Improving soil fertility, rice productivity and fodder resources in the lowlands rice of Cambodia: a complex trade-off

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1. Briefs on rice production systems in Cambodia
2. Conservation Agriculture (CA) for lowland rice
3. Results of experiments and demonstration
4. Trade-off and challenges for dissemination
Briefs on rice production systems in Cambodia

**Major rice agro-ecosystems**

Total Cultivated Area of Rice ≈ 3 millions ha

<table>
<thead>
<tr>
<th>Rainfed Upland</th>
<th>Rainfed Lowland Rice</th>
<th>Dry Season Rice</th>
<th>Floating Rice</th>
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<tbody>
<tr>
<td>1.9%</td>
<td>80.2%</td>
<td>14.5%</td>
<td>3.4%</td>
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**Trends in the RFL Rice Agro-ecosystems**

- More secured water supplies
- Better soils' quality

**Soils**

- Red & Black soils: Oxisol, Ultisol
- Sandy Podzolic soils: Entisol, Ultisol, Alfisol
- Hydromorphic plains: Ultisol, Alfisol, Vertisol
- Flooded area: Entisol, Inceptisol

**From Florent T., 2014**
• Extensive rice-based system with increasing broadcasting and mechanization (combine harvester)
• Few diversification, low soil fertility and highly vulnerable
• Constant state of undernourishment for cattle and buffalo; rice stubble is often burned
**Step I:** broadcast cover crop Centro + Stylo in Nov (Phkar Rumdoul)

**Step II:** Roll down + Spray in May

**Step III:** No-till sowing 40kg/ha seed in Jun.
Matrix experiment: main cropping patterns (CT and CA)

**CT2/CA2**: Early wet season rice / wet season rice + cover crops

**CT3/CA3**: Wet season rice / counter season rice

**CT4/CA4**: 1 wet season rice + cover crops

- **December to June/July**
  - CT2/CA2: Early wet season rice / wet season rice + cover crops
  - CT4/CA4: 1 wet season rice + cover crops

- **December to May**
  - CT3/CA3: Wet season rice / counter season rice
  - CT4/CA4: 1 wet season rice + cover crops

- **Stylosanthes + Centrosema**
  - 2 rice + high C inputs
  - ~ 20 tons/ha of fresh matter

- **Wet season: June/July - November**
  - 2 rice + high C inputs
  - 2 rice, no diversification

- **Wet season: June/July - November**
  - 2 rice, no diversification
  - ~ 20 tons/ha of fresh matter
Results: Temporal changes in SOC stocks (0-40 cm depth)

Paired plot

DMC 4 yrs CT « native vegetation »

SOC stock 49 tons C/ha

22 to 36

17 to 33

Leng et al. forthcoming. Tokyo University of Agriculture and Technology, GDA and CIRAD
Temporal changes in SOC stock

- Native
- NV: 49 Mg C ha\(^{-1}\)
- 40 years continuous rice cultivation
- t\(_1\): 4 years under NT
- CT: 17 to 33 Mg C ha\(^{-1}\)
- 22 to 36 Mg C ha\(^{-1}\)

\(\Delta\text{SOC}: 0.65\) to \(1.2\) Mg C ha\(^{-1}\) yr\(^{-1}\)
4 Years

SOC: + 0.65 – 1.2 t/ha/year
TN: + 0.10 – 0.23 t/ha/year
Soil respiration: + 20 – 70%
Productivity improvement

We move for 1.5 ton to close to 3.5 tons of Pkha Rumdoul in Stung Chinit (> 80% sand, less than 1% of OM)

Pkha Rumdoul direct seeded on mulch of *S. guianensis* and *C. Pascuorum*
Fertilization: N:53-P$_2$O$_5$:60-K$_2$O:30 (150$/ha) + cover crops (32$/ha)
Trade-off: fodder and soil-yield improvement

Conventional grazing rice stubble areas

Cut and carry fodder


Fodder source, integration with animal husbandry + use as a green manure or cover crop

~ 20 tons/ha of fresh matter
Challenges for dissemination

- Medium-long term monitoring of soil fertility for the integration with livestock
- Green manure with conventional practice (plow + broadcast)
- Cover crops with CA technique: best management for soil and crop but, access to no-till planters remain a key constraint
- Collective decision is required to manage the grazing areas of rice stubble and fodders within the village/community
Iterative and adaptation process with smallholders
Thank you very much for attention!