DEVELOPING GROUNDWATER SCENARIOS FOR NORTHERN CHINA AND COMPARISON OF THEIR VULNERABILITY WITH FOCUS GROUNDWATER SCENARIOS

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Introduction

- Groundwater: important resource to be protected against pesticide contamination

- in Europe
  - leaching assessment based on the 0.1 μg/L criterion
  - environmental fate modelling → essential part of the risk assessment supporting pesticide registration
  - in 2000 FOCUS groundwater working group defined 9 standardised realistic worst-case scenarios (improved in 2009)

- in China
  - leaching assessment based on human toxicological criteria
  - PERAP project - cooperation with Chinese regulatory authority (ICAMA)
  - in 2010 standard scenarios developed within the PERAP project
Aim

compare the vulnerability of the Chinese and European scenarios

HOW

comparing leaching concentrations of Chinese and European scenarios calculated as a function of the half-life in soil at reference temperature (DegT50, d) and the coefficient of sorption on organic matter ($K_{OM}$, L/kg).
Scenario development - Europe

2000: FOCUS groundwater WG

- Information on temperature, rainfall, land use, etc...
- Overall vulnerability of the 90th percentile of all possible situations
- Definition of 9 standardised realistic worst-case scenarios

- 9 locations representing major European agricultural areas
- 80th percentile value for soil: selected by expert judgement
- 80th percentile for weather: performing simulations using multi-year weather data
Scenario development - Europe
Scenario development - Europe

- 2009: improvements of the scenarios
  - new soil profiles for Porto and Piacenza
  - new irrigation schedule
  - harmonisation among models
  - same dispersion length for all models
  - runoff eliminated
  - new crop factors
  - new evapotranspiration factors
  - etc...
Scenario development - China

- PERAP (Pesticide Environmental Risk Assessment Project)
  → scenarios for dry land farming system

- Maps of annual average precipitation and temperature
- 3 climatic zones: North, North East and North West

- Overall vulnerability of the 99th percentile of all possible situations
- 90th percentile for soil: selected from organic matter map
- 90th percentile for weather: performing simulations using multi-year weather data.

- 6 locations that represented the overall vulnerability were selected
Scenario development - China
## Main risk management differences

<table>
<thead>
<tr>
<th></th>
<th><strong>EUROPE</strong></th>
<th><strong>CHINA</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall vulnerability</strong></td>
<td>90(^{th})</td>
<td>99(^{th})</td>
</tr>
<tr>
<td><strong>Leaching assessment</strong></td>
<td>PPPs concentration &lt;0.1 μg/L</td>
<td>human toxicological criteria (2-30 μg/L)</td>
</tr>
</tbody>
</table>
Set up of the calculations

- Application: annual, 1 kg/ha, the day before emergence
- Pesticide properties other than DegT50 $K_{OM}$: FOCUS substance A (non-volatile substance)
- Model: FOCUS_PEARL_4.4.4 for EU, ChinaPEARL_1.1.1 for China
- Crop: maize
- Irrigation: once a week on a fixed day, amount based on the soil water content in the root zone
- Select scenario covering full range
  - Europe: Châteaudun, Piacenza, and Sevilla
  - China: Urumchi (NW), Xinmin (NE) and Wugong (N)
### Characteristics of the selected scenarios

<table>
<thead>
<tr>
<th>Location</th>
<th>Texture class (USDA) 0-25 cm</th>
<th>Clay (%) 0-25 cm</th>
<th>Organic matter (%) 0-25 cm</th>
<th>Annual average water input (mm) rain+irrigation</th>
<th>Annual average temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Châteaudun</td>
<td>Silty Clay loam</td>
<td>30</td>
<td>2.4</td>
<td>913</td>
<td>11</td>
</tr>
<tr>
<td>Piacenza</td>
<td>Loam</td>
<td>15</td>
<td>2.2</td>
<td>1044</td>
<td>13</td>
</tr>
<tr>
<td>Sevilla</td>
<td>Silt clay</td>
<td>14</td>
<td>1.6</td>
<td>872</td>
<td>18</td>
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<tr>
<td>Wugong</td>
<td>Silt loam</td>
<td>26</td>
<td>0.6</td>
<td>757</td>
<td>14</td>
</tr>
<tr>
<td>Xinmin</td>
<td>Loam</td>
<td>20</td>
<td>1.2</td>
<td>914</td>
<td>9</td>
</tr>
<tr>
<td>Urumchi</td>
<td>Silt loam</td>
<td>23</td>
<td>0.6</td>
<td>1043</td>
<td>8</td>
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Characteristics of the selected scenarios

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→ Chinese scenarios more vulnerable to pesticide leaching than the European scenarios
Results

DegT50 = 30; $K_{OM} = 60$

Leaching concentration ($\mu g/L$)

ORGANIC MATTER (%)
Results

DegT50 = 30; $K_{OM} = 60$
Results

DegT50 = 30; $K_{OM} = 60$
Results

DegT50 = 30; $K_{OM} = 60$

China toxicity criterium

EU 0.1 µg/l criterium
Conclusions

- Chinese scenarios more vulnerable to pesticide leaching than the European scenarios → lower organic matter, lower temperatures

- The higher vulnerability of the Chinese scenarios compensated by the use of human toxicological criteria for Chinese decision making

- Usefulness of standard scenarios in order to evaluate the leaching potential of PPPs even among different countries
Thanks for your attention!

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