Additive impacts of climate-smart agriculture practices in mixed crop-livestock systems in Burkina Faso

Rigolot C¹-², De Voil P³, Douxchamps S⁴, Prestwidge D¹, Van Wijk M⁴, Thornton P⁵, Henderson B¹, Medina Hidalgo D¹, Rodriguez D³, Herrero M¹

¹ Commonwealth Scientific and Industrial Research Organization (CSIRO)  
² French National Institute for Agricultural Research (INRA)  
³ University of Queensland, Queensland Alliance for Agriculture and Food Innovation (QAAFI)  
⁴ International Livestock Research Institute (ILRI)  
⁵ CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)
Key Messages

• Interventions aimed to improve multiple components of the agricultural system show additive effects.

• Highest input alternatives are not the ones with highest cost-efficiency levels.

• Highest input alternatives increase downside risks.
Introduction

• Identify the impacts of interventions aimed to improve household income and food security, against a background of climate variability.

• Use of whole farm models to simulate crop and animal production, income and food security indicators in four representative farms.

• Part of the CCAFS sites in West Africa.
Context of the research area

- Low agricultural productivity - Low food self-sufficiency - Household poverty

**Climatic Conditions:** Sahelian agro-ecological zone with 650 mm of annual rainfall concentrated during one rainy season (May to October). High rainfall variability (300-900mm). Drought prone, with annual rainfall falling below 500mm every 5 years on average.
Identification of case studies

• A farm survey was performed in 2012 in a total of 200 households by CCAFS.
• Data were collected using the Impactlite standardized questionnaire.
• Four different households were selected based on food security indicators, relative area per capita and market orientation.

Photo Credits: CCAFS
Household Typology

Market orientation

Area per capita

SHC
Smaller area per capita oriented to home consumption

11 (4 adults, 7 children)

4 Livestock units

Millet (1Ha) Maize (0.25 Ha)
Modelling Framework

INPUTS
- Climate
- Soil characteristics
- Farm characteristics
  - Area
  - Crops allocation
  - Herd structure
  - Management
- Prices

MODEL FRAMEWORK
- APSFARM
- LIVSIM
  - Feed
  - Manure
  - Crop inputs/output
  - Livestock inputs/output

OUTPUTS
- IAT Household module
- Food security
- Livestock contribution
- Crop contribution

DATA SOURCES
- Marksim
- HC27
- ImpactLite Database
To integrate the effects of climate variability the simulation was developed over a long term climate series (100 years).
### Packages of Interventions

<table>
<thead>
<tr>
<th>Residue Collection</th>
<th>Fertilization Level</th>
<th>Animal Supplementation</th>
<th>Target Feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High supplementation and fertilization</strong></td>
<td>yes</td>
<td>+60kgN/ha cereal</td>
<td>+3kg/day</td>
</tr>
<tr>
<td><strong>Medium supplementation and fertilization</strong></td>
<td>yes</td>
<td>+30kgN/ha cereal</td>
<td>+1kg/day</td>
</tr>
<tr>
<td><strong>Medium Fertilization no supplementation</strong></td>
<td>yes</td>
<td>+30kgN/ha cereal</td>
<td>no</td>
</tr>
<tr>
<td><strong>Baseline</strong></td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
</tbody>
</table>
Average household energy production

- **High Input**
  - Millet
  - Maize
  - Cow Meat
  - Cow Milk
  - Sheep Meat
  - Sheep Milk

- **Medium Input**
  - Millet
  - Maize
  - Cow Meat
  - Cow Milk
  - Sheep Meat
  - Sheep Milk

- **Medium Fertilization**
  - Millet
  - Maize
  - Cow Meat
  - Cow Milk
  - Sheep Meat
  - Sheep Milk

- **Baseline**
  - Millet
  - Maize
  - Cow Meat
  - Cow Milk
  - Sheep Meat
  - Sheep Milk

(MJ/year)
Average household income and costs

Household net income

USD/capita/day

Baseline | Medium Fert | Medium Input | High Input

0,50 0,00 0,50 1,00 1,50 2,00
Distribution of household income

Poverty Line

Baseline
Medium Fertilization
Medium Input
High Input

100 years simulation

CLIMATE-SMART Agriculture 2015
Distribution of household energy production

Energy Requirements

100 years simulation

Baseline
Medium Fertilization
Medium Input
High Input

(CLIMATE-SMART Agriculture 2015)
Conclusions

- Integration of **multiple approaches and interventions** to enhance crop-livestock productivity and overall household resilience.

- Different households have **different levels of intrinsic resilience**, hence their performance varies under the simulated intervention packages.

- There is **no silver bullet** approach particularly in the face of increasing **climate variability and climate change**.
Thank you