for smallholder resource-poor farmers of West Africa, include:

(a) which CAPs can positively contribute to productivity, address needs of farmers and under what specific conditions;

(b) what are positive and negative aspects (trade-offs) of CAPs both in short-term and long-term;

(c) can CAPs be economically beneficial in short run, can they be adopted by smallholder farmers and if preconditions for adoptions exist; and

(d) which types of processes are most efficient in assessing CAPs with farmers and extending them to larger scale.
Conservation Agricultural Practices (CAPS)

Crop residue is available.
Crop residue is valuable forage, and important building material.
Conservation Agricultural Practices: Challenges

If left in field problem of free grazing, termites and fire.
Discovery, capacity building and dissemination are the key for improving agriculture in Africa.
Farmers Driven Research Approach

Farmers should be the key component at all stages of research and development.

Farmers should feel ownership in research. Build-on existing local technologies.
Farmers Driven Research Approach

Perceptions / Needs
Farmers, Researchers
Marketers

Research Projects
- Multi-factor on-station and on-farm experiments (Mother Trials)
- Applied Research
  - Components of CAPs
    - Minimum tillage
    - Cover crops
    - Residue Management
    - Crop Rotations

Extension Projects
- Technology Transfer
  - Existing / New technology
  - Training extension agents
  - Training NGO
  - Training village leaders
  - Training farmers

Capacity Building and Education
- Graduate Students
- U.G. Internships
- Researchers
- Farmers

Year 1
Year 1 through 5
Approach and Road Map

1. Needs Assessment: Problem Diagnosis with Farmers

2. Collecting base line information on socio-economic and biophysical conditions

3. Gender Sensitization Training

4. Community Engagement / Network Building with all Stakeholders

5. Farmers Identified CAPS for evaluation

6. On-Farm (5 -10 villages) and On-Station (2 – 3) Demonstrations (Mother-Trials)

7. Farmers led and managed : single / multiple CAPs in their own fields (Baby-Trials): 10 – 25 in each village

8. Technical and Impact Assessment of CAPs

9. Methodology Assessment and Gender Impact Analyses

10. Extend and Scale-up in other villages with in and outside the region (Baby trials)
<table>
<thead>
<tr>
<th>Year/Month</th>
<th>Plan of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec – Jan 09</td>
<td>- Planning meeting collaborators</td>
</tr>
<tr>
<td></td>
<td>- Identification of sites, and villages for surveys</td>
</tr>
<tr>
<td></td>
<td>- Interviewing potential students</td>
</tr>
<tr>
<td>Jan - Feb 10</td>
<td>- Development of questionnaires, and minimum data-set for social and biophysical data</td>
</tr>
<tr>
<td></td>
<td>- Identification of graduate students</td>
</tr>
<tr>
<td>Mar – Apr 10</td>
<td>- Pretesting of questionnaires, and conducting village baseline surveys</td>
</tr>
<tr>
<td>May – June 10</td>
<td>- Analysis of village survey</td>
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<tr>
<td></td>
<td>- Determination of treatments (for multi-factor long-term trial and technology transfer experiments)</td>
</tr>
<tr>
<td>June 10</td>
<td>- Defining and planting research studies, and planning extension and capacity building activities.</td>
</tr>
<tr>
<td>Jul – Sep 10</td>
<td>- Evaluating progress and data collection from different experiments</td>
</tr>
</tbody>
</table>
Training of Enumerators / Staff: Ghana
Developing Base Line Surveys with Partners