Session “Perspectives on the implementation of IPM in EU”

The contribution of PURE

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and the PURE consortium

http://www.pure-ipm.eu

IPM Innovation in Europe, 12th January 2015

PURE objectives

- To provide practical IPM solutions to reduce reliance on pesticides *(cropping system-specific, integrative research)*
  - Design and test in real conditions for selected cropping systems and pest situations
- Scientific knowledge to design future solutions *(generic, analytical research)*
  - Based on innovative research in challenging fields: **pest evolution**, **plant-pest-enemy interactions**, **ecological engineering** (soil and landscape ecology), **emerging technologies**

➔Toolbox of approaches, methods and tools for implementing efficient IPM solutions *(flexibility)*

PURE partnership

PURE project

Research
1 - INRA
2 - RRES
3 - AU
4 - JKI
5 - DLO
6 - WUR
7 - CNR
8 - KIS
9 – JHI (SCRI)
10 - FEM
11 - IVIA
12 - IOR
13 - UDCAS
14 - JRC-IPTS
23- USFD

Extension
15 - DAAS

16 - ACTA

Industry
17 - BCS
18 – BIOTOP
19 – NPP
20 - Burkard
21 – Blgg
24 – IAS
26- SOILC-R

Management
22 - INRA Transfert

PURE objects

- All pests
  - Pathogenic agents, animal pests and weeds

- Cropping systems
  - Annual: winter wheat based rotations (=choice + sequence), maize-based rotations, field vegetables)
  - Perennial: grapevine, fruit crops
  - Protected: vegetables under cover

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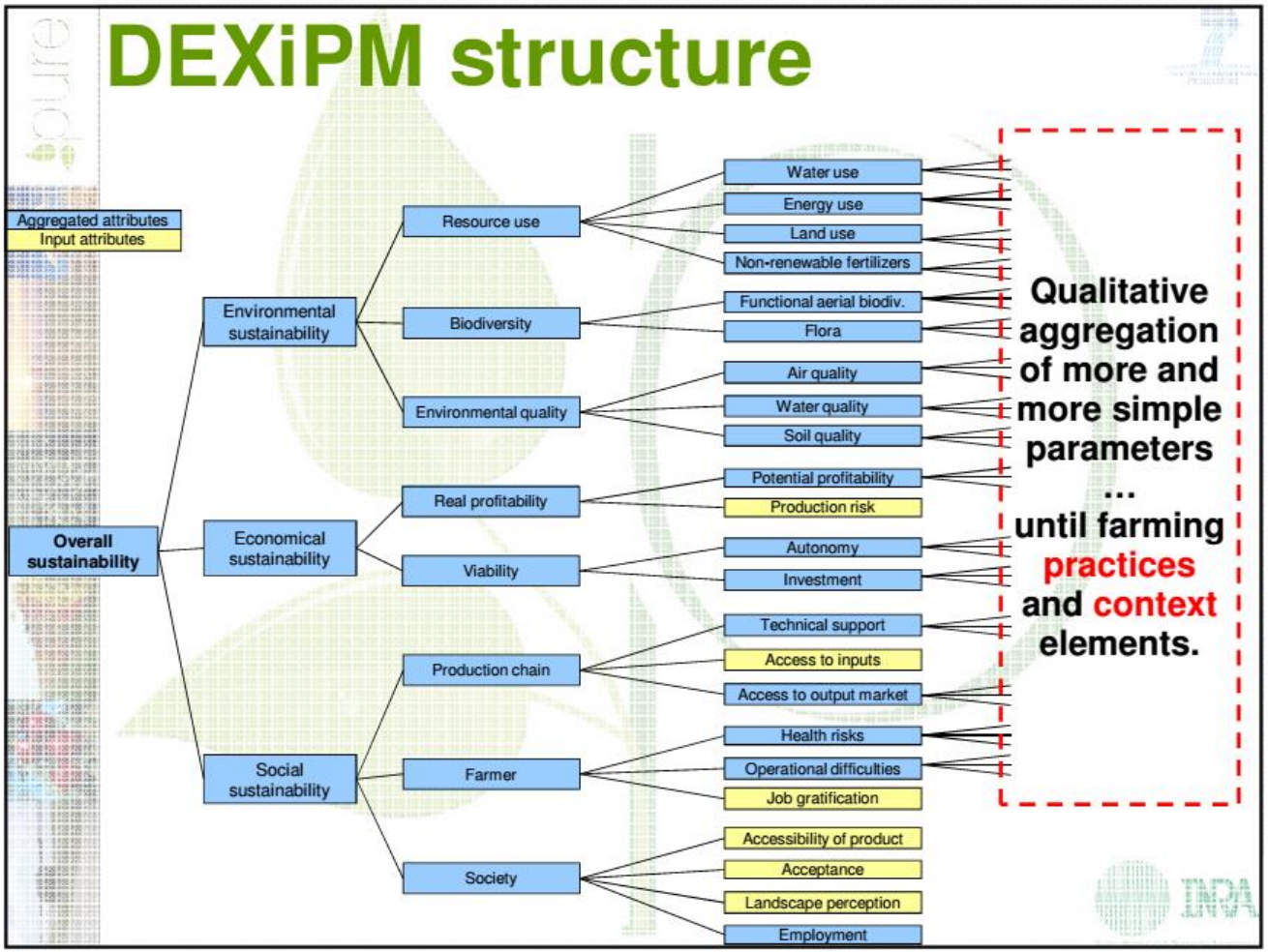
IPM solutions: three characteristics for an integrative IPM research

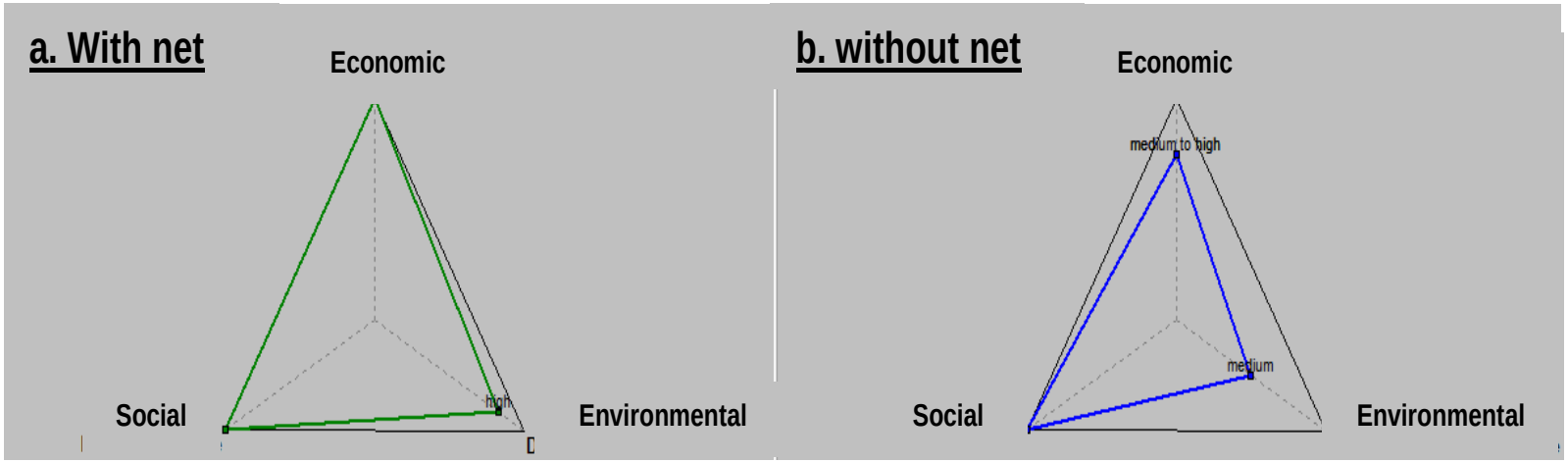
- Assessment and design tools
- Involvement of stakeholders
- From design to field tests
  - Identifying efficient alternatives
  - Combining tactics and strategies
  - Performance analysis

IPM solutions: DEXiPM, a multicriteria *ex-ante* and *ex-post* assessment tool



Booklet 2013

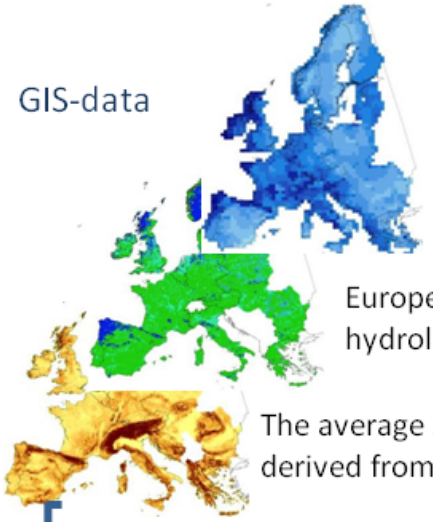
Ex-ante assessment of IPM solutions with DEXiPM



The case of pomefruit systems in SE France

Deliverable 5.1

IPM solutions: Synops for pesticide risk assessments ➔ farm and regional levels



Longterm average temperature and average precipitation have been spatially interpolated onto the MARS 25 km x 25 km grid (Mulligan and Bouraoui, 2007).

European soil map includes organic carbon, soil pH, soil texture class, soil hydrological. (1*1 km).

The average slope is calculated using the global digital elevation model (DEM) derived from GTOPO30 (1*1 km)

manual input of surface water parameters: minimal distance, width, depth , SW type

active ingredient database

Connect to GIS databases

Select and store input data of grid cell

a.i.	date	AR
xxx	1.4.12	1,00
yyy	6.4.12	1,50

Enter and store application calendar

SYNOPS

Run SYNOPS

Risk classes for target organisms and compartments

Deliverable 5.1

IPM solutions: cost-benefit analysis (CBA)

	Description
Complete CBA	Information on costs is collected for all operations. **This approach is relevant when the tested IPM solution corresponds to an important change in the system, i.e. impacting various operations.**
Partial CBA	**When the tested IPM solution corresponds only to a marginal change** (impacting only 1 or 2 operations for example), **data are collected ONLY for these operations impacted by IPM.** The economic analysis limits to the comparison of the extra costs or costs saving associated to the IPM solution.

IPM solutions: modelling platforms and models to help design IPM solutions

- Modelling platforms:
  - **Unisim** for collaborative development
  - **X-Pest** for models of crop losses caused by injury profiles
  - **Ipsim** for models of crop injury profiles
- Model to help design protection strategies in apple orchards: **Premise**
- Optimisation techniques

IPM solutions: co-design with stakeholders (1/2)

Involving the farmers since the beginning

- Four “pilots” (groups of stakeholders) in four countries: Denmark, France, Germany and NL
- How to combine formal and farmer knowledge to design IPM solutions?
- System analysis and learning

Booklet
2013

IPM solutions: co-design with stakeholders (2/2)

Problem analysis and agenda

- Who is involved? DK: a group of farmers plus advisers

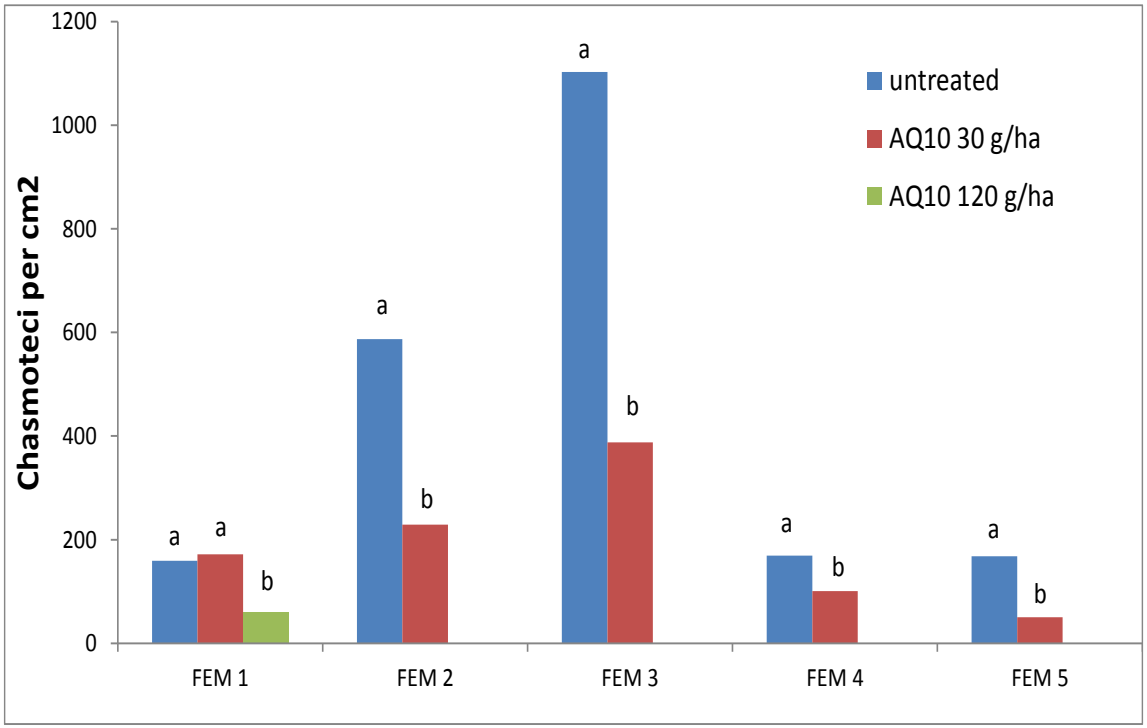
- Questions to be solved: DK: how to reduce the use of fungicides and herbicides while protecting the crops?
- Possible solution: sowing in wide row distance ➔ mechanical weed control and positive effect on the micro climate / fungi
- ➔ field experiments

Booklet 2013

Photos: JE Jensen, SEGES

IPM solutions: efficient alternatives (1/4)

- Biological methods



e.g. Ampelomyces quisqualis against powdery mildew in vineyards : reduction of the overwintering inoculum

IPM solutions: efficient alternatives (2/4)

- Biological methods

- Cultural methods: e.g. in maize rotations:
  - careful choice and integration of crops/varieties and their sequence in the rotation
  - using GPS systems coupled with narrow-band herbicide treatments applied along the crop-rows

IPM solutions: efficient alternatives (3/4)

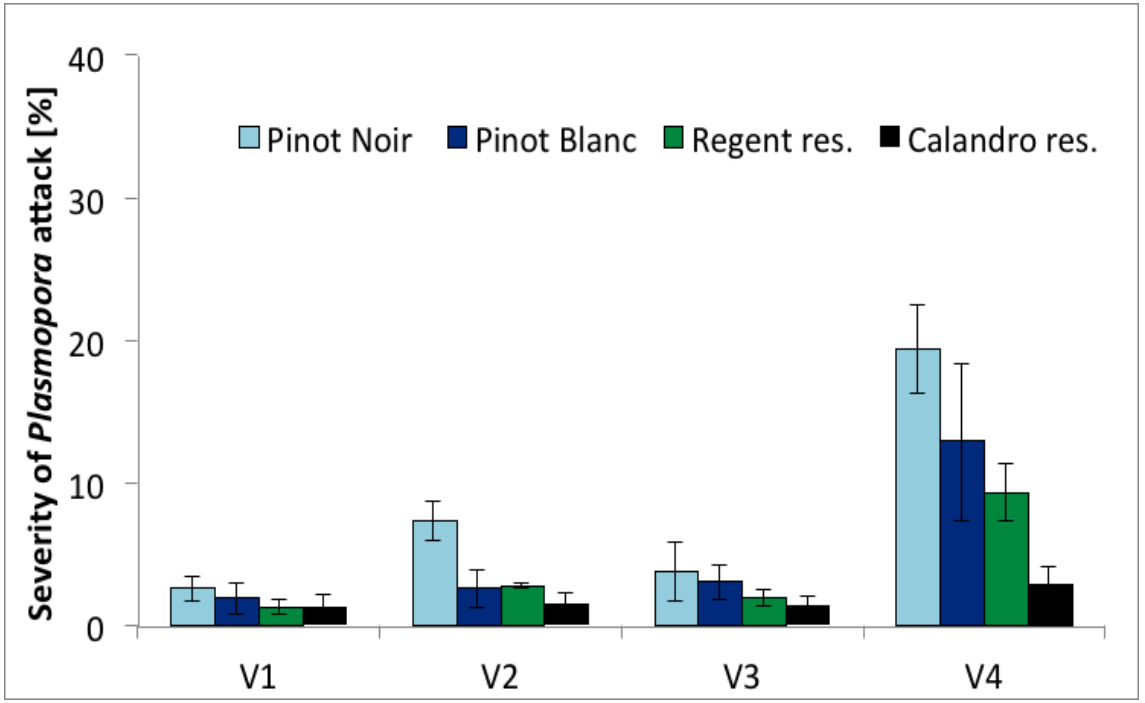
- Biological methods
- Cultural methods
- Physical methods:

  e.g. Mechanical weed control>70% on cauliflower

Deliverable 4.2

IPM solutions: efficient alternatives (4/4)

- Biological methods
- Cultural methods
- Physical methods



- Genetic methods:

  e.g. Resistant varieties against mildew in vineyards

IPM solutions: combining tactics and strategies

	Italy, Po valley	
Conventional	**IPM1 (advanced)**	**IPM2 (innovative)**
M/M/WW/M	**M/WW/S/M**	**M/WW/(CC)/S/(CC)//M**
Weeds: pre + post emergence herbicide, 1 inter row cultivation **(maize),** 1 post emergence herbicide **(winter wheat)** **Insects:** Soil insecticide at sowing, 1 insecticide **(maize)**, 1 insecticide **(winter wheat)** **Diseases:** seed dressing **(maize),** seed dressing, 1 fungicide **(winter wheat)**	**Weeds:** pre +post emergence herbicide (when predictive models indicate) in band application (choice of products with acceptable mobility and ecotoxicity), 1 inter row cultivation **(maize)**, false seedbed, narrow spacing, 1 post emergence herbicide if scouting indicates **(winter wheat),** narrow spacing, early post emergence herbicide when predictive models indicate **(soybean)** **Insects:** choice of variety, 1 insecticide application (careful choice of product) when early detection (traps and scouting) indicates, **(maize)**, 1 insecticide (careful choice of product) if scouting indicates 80% plants with aphids **(winter wheat),)**, 1 insecticide (careful choice of product) if scouting indicates 2 mites/leaf (**soybean)** **Diseases:** choice of variety, seed dressing **(maize),** late sowing, choice of variety, balanced N input, seed dressing, 1 fungicide if disease forecasting model indicates **(winter wheat),** seed dressing, choice of variety **(soybean)**	**Weeds:** early post emergence using band spraying when predictive model indicates (choice of products with acceptable mobility and ecotoxicity), 1 inter row cultivation **(maize)**, false seedbed, narrow spacing, 1 post emergence herbicide if scouting indicates **(winter wheat),** narrow spacing, early post emergence herbicide when predictive models indicate **(soybean)** **Insects:** choice of variety, biological insecticide when early detection (traps and scouting) indicate **(maize**), biological control with *Phytoseiulus persimilis* if scouting indicates 0.1-0.2 mites/leaf **(soybean)** **Diseases:** choice of variety, seed dressing **(maize),** late sowing, choice of variety, balanced N input, seed dressing, 1 fungicide if disease forecasting model indicates **(winter wheat),** seed dressing choice of variety **(soybean)**

Deliverable 3.1

IPM solutions: performance analysis – IPM vs conventional protection (1/2)

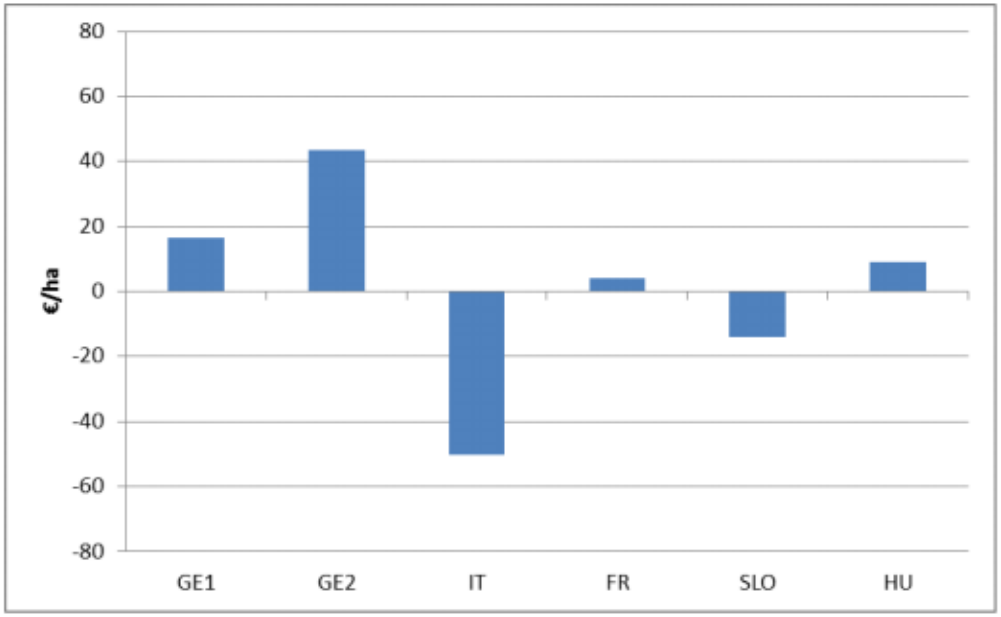
- IPM can be as good or better than conv. for the 3 pillars of sustainability: e.g. wheat-based rotations, on-farm trials in France (**DEXiPM** ex-post)
- Better environmental performances: e.g. pear orchards, NL

	Aquatic	Algae	Daphnia	Fish	Lemna	Chironomus	Terrestrial	Earthworm	Bee	Groundwater
Acute risk										
Conv.	18.291	0.000	0.942	1.152	0.000	18.291	0.263	0.000	0.263	32.654
IPM	0.003	0.003	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000
Chronic risk										
Conv.	34.079	0.000	34.079	5.325	0.000	8.019	2.375	0.005	2.375	6.531
IPM	0.022	0.022	0.000	0.002	0.002	0.008	0.000	0.000	0.000	0.000

Synops-web

IPM solutions: performance analysis – IPM vs conventional protection (2/2)

- IPM can be as good or better than conv. for the 3 pillars of sustainability
- Better environmental performances
- Costs may be higher: e.g. IWM in maize-based rotations



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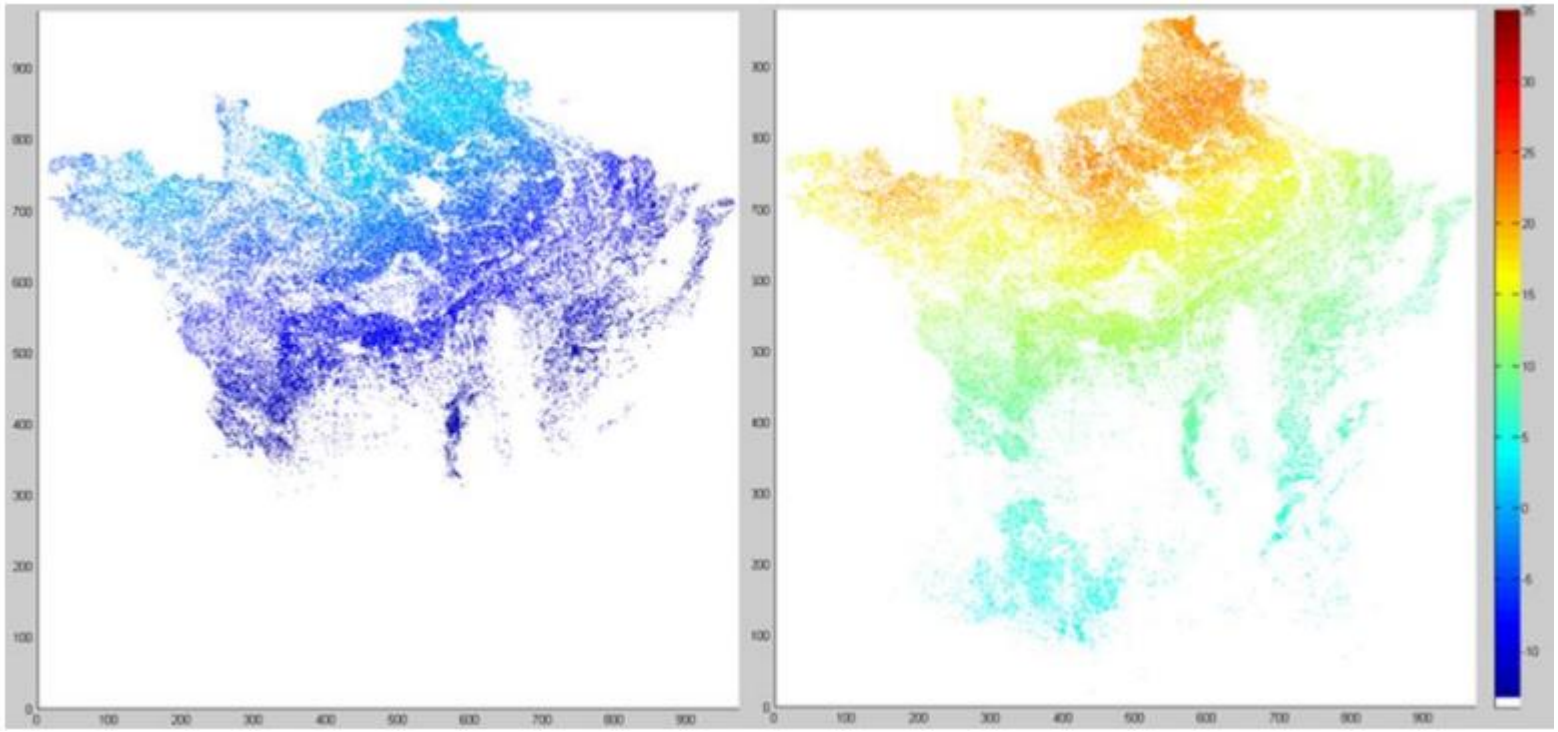
Pest evolution

- Assessing and mitigating the risks of « super-strains »

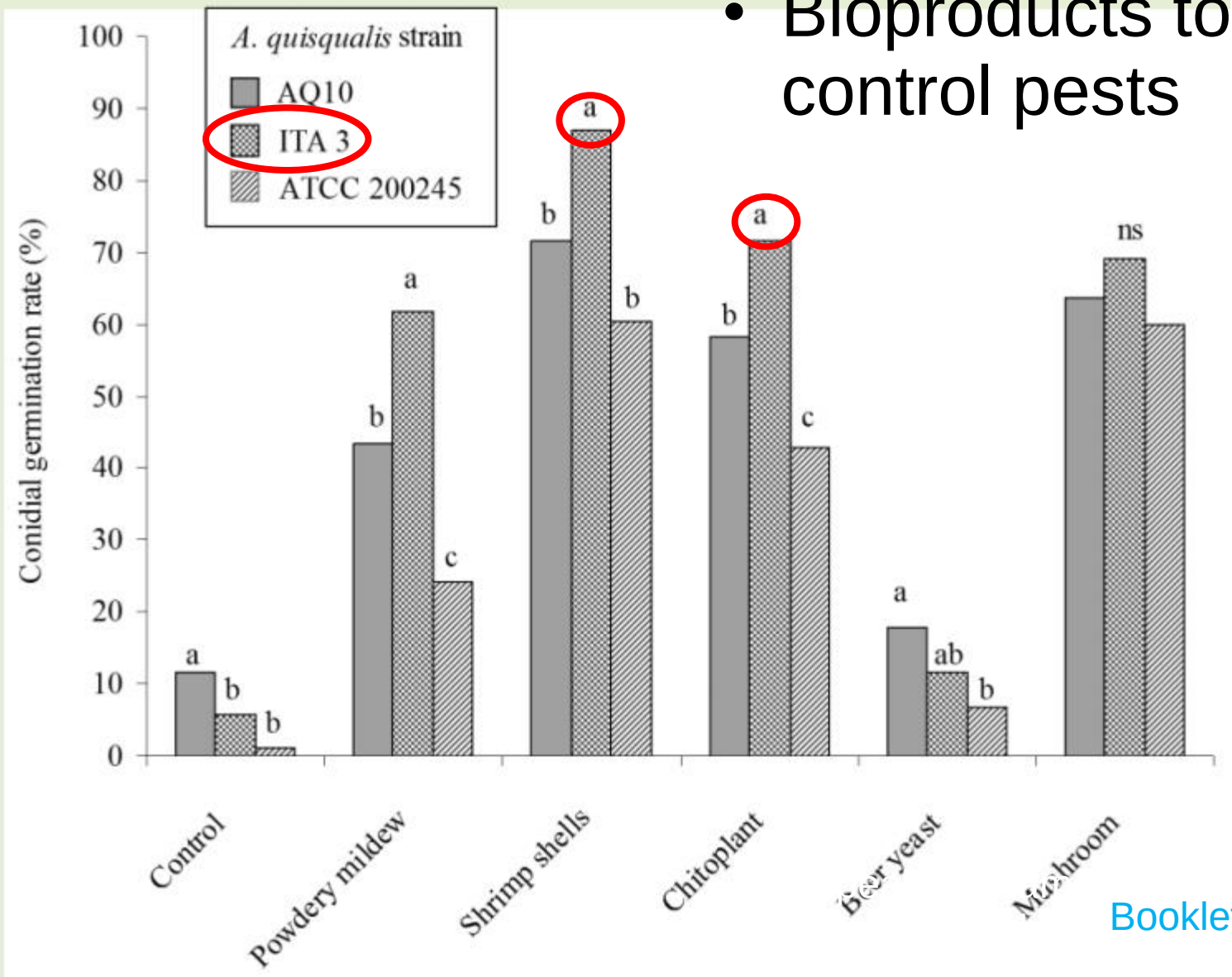


Model images of a yellow rust epidemic in France
Model ← fraction of resistant wheat fields and degree of clustering

Deliverable 8.2 & Booklet 2014

Plant-pest-enemy interactions

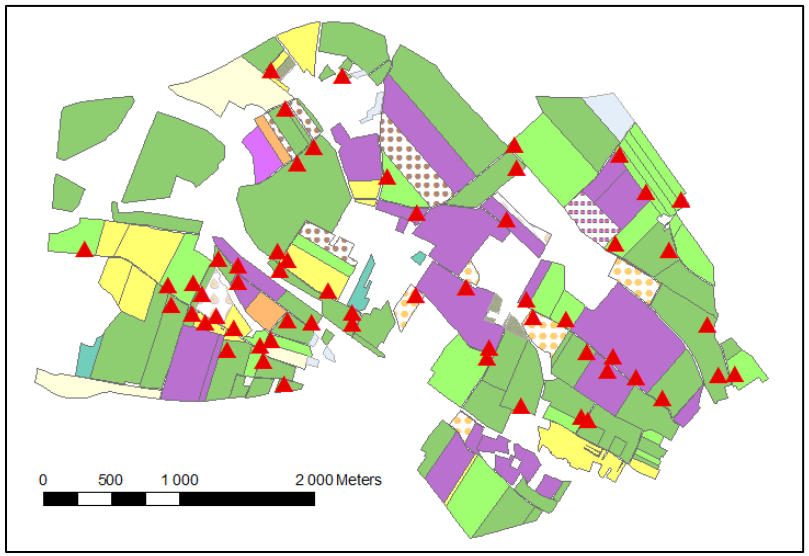
- Bioproducts to control pests



Booklet 2014

Ecological engineering

- Multi-scale effects



They were found across the three disparate systems we looked at: weeds, lepidopteran pests and their parasitoids, and also generalist predators.

In each case the fields, their boundaries, and the surrounding landscape, from neighbouring fields up to large landscapes of 79km^2 were found to affects pest and natural enemy populations.

Deliverable 10.2 & Booklet 2014

Emerging technologies

- From monitoring systems…
- …to precision spraying techniques

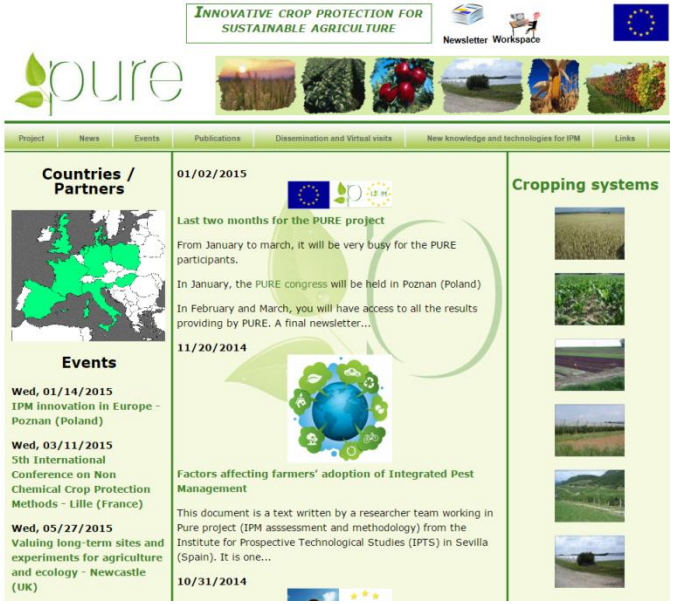
Air sampler (patent) in operation to detect spores of *Sclerotinia sclerotiorum*

Canopy Density Spraying for orchards

Deliverables 11.1 & 11.5

PURE dissemination activities (1/2)

- Classical…
  - **Form**: scientific and technical articles/seminars/ congresses, documents, newsletters, bookets
  - **Channels**: mailing lists, website



PURE dissemination activities (2/2)

- Classical…
- Virtual field visits

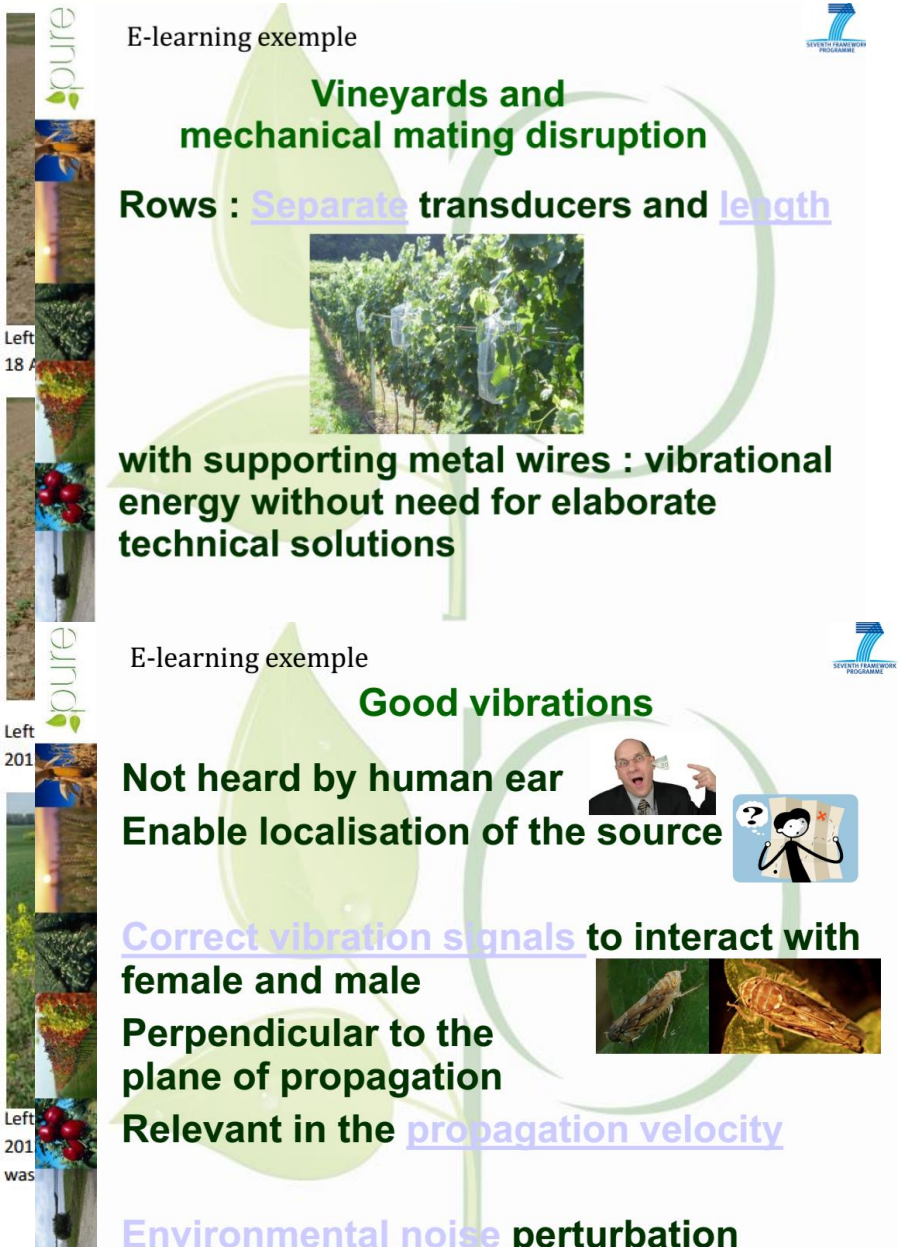
Left: winter oil seed rape at 50 cm row spacing in the advanced system after a long and frosty winter, image 18 April 2013. Right: inter-row hoeing on the 30 April 2013.

Left: winter oil seed rape at the normal 12.5 cm row spacing in the conventional system (image 18 April 2013). Right: the same plot on the 17 May 2013.

Left: winter oil seed rape inter-row cultivated in autumn and spring (intermediate system, image 17 May 2013. Right: also intermediate system close to harvest. Mayweed (*Tripleurospermum inodorum*) in the rows was a minor problem in 2013 with no need for chemical control (image 30 July 2013).

PURE dissemination activities (2/2)

- Classical…
- Virtual field visits
- E-learning:
  example of mechanical mating disruption against vine leafhopper *(extract)*



Conclusions

- IPM solutions to adapt to specific cases
- Practical tools and methods for application and industrial development
- Generic approaches, assessment tools and models to help advisors and groups implement IPM
- Generic knowledge for future IPM solutions

Prospects

- Extending PURE initiatives
  - The system approach of IPM
  - The connection between analytical and integrative research
  - A multi-scale ecological engineering approach
  - Technological tools *(e.g. diagnosis tools with smartphone applications…)*
  - Co-innovation approaches and tools to facilitate the implementation of IPM with stakeholders
- Other research topics, e.g.
  - The role of the crop in pest control: designing practices and plant ideotypes *(acceptable tradeoffs between productivity and resistance/tolerance)*
  - Designing public policies to encourage IPM adoption
- Scaling up IPM

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

Thank you for your attention