Can low-input agriculture in semi-arid Burkina Faso feed its soil, livestock and people?

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General context & objectives

Burkina Faso in Africa

Climate zones
2 villages: Yilou & Tansin

Semi-arid climate
General context & objectives

- **Dominance of mixed Crop and Livestock farms**

Farming System Characteristics

- Yield gaps + low resources use efficiency at farm level
- Climate variability + Poor smallholders' livelihood conditions
- Low and unstable biomass production
- Limited crop & livestock integration and production

*Diarisso et al 2016*
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**Objectives**

To assess the extent to which the current management options were able to sustain crop and livestock production and fulfil household food requirements.

- SOIL: nutrient balance & crop residue dynamics
- LIVESTOCK: feeding strategies & feed gaps
- PEOPLE: food availability and self-sufficiency

**Methods**

- Monitoring (inputs, outputs, management) of 178 fields
- Weekly monitoring of crop residues on soil
- Record (with farmers) of amount and type of feed + livestock location
- Food production; food inflow and outflow
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Background – Farm diversity

Four (04) farm types identified:

- Most discriminating variables:
  - Cultivated area
  - % cultivated area rented in
  - Herd size and structure (% small ruminants)
  - % off-farm revenue in total income

Diagram:

- SOC: Subsistence-oriented crop (85)
- SOL: Subsistence-oriented livestock (79)
- MOD: Market-oriented diversified (51)
- LCL: Land-constrained livestock (10)
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Results – Soil: Nutrient management

Soil mining: $N_{output} > N_{inputs}$
- SOC = 64% of fields, LCL = 76%
- SOL = 85%, MOD = 87%

Distance from settlement to fields & field area did not impact nitrogen balance ($p > 0.05$)
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Results – Soil: Nutrient management

<table>
<thead>
<tr>
<th>Farm types</th>
<th>N balance (kg/ha)</th>
<th>NUE (kg/kg N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCL</td>
<td>-25±20b</td>
<td>1±0a</td>
</tr>
<tr>
<td>MOD</td>
<td>-19±17b</td>
<td>2±1a</td>
</tr>
<tr>
<td>SOC</td>
<td>8±17a</td>
<td>1±0a</td>
</tr>
<tr>
<td>SOL</td>
<td>-12±18ab</td>
<td>3±2a</td>
</tr>
</tbody>
</table>

CS level: highest N balance in SO farms but similar NUE.
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Results – Soil: CR dynamic

<table>
<thead>
<tr>
<th>Fertile</th>
<th>P-value</th>
<th>Intercept (kg/ha)</th>
<th>Weekly decrease (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>739</td>
<td>SOL = 75</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td>LCL = 64</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SOC = 50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MOD = 26</td>
</tr>
</tbody>
</table>

More CR in most fertile field at harvest

Quick decrease of remaining CR, reaching zero after 3 months

Rapid decrease caused by livestock grazing
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**Results—Livestock feeding**

First 5 weeks from harvest, crop residue fed to livestock was negligible.

From Week 5 onward, amount of CR fed to livestock increased until week 30 (end of June).

From sowing to new harvest, livestock feed requirement for maintenance was met probably through grazing only.
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Results: Households food availability

Food unsecure = AE/ha > 3
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**Discussion & Conclusion**

- **Can they feed their soil?**
  - No, not enough. Improvement through higher legume integration, organic & mineral inputs? (Sanou et al 2016, Franke et al 2018)

- **Can they feed their livestock?**
  - Yes, with important contribution of grazing. Potential improvement: High-yielding dual purpose cereals and legumes + better feed storage conditions (Zampaligre et al 2022, Akakpo et al 2020)

- **Can they feed their people?**
  - Yes, for most.

**Perspective:** Options for better C-L integration = f (farm diversity)
Barka!

Questions & Suggestions, please