The 23rd World Congress of Soil Science
Soil and the Shared Future for Humanity

Managing Cadmium Uptake in Vegetables with Repeated Applications of Amendments: Lessons from a Multi-year Field Experiment

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INTRODUCTION

Past industrial activities in central Belgium have led to significant atmospheric deposition of metallic **trace elements** (TE) in soils.

This raises food safety concerns due to **Cd and Pb** transfer to vegetables grown in market gardens.

Previous pot experiments showed that **soil amendments** can reduce Cd uptake. However, their effectiveness must be validated **under field conditions**.

Objective

Evaluate the **effectiveness of soil amendments** under field conditions (3-year trial).

METHODS

Experimental design

- **2 market garden sites** (Province of Liège)
- **Soil amendments:**
  - Biochar
  - Green waste compost
  - Lime
- **Crops:** lettuce and Swiss chard
- **Amendment rates adapted to each site**

Field layout

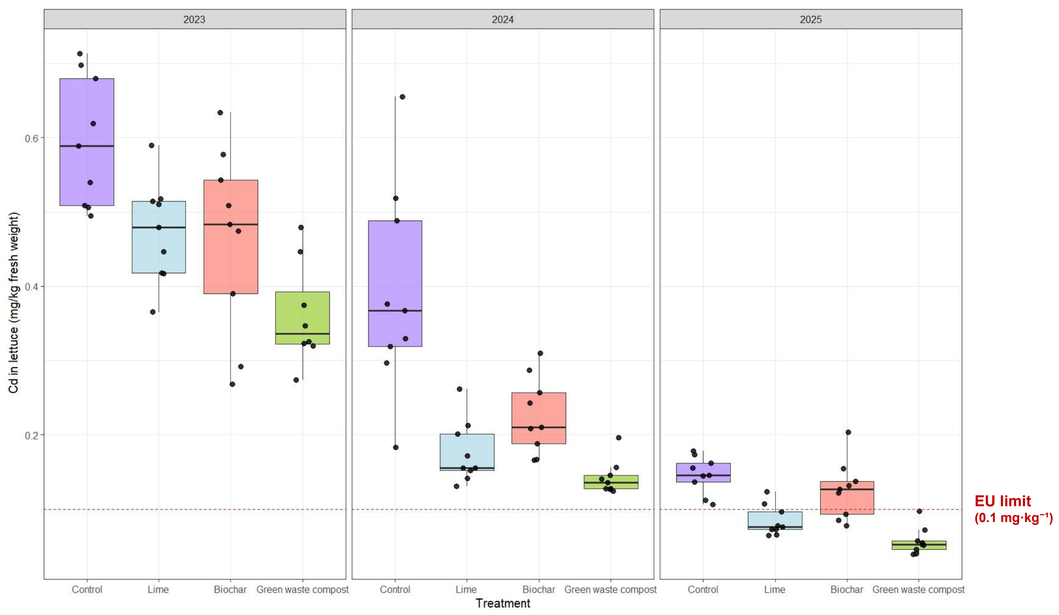
- Replicated plots
- Amendment application before cropping

Monitoring (3 years)

- **Annual harvests**
- **Soil:**
  - pH and Cd ($CaCl_2$)
- **Plant:**
  - Cd concentrations

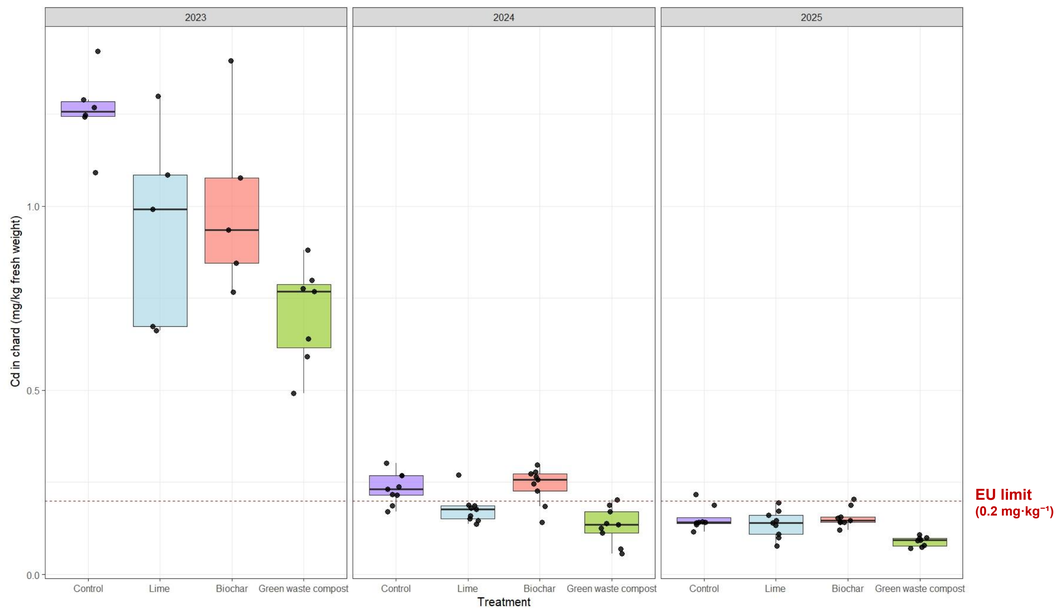
RESULTS

Cadmium uptake in lettuce over time (Site 1)



- Cd concentrations decreased from 2023 to 2025
- Differences between treatments were observed in all years
- Compost showed the lowest Cd concentrations, below the EU limit after 3 years
- Cd concentrations also decreased in the control treatment

Cadmium uptake in Swiss chard over time (Site 1)



- Cd concentrations strongly decreased from 2023 to 2024
- Cd concentrations remained low and stable in 2025
- In 2025, most values were close to or below the EU limit
- Green waste compost showed the lowest Cd concentrations

DISCUSSION

Interpretation

- The decrease in Cd concentrations in both crops suggests a progressive effect of soil amendments over time
- The faster response observed in Swiss chard suggests crop-dependent differences in Cd uptake dynamics
- The reduction observed in the control indicates interannual variability and/or environmental effects

Across sites

- Similar trends observed at both sites
- High variability highlights the importance of site-specific factors

Comparison with pot experiment

- Results are consistent with pot experiments
- Compost showed the strongest effect

KEY MESSAGES

- Amendments reduce Cd concentrations in crops under field conditions
- Effects strengthen over time
- Green waste compost shows the most consistent performance
- Crop type influences Cd uptake dynamics
- Field variability remains important

See complementary poster: long-term pot experiment (5-year trial)