Practice rice straw management in Lao PDR

Tuesday, 25 Oct 2022
Outline

• Lao PDR Landscape
• Rice straw and crop residue production in Lao PDR
• Rice straw and other crop residue practice management
• Next forward for straw management
### Lao PDR Landscape

#### Lao PDR area
- Plain area 46%
- Plateau 1%
- Steep slope area 53%

#### Agricultural Land Usage

<table>
<thead>
<tr>
<th>No</th>
<th>Agricultural Land</th>
<th>Used (ha)</th>
<th>Remain (ha)</th>
<th>TT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Paddy rice area</td>
<td>1,019,548</td>
<td>980,452</td>
<td>2,000,000</td>
</tr>
<tr>
<td>2</td>
<td>Short cycle crop area</td>
<td>867,763</td>
<td>132,237</td>
<td>1,000,000</td>
</tr>
<tr>
<td>3</td>
<td>Long cycle crop area</td>
<td>128,073</td>
<td>671,927</td>
<td>800,000</td>
</tr>
<tr>
<td>4</td>
<td>Pasture</td>
<td>691,527</td>
<td>8,473</td>
<td>700,000</td>
</tr>
<tr>
<td>TT</td>
<td></td>
<td>2,706,912</td>
<td>1,793,089</td>
<td>4,500,000</td>
</tr>
</tbody>
</table>

% 60% 40% 100%
## Rice straws and crop residue production in the Lao PDR

### Table: Rice cultivation area, crop and its straw in Laos
(Source: Laos year book 2020&2021)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area (ha)</th>
<th>Crop production (ton/year)</th>
<th>Tot Straw (ton/year)</th>
<th>used straw (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>904,372</td>
<td>3,567,121</td>
<td>1,961,916</td>
<td>**</td>
</tr>
<tr>
<td>Maize</td>
<td>133,697</td>
<td>726,766</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Legume</td>
<td>7,532</td>
<td>17,480</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Root crop</td>
<td>25,028</td>
<td>759,394</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Upland crop</td>
<td>17,653</td>
<td>65,912.11</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Fruit tree</td>
<td>11,670</td>
<td>208,379</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Vegetable</td>
<td>57,518</td>
<td>483,926</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>
Rice straw and crop residues use in agriculture

Rice straw used for:
- Cover soil surface on field
- Rice straw incorporation into the soil

Crop residue management:
- Cover on the soil surface in the field,
- Animal feeding
Direct seeding Mulch-base cropping systems (DMC)

Principles of DMC:

✓ Soil no longer disturbed, or as little as possible, by mechanical action and is always kept covered by crop residues and the cover crop. Boyer et al. 2001; Scopel and Findeling 2001).
  • Soil erosion decrease, mulch control soil erosion, decrease temperature fluctuation, enhance macro-micro-fauna activity.

✓ Spatial and temporal diversified schemes (rotation, association, annual crop sequence)
  • Provide increase farming income by reduction cost production and climatic risks (Sguy et al. 1998; Richter et al., 2002)

✓ Maintain Soil-plant stability and resilience, cover crops are used to produce grain and dry matter,

✓ Cover crops enhance the efficiency of the whole system fulfilling many agronomic and ecological functions emphasise the multi-functionality of cover crops, which are nutrient pumps.
Direct seeding Mulch-base cropping systems

Multi-functions of cover crops in DMC systems

Aboveground

- Feeding function
  - Crops
  - Livestock & Fauna
- Weeds control function
  - Shade allelopathy
- Protection function
  - $T_0$, P Xenobiotic

Belowground

- Soil congregation function by root systems (polysaccharides)
- Recycling function (NO$_3$, bases)
- Soil improvement structure by root systems
- C content improvement function CEC

Recycling water of deeper part of the profile
Organic skeleton

Source: Scopel et al., 2003.
Crop residue management in DMC in Lao PDR

1. Rotation fodder and annual cropping systems
2. Rotation cropping system (Maize- and rice bean)
3. Intercropping Maize/rice bean
4. Intercropping Maize/pigeonpea
5. Rotation cropping upland rice/Soybean
Rotation fodder and annual cropping systems
Rotation cropping system (Maize- and rice bean)

Rain season last year
- Rice bean

Early rainy season
- Biomass rice bean (DM < 5 t.ha-1)

Rainy season
- Rice bean on maize’s mulch
- Maize residue (DM 5 t.ha-1)
- 5000 ha in Sayaboury
Intercropping Maize/rice bean
Intercropping Maize/pigeonpea

Pigeonpea in the maize

Pigeonpea after harvest maize

Pigeonpea residue
Rotation cropping upland rice/Soybean

- **Rainy season last year**: Upland rice
- **Dry season**: Biomass of rice (DM < 3 t.ha⁻¹)
- **Rainy season**: Soybean on the rice biomass

- Upland rice on soybean biomass
- Biomass of soybean (DM 3 t.ha⁻¹)
Steps decomposition of crop residue

- Initial Zone of contact
- C flow to soil layers
- Zone of contact

Levels:
- Initial
- Low
- Moderate
- High
Comparison of conventional tillage vs. No tillage on soil preparation

Source: Sá and Lal, 2009

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>CT</th>
<th>NT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>27 g kg⁻¹</td>
<td>55 g kg⁻¹</td>
</tr>
<tr>
<td>5-10</td>
<td>25 g kg⁻¹</td>
<td>43 g kg⁻¹</td>
</tr>
<tr>
<td>10-15</td>
<td>23 g kg⁻¹</td>
<td>32 g kg⁻¹</td>
</tr>
<tr>
<td>15-25</td>
<td>19 g kg⁻¹</td>
<td>19 g kg⁻¹</td>
</tr>
<tr>
<td>25-50</td>
<td>12 g kg⁻¹</td>
<td>11 g kg⁻¹</td>
</tr>
<tr>
<td>50-75</td>
<td>8 g kg⁻¹</td>
<td>8 g kg⁻¹</td>
</tr>
</tbody>
</table>

25 years

Source: Sá and Lal, 2009
Rice straw management on paddy field

• Farmers use rice straw cover soil surface for cropping systems during dry season (garlic, vegetable, legume and also fruit tree).

• Plowing rice straw in to the soil on paddy rice field around 1,000 ha (2020). Mostly in the dry season rice cultivation.
Next forward for straw management

- Database setting crop residue management,
- Research on impact of difference technology residue management.
- Scaling up good management of residue and straw to farmers,
- Capacity building staff and farmer producers,
Thank you for attention