Potential for reducing pesticide use
lessons from networks of demo farms

Nicolas Munier-Jolain
• **A strong societal and political pressure to reduce pesticide use in Europe**
  
  European Green Deal, Farm-to-fork strategy >> target : -50% by 2030

• **Some pioneer farmers do use less pesticides than neighbouring farms**
  
  implementing a holistic vision of Integrated Pest Management (IPM), based on combinations of non-chemical approaches, including a stronger use of ecology-based processes, more diversity and more biodiversity, eventually combined with innovative technologies (robotics, precision agriculture, Decision Support Systems, biocontrol).

**Main objective : demonstrate with those pioneer farmers...**

...that IPM indeed works

*reduces the reliance on pesticides*

*while boosting economic profitability at the farm level*
In France: the DEPHY network of demo farms

Launched in 2010

- Up to 3,000 volunteer farmers
- 6 agricultural sectors: arable crops, vineyards, orchards, vegetables, ornamentals, tropical crops

- Large agricultural partnership
  chambers of agriculture, farming organizations, academic & applied research…

- Explicit objective: decrease pesticide use

- Explicit approach: cropping system re-design >>
  holistic view of IPM
  “find my own solutions adapted to my specific context!”
  … through individual and collective support, promoting peer-to-peer knowledge exchange

- A shared information system to collect data
## Evolution of the Treatment Frequency Index
from initial practices to 2018-2020

<table>
<thead>
<tr>
<th>Category</th>
<th>TFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable Crops</td>
<td>2.6 → 1.9</td>
</tr>
<tr>
<td>Vegetables</td>
<td>3.5 → 2.3</td>
</tr>
<tr>
<td>Ornamentals</td>
<td>6 → 3.7</td>
</tr>
<tr>
<td>Tropical Crops</td>
<td>4.7 → 3.8</td>
</tr>
<tr>
<td>Viticulture</td>
<td>10.4 → 7.9</td>
</tr>
<tr>
<td>Orchards</td>
<td>15.3 → 10</td>
</tr>
</tbody>
</table>

"These averages hide a wide variability across farms!"
1. What are the technical strategies of farmers using little amounts of pesticides?
2. Low TFI = low productivity? Low profitability? Cost-efficiency of IPM
3. Scenario of general adoption of IPM-based systems at the country level – what consequences?

Profiles with low TFI always combine several management measures:
- Temporary grasslands
- Crop diversification: rustic crops, sowing seasons
- Cultivar diversification, disease resistant cultivars
- Cereal delayed sowing dates
- Reduced doses
- Soil tillage – alternating ploughing
- Moderate fertilisation

TFI : Treatment Frequency Index

Lechenet et al., Agricultural Systems 2016
A unique database for producing knowledge on IPM systems

1. What are the technical strategies of farmers using little amounts of pesticides?

Effects of crop diversification

Guinet et al., unpublished
A unique database for producing knowledge on IPM systems

PhD Martin Lechenet, 2017

Sector: Arable Field Crops

2. Low TFI = low productivity? Low profitability? Cost-efficiency of IPM

Correlation between pesticide use and performances

Positive slope: antagonism
Nil slope: no antagonism
Negative slope: no antagonism

Lechenet et al., Nature Plants 2017
A unique database for producing knowledge on IPM systems

PhD Martin Lechenet, 2017

Sector: Arable Field Crops

Correlation between pesticide use and performances  
scale = Wheat crop

“Scale matters!”

The BCPC Congress, 7-8 November 2023, Harrogate, UK
A unique database for producing knowledge on IPM systems

PhD Martin Lechenet, 2017

Sector: Arable Field Crops

3. Scenario of general adoption of IPM-based systems at the country level – what consequences?

- Decrease in wheat exports
- Decrease in barley exports
- Decrease in Rape-based Energy imports
- Decrease in Energy imports
- Decrease in Soybean imports
- Increase in Maize exports

- Trade gains
- Trade shortfall

**Pesticide use**

≈ - 40%

**Productivity of French agriculture**

≈ + 6%

**French trade balance**

Price scenario 2010-2015
A unique database for producing knowledge on IPM systems

PhD Romain Nandillon, in progress

Evolution of practices along time (≈ 10 years)

Sector: Arable Field Crops

Classification tree: combination of factors explaining $\Delta IFT_{\text{final} - \text{initial}}$

Nandillon et al., submitted
A unique database for producing knowledge on IPM systems

PhD Romain Nandillon, in progress

Sector: Arable Field Crops

Evolution of practices along time (≈ 10 years)

<table>
<thead>
<tr>
<th>Cluster number</th>
<th>1</th>
<th>21</th>
<th>26</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farms</td>
<td>7</td>
<td>29</td>
<td>40</td>
<td>18</td>
</tr>
<tr>
<td>Average initial TFI</td>
<td>9.65</td>
<td>2.14</td>
<td>1.66</td>
<td>1.72</td>
</tr>
<tr>
<td>Average TFI evolution</td>
<td>-6.52 (P ≤ 0.05)</td>
<td>-1.43 (P ≤ 0.0001)</td>
<td>-0.086 (P ≤ 0.0001)</td>
<td>1.99 (P ≤ 0.0001)</td>
</tr>
</tbody>
</table>

Management practices

- Mechanical weeding frequency
- Total N fertilisation
- Ploughing frequency
- Mean relative PPP dose
- Shallow tillage frequency
- Shannon index (rotation)
- Proportion of organic N fertilisation

Nandillon et al., submitted
A unique database for producing knowledge on IPM systems

PhD Romain Nandillon, in progress

Evolution of practices along time (≈ 10 years)

Factors explaining $\Delta IFT_{\text{final}} - \text{initial}$

Variance partitioning among groups of factors

Improving decision making for treatments seems to be a major component of the decrease in PPP use

The BCPC Congress, 7-8 November 2023, Harrogate, UK
IPMWORKS: A European network of demonstration farms promoting low pesticide use and economically efficient management strategies

2020-2024

PRINCIPLES OF IPMWORKS
FARM GROUPS

- 10 to 15 farmers in each hub
- supported by an advisor-facilitator Hub Coach
- farmers exchange practical knowledge
- shared objective: better control pests and diseases with less pesticides, thanks to systemic IPM
- DEMOs promote cost-effective IPM strategies

« Integrated Pest Management... ... indeed works! »
"Holistic" Integrated Pest Management (IPM)

The 5 pillars of holistic IPM

Agricultural landscapes with diverse semi-natural habitats

Cropping systems designed to decrease invertebrate pest, weed and disease pressure

Optimized decision making guiding operational and strategic IPM choices

Preferential use of non-chemical control options

Increased efficiency of treatments

Healthy crop
- reduced pesticide use and impact
- safer environment
- enhanced biodiversity
- avoidance of resistances
- better pest control
IPMWORKS A European network of demonstration farms promoting low pesticide use and economically efficient management strategies
2020-2024

5 sector leaders in charge of technical knowledge sharing, coordination of activities & communication at the sector level

+ IFOAM coordinating Organic farms
A specific methodology for fostering IPM adoption
Based on peer-to-peer knowledge exchange... and facilitation

- **22 Hub coaches** with a specific Role

  ‘IPMWORKS hubs are guided by a hub coach. Do you want to know how they work? Check it out in this video!’

  **Jolien Claerbout, Hub Coach** at INAGRO, Belgium

  [https://www.youtube.com/watch?v=7zLqcKjD7U](https://www.youtube.com/watch?v=7zLqcKjD7U)

1. **Individual advice to farmers** help them «think holistic »... and find non-chemical solutions
2. **Collective coaching of the group** facilitate peer-to-peer knowledge exchange
3. **Organisation of Demo events** >> hit other farmers, enlarge the audience
4. **Share information with other Hub Coaches**
   Technical skills of IPM & soft skills for facilitation IPM adoption
5. **Collect data** describing IPM-strategies
   >> demonstrate to farmers
   - decrease in pesticide use
   - cost-efficiency
A specific methodology for fostering IPM adoption
Based on peer-to-peer knowledge exchange... and facilitation
Strategy for data collection in IPMWORKS farms

1. **Survey #1: 2021**
   Qualitative data: IPM awareness, IPM adoption, approximate of PPP use, and self-assessment

2. **Survey #2: 2023**
   Quantitative data: Details of cropping systems and crop management
   >> Computation of indicators of pesticide use and pesticide impact, indicators of cost-efficiency
   >> Demonstration that « IPM indeed works! »

3. **Enquête #3: 2024**
   Similar to Survey #1
   Evaluation of changes in IPM adoption in IPMWORKS farms thanks to the work done in hubs

A compromise between required data for the demonstration... ...and limited time available for hub coaches
A few results from Survey#1

 Attempt for an IPM adoption score

*sum of scores for a range of IPM measures*
A few results from Survey#1

Quality of Weed Control
as compared to neighbour farmers...

Quality of Disease Control
as compared to neighbour farmers...

Quality of Pest Control
as compared to neighbour farms...

« IPM allows satisfying pest/weed/disease control »
A few results from Survey#1

Self-assessment  Economics

Workload/ha as compared to neighbour farmers...

Equipment Costs as compared to neighbour farms...

Gross Margin as compared to neighbour farms...

« IPM is cost-effective » ...to be confirmed with quantitative data
Some productions [https://ipmworks.net/]

Booklets survey#1
One for each sector

Booklets
Individual IPM strategies
Some productions https://ipmworks.net/

IPM Resource Toolbox

IPMWORKS YouTube channel

The BCPC Congress, 7-8 November 2023, Harrogate, UK
Contribution to debates at European Institutions

Public Hearing at the European Parliament, Brussels, 23 May 2023

Exhibition at the European Parliament, Strasbourg, 13-16 February 2023

The BCPC Congress, 7-8 November 2023, Harrogate, UK
Thanks for your attention!