SANREM 2014 Annual Meeting

“Building a sustainable future from a foundation of research”

Farmers’ experiences on Conservation Agriculture in Cambodia

Presented by Rada KONG, on behalf of farmer Ms. Pheap PHENG

19th-21st Crystal Gateway Marriott Hotel in Arlington, Virginia
Localization of the main R&D areas “on farms, with and for farmers”

- Boskhnor Station 14ha CA R&D on Red oxysol on basalt CA since 2004
- Pilot extension: smallholders on Verti-oxysol on basalt since 2009
- Pilot extension: Medium-big farmer on Vertisol on limestone since 2009

Bos Khnor Station
Ministry of Agriculture, Forestry and Fisheries
Research and Development work on DMC
SANREM 2014 Annual Meeting:
“Building a sustainable future from a foundation of research”

Plan of Presentation

1. General context of agrarian systems in the pilot areas
2. Proposed cropping systems and evolution of CA extension
3. What do the farmers have learned and constraints / need faced for DMC adoption and scaling up?
4. Project’s strategic plan for the 5th (“last”) year
Western Areas of Cambodia

440,000 ha of forest land reclaimed as farming land in 10 years
1. General context of village agrarian system

- **Plow-based conventional cropping system:**
  - 2000-2004: Mungbean/Peanut, Mungbean/Soybean and Peanut/Peanut
  - 2004-2008: Mungbean/Maize and Fallow/Maize
  - Since 2008: Farmers started to grow Maize/Maize, and recently shift to Cassava
  - Initially maize yield 1\textsuperscript{st} cycle 4.7 t/ha and 2\textsuperscript{nd} cycle 6 t/ha but now 1\textsuperscript{st} cycle 2.5 t/ha and 2\textsuperscript{nd} cycle 4 t/ha

- **Risks of 1st cycle crops:** Maize and Mungbean
Drought effects on 1st cycle corn and mungbean

Annual rainfall (mm year\(^{-1}\)):
- 2013: 2104
- 2012: 1177
- 2011: 1732
- 2010: 1176
1. General context...(cont.)

- Constraints of plow-based conventional cropping system:
  - Soil erosion and soil lost via run-off
  - Continuous decrease of soil fertility \(\rightarrow\) soil degradation \(\rightarrow\) Yield drop
  - Increasing weed pressure \(\rightarrow\) higher cost for its control
  - Soil compaction and waterlogged problems
  - More vulnerable to climate changes (drought and flood)
  - Higher production cost \(\rightarrow\) less profits
2. Proposed CA maize cropping systems and evolution of extension:

Location of Experiment Site

Site 1: 2ha in 2009
Site 2: 1ha in 2010
Experimentation sites:
Tested CA cropping systems

**Year n**

- "scattered" rains
- heavy rains

**Year n+1**

- "scattered" rains
- heavy rains

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**Mono-cropping:**
Maize “mono cropping”

**Biannual rotation crops:**
- Maize // Soybean rotation
- Maize // Rice rotation
- Maize // Cassava rotation

**Intensified crops:**
Cassava // Maize - Maize rotation
Targeted villages

Proposed cropping systems?
A.2/ Principles of DMC and cropping systems typology

A.2.1/ Principles of DMC technologies

"An integrated CARBON based soil's fertility management"

1/ No soil's tillage
2/ Soil's permanent plants' cover
3/ Succession / Rotation of species

Biological parameters
- carbon & Soil organic matter,
- weeds, pests, ...

Chemical parameters
- pH, ECC, bases, ...

Physical parameters
- erosion, porosity, water, ...

The 3 principles of DMC

1/ No soil's tillage
2/ Soil's permanent plants' cover
3/ Succession / Rotation of species

a continuous flux of CARBON
Principles of DMC and cropping systems typology

Principles of DMC technologies

The “notion” of biological pump

### Principles of DMC and cropping systems typology

#### Principles of DMC technologies

The “Multi-functionality” of **biological pump**

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>EFFECT</th>
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<tbody>
<tr>
<td><strong>Food</strong></td>
<td>Nutrient for crops, Fodder for Cattle&lt;br&gt;Biomass for soil’s fauna/µflora chains</td>
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<tr>
<td><strong>Protection</strong></td>
<td>Erosion / run-off, Evaporation, T (°C)&lt;br&gt;Xenobiotiques bio-degradation ®</td>
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<td><strong>“Pest-buster”</strong></td>
<td>Weed control (shade, allelopathy)&lt;br&gt;Disease (splash effect, blast on rice…®)&lt;br&gt;Insect (…via biodiv. … ®)</td>
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<td><strong>C Loader</strong></td>
<td>C storage - ECC increase, pH buffer …&lt;br&gt;Biо activity / diversity increase ® publi.)&lt;br&gt;Biо-degradation / detoxification (?) ®</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Roots system matrix, decompaction&lt;br&gt;Porosity, Water reserve&lt;br&gt;Aggregation &amp; O.M. % ®</td>
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<td><strong>Recycling pump</strong></td>
<td>Connection to deep water <em>i.e.</em> maximization of the water potential&lt;br&gt;Recycling of lixiviated ions NO₃⁻, bases ®</td>
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Logical questions from farmers:

- Increase crop productivity?
- Reduce labor and input cost?
- More profitable?
2. Proposed CA maize cropping systems:

**Year n**

- March: Maize
- April: Maize
- May: Maize
- June: Maize
- July: Maize
- August: Maize
- September: Maize
- October: Maize
- November: Maize
- December: Maize

**Year n+1**

- March: Maize
- April: Maize
- May: Maize
- June: Maize
- July: Maize
- August: Maize
- September: Maize
- October: Maize
- November: Maize
- December: Maize

**Stylo**

- Maize + Stylo
- Stylo
- Maize + Stylo
- Stylo
Stylo is not suitable for Alkaline soil!
Moving from Stylo to Pigeon pea...

**Year n**

- Mungbean
- Sesame
- Maize

**Year n+1**

- Mungbean
- Sesame
- Maize

**Maize “mono cropping”**

- **Stylo.**
- **Maize + Stylo.**
- **Stylo.**

- **Pigeon pea**
- **Maize + Pigeon pea**
- **Pigeon pea**

Moving from Stylo to Pigeon pea...
3. What have the farmers learned about CA?

Some key advantages perceived by farmers are:

- Stop plowing from 2nd year of DMC implementation → save labour and reduce cost
- Protect soil erosion and soil lost via runoff
- Reduce weed pressure and population esp. gramineae species → reduce labor
- Restore and improve soil fertility, and proper cropping management advised by the project → increase yield
- Proper use of agrochemicals so save time, labor and lower cost
But....!

Constraints and need for adoption...
3. What have the farmers learned about CA?

**Constraints**

- So far not yet have suitable cover crops, the proposed cover crops pigeon pea required additional sowing labor and no market.
- The presence of cover crops requests for locally herbicides which require more labor and less efficiency without **Atrazine** and **Paraquat**.
- Not yet available CA based **Cassava**!
- Limited direct seed planters, depending totally on the services provided by the project.
Limited capacity of direct planter to sow on wet soil conditions compared to normal Thai planter

Credit access to invest fertilizers, the farmers take inputs as credit from the suppliers

Secondary constraints with insects (millipedes, crickets, ants...) damaging young maize seedling on mulching plot
Needs

Three key needs conditioning CA adoption for the farmers:

- Market for cover crops to get extra income, animal feeds request more investment and labour
- Making services on CA practices esp. sowing accessible with private contractors like plow and conventional sowing
- Project, NGOs, GOs...provide cheap interest credit for fertilizers inputs; Farmer Cooperative credit fund is limited!
4- What project’s strategic plan 2014?

Cover crops

From PADAC-SANREM – Pigeon pea growing after maize harvest – Dec 2012
Cover crop pigeon pea sown on maize line

Pigeon pea in dry season

Rolling down pigeon pea in May-June

Pigeon pea mulch for corn sowing
Cover crop pigeon pea sown on corn line

From PADAC-SANREM – Pigeon pea slowly growing with maize– Aug. 2013
New proposal: Trial on 1.2m pigeon pea

- Free seed at reduced density 60,000 to 40,000 plant/ha
- Subsidized 23N/ha (12.5$/ha)
- But farmer apply basal 16N-20P-00K and spray 2,4D inter-row

Farmer: 7.5 ha
International market:
Thai market with Cattle fattening

Local market:
Market of Pigeon pea

ICL
GRAVITY INTERTRADE CO. LTD.

ACIAR
aciar.gov.au
Testing new cover crops
4- What project’s strategic plan 2014?

Direct planters:

- Disc scrapper allows sowing on wet conditions
- 3 direct planter meeting sowing date wanted by farmers
4- What project’s strategic plan 2014?

Direct planters:

Thai 2-row direct planter: 1500$/unit

Renting planter and sprayer to existing Farmer Cooperative:

**Agricultural Cooperative of Kaksekor Nhor Nheum**

Brazilian 2-row planter: 3500$/unit in 2012

Thai 4-row direct planter: 7500$/unit
4- What project’s strategic plan 2014?

CA based cassava: Skyrocket cassava 2014

Cassava area: ~70-80%!
4- What project’s strategic plan 2014?

CA based cassava:
Thank you very much for your attention!

The DMC techniques help the farmers, especially my family; clearly understand the methods of soil fertility restoration

Acknowledgement: