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Plant nutrient and harmfull heavy metal concentrations in agricultural soils of EU27 and UK

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Introduction

Farm-to-Fork strategy aims to reduce nutrient losses by 50%, which is expected to decrease the requirement for fertilisers by 20% by the year 2030. To reach these ambitious targets, it is of utmost importance to know the nutrient status of agricultural soils for optimising fertilisation according to crop requirement. Furthermore, substitution of mineral fertilisers with bio-based fertilisers (BBF) reduces the need for finite phosphorus (P) resources and production of energy intensive mineral nitrogen (N) fertilisers. However, BBFs may contain other elements than only desired plant nutrients. Therefore, both nutrient and harmful heavy metal concentrations in BBFs and agricultural soils needs to be known in order to select technologies for producing safe BBFs for ensuring food and feed safety.

Material and methods

In this study, a sub-set of soil samples from the LUCAS soil sample archive, collected in 2015 (https://publications.jrc.ec.europa.eu/repository/handle/JRC107926), were analysed for their soluble elemental composition. The selection of soil samples from the EU27+UK was based on proportional allocation with the following criteria: soil pH, carbonate content, texture, organic carbon content, and Olsen-P values. A total of 1,661 soil samples from cropland (out of 9,246 samples) were selected and soluble concentrations of P, K, Zn, Cu, Pb and Ni were analysed with the electro-ultrafiltration (EUF) method .

Results

- Soluble P concentration varies greatly across Europe with highest concentrations in western Europe (Fig. 1)
- Soil K concentrations are evenly distributed in Europe
- Highest concentration of Zn follows the same pattern as P
- High Cu concentrations were found from the Mediterranean region.
- Highest average Pb concentrations were found from the western Europe, whereas Ni concentration were more elevated in the eastern Europe.

Conclusions

- Requirement for P fertilization varies across Europe and high soil P and Zn concentrations are found in regions with high animal density
- Concentration of soil Cu high in regions with vineyards and orchards, probably originating from pesticides
- Soluble Pb concentration follows the same trend with Zn, whereas high Ni concentrations may be due to indigenous soil properties
- Due to the variation in soluble elemental composition of agricultural soils in Europe, properties of BBFs needs to match to local soil conditions in order to secure food and feed safety and minimize environmental losses

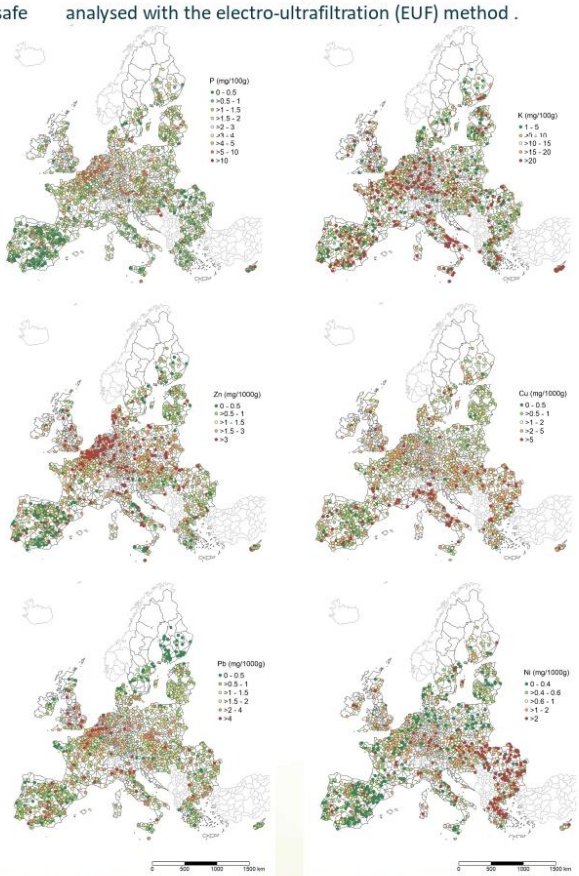

Figure 1. Soluble P, K, Zn, Cu, Pb and Ni concentrations in European croplands (EU27 + UK) according to the EUF-method

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