Modeling multiple pests for agroecological rice protection in Cambodia

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INTENSIVE RICE CULTIVATION

Overuse of pesticides
- Risk to human health
- Affect biodiversity
- Economic impacts

Standards for European imports

A NECESSARY AGROECOLOGICAL TRANSITION

How to assess the risk of yield losses caused by pests, diseases and weeds?
What levers, methods, and tools for agroecological rice protection?
Objectives of the PhD thesis

Mobilizing the various levers of Agroecological Crop Protection against the main pests of rice

**KNOWLEDGE PRODUCTION**

- What are the effects of cropping practices on pest dynamics and their impacts?
- What are the damages associated with a given injury profile?

**DESIGN OF A DYNAMIC MODEL**

- How to integrate in the same dynamic model the abiotic and biotic drivers of yield build-up, under the influence of cropping practices and production situation?
- What are the best combinations of cropping practices for agroecological rice protection in a given field?
PhD organization

**Conceptual diagram of the rice agroecosystem functioning**

- **Axis 1**: Literature review
  - Crop Growth Models
  - Epidemiological Models
  - Crop-pest Models

- **Axis 2**: Field work in Cambodia
  - Experiments
  - Farmer field network

- **Axis 3**: Model implementation

- **Axis 4**: Test of ACP strategies using simulations

**Key topics**

- Crop Growth Models
- Epidemiological Models
- Crop-pest Models
- Farmer field network
- Experiments
- Simulations
Conceptual diagram

Draw from:
Pinnschmidt et al, 1994
Willocquet et al, 2002
Field experiments in Cambodia

ON-SITE MISSIONS

• 2021: June – December
  6 months
• 2022 - 2023: May – May
  1 year

SEVERAL EXPERIMENTAL SITES

• Multi-site monitoring in different environments and cropping systems
  Water management, soil types, diversity of production systems
  Conventional, agro-eco, organic

• Farmers field networks
• A joint laboratory at ITC, a soil laboratory at UBB and agro / soil at RUA
Conventional farmer practices
2 rice cycles
Manual broadcast
Sen Kraop variety

1 rice cycle + vegetable production
Phka rumdoul variety

1 rice cycle + cover crops
Sen Kraop variety

1 rice cycle + grains and cover crops
Phka rumdoul variety

Low fertility level
Medium fertility level
High fertility level
Addition of an organic fertilizer containing silicon

Rice with a legume crop in rotation with tillage

Traditional rice cropping system

Rice with a mixture of crops in rotation and no tillage

Rice with a legume crop in rotation, but no tillage
Conventional tillage

Conservation agriculture

COSTEA – Os Tuk
Cover crop 1 year

Cover crop 2 years

Conventional tillage

Conservation agriculture 7 years

COSTEA – Veal Cropeu
Field experiments in Cambodia

**MONITORING**

- **Weeds, pests, and diseases** dynamics  
  *Kobo tools*

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Bacterial leaf blight incidence on Phka rumdoul  
(WAT4CAM experiment)

- T3F1  
- T3F2  
- T3F3  
- T4F1  
- T4F2  
- T4F3

% OF SURFACE INFECTED

- 0%  
- 1%  
- 3%

- 13-jul  
- 19-juil  
- 02-aout  
- 09-aout  
- 18-aout  
- 03-sept  
- 14-sept  
- 28-sept
Field experiments in Cambodia

**MONITORING**

✓ **Weeds, pests, and diseases** dynamics
  *Kobo tools*

✓ **LAI** dynamics
  *SunScan*
Field experiments in Cambodia

**Monitoring**

- **Weeds, pests, and diseases** dynamics  
  *Kobo tools*

- **LAI** dynamics  
  *SunScan*

- **Biomass** components  
  *At flowering and harvesting stages*

Number of panicles for the different treatments of Healthy rice
Field experiments in Cambodia

MONITORING

✓ Weeds, pests, and diseases dynamics
  Kobo tools

✓ LAI dynamics
  SunScan

✓ Biomass components
  At flowering and harvesting stages

✓ Yield
# Field experiments in Cambodia

**MONITORING**

- **Weeds, pests, and diseases** dynamics
  - *Kobo tools*
- **LAI dynamics**
  - *SunScan*
- **Biomass** components
  - *At flowering and harvesting stages*
- **Yield**
- **Cropping practices**

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<th>Plot 1</th>
<th>Risk product 1</th>
<th>Risk product 2</th>
<th>Risk product 3</th>
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<tr>
<td>Active ingredient</td>
<td>Bispyribac sodium 40%SC</td>
<td>2,4-D</td>
<td>Alpha cypermethrin</td>
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<tr>
<td>LD50 dose/ha</td>
<td>2</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Frequency</td>
<td>3,5</td>
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<td>Application</td>
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<td>1</td>
<td>1</td>
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<td>TOTAL</td>
<td>8,5</td>
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*Sum TOTAL* 18
Reference: RG Model, Projet Sunflower Pest
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Thank you for your attention