ASEA plaform PhD days – 01/12/2021

Modeling multiple pests for agroecological rice protection in Cambodia

PhD student: Mathilde Dionisi – CIRAD

PhD supervisors: Jean-Noël Aubertot, UMR AGIR - INRAE
Mathilde Sester, UPR AÏDA - CIRAD

Background and key issues

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

Axis 1

Literature review

Crop Growth Models
Epidemiological Models
Crop-pest Models

Conceptual diagram of the rice agroecosystem functioning

Axis 2

Field work in Cambodia

Experiments
Farmer field network

Axis 3

Model implementation

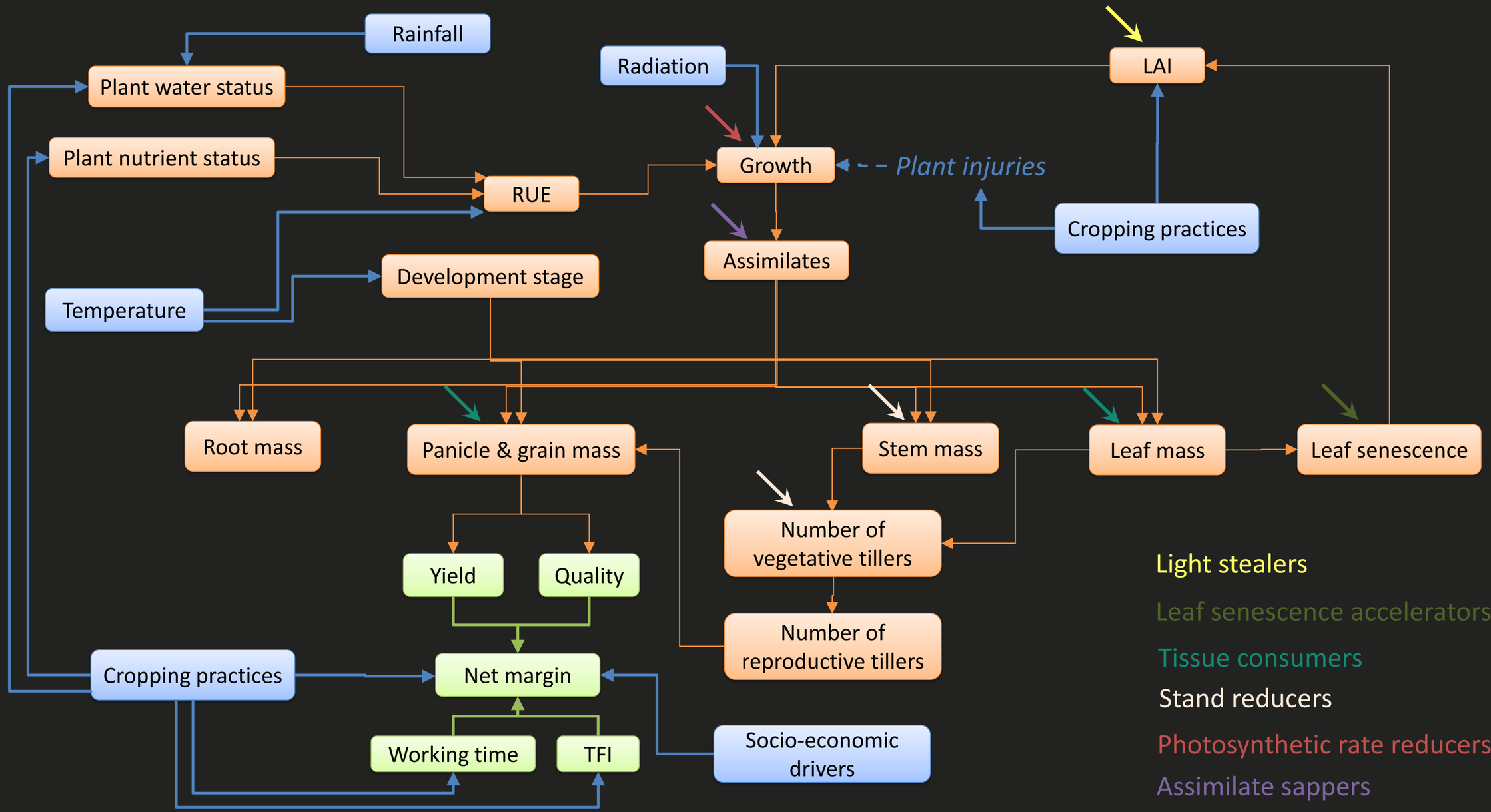
Model evaluation

Axis 4

Test of ACP strategies using **simulations**

Draw from:
Pinnschmidt et al, 1994
Willocquet et al, 2002

Conceptual diagram



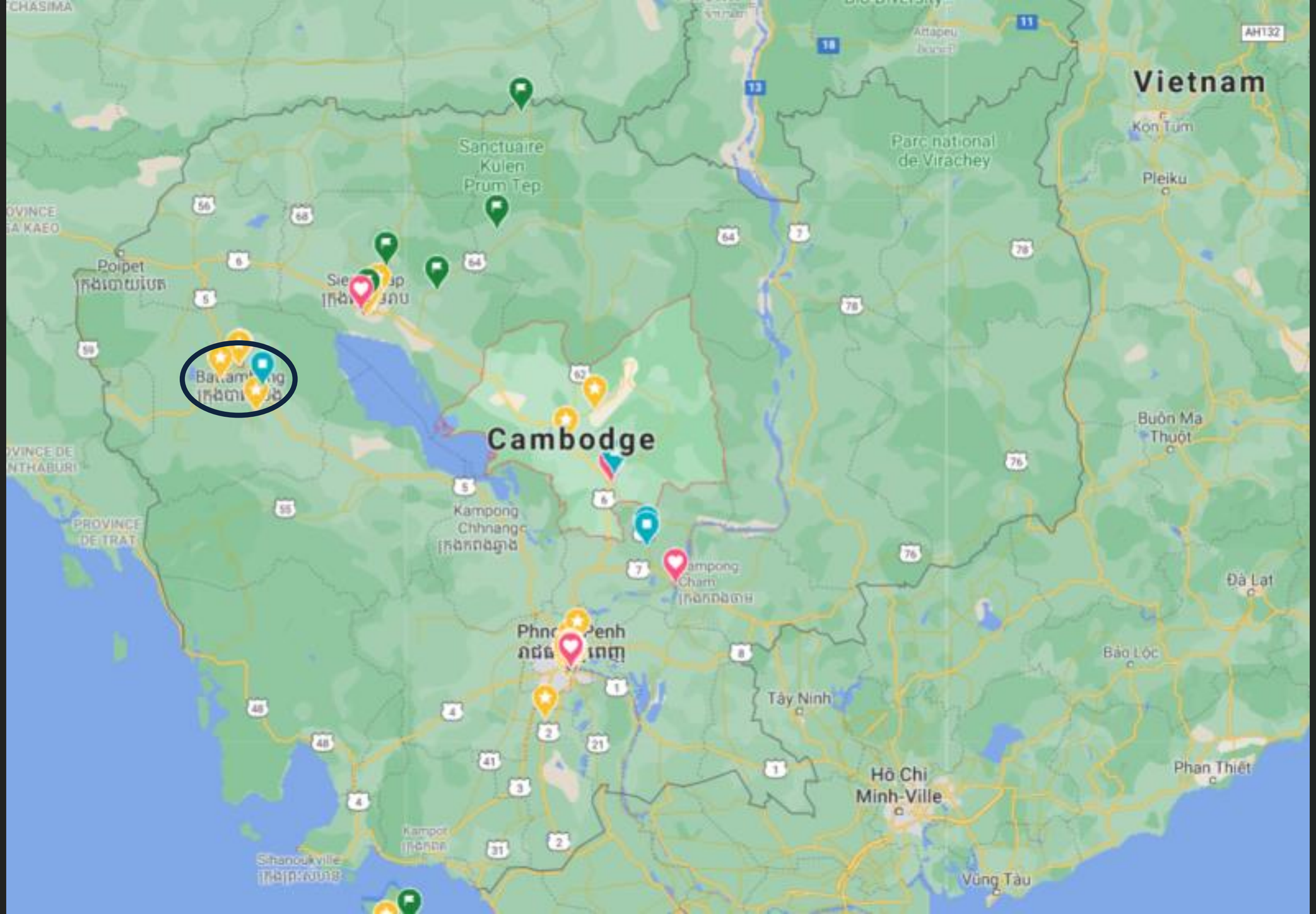
Field experiments in Cambodia

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


Vietnam
Cambodge
Sanctuaire Kulen Prum Tep
Parc national de Virachey
Poipet
Kampong Chhnang
Kampong Cham
Phnom Penh
Tây Ninh
Hồ Chí Minh-Ville
Vũng Tàu
Phan Thiết
Đà Lạt
Bảo Lộc
Buôn Ma Thuột
Pleiku
Kon Tum
Kampot
Sihanoukville
PROVINCE DE TRAT
AH132

Battambang

COSTEA – Veal Kropeu

Biochar – UBB Farm

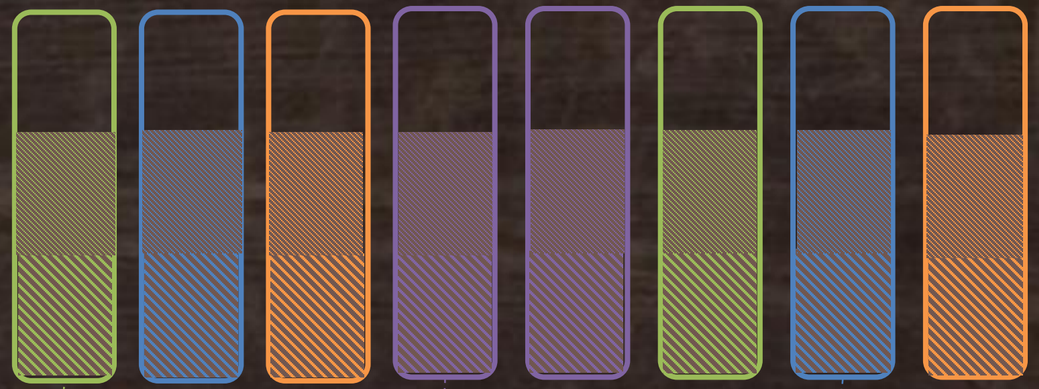
Healthy Rice – UBB Farm

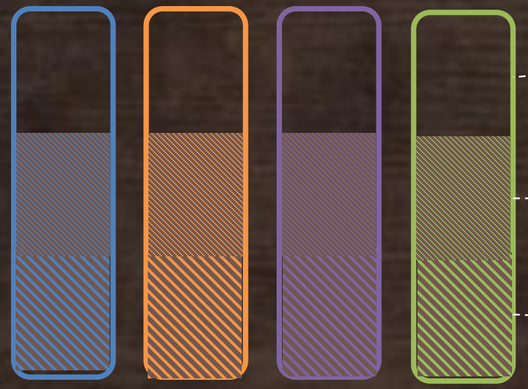
COSTEA – Damnak Dangkao

COSTEA – Os Tuk

WAT4CAM – Reang Kesei

WAT4CAM – Reang Kesei





Low fertility level

Medium fertility level

High fertility level

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

Healthy rice – UBB Farm

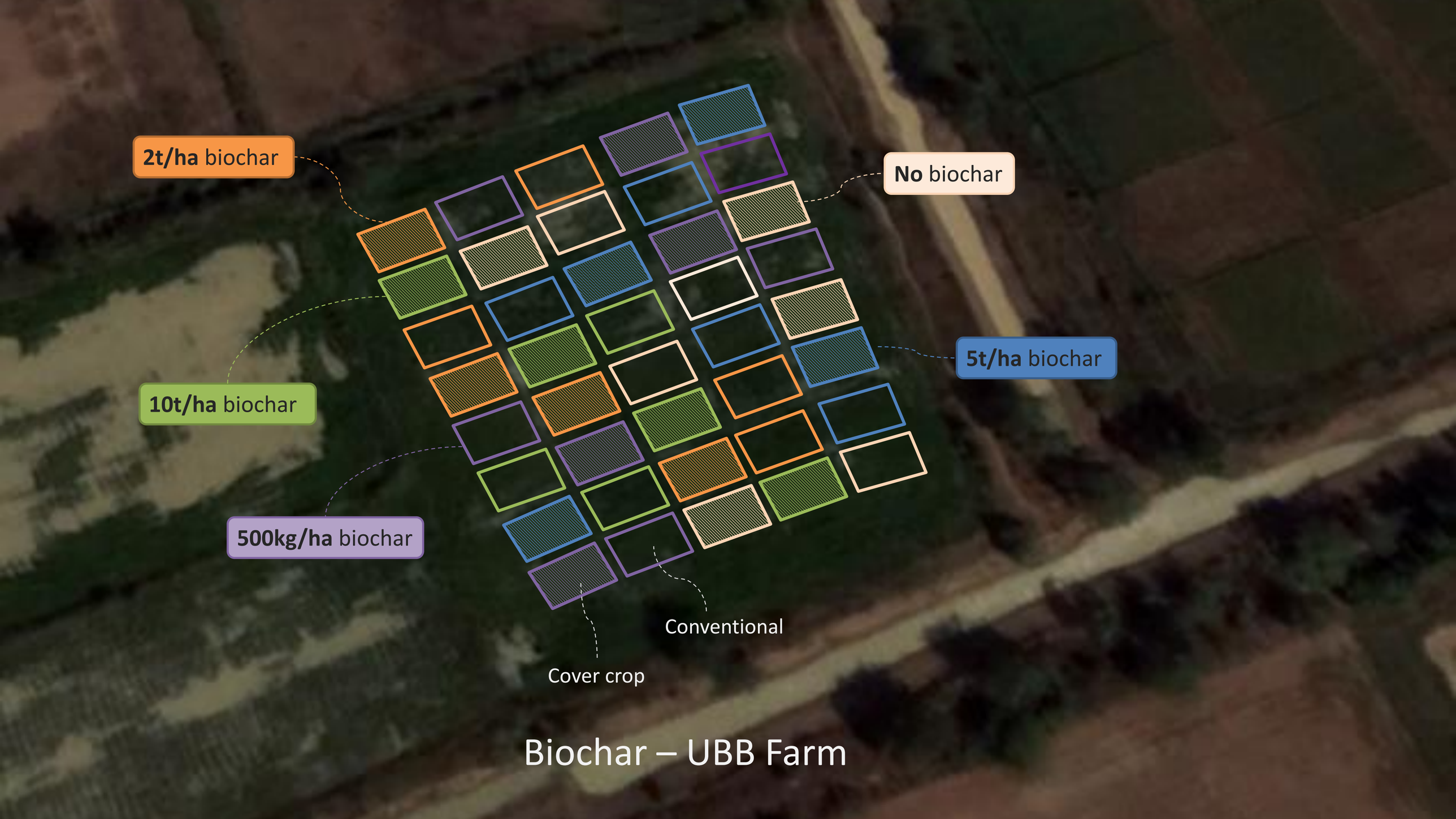
Addition of an organic fertilizer containing silicon

Rice with a **mixture** of crops in rotation and **no tillage**

Rice with a **legume** crop in rotation **with tillage**

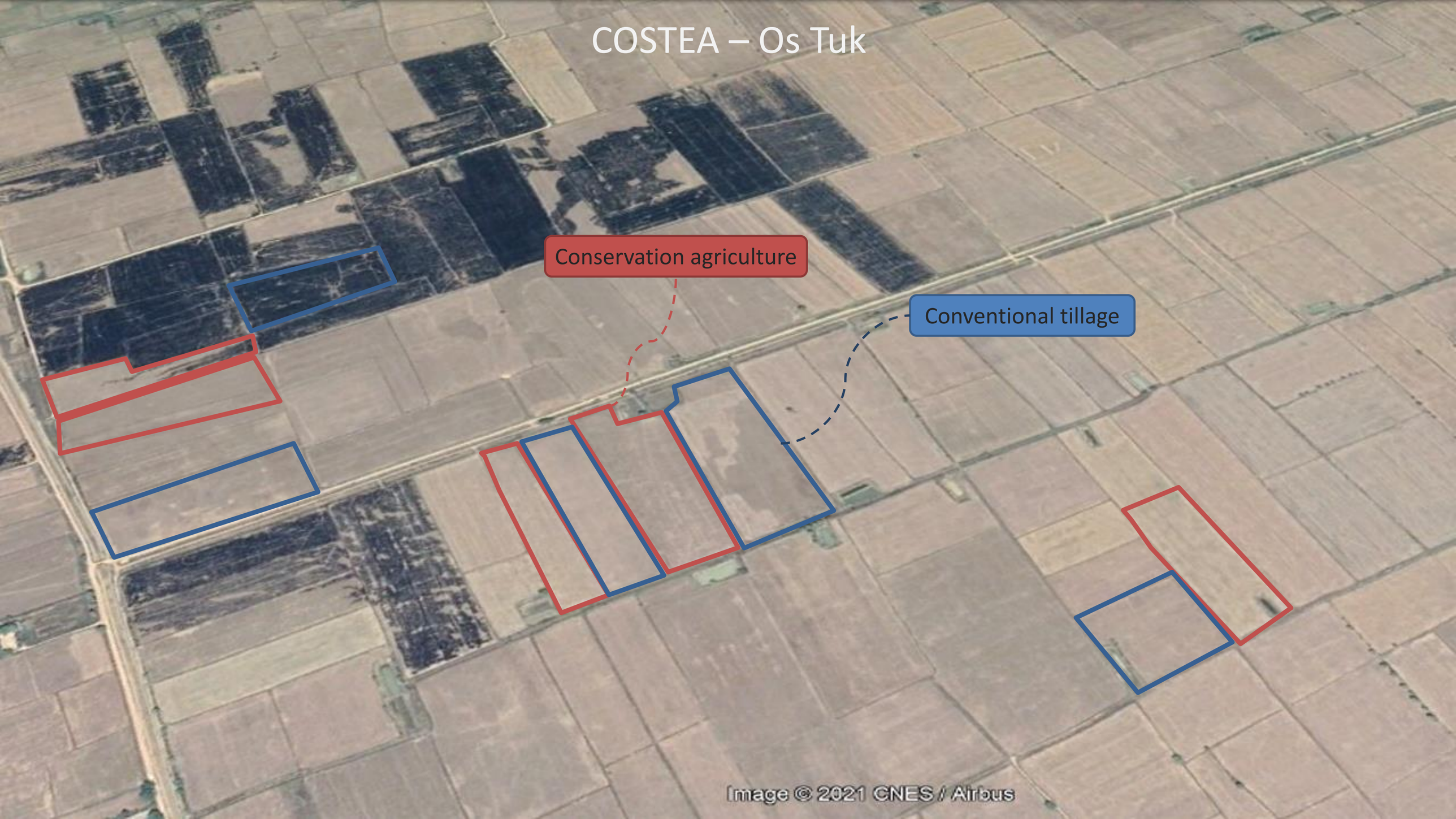
Traditional rice cropping system

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

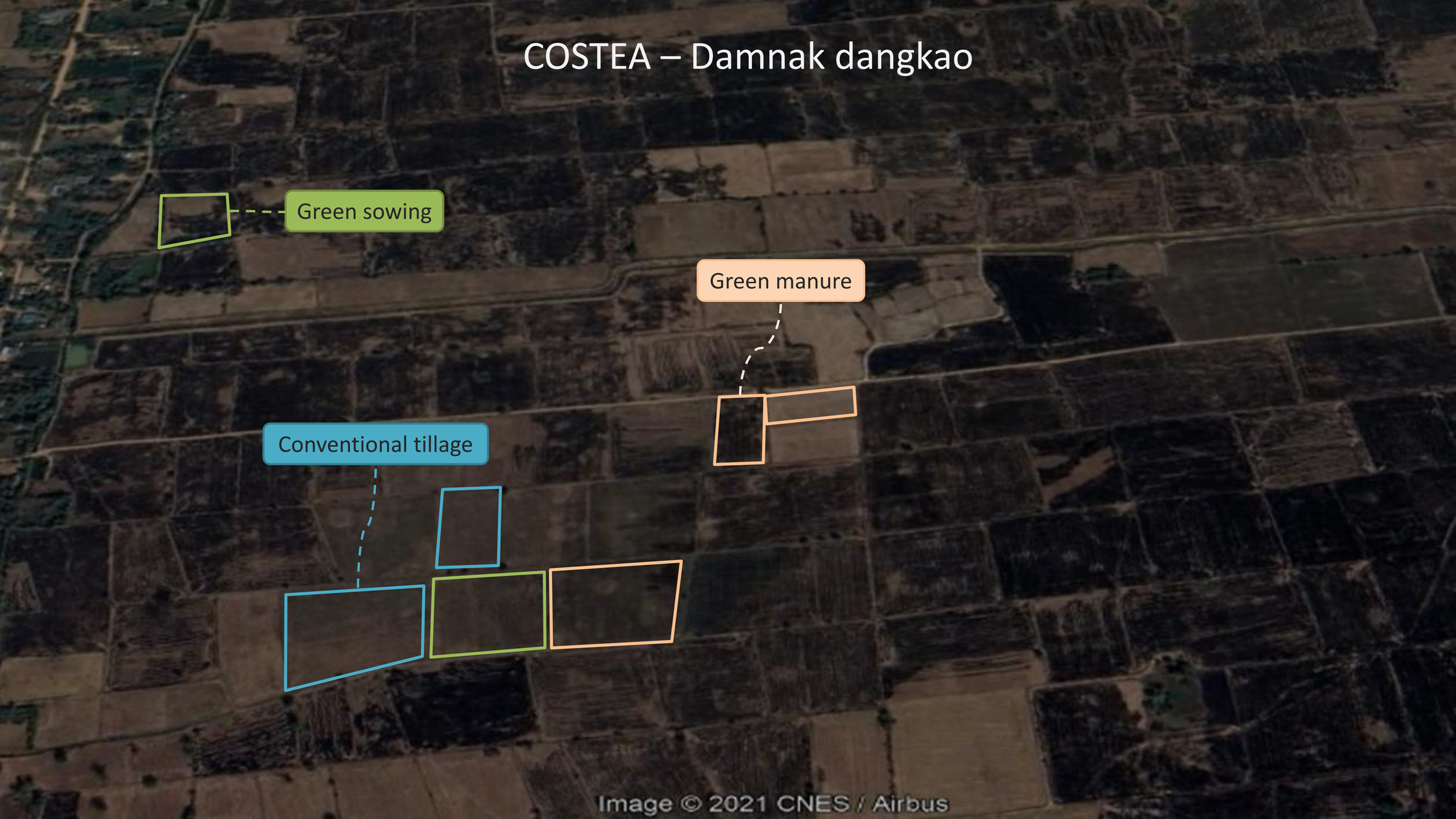


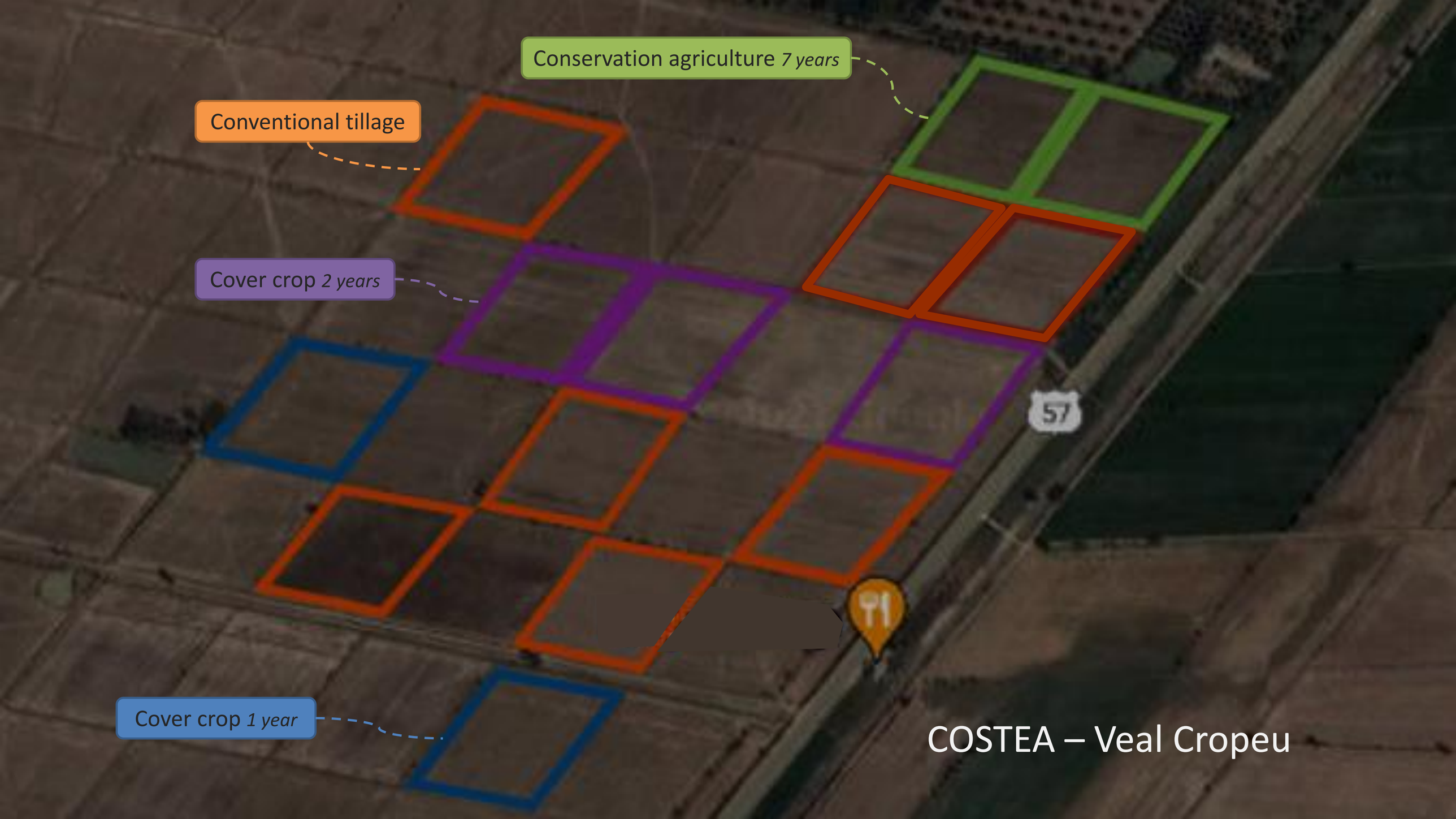
Biochar – UBB Farm

COSTEA – Os Tuk



COSTEA – Damnak dangkao



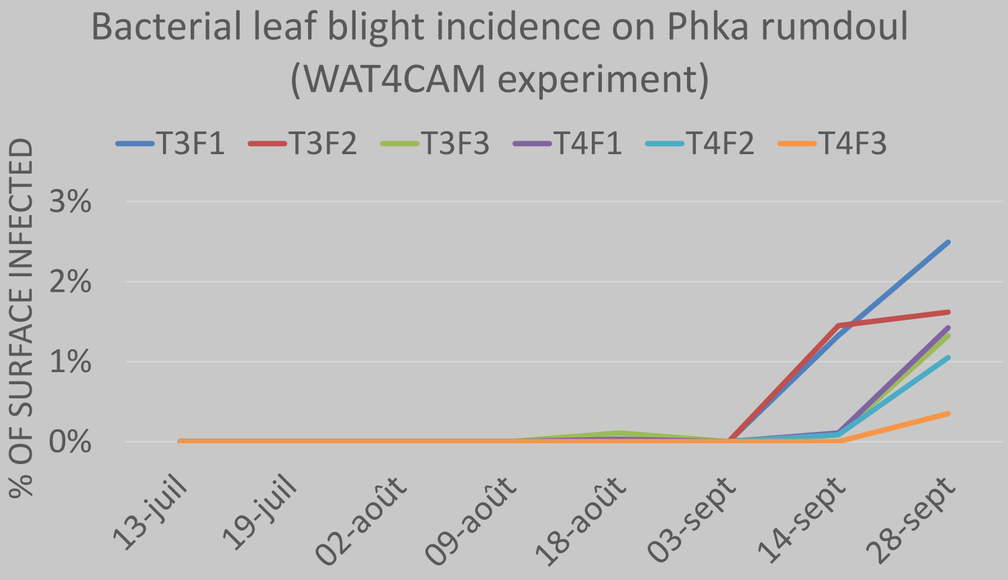

Conservation agriculture 7 years
Conventional tillage
Cover crop 2 years
Cover crop 1 year
57
COSTEA – Veal Cropeu

Field experiments in Cambodia

MONITORING

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

KoBo Toolbox



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
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- ✓ **LAI** dynamics
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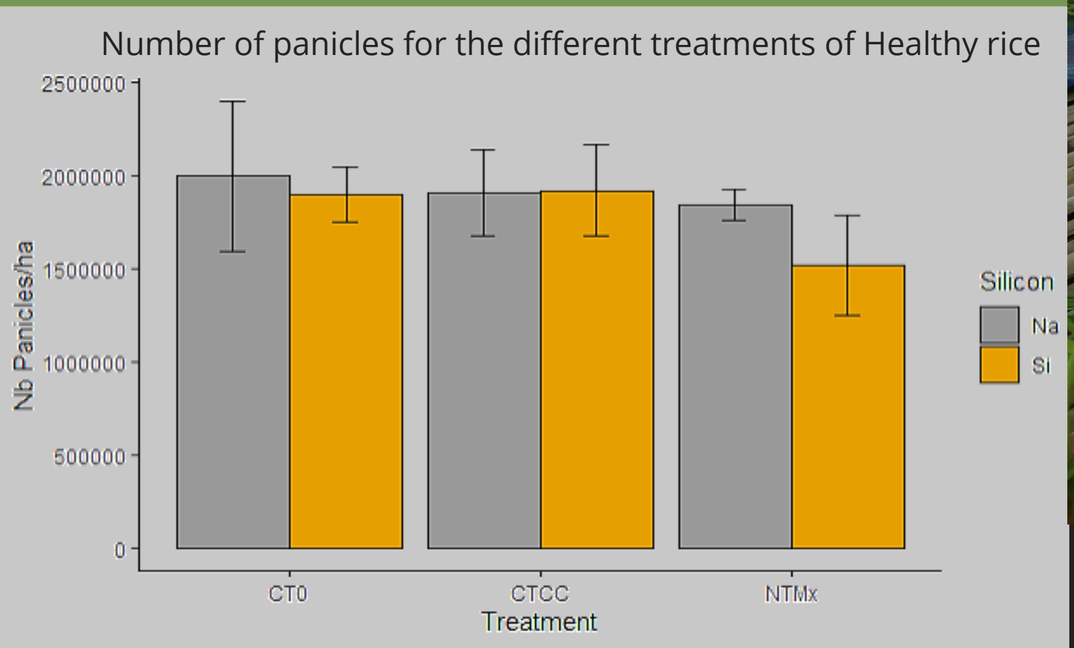
- ✓ **Biomass** components
  At flowering and harvesting stages



Field experiments in Cambodia

MONITORING

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

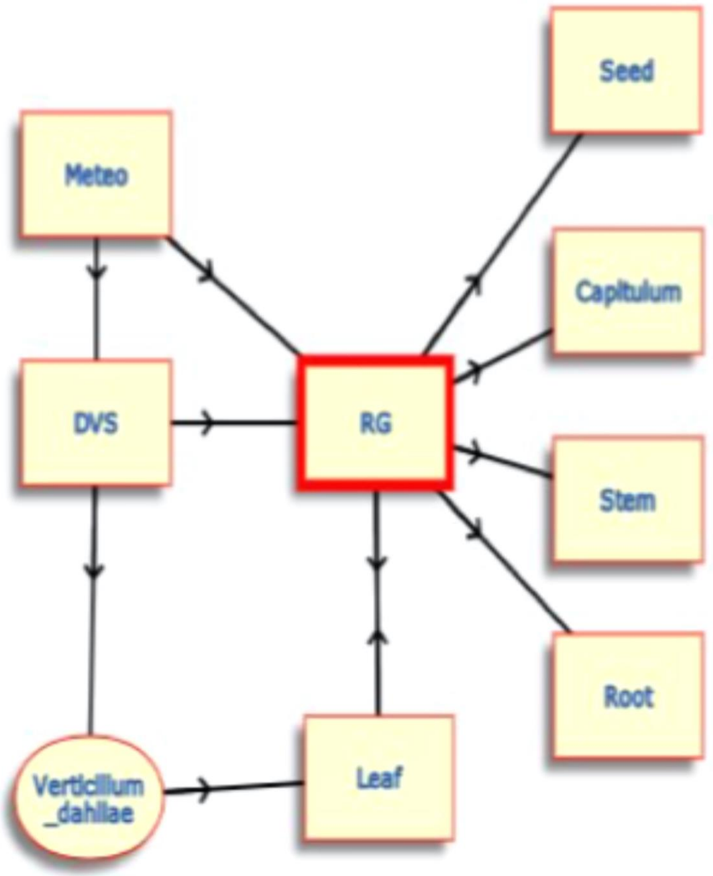
Field experiments in Cambodia

MONITORING

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

Plot 1	Risk product 1	Risk product 2	Risk product 3	
Active ingredient	Bispyribac sodium 40%SC	2,4-D	Alpha cypermethrin	
LD50	2	1	1	
dose/ha	3,5	1	0,5	
Frequency	1	1	1	
Application	2	2	2	
TOTAL	----------	----------	----------	***Sum TOTAL***
	8,5	*5*	*4,5*	**18**

Model Builder



Expressions de variables

Variable	Expression	Init.	Unité
RG	RAD*RUE*(1-exp(-k*LAI))*dt	1	g.m-2

Paramètres

Paramètre	Valeur	Unité
dt	1	day
k	0.9	Dimensionless

Paramètres et variables dynamiques

Variable	Fichier	Temps	Unité
RUE	RUEf.txt	DVS	g.MJ-1

Liens

Variable	Modèle	Mode	Unité
DVS	ModelDVS	synchrone	Dimensionles
LAI	ModelLeaf	synchrone	m2.m-2
RAD	ModelMeteo	synchrone	MJ.m-2.day-

- Reference : RG Model, Projet Sunflower Pest

PUBLICATION AGENDA

Axes	Planned publication	S1	S2	S3	S4	S5	S6
1	Modeling for Agroecological crop protection of rice. A review	✎	✎				
2	Impact of agroecological cropping practices on rice growth and yield		✎	✎	✎	✎	
2	Impact of different agroecosystems on the incidence of pest, diseases, and weeds in rice crop in Cambodia		✎	✎	✎	✎	
3	Modeling the impact of pests, diseases, and weeds on rice growth and yield establishment in agroecological cropping systems. Model construction and evaluation			✎	✎	✎	✎

Thank you for your attention