Chemicals in Agricultural Soils in Germany

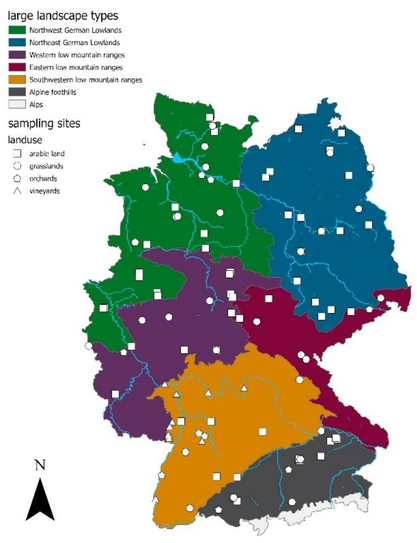
Judith Klein[1], Karlheinz Weinfurtner[1], Fabian Essfeld[1], Cecilia Diaz[1] , Bernd Göckener[1], Udo Hommen[1], Michael Hüben[1], Benedikt Ringbeck[1], Marie Winter[1], Dimitrios Skodras[1], Nina Lohmann[2] ,Kai Thomas[3], Daniela Gildemeister[4], Lisa Noll[4], Ricardo Schöps[4], Pia Kotschik[4]

[1] Fraunhofer Institute for Molecular Biology and Applied Ecology (IME), Schmallenberg, Germany
[2] Eurofins GfA Lab Service, Germany
[3] RLP AgroScience, Institute for Agroecology, Germany
[4] German Environment Agency, Dessau, Germany

Introduction and Study Objective

Agricultural soils are exposed to multiple chemical inputs, but nationwide data on chemical residues in soil across land use types remain limited.

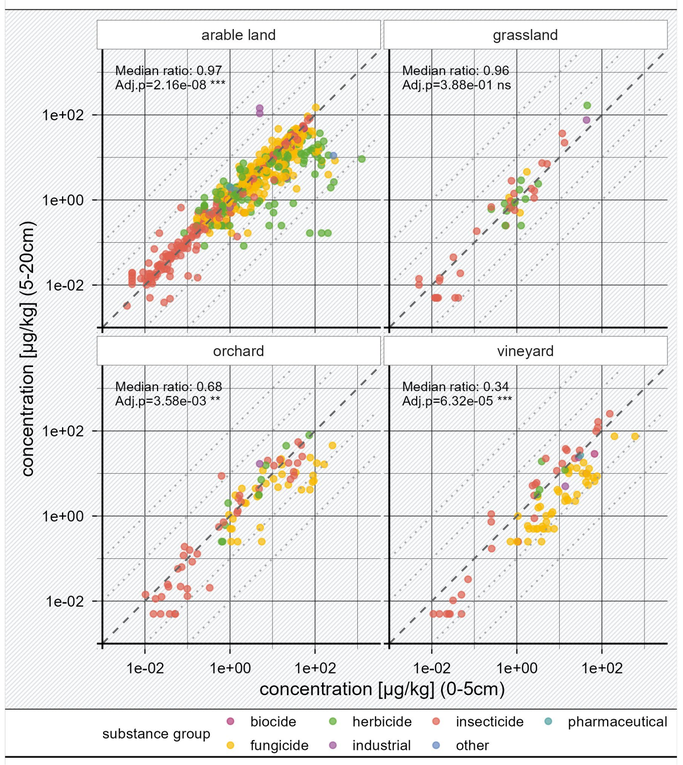
Aim: To provide a nationwide overview of chemical residues in agricultural soils in Germany, focusing on: Substance occurrence and diversity, differences between land use types and vertical distribution within the soil profile.



Sampling Methodology

- 110 sites across Germany
- 4 land use types: arable land (62), grassland (30), orchards (9) and vineyards (9)
- 2 soil layers (0–5 cm and 5–20 cm)
- Chemical groups assessed: plant protection products (herbicides, fungicides, insecticides), biocides, pharmaceuticals and selected industrial chemicals
- Analytical strategies evolved over the study: broad screening initially (2022), targeted analyses with lower detection limits later (2023, 2024)
- 5 Neonicotinoids analysed with consistently low LOQs (10 ng/kg) across all sampling campaigns (see Poster Th136)

Comparison of concentrations in the upper (0–5 cm) and lower soil layer (5–20 cm)



Vertical Distribution

Concentrations were generally higher in the upper soil layer (0–5 cm) compared to the deeper soil layer (5–20 cm).

Concentrations of substances measured in the upper soil layer (0–5 cm)

Arable Land

- Highest number of detected substances
- Broad spectrum of fungicides, herbicides, and insecticides
- Reflects frequent and diverse PPP applications

Grassland

- Only one sampling site residue free, but generally low concentrations of fewer substances
- Detections mainly related to ubiquitous legacy compounds, spray drift, or atmospheric deposition

Vineyards & Orchards

- Moderate to high number of detected substances
- Dominated by fungicides and insecticides
- Clear accumulation in upper soil layer

Dominant substance group

- High detection rates for 5 neonicotinoids reflect the prior development of a specific, highly sensitive method
- Fungicides were abundant in arable land, vineyards, and orchards
- Herbicides occurred mainly in arable soils
- Pharmaceuticals and industrial chemicals were detected only occasionally at few sites

Substances (top 31) ranked by number of sites with detections in the upper soil layer (0–5 cm)

Conclusion:

- Chemical residues are ubiquitously present in German agricultural soils
- Residue patterns differ clearly between land use types
- Soil monitoring provides essential context for understanding:
  - Long-term accumulation
  - Background exposure
  - Basis for subsequent risk assessment (see poster Tu151, Tu152)

Contact:
Dr. Judith Klein
Fraunhofer IME
Phone: +49 2972 302 256
Mail: Judith.klein@ime.fraunhofer.de

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