

PESTICIDE RESIDUES IN ORGANIC AND CONVENTIONAL AGRICULTURAL SOILS ACROSS EUROPE: MEASURED AND PREDICTED CONCENTRATIONS

- Pesticide residues were found in 97% of the 201 soil samples collected from conventional and organic agricultural fields across 10 European countries
- Most samples (88%) contained more than one pesticide, with up to 21 different substances found in a single sample
- Residues have accumulated over the years - only 21% of the pesticides detected in soil samples were applied during the year samples were taken (2021)
- A mismatch was found between predicted and measured environmental concentrations of pesticide residues

WHY SOILS?

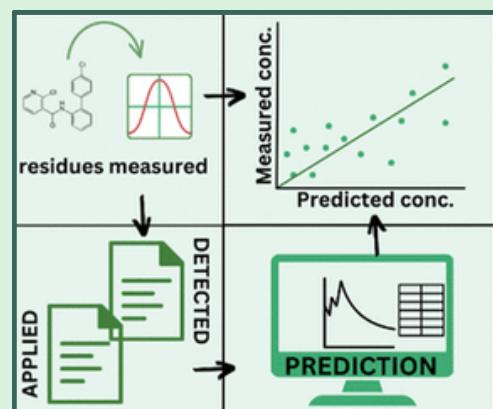
Soils are crucial for agricultural food production, making it crucial that they remain healthy. As such, the prevention and reduction of soil pollution by, for example, pesticides, is included in several EU policies.



METHODS



201 SOIL SAMPLES



192 different pesticides were analysed in 201 soil samples...

...97% of which contained pesticide residues

This factsheet is based on research by Knuth et al (2024), conducted as part of the EU Horizon 2020 SPRINT project.

Underlined text?
Click me!

...turn over for more findings!



<https://sprint-h2020.eu>

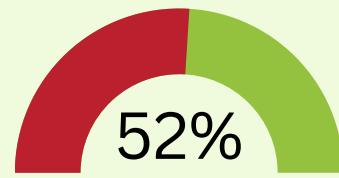


FINDINGS

87.6% of soil samples contained pesticide mixtures

including at least two substances. This was higher in conventional samples (96%) than in organic (79.2%)

Obsolete organochlorine pesticides (OCPs) such as DDT were among the most common compounds in these soils.



of the 192 pesticides tested for were detected above their respective detection limits

RESULTS BY COUNTRY

Croatia



Lowest number of different pesticides detected in soils

Czech Republic



Highest number of different pesticides detected in soils

DDE and HCB, both of which are no longer approved for use in the EU, were detected in all sampled fields in the Czech Republic.

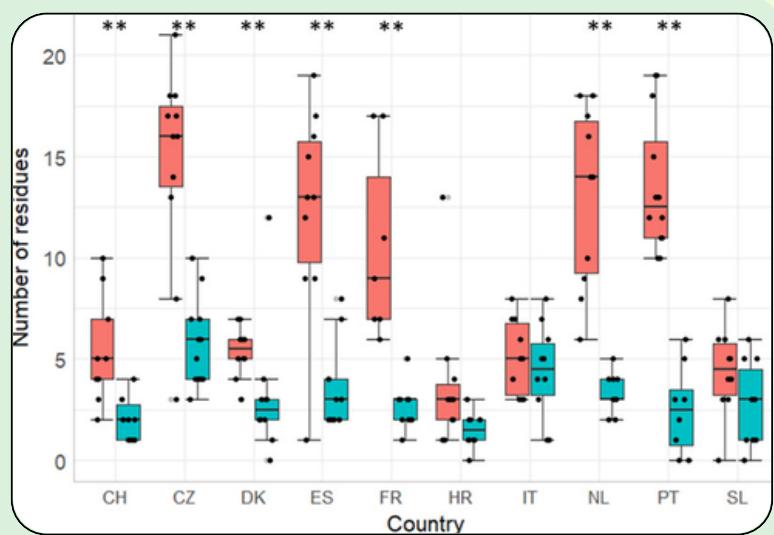


Figure 1. Number of residues per case study country, broken down by conventional vs organic management (red = conventional; blue = organic)

The most frequently detected pesticides were:

1. DDE, a breakdown product of banned insecticide, DDT (85% of samples)
2. AMPA, a degradation product of Glyphosate, a widely used herbicide (also known as 'Round-up') (40%)
3. HCB, a fungicide previously used to protect wheat from bunt disease (39%)
4. Chlorpyrifos, an insecticide (33%)
5. Glyphosate, a commonly used herbicide (24%)

Pesticides in red are not currently approved for use in the EU.

Aside from glyphosate, these substances are all known for being highly persistent in the environment and prone to particle-bound transport within the environment (e.g., to waterbodies)

PESTICIDE MIXTURES

In total, 151 different mixtures containing 2-21 substances were detected.

Mixtures were found in 96% of samples from conventionally farmed fields, and 79% of organic. These figures reduced to 89% and 38% when obsolete OCPs were excluded from analysis.

TRANSITIONING FROM CONVENTIONAL TO ORGANIC

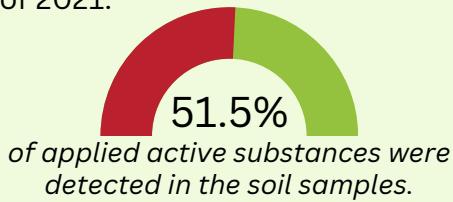


The findings of this study suggest that a transition period of 2 years to go from conventional to organic farming may not be sufficient for making sure that pesticide residues that are low to moderately persistent have left the fields.



HOW MANY DETECTED PESTICIDES HAD BEEN APPLIED ON-FARM?

Comparisons were made to determine which detected residues were due to pesticides that had been applied on-farm during the growing season of 2021.



48.5% of active substances that were applied were not detected in soil samples. Not all applied pesticides were analysed. This does, however, indicate that some of these substances may not persist in soils for long after applications.



of the substances detected in soil samples had not been applied on-farm. This could be due to deposition from nearby applications, or historic residues due to applications in previous years.

PESTICIDE RESIDUE CONCENTRATIONS



Soil samples taken from fruit and maize cropped fields had the lowest concentrations of pesticides. All of these fields had concentrations of less than $500 \mu\text{g kg}^{-1}$

Soil samples taken from fields growing grapes had the highest pesticide concentrations, with some samples of over $10,000 \mu\text{g kg}^{-1}$



PREDICTED VS ACTUAL CONCENTRATIONS

Predicted environmental concentrations were calculated and compared against actual measurements. Predicted concentrations were calculated using application rates and dates alongside soil sampling dates. There were 54 cases where measured concentrations were higher than the predicted concentration.

CONCLUSIONS

The main findings of this paper are:

- Mixtures of up to 21 different pesticide residues were found in 96% of conventional samples
- Up to 12 different pesticides were detected in 79% of organic samples
- Total concentrations in soil samples were up to 28.7mg kg^{-1} for conventional samples and 5.46mg kg^{-1} for organic samples
- For 48.5% of pesticides applied during the sampled growing season, no residues were detected in the soils
- Predicted environmental concentrations, as calculated for the EU when approving substances were found to be imprecise when compared against actual concentrations



INTERESTED IN READING MORE?

Access the full paper by Knuth et al (2024), which provides further detail about the methods, analytical approach, and implications by clicking [here](#).

Any questions?
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