Innovative decision support system for IPM in greenhouses

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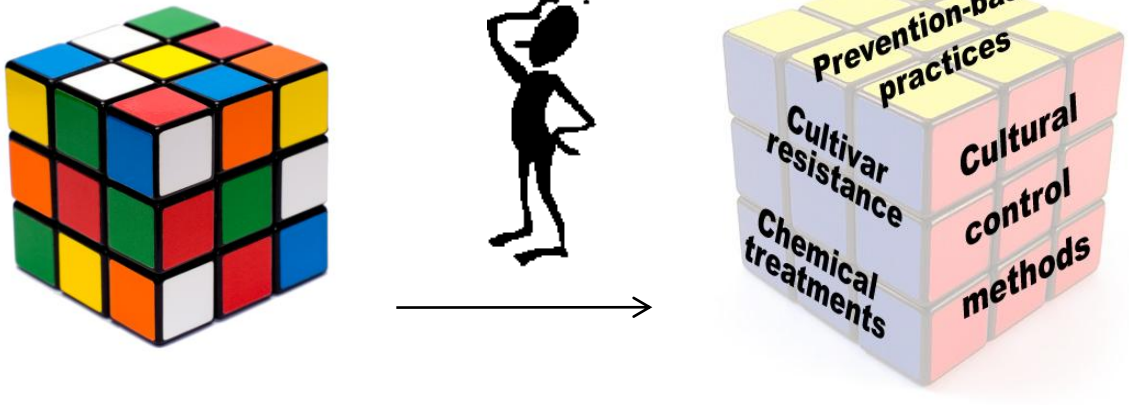
INRA

invivo AgroSolutions

Pest protection in protected cultivation:

Integrated pest management: a success story



But a wide range of interpretations in real life situation

Important shift **IPM= Integrated Pesticide Management**

Biological Control | **Environmentally Friendly Biocides** | **Conventional Pesticides**

Agroecosystem complexification

Trophic level

3

2

1

Positive effect
Negative effect
Direct interaction
Indirect interaction

Natural enemy

(-)

(+)

Pest

(-)

Crop plant

Agroecosystem complexification

Natural enemy

Natural enemy

Natural enemy

Natural enemy

Pathogen 3

Pathogen 2

Pest 3

Pest 2

(-)

(+)

(-)

Crop plant

Positive effect

Negative effect

Direct interaction

Indirect interaction

Monitoring agro-ecosystem communities

Higher spatio-temporal resolution of **data** for **natural enemy** and **pest abundance** is **required** in order to **implement** robust **IPM statregies***, **

Global and integrative sampling methodology and forecasting models

Objectives:

- to **gather** the **accurate**, i.e. **necessary** and **sufficient**, **information** in order to take the **optimal management decision**

- to **optimize** the **cost benefit balance** of **data gathering** and **the accuracy** of the **decision rules**

*Jonsson et al 2014 : Ecological production functions for biological control services in agricultural landscapes Methods in Ecology and Evolution 2014, 5, 243–252

**Chaplin Kramer et al 2013 ; Detecting pest control services across spatial and temporal scales Agriculture, Ecosystems and Environment 181 (2013) 206-212

Sophi@data_market:
An information system dedicated to biocontrol

➔ A **blending** of **computers** and **wireless telecommunications technologies**, ostensibly with the goal of efficiently **conveying information** over vast **networks** to **improve** a host of business functions or **public services**.

➔ An academic study of the **complementary networks** of **hardware** and **software** that people and organizations use to **collect**, **filter**, **process**, **create** and **distribute data**.

Any specific information system aims to support **operations**, **management** and **decision making**.

Today: 2015-01-14 *Last update: 23-09-2014 by R. Boll*

INRA will not be held responsible under any circumstances for the use of data and tools.

Institut SOPHIA AGROBIOTECH
SANTE DES PLANTES - ENVIRONNEMENT

Sophi@ data market

INRA SCIENCE & IMPACT

USERS

OPEN ACCESS

SOPHI@DATAMARKET for a shared, collective research

SOPHI@DATAMARKET, numbers at:2015-01-14

START AN EXPERIMENTATIONATION

DATA RECORDING

DISPLAY

DATA EDITING

PRESENTATION

TRAINING

PROTOCOLS

TOOLBOX

Access request

Optimized for Firefox & Google Chrome

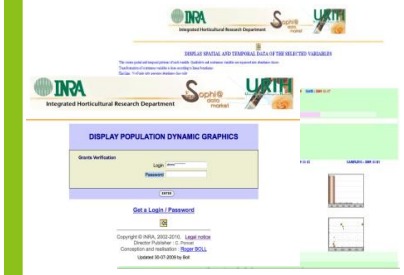
Organisation of the Sophi@data_market

Data recording

Entry form template for on-line recording

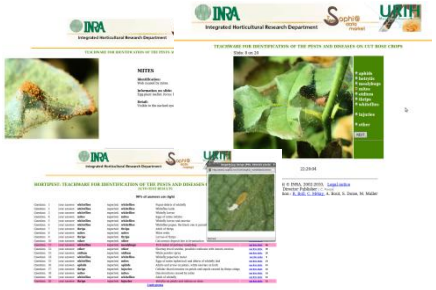
Data management

Spatio-temporal maps



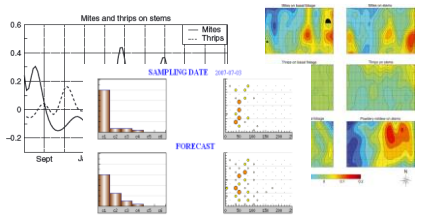
Training

Teachware and scoring self test guides



Predictive models of epidemics

Contineously improved by new data



Decision rules module and guidelines

Generalities

- Hardware et software web hosted by INRA
- MySQL, phpMyAdmin and Php languages
- BDD and web site managed by ISA-TEAPEA TEAM (formerly URIH)
- WEB access – safety monitoring of the data
- Partial open access

Weekly monitoring of pest and BCA dynamics

« QuickSampling » method

➔Generic entry form template

➔Observations adapted to each crop

➔Dividing the canopy in layers correponding to ecological niches of biological communitites.

➔Training to real time recording

+ Set of data recorded in the database:

- climatic data
- operations, treatments

Example of abundance classes for tomato

	For each strata (Low, Medium & High)						Entire plant
	Macrolophus	Nesidiochoris	Neoseiulus	Mites	Aphids	Whiteflies	Tuta absoluta
Class i							
1	none	none	none	none	abscence	none	1 leave
2	1 adult	1 adult	presence	presence	1-3	adults	2-3 leaves
3	adult + larvae	adult + larvae	many	many	4-10	eggs + larvae	> 3 leaves
5	Generalized	Generalized		cobwedded	11-30	generalized	
6					31-100		

No precise count. Only an overall evaluation on one process.

Adaptation for new organisms like *Tuta absoluta* or predatory bugs

- **choice of classes**
- **choice of level of observation e.g. entire plant or strata**

Data Management and Data Mining

OUTPUT : Data Selection

Integrated Horticultural Research Department

DISPLAY MAPS AND DISTRIBUTION OF THE VARIABLES

Experiment: PIC-ROSIER 2003-2007-Terminé-Echantillonnage des bioagresseurs-ref 330
Avalaible variables for: 2003-08-18

Order	Variable	Comment
rank the variables having to be analyzed OR	Hit this link to display all the variables	
	acariens sur bloc-qualitatif-acari.spp-tous	observations sur rosier
	acariens sur poumon-qualitatif-acari.spp-tous	observations sur rosier
	acariens sur tige-qualitatif-acari.spp-tous	échantillonage intégratif sur rosier
	aleurodes sur bloc-qualitatif-aleurodes.spp-tous	observations sur rosier
	aleurodes sur poumon-qualitatif-aleurodes.spp-tous	observations sur rosier
	aleurodes sur tige-qualitatif-aleurodes.spp-tous	observations sur rosier
	botrytis sur poumon-qualitatif-botrytis spp.-spores, degats	observations sur rosier
	botrytis sur tige-qualitatif-botrytis spp.-spores, degats	observations sur rosier
	oidium sur bloc-qualitatif-sphaeroteca spannosa-spores, degats	observations sur rosier
	oidium sur poumon-qualitatif-sphaeroteca spannosa-spores, degats	observations sur rosier
	oidium sur tige-qualitatif-sphaeroteca spannosa-spores, degats	observations sur rosier
	proximite tige-poumon sur rosier-qualitatif-rosa spp.-tous	evaluation de la distance tige-poumon
	pucerons sur bloc varietal-qualitatif-spp.-tous	observation de pucerons sur rosiers
	pucerons sur poumon-qualitatif-spp.-tous	observations pucerons sur rosier
	pucerons sur tige-qualitatif-spp.-tous	observation de pucerons sur rosiers
	stade floral du rosier-qualitatif etalonne-rosa spp.-inflorescence	en fonction de la documentation et de l espece
	thrips sur poumon-qualitatif-thrips spp.-tous	observations thrips sur rosier
	thrips sur tige-qualitatif etalonne-thrips spp.-tous	observations thrips sur rosier

ENTER

HELP

OUTPUT : Display of Observed and Measured Variables

DISPLAY MAPS AND DISTRIBUTION OF THE VARIABLES

This screen displays spatial maps for each variable and informations related to the previous sampling session. Qualitative and qualitative variables are expressed as abundance classes.

Transformation of continuous variables is done according to linear boundaries.

First line : % of units into presence abundance class only

Second line : dispersal of infested units on the field

Get your data by mail or contact Roger Boll

EXPERIMENT: PIC-ROSIER 2003-2007-Terminé-Echantillonnage des bioagresseurs-ref 330 **DATE :** 2003-08-18

EVENTS FOR THE PREVIOUS WEEK

TREATMENT 1 : acariens PRODUCT 1 : phytoseiulus persimilis Biobest

TREATMENT 2 : acariens PRODUCT 2 : neoseiulus californicus Biobest

TREATMENT 3 : PRODUCT 3 :

PLEASE WAIT SYSTEM LOADING GRAPHICS

acariens sur tige-qualitatif-acari.spp-tous

Protocole: évaluation visuelle des densites acariens sur tige

Technique: observation tige+2 frappages puis classes : 1-absence 2-presence 3-abondance 4-entoilages

STATISTIQUES

N of observed units : 90

N of infested units : 34

% of infested units : 37.8

Range of all the values : 1 - 4

Classe 1 : absence

Classe 2 :

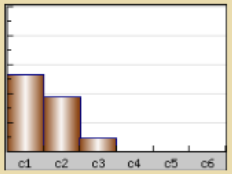
Classe 3 :

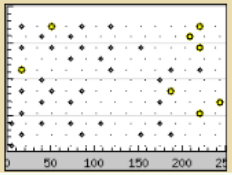
Classe 4 :

Classe 5 :

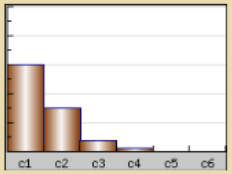
Classe 6 :

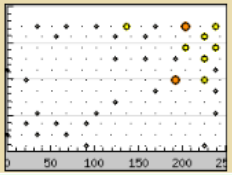
SAMPLING : 2003-08-04



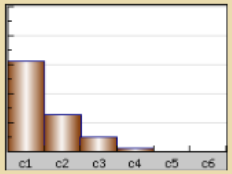


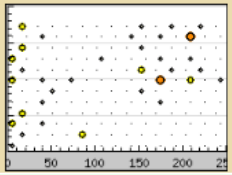
SAMPLING : 2003-08-11





SAMPLING : 2003-08-18





Forecast acari on shoots for next week

NEW QUERY hit there to select a new sampling session

OUTPUT : Climatic and Statistical Data

Integrated Horticultural Research Department

DISPLAY CLIMATIC GR

Username : boll

Experimentation: PIC-ROSIER 2003-2007-Terminé-Echantillonnage des bioagresseurs-
Observed variables during the period 2003-08-01 **to** 2003-08-30
Measures from the sensor: 13

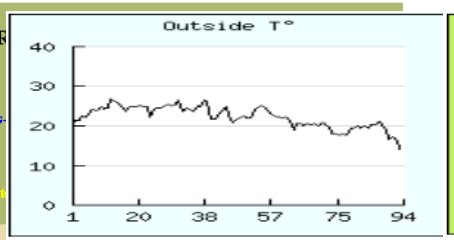
Select rank for any variable having t

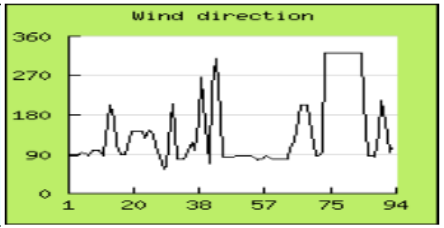
Hit this link to display all the follov

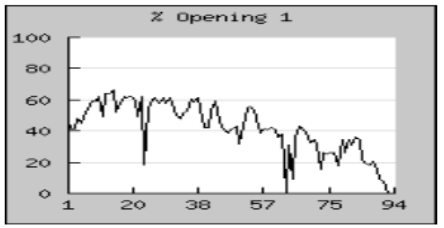
Outside temperature
Outside radiance
Outside wind speed
Inside temperature
Percentage opening 1
Percentage opening 3
Percentage opening 5
Percentage opening 7
Percentage closing screen2

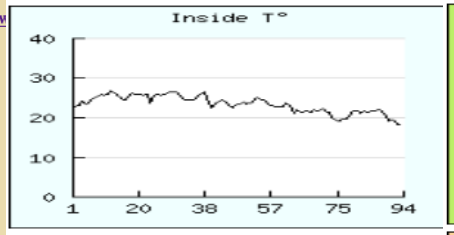
ENTER

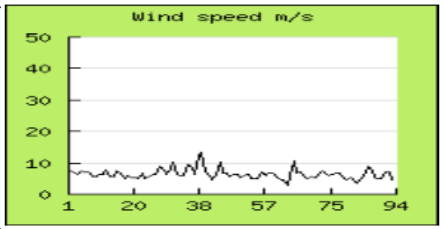


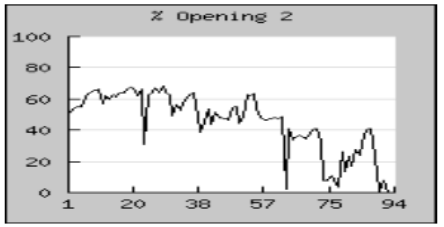


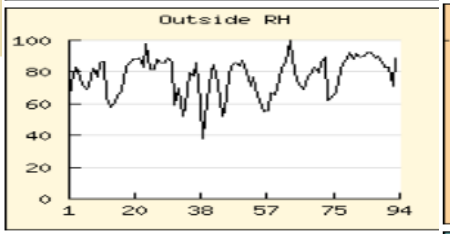


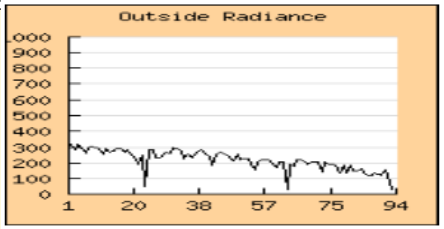


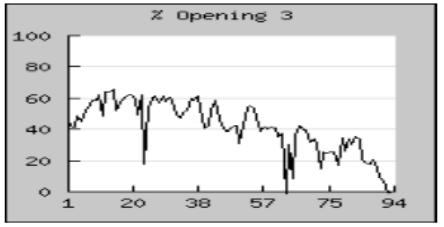


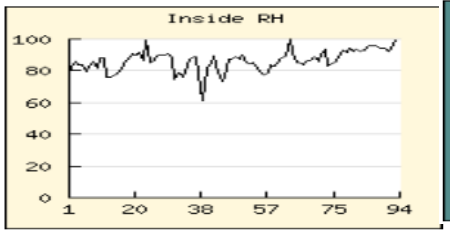


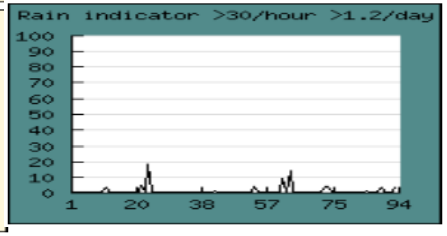


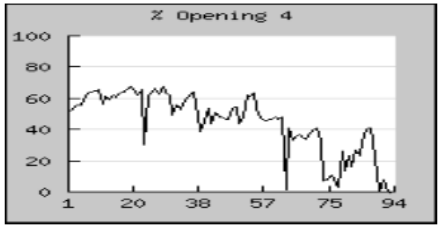












Models

Predictive models of pest dynamics

Setting up of **black-box models** of spatio-temporal dynamics in order to facilitate decision process.

Use of these black box models to understand and **highlight** the **key factors** in triggering epidemics

Tetranychus urticae©Bout.Alexandre

300 predictors tested

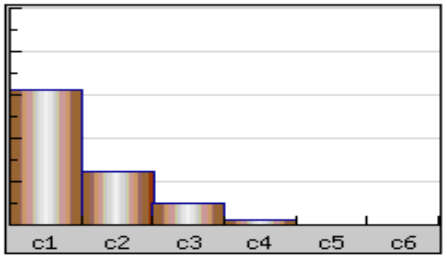
Infestation (distributed)	Local abundance on stem or bent shoot	D & D-7
	Global infestation rate	D & D-7
	Maximum infestation on stem & bent shoot	D & D-7
	Infestation Evolution	D & D-7
	Neighbourhood	D
Climate (mean)	Temperature & Humidity (Mean)	D-7 & D-15
	Temperature & Humidity (Maximum)	D-7 & D-15
	Climate Evolution	D-7 & D-15
Treatment (mean)	Chemical	D-7 & D-15
	Biological	D+7 D-7 & D-

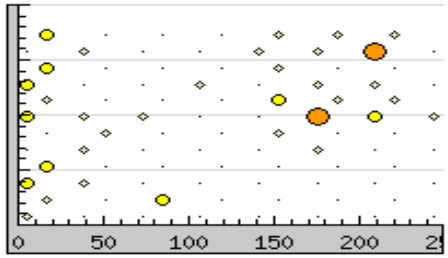
FORECAST ACARI ON SHOOTS

Projection pursuit models provides individual forecast for each sampled zone according to the abundance class and without any treatment effect

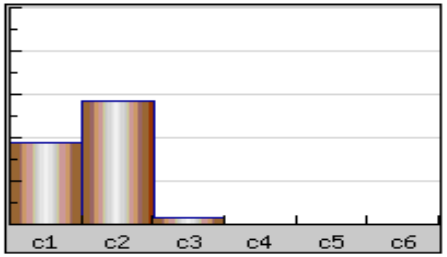
INRA is not responsible of use of these predictions

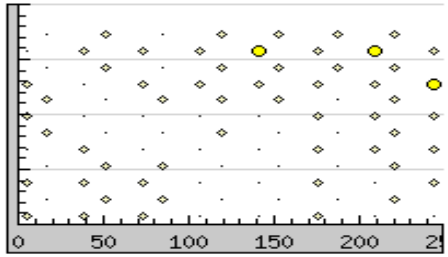
OBSERVED ON DATE 2003-08-18





FORECASTED FOR NEXT WEEK

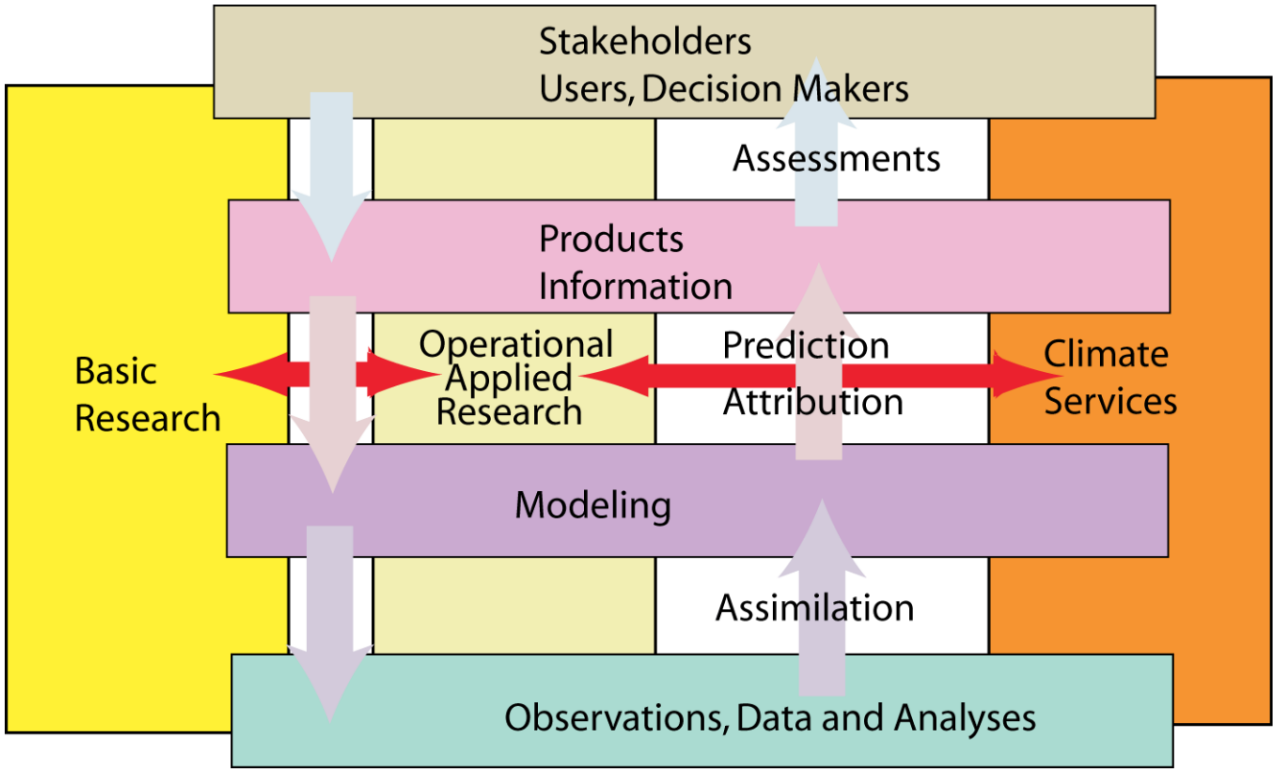




Thank you for your attention!

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/ 2007-2013) under the grant agreement n° 265865- PURE

Sophi@data_market: Flow of the information



Basic research feeds into applied and operational research and the development of services. The system is built on the analysis and fields for initializing models; the use of models for Prediction and with all the information assessed and assembled into products and information that are disseminated to users.

The users in turn provide feedback on their needs and how to improve information.