Assessment and reduction of heavy metal input into agro-ecosystems

Concerted Action AROMIS

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Soil protection policy developments

- EU-level
- national level

Knowledge gaps

- input pathways of heavy metals into agro-ecosystems
- relevance of the input pathways
- long-term implications for soils
- options for input reduction
AROMIS Consortium

Institutions from
- EU Member States
- Candidate Countries
- Associated Countries

Coordination
KTBL, Darmstadt, Germany
Objectives

- assessment of the contribution of agriculture to the heavy metal input into soils
- description and assessment of measures to reduce the heavy metal input
- identification of research demands
AROMIS Heavy Metal Database

Compilation of data and background information on heavy metals in agriculture

- agricultural inputs (mineral fertilisers, manures, livestock feeds etc.)
- heavy metal outputs (crops, animal products)
- legal regulations (national level, EU-level)
http://daten.ktbl.de/aromis
Heavy metal farm balances

- livestock farming
- crop production

**INPUTS**
- Deposition
- Irrigation
- Purchased livestock feeds
- Fertilisers
- Other means of production

**LIVESTOCK FARM**

**OUTPUTS**
- Animal products
- Crops
- Exported livestock manure
- Leachate
In order to

- evaluate the relevance of the various input / output pathways
- calculate the extent of accumulation / depletion of metals for various types of farms
- develop an instrument for the evaluation of the effect of input reduction measures
Livestock farming

- Animal nutrition
- Other inputs

Crop production

- Fertilisation
- Plant protection

Level of supplementation
- Type of supplement
- Quality of supplements

- Veterinary medicines
- Disinfectants (Cu/ZnSO₄)
- Stable equipment

- Metals in mineral fertilisers
- Metals in manures
- Metal based fungicides
Example for input reduction measure

Reduced level of Copper and Zinc supplementation in pig nutrition
according to Commission Regulation (EC) No 1334/2003

DOES IT HELP?
Heavy metal inputs – pig production farm

- 34 ha for feedstuff production
- 80,5 livestock units (sows, pig rearing and finishing)
- measured heavy metal contents of all inputs and outputs
Scenarios

Cu and Zn supplementation according to maximum allowances of

- 70/524/EEC – Council Directive on additives in feedingstuffs = basis for comparisons (100 %)
- FSC - proposal of German Standing Committee for Feedstuffs for the revision of EC Directive
## Maximum allowances

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cu [mg/kg feedstuff (88% dm)]</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>70/524/EEC</td>
<td>175 &lt;16 weeks 35 250</td>
<td></td>
</tr>
<tr>
<td>EC 1334</td>
<td>170 &lt;12 weeks 25 150</td>
<td></td>
</tr>
<tr>
<td>FSC</td>
<td>30 &lt;8 weeks 20 100</td>
<td></td>
</tr>
</tbody>
</table>
### Reduction of total farm inputs

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cu reduction [%]</th>
<th>Zn reduction [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: 70/524/EEC → EC 1334</td>
<td>27</td>
<td>33</td>
</tr>
<tr>
<td>2: 70/524/EEC → FSC</td>
<td>62</td>
<td>49</td>
</tr>
<tr>
<td>3: EC 1334 → FSC</td>
<td>49</td>
<td>24</td>
</tr>
</tbody>
</table>
Reduction of manure metal content

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cu manure metal content [mg/kg dm]</th>
<th>Zn manure metal content [mg/kg dm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>70/524/EEC (= 100%)</td>
<td>251</td>
<td>886</td>
</tr>
<tr>
<td>EC 1334</td>
<td>182</td>
<td>576</td>
</tr>
<tr>
<td>FSC</td>
<td>91</td>
<td>422</td>
</tr>
</tbody>
</table>

Effect on other metals (Cd, Cr, Ni, Pb)

- evident in feedstuffs, but small on farm level
Research demand

Metals in fertilisers
• improving fertilisation management (choice / quality)

Metals in livestock manures
• optimising feeding strategies (level of trace element supplementation, feedstuff quality)

Metals in soils and plants
• refining models for leaching and soil-plant transfer of metals
• improving long-term scenarios and linking results to quality requirements (water, feedstuffs, food)

Information exchange and technology transfer
• linking research, monitoring, and advisory institutions (European network)
Special thanks to

- all project partners for their contributions and their help
- the European Commission for the financial support
- IUNG for the occasion to present the result of AROMIS

Final report available at KTBL:
www.ktbl.de/shop or mail to h.eckel@ktbl.de