Crop-livestock integration through no-tillage on cover-crop in Vietnam

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Context
• Northern Viet Nam
• 50 inh./km²: “empty”
• Farm size: 2-3 ha
• Increasing population
• Various ethnic groups
Sub-tropical climate

Average: 1 800 mm/year, high variability in space and time
Hot rainy season : April to September
Cold dry season: October to March

- Acid ferralsols (pH KCl: 4)
- Steep slopes (30 °)
Strong erosion

Context

• Mountainous area (remoteness, no access to market or information, low investment capacity, etc.)
• De-collectivisation
• Land tenure reforms

==> Fast changes in production systems
Agricultural systems

- Irrigated rice in lowlands (Tay)
- Maize (Tay)
- Rice and cassava in upland (Dao)

Fast changes in production systems
Return to slash and burn
The crisis

• Poor performances (crops and animals)
• Mining of the environment
• Vicious cercle of soil degradation and declining yields

No longer sustainable under the present situation
SAM (Moutainous Agrarian Systems) Project
VASI/CIRAD/IRD/IRRI

Initial objective (1998):
Finding alternatives to slash-and-burn systems
in order to stop de-forestation

The only hope relied in adaptation of CA
(DPPSC) to the difficult environment of
mountainous areas (1999)

Competition crop/livestock

Destruction of crops by animals
Competition for limited natural resources

Free grazing
Forage/mulch

A real revolution
Need of an important work at all scales
From competition to integration crops/livestock
Finding technical solutions at field level

Developing sustainable and profitable cropping systems

Simple mulching: risk on steep slope
Finding technical solutions at field level

Developing sustainable and profitable cropping systems

Producing mulch in the field: crop residues or cover crop

Maize and Arachis pintoï Maize and Brachiaria ruziziensis

Living mulch: Miniterraces
Finding technical solutions at field level

Soil regeneration by plants
Growing in difficult conditions
High biomass production

Soil regeneration by plants
Strong root system
Finding technical solutions at field level

Increasing biomass production and forage quality

**Fodder trials** (5 plots)
- 8 grasses & 2 legumes species
- karstic & ferralitic soils
- young fallows & degraded meadow
- with or without fertilisation

- Cutting interval: 28 days
- Unit surface: 4 m²
- Cut at: 5 cm

**Average monthly fodder production from April to October**

<table>
<thead>
<tr>
<th>Species</th>
<th>Kg DM/ha/month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brachiara briz.</td>
<td>1200</td>
</tr>
<tr>
<td>Brachiara ruz.</td>
<td>1000</td>
</tr>
<tr>
<td>Brachiara dec.</td>
<td>800</td>
</tr>
<tr>
<td>Paspalum atr.</td>
<td>600</td>
</tr>
<tr>
<td>Panicum max.</td>
<td>400</td>
</tr>
<tr>
<td>Pennisetum pur.</td>
<td>200</td>
</tr>
<tr>
<td>Stylosanthes gu.</td>
<td>100</td>
</tr>
<tr>
<td>Cassia rotundifolia</td>
<td>50</td>
</tr>
<tr>
<td>Natural vegetation</td>
<td>0</td>
</tr>
</tbody>
</table>

Finding technical solutions at field level

Forage value

PDI = Digestible Protein content (g/kg dry fodder) ; UFL = Energy Unit.

3 main systems enabling increase and share of produced biomass:

Perennial systems: Meadows, cover crops in orchards and plantations
Finding technical solutions at field level

3 main systems enabling increase and share of produced biomass:
Perennial systems: Meadows, cover crops in orchards and plantations

Intercropping, associations

Maïs / Arachis pintoï
Miniterraces

Cassava + Stylosanthes guy.

Finding technical solutions at field level

3 main systems enabling increase and share of produced biomass:
Perennial systems: Meadows, cover crops in orchards and plantations
Intercropping, associations

Relay cropping, rotations (use of winter periods)

Brachiaria ruzi, after maize

Oats in paddy fields
Finding technical solutions at field level

Forage conservation

Bana grass on hedgerows

Finding technical solutions at field level

A set of alternatives, including crops and forage production
Integrating solutions at farm and village levels

Everyone acts firstly as an individual, according to his own project and strategies

- Farm typology
- Need to jointly design solutions, adapted to farmers’ strategy and based on opportunities given by DPPSC
- Need a common understanding of the problems

We rarely perceive fully the impact of the sum of individual behaviors at the scale of a village

- Need to have a common spatial representation of the territory as tool for awareness raising and mediation
Elevation 3D model

Extracting and representing information

Spatial data transfer

Communal pasture

Piedmonts

Village & gardens

Lowland (rice)

Graphic representation with simple symbols
Simplified quantitative representation
Model with compartments

Designing feeding systems at farm level

- Natural resources
  - *Arachis pintoï* in orchards
- Associated trees and fodder
- Rotated or intercropped fodder production

Feeding animals by playing on resources complementarity, spatially and timely...

- Improved meadows
- Mini-terraces
- *Stylosanthes guyanensis* under cassava
- *Bracharia ruzi* in paddy field
- *Brachiaria ruzi*
- *Rainfall upland rice*
- *Oats*
- Irrigated lowland rice
- *Oats*

| Brachiaria | 1.0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.2 |
| Brach. ass | 0.5 | 1 | 1 | 1 | 1 | 1.2 |
| Stylosanthes | 1.0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.2 |
| Arachis | 1.0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.2 |
| Avoine | 1.0 | 1 | 1 | 1 | 1 | 3 |
| Rice straw | 2 | 1 | 1 | 1 | 1 | 3 |

- **Brachiaria**: 1.0
- **Brach. ass**: 0.5
- **Stylosanthes**: 1.0
- **Arachis**: 1.0
- **Avoine**: 1.0
- **Rice straw**: 2

**Notes**:
- 1 year to settle
- 3.5 years to settle
- Need 5 kg of urea for 100 kg of straw
- No water logging
- Need 5 kg of urea for 100 kg of straw

**Farmer's Field boundaries**

**Diagram**

- **BTX**
- **Arac.**
- **Winter**
- **Summer**
- **RS**
- **Oat**
- **RS**
- **Oat**

**Legend**

- 1
- 2
- 3
- 4

**Notes**

- 1
- 2
- 3
- 4

**Image**

- Document obtained on the Cirad network site: [http://agroecologie.cirad.fr](http://agroecologie.cirad.fr)
Farmers experiments
Work on management and practices

Fencing or not fencing?

Integrating solutions at village levels

MAS

Raises awareness
Mediation tool

Role play

Conclusions

- Technical solutions (even if economically attractive) often are not sufficient.

- But necessary: DPPSC brings solutions for integration of animals, crops, and trees.

Benefited to animals, crops, farmers, trees, and soils.
Conclusions

• The conflict over the resources sharing between animals and crops became a strength for extension of DPPSC

• For very different situations (South America, Africa, Asia), solutions are based on the same principles. Only the application conditions change. Behind heterogeneity, some universal processes exist. Importance of exchanges and transmission of experiences.

Muito Obrigado!
Xin Cam On!