Modeling for decision support and modeling for impact assessment. How do the modeling projects differ?

François Brun

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Modeling for decision support and modeling for impact assessment. How do the modeling projects differ?

François Brun (ACTA)

RMT modélisation, Seminar September 7, 2010 (Paris)
« What's new, what's next in dynamic system modeling in agronomy »

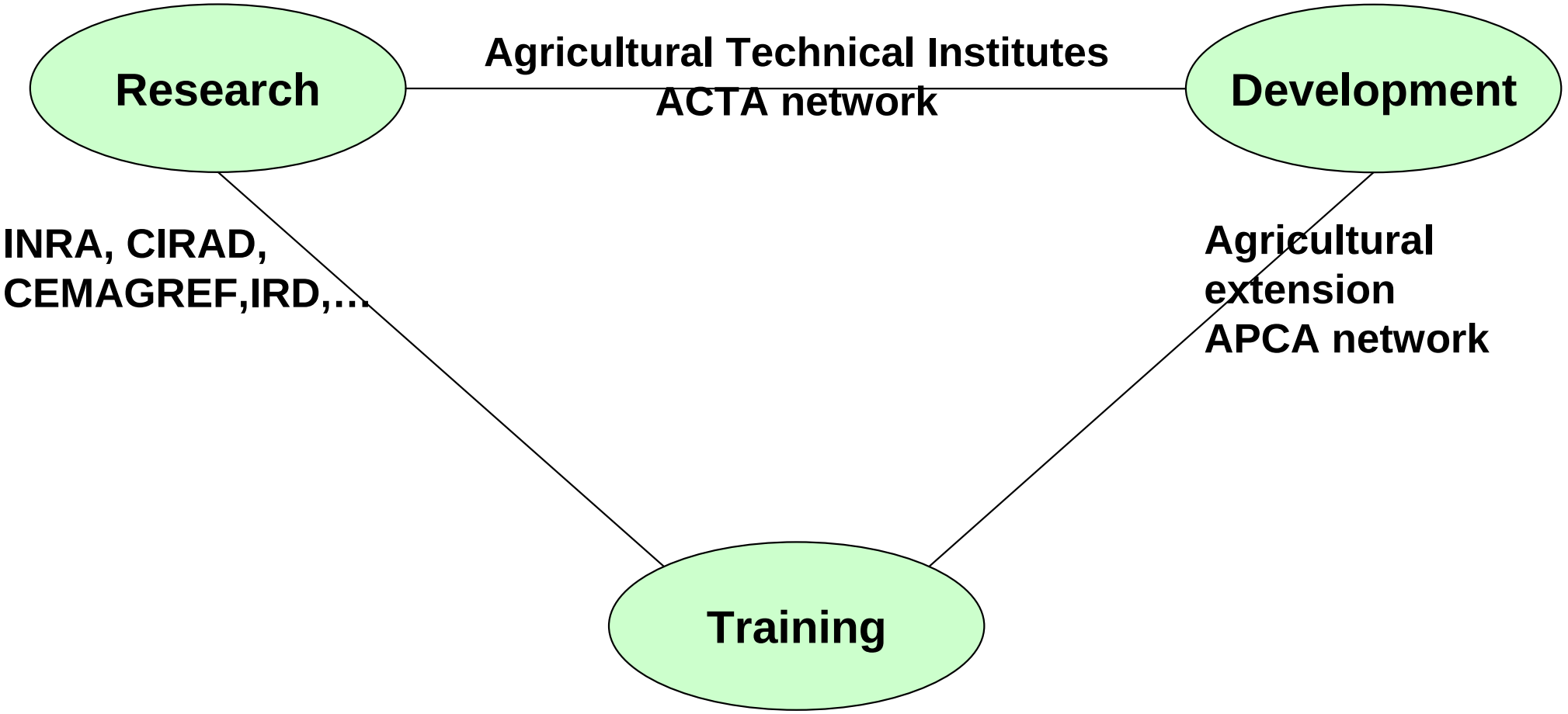
Pour mémoire ACTA, le réseau des instituts des filières animales et végétales, ce sont :
- 16 instituts techniques agricoles qualifiés dont une tête de réseau.
- Les outils professionnels de recherche appliquée et de transfert technologique au service des filières agricoles.
- Une forte présence sur le territoire national avec près de 200 implantations en région.
- Une force de 1100 ingénieurs et techniciens.
- Un budget de 168 millions d'euros en 2007 dédiés à la recherche agricole appliquée.

Overview

- Introduction
  - French Agricultural Technical Institutes
  - Modeling for agricultural development ?
- Modeling projects for agricultural development
  - Phases and stages proposed
  - Duration
  - Two types of projects and examples
  - Software
  - Evaluation
  - From type 2 to type 1?

Introduction

French Agricultural Technical Institutes



Technical education (agricultural high school ...)
University education

Agricultural Technical Institutes
ACTA network

- Applied research, technical support, experiment, expertise, training and information. Operational mission on the field. Creation and dissemination of technical progress in agriculture.

- **Head of network**
- ACTA, coordinator and representative of the **technical institutes of agricultural sectors**
- **Applied plant research**
- ARVALIS - Institut du végétal
- CETIOM, Centre Technique Interprofessionnel des Oléagineux Métropolitains
- CTIFL, Centre Technique Interprofessionnel des Fruits et Légumes
- IFV, Institut Français de la Vigne et du Vin
- AGPH, Association des Producteurs de Houblons de France
- ANIFELT, Association Nationale Interprofessionnelle des Fruits et Légumes Transformés
- ANITTA, Association Nationale Interprofessionnelle Technique du Tabac
- ARTB, Association de Recherche Technique Betteravière
- ASTREDHOR, Association Nationale des Structures d'Expérimentation et de Démonstration en Horticulture
- IDF, Institut pour le Développement Forestier
- IFPC, Institut Français des Productions Cidricoles
- ITAB, Institut Technique de l'Agriculture Biologique
- ITB, Institut Technique Français de la Betterave Industrielle
- ITEIPMAI, Institut Technique Interprofessionnel des Plantes à Parfum, Médicinales et Aromatiques
- ITL, Institut Européen du Lin
- UNIP, Union Nationale Interprofessionnelle des Plantes Riches en Protéines
- **Applied animal research**
- INSTITUT DE L'ELEVAGE
- IFIP, Institut du Porc
- ITAVI, Institut Technique de l'Aviculture
- ITSAP, Institut Scientifique et Technique de l'Abeille et de la Pollinisation (ex. CNDA, Centre National du Développement Apicole)

=> 1100 engineers and technicians

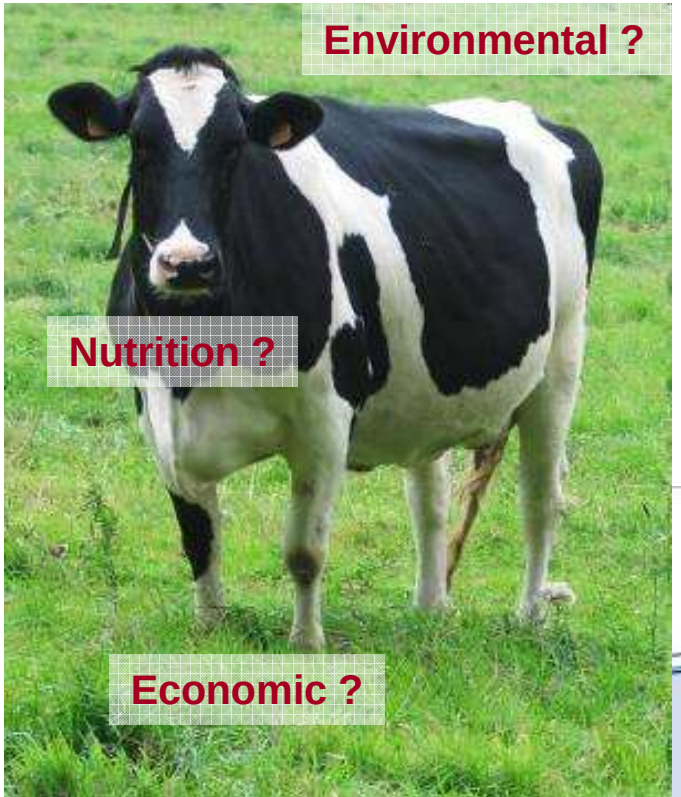
Role of modeling in the activities of Agricultural Technical Institutes

INSTITUT FRANÇAIS DE LA VIGNE ET DU VIN

- Ex.1 : **IFV (vine and wine)**, main modeling themes
  - **Vineyard protection** against pests and diseases
  - **Yield Quality** : evaluation of potential of a field or year.
  - **Physiology of vine** : information on key phenological stages to predict yield and maturity of grape.
  - **Vineyard soil water status:** drought constraint and global warming impact assessment.

Role of modeling in the activities of Agricultural Technical Institutes

INSTITUT DE L'ÉLEVAGE



- **Ex.2 : Institut de l'Élevage (Livestock)**, main modeling themes
  - **Environment impact assessment** : fluxes (C, N, P, K, Cu, Zn) to water, air and soil. Ex ante and multicriteria assessment of production strategies.
  - **Milk production system** : consequences of management on milk production.
  - **Technical and economical.**

Modeling activity…

- **Existence of a huge quantity and variety of models**

=> Importance of clarifying what are these modeling works and their place in our community.

- **The goal of such work is not to construct a model, but to answer a practical issue with a specific purpose.**

=> Viewpoint of "modeling project"

Modeling projects for agricultural development

Materials and methods

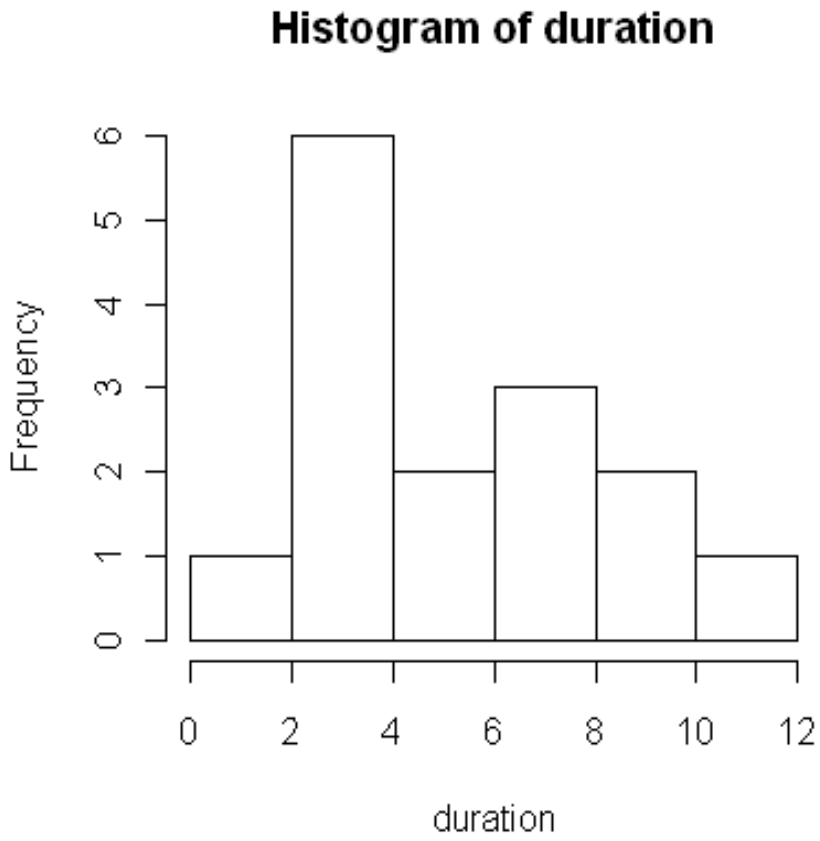
- **A survey of projects of the partners of our modeling network for agriculture (“RMT modélisation”)**
- **Questions on all the project’s steps**
- **Which projects ?**
  - **By or with Technical institute as a partner**
  - **Dynamic system model**
  - **20 projects analysed**
- **Examples:**
  - **Apricot date of yield (CTIFL)**
  - **Wheat Septoriose (Arvalis)**
  - **Sunflower (INRA - CETIOM)**
  - **Environmental assessment Livestock (INRA – Inst. élevage)**

Phases and stages proposed

PHASE	STAGES
Initiate project	Specify objectives
	Identify partners
Plan	Propose initial plan
	Identify personnel
Execute	Formulate conceptual model
	Formulate model equations
	Write software
	Identify and obtain data
	Estimate model parameters
	Analyze and evaluate model
	Provide documentation
Close out	Deliver software

A loop process….

Duration


Histogram of duration
Frequency
0
1
2
3
4
5
6
0
2
4
6
8
10
12
duration

Two types of projects

Type 1. projects aiming at decision aids for agricultural production systems

- **For advisers and farmers**
- **Dissemination outside developers**
- **To deal with specific cases**

Type 2. projects aiming at assessment of agricultural production systems

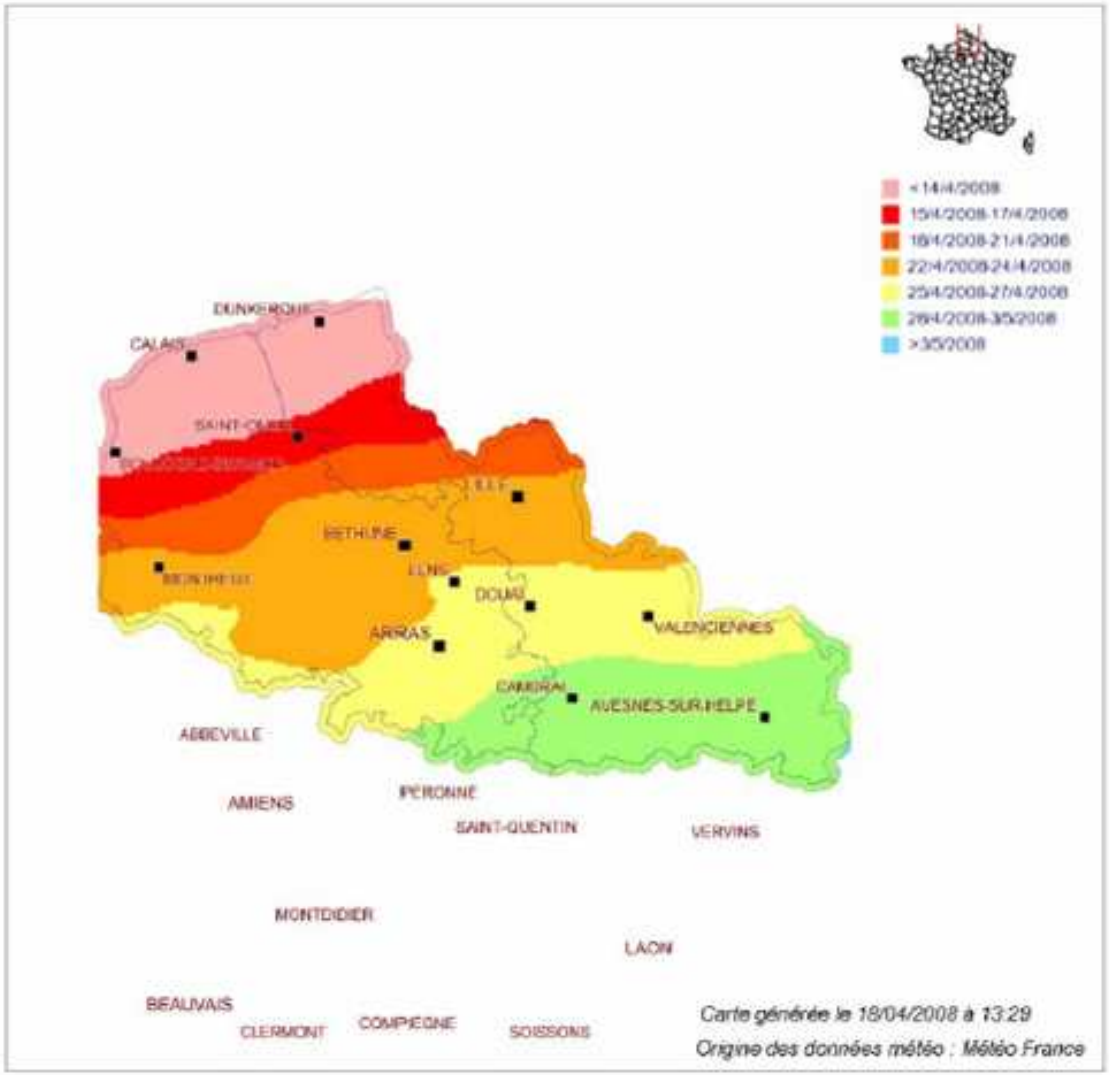
- **For researchers and engineers**
- **Few users**
- **To analyze scenarios**

Septo-LIS®
Blé tendre

Protection contre la septoriose

UNEAL

Variété Dinosor – semis du 05/10/2007

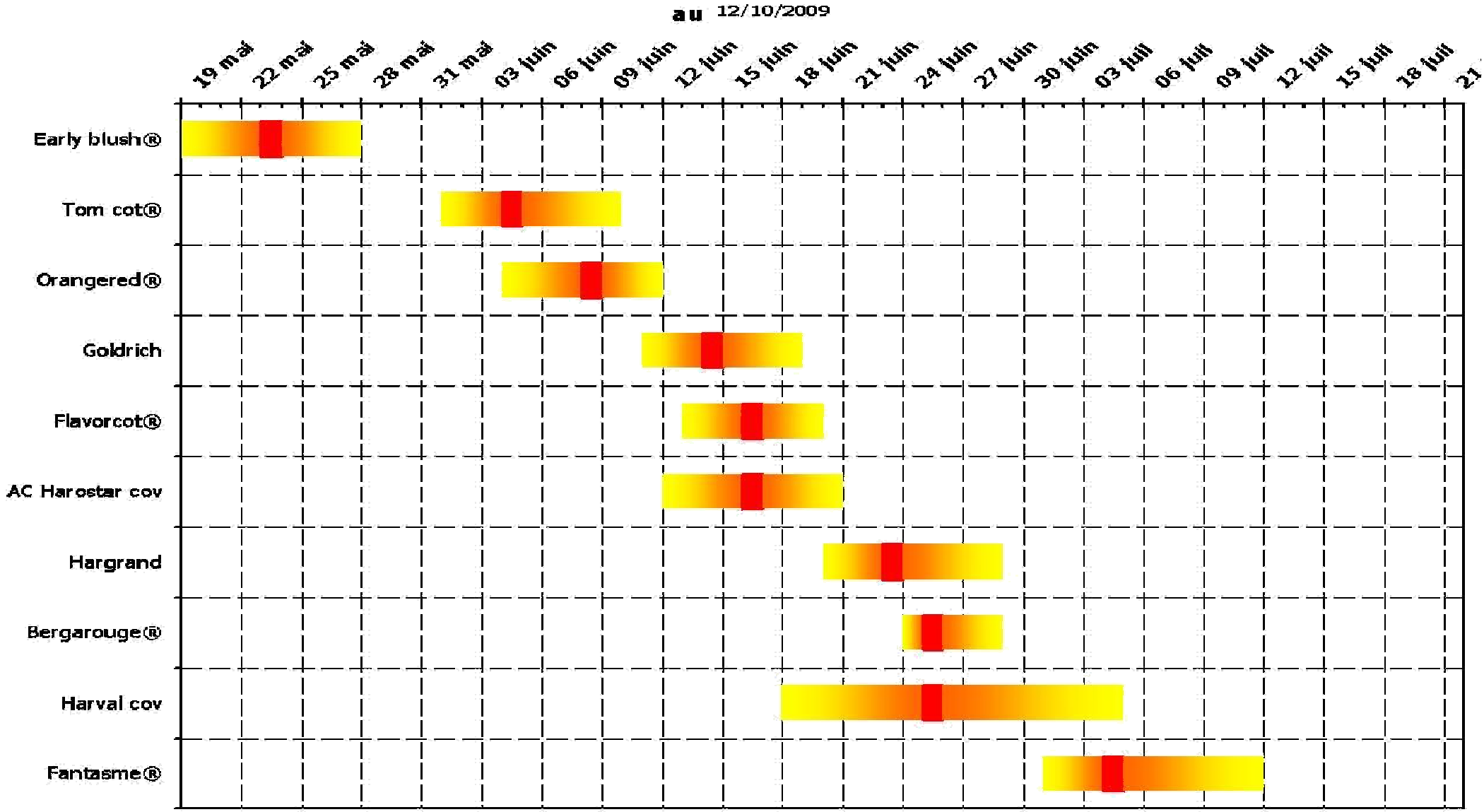


ARVALIS
Institut du végétal

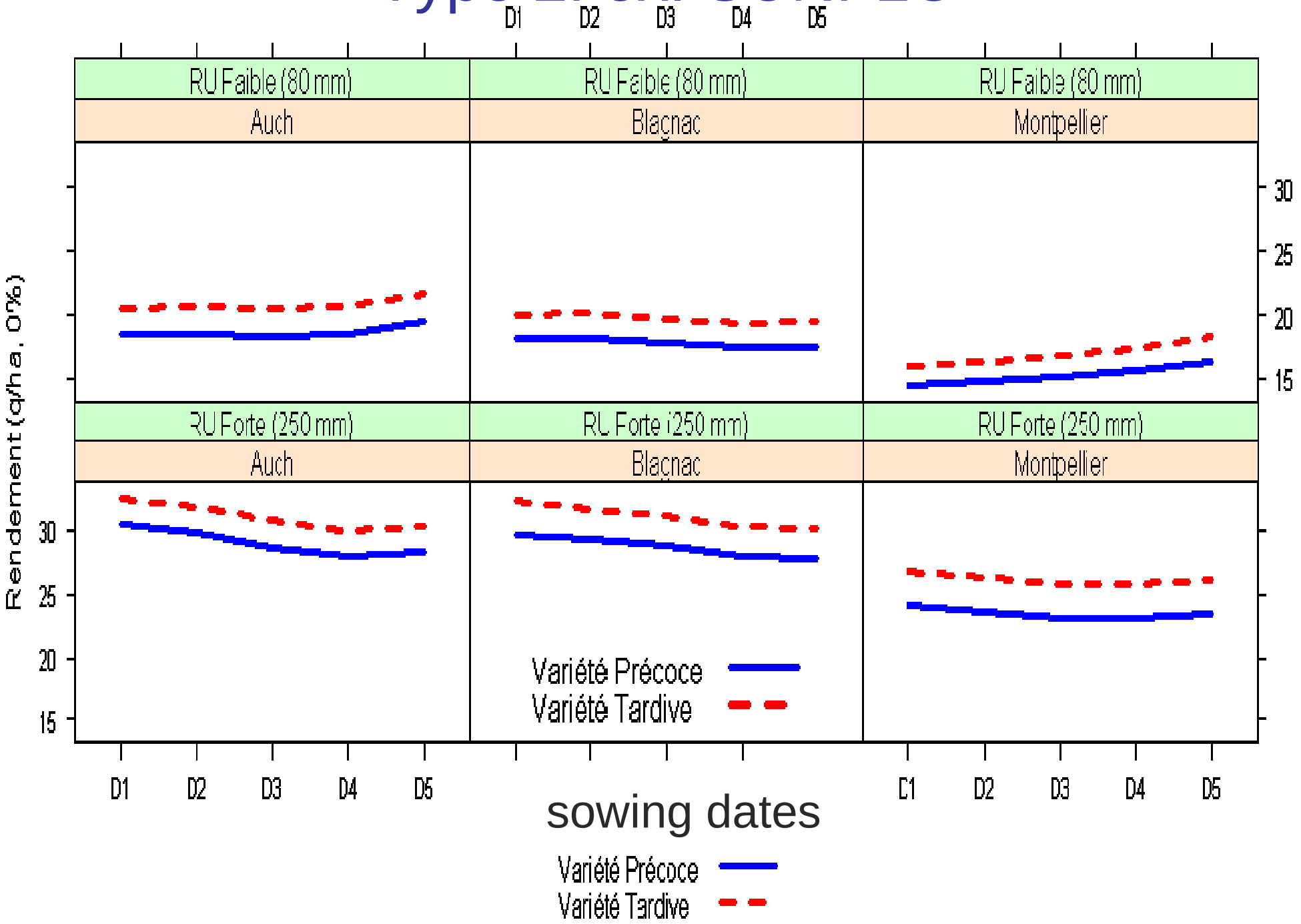
- A clear and operational message provided to farmer
- Real time data
- Regional map
- Suggested date for the first treatment

David Gouache et col., Arvalis

Type 1: ex. Apricot yield planning



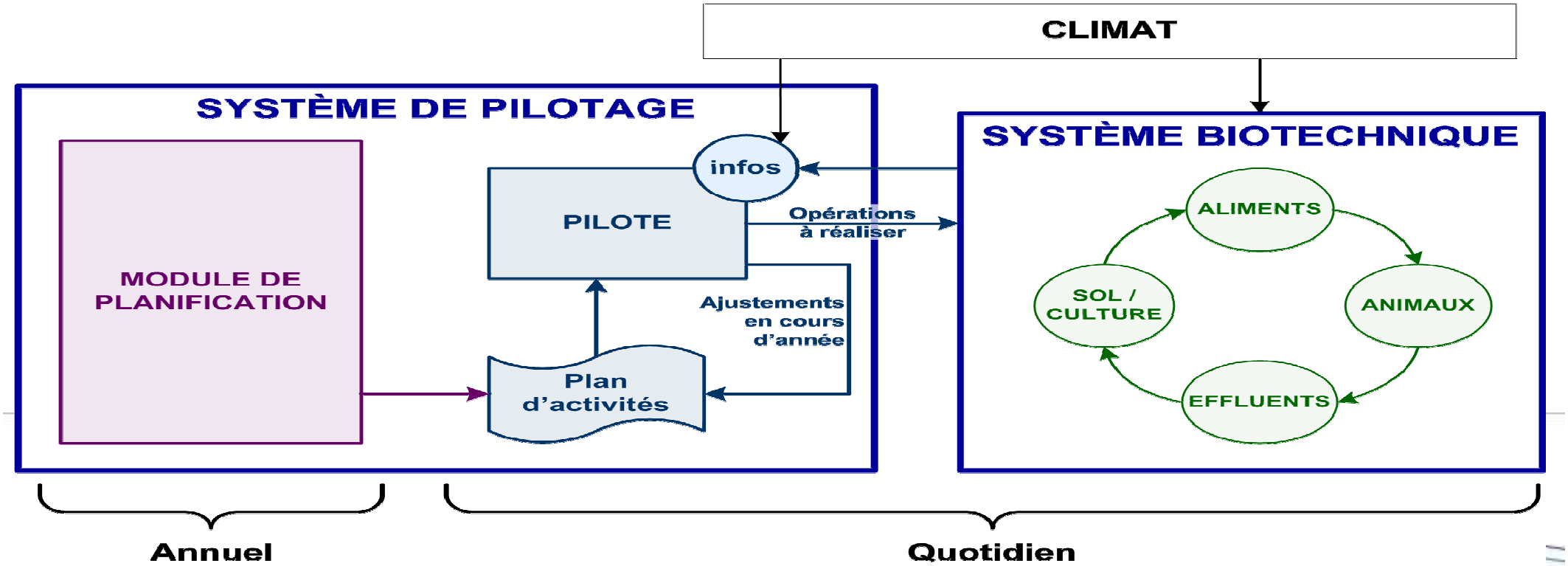
Type 2: ex. SUNFLO



Pierre Casadebaig et col., CETIOM/INRA

Type 2: ex. MELODIE

- MELODIE model (INRA-IE-IFIP) used to assess environmental impact of livestock dairy cattle or pig
- Scenarios of farm management
- At short (months) and long term (decades)
- Access to variables that can not be measured



Partnership

Type 1. Technical institute, extension services

Type 2. Research institute (INRA), Technical institute

Modeled system

Type 1. quite simple

- **Ex. disease population**

Type 2. can be more complex

- **Ex. disease population + crop growth + crop practices**

Software considerations

Type 1. User's interface is an essential point

- **To facilitate real time data (weather)**
- **Modeling framework for final users**

Type 2. To get rid of program errors in the model

- **To reuse existing modeling modules**
- **Modeling framework may be useful**

=> See debate: what role for modeling and simulation frameworks (Hélène Raynal) ?

Evaluation

- Type 1. From a representative sample
  - Target Population = conventional management
  - Evaluation representative of future prediction
- Type 2. Using data collected, when available
  - Target Population = innovative management
  - Difficult to have a representative sample
  - Partial evaluation

Summary of the two types

- Type 1.
  - duration : Several years, mainly devoted to the evaluation of the model compared to real references (networks of observation).
  - Importance of quality for prediction OR for decision

- Type 2.
  - duration: Several years, mainly devoted to the design and improvement of the model.
  - Importance of the conceptual model

From type 2 to type 1?

- **It’s possible**
- **In some case, it may be expected**
- **We should consider it as a new project (because issue, objective and end-users are not the same)**

Conclusion

- **All the modeling projects are long and mobilize different skills**

- **the projects can be divided into two types**
  - **projects aiming at decision aids for agricultural production systems**
  - **projects aiming at assessment of agricultural production systems**
- **In general, the same steps in the modeling projects**
- **The way each step is carried out is quite different, and resources' management should be adapted to the project.**

=> it’s really important to clarify the issue and the objective