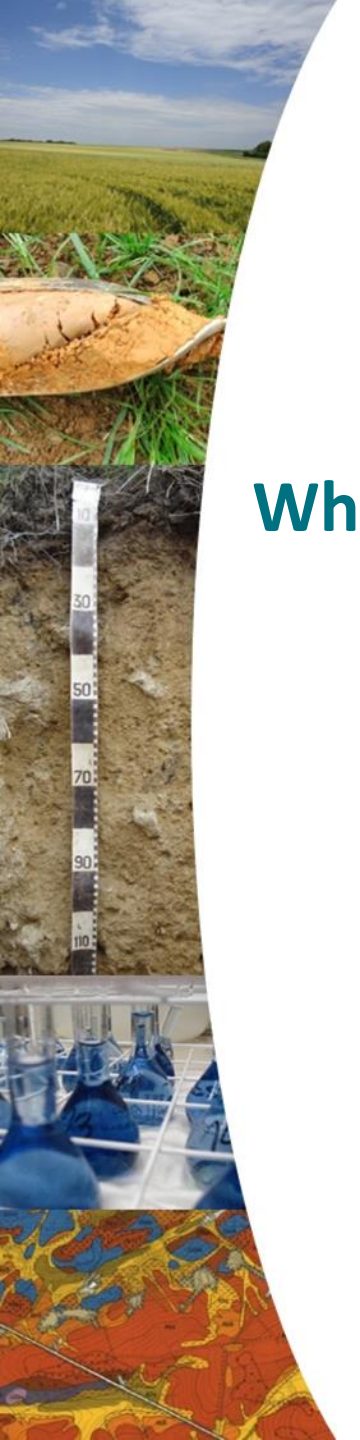


What solutions to reduce trace elements uptake by vegetables in market gardens?

Lessons from a three-year pot experiment

Sibylle Comeliau – PhD student

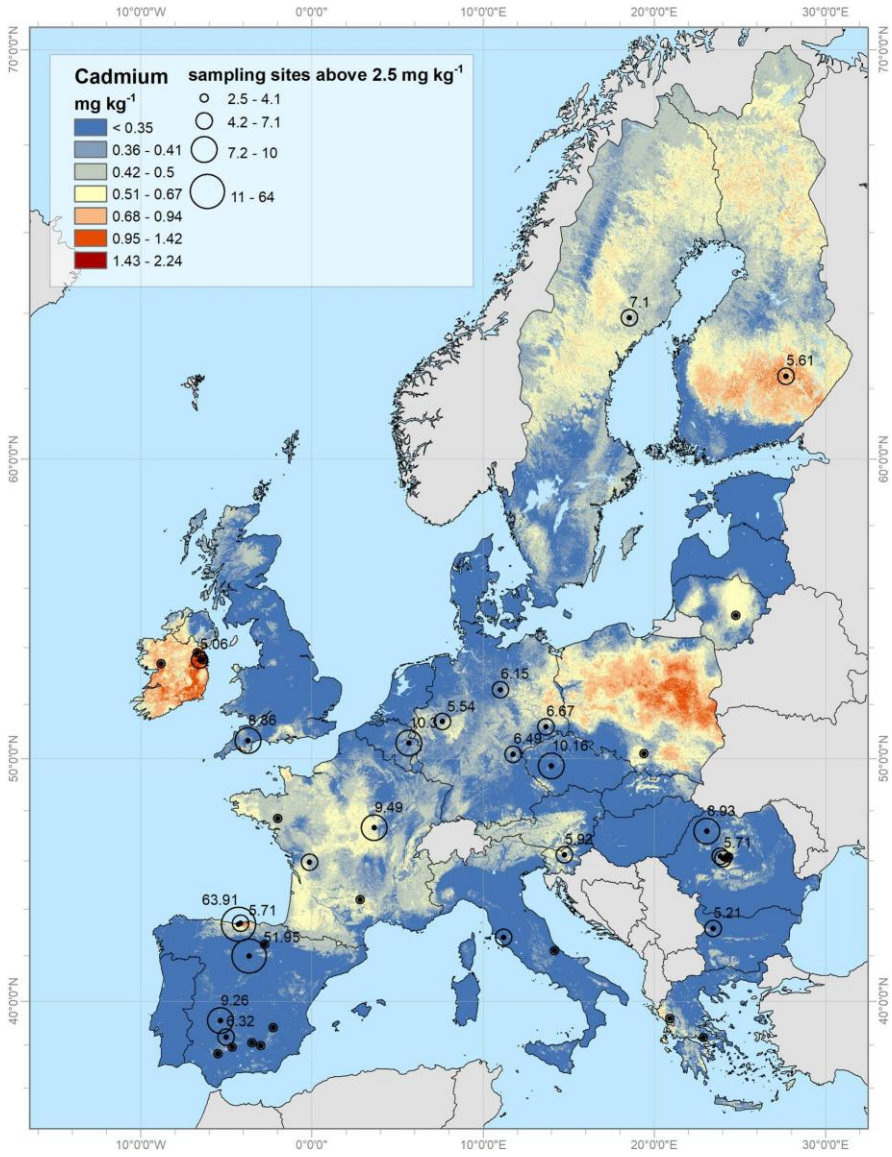
LIÈGE université
Gembloux
Agro-Bio Tech

Context

<u>Focus on Cd and Pb</u>

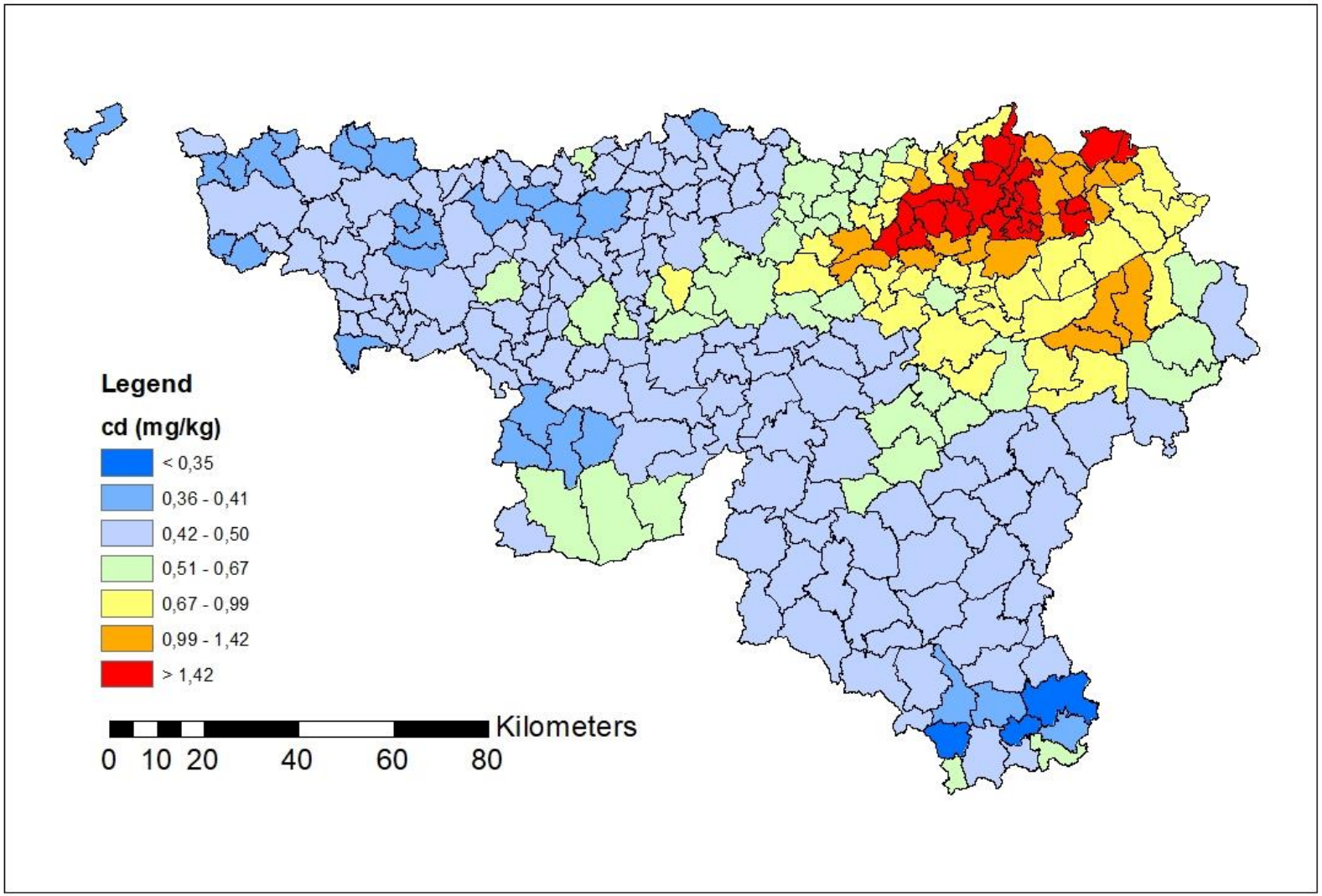
Main sources :

- Past industrial activities
- Agro-chemicals



Soil Cd map from LUCAS dataset (Ballabio et al, 2024)

Context



Predicted soil Cd map for Wallonia (data from CAPASOL)

Food chain contamination

Vegetables and fruits contamination ?

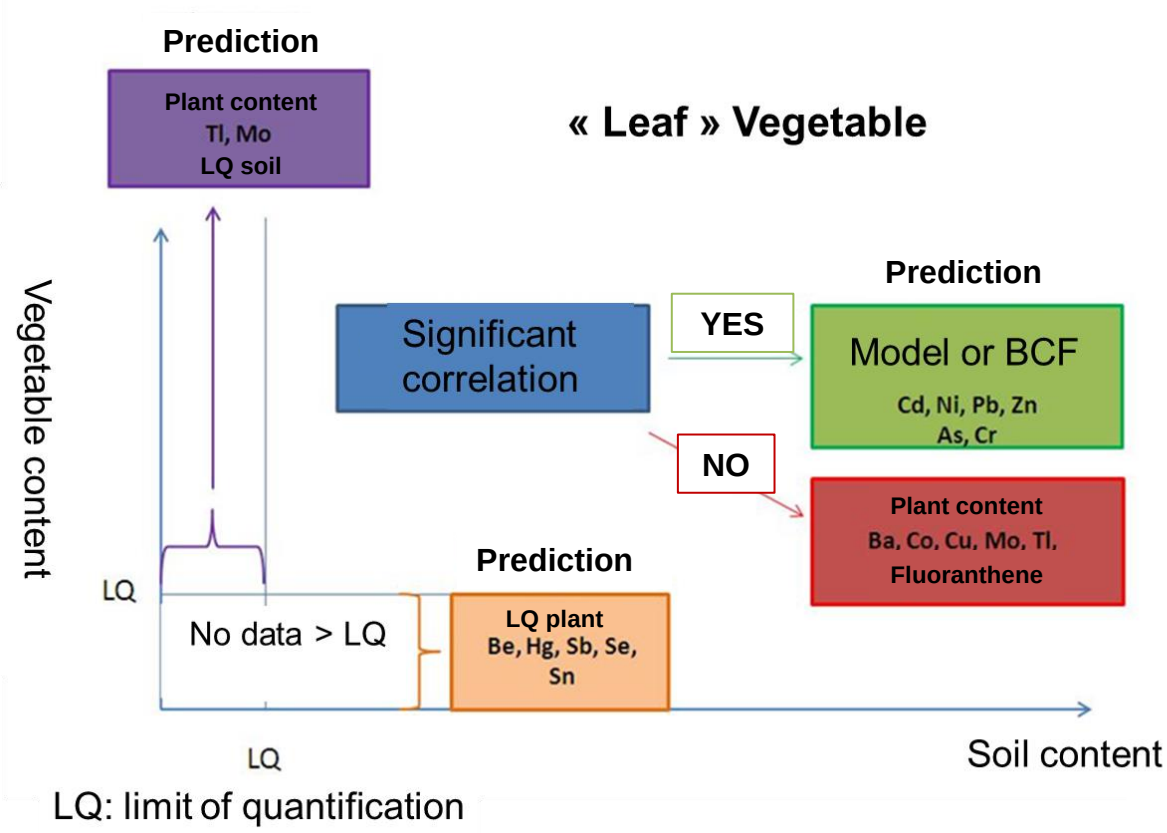
Risk to human health ?

Soil pollution ?

Soil – plant transfers

Several predicting soil-plant transfer models in the litterature

Often based on soil properties such as soil pH and total content



Soil-plant transfer model for leafy vegetables from Pollusol 2

EU legislation on contaminants

- Only for foodstuffs commercialization
- Different contaminants which include heavy metals - For vegetables : Cd and Pb
- First published in 2006 : regulation EC 1881/2006.
- Recently updated in 2021 and in 2023 - lays down the maximum levels for certain products

	Foodstuffs (1)	Maximum levels (mg/kg wet weight)
3.2.11	Cereals excluding bran, germ, wheat and rice	0,10
3.2.12	Bran, germ, wheat and rice	0,20
3.2.13	Soybeans	0,20
3.2.14	Vegetables and fruit, excluding leaf vegetables, fresh herbs, fungi, stem vegetables, pine nuts, root vegetables and potatoes (27)	0,050
3.2.15	Leaf vegetables, fresh herbs, cultivated fungi and celeriac (27)	0,20
3.2.16	Stem vegetables, root vegetables and potatoes, excluding celeriac (27). For potatoes the maximum level applies to peeled potatoes	0,10

EU legislation on contaminants

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3.2.5.2	Leafy brassica	0,10	
3.2.6	Leaf vegetables and herbs		The maximum level applies to the wet weight. The maximum level applies after washing and separating the edible part.
3.2.6.1	Leaf vegetables except products listed in 3.2.6.2	0,10	
3.2.6.2	Spinaches and similar leaves, mustard seedlings and fresh herbs	0,20	
3.2.7	Legume vegetables	0,020	The maximum level applies to the wet weight. The maximum level applies after washing and separating the edible part.
3.2.8	Stem vegetables		The maximum level applies to the wet weight. The maximum level applies after washing and separating the edible part.
3.2.8.1	Stem vegetables except products listed in 3.2.8.2 and 3.2.8.3	0,030	
3.2.8.2	Celeries	0,10	

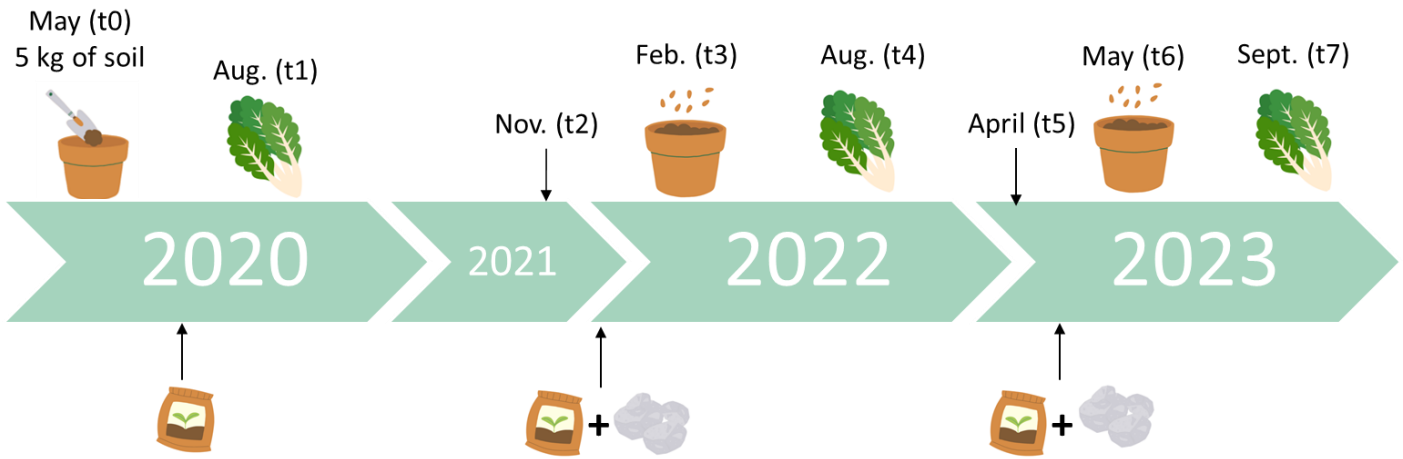
uropean Union

5.5.2023

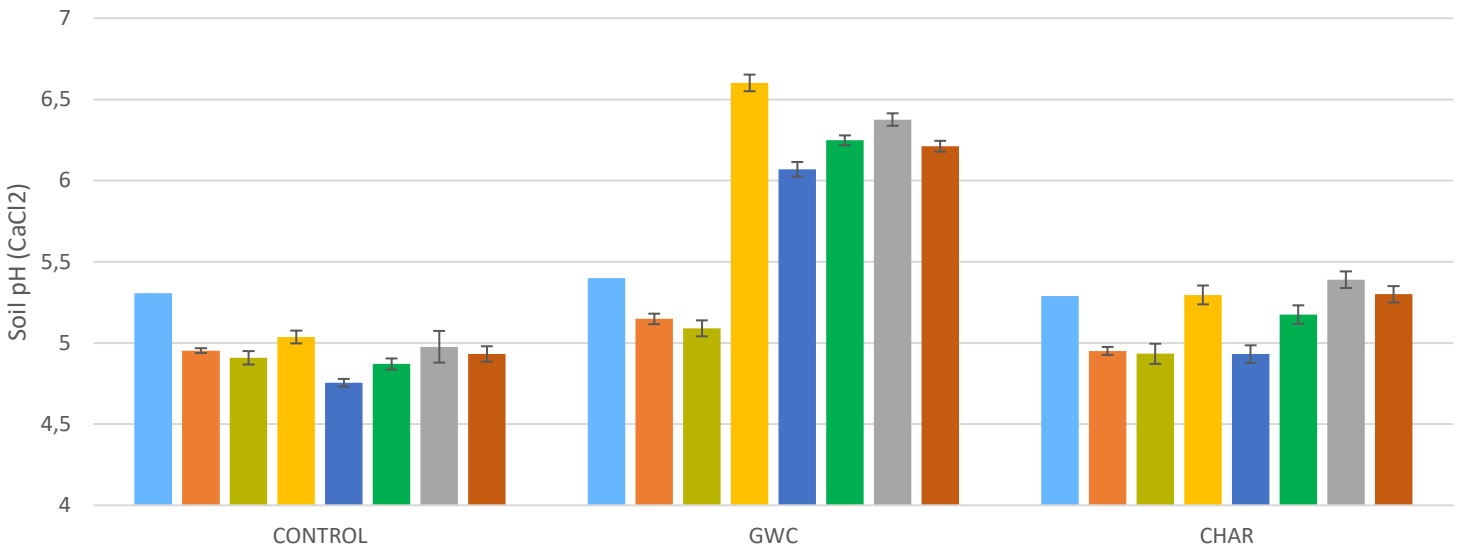
Pot experiment

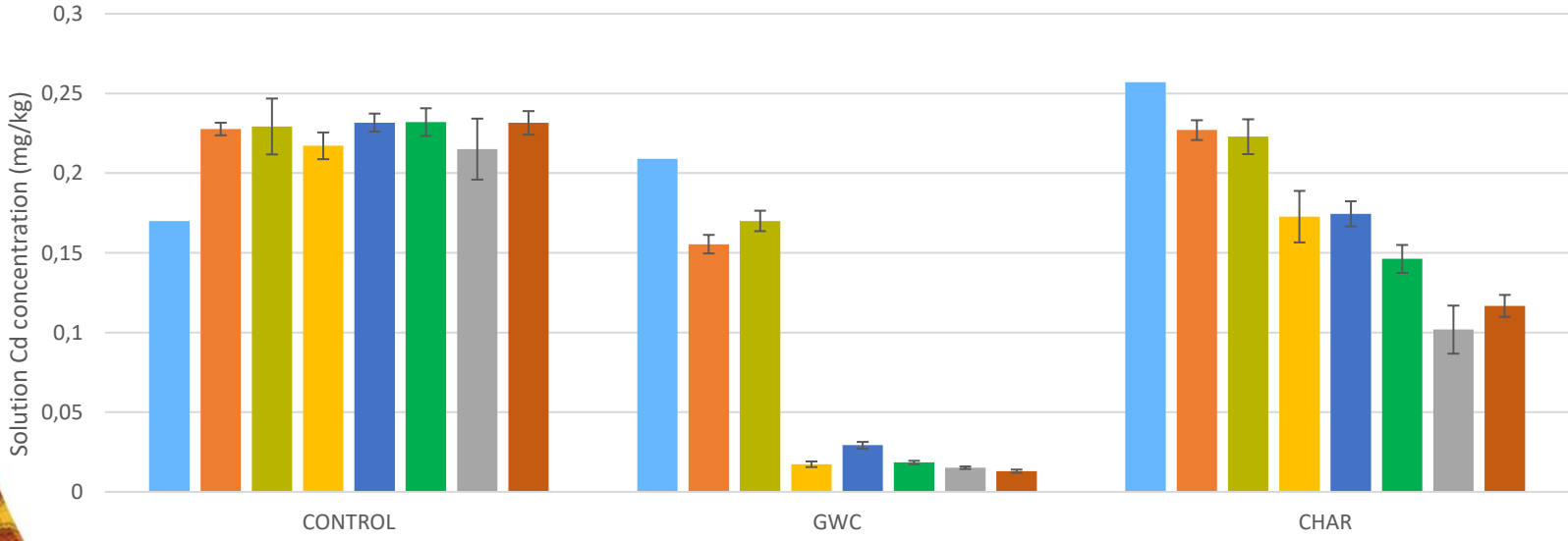
Experimental set-up

- Repeated applications of amendments
  biochar and green waste compost (150g/5kg)
- From December 2022 :
  additional lime treatment (0 – 1 – 2/5 kg)
- Swiss chard culture
- Soil from a market garden :
  ~ 1,5 mg/kg Cd - ~ 65 mg/kg Pb

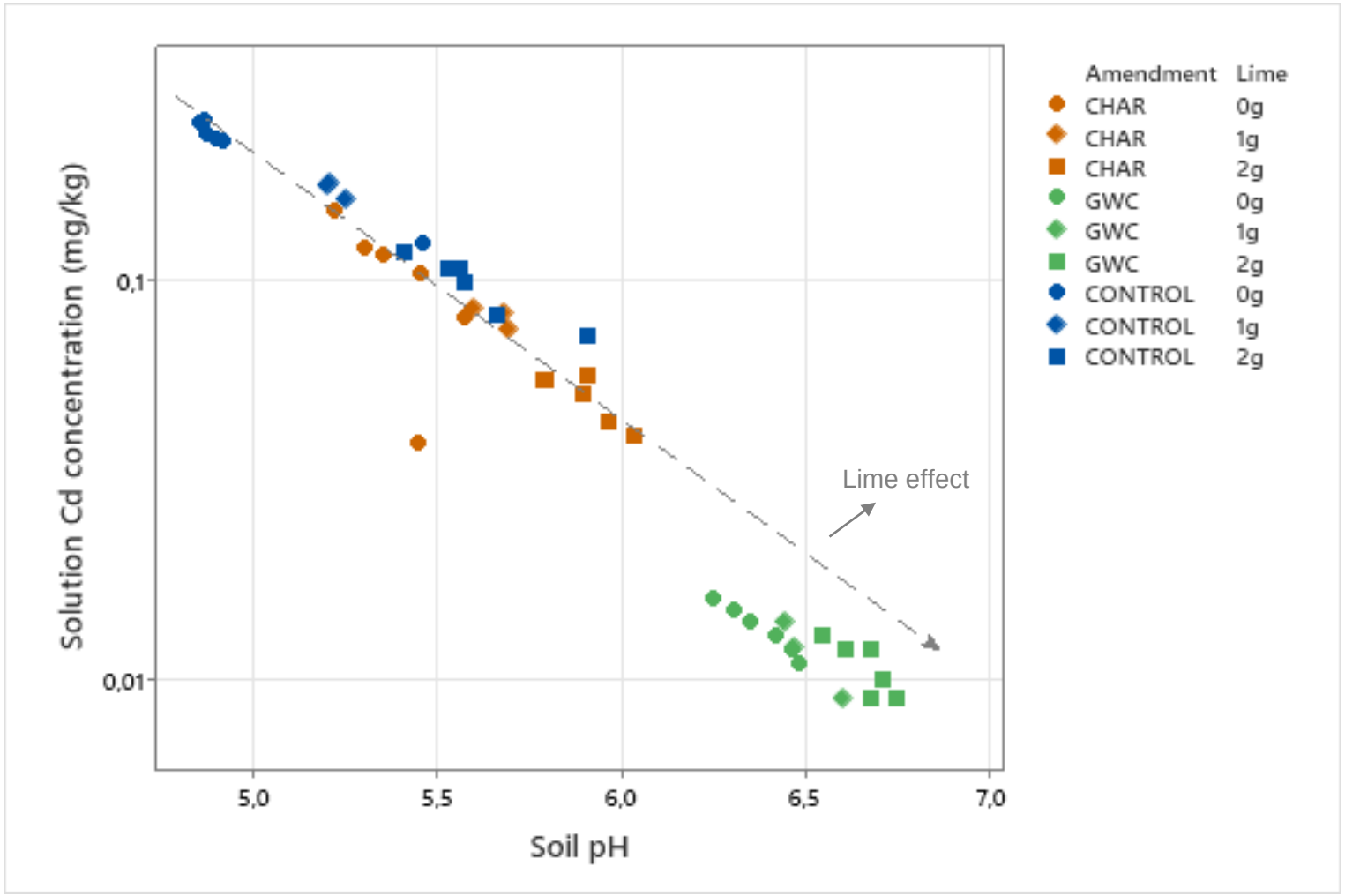


Pot experiment



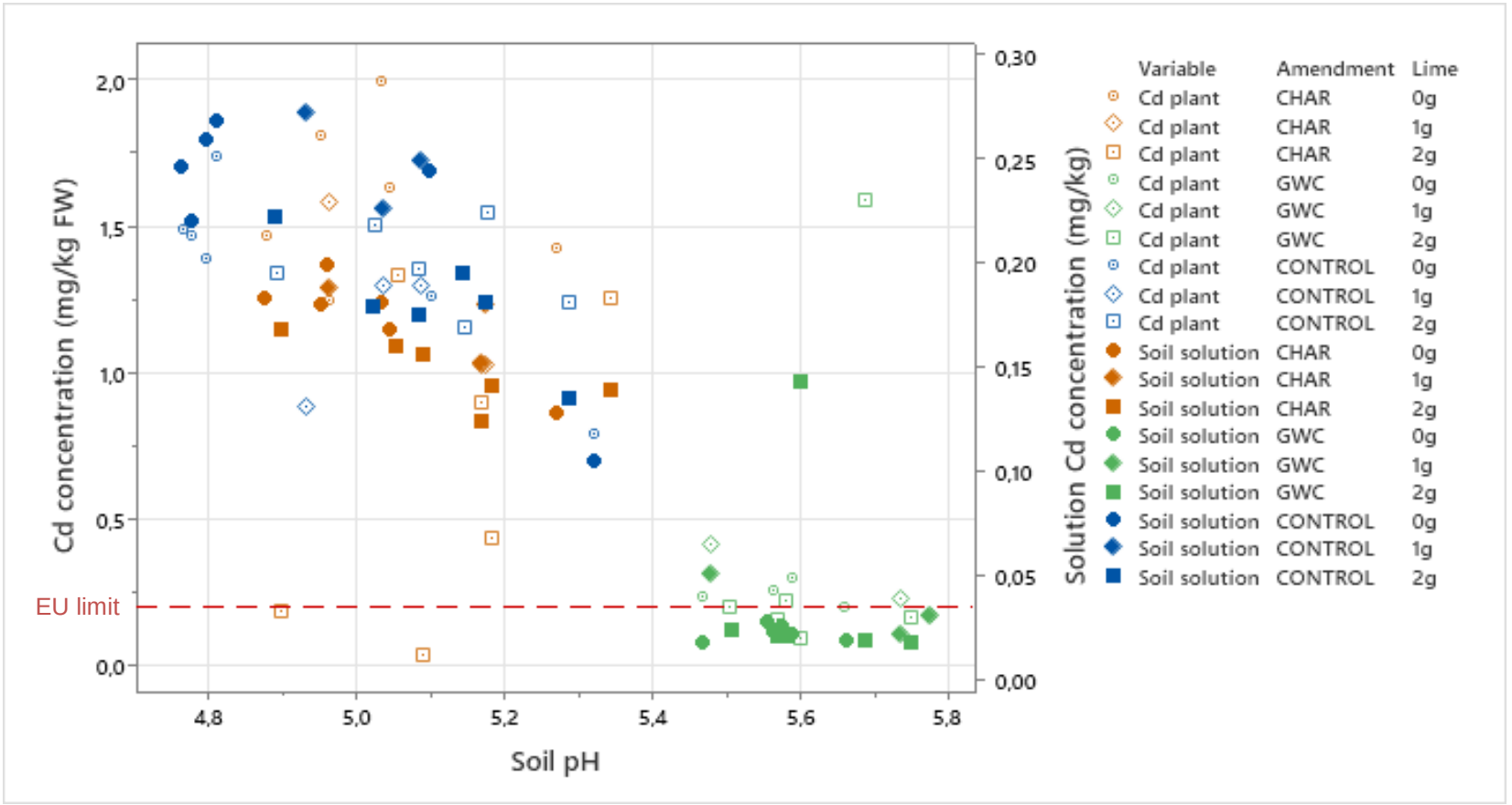


Pot experiment



Relationship between CaCl2 Cd concentration (mg/kg) and soil pH (t6) according to treatments

Pot experiment



Relationship between Cd content in Swiss chard (mg/kg FW) and soil pH (t4) according to treatments

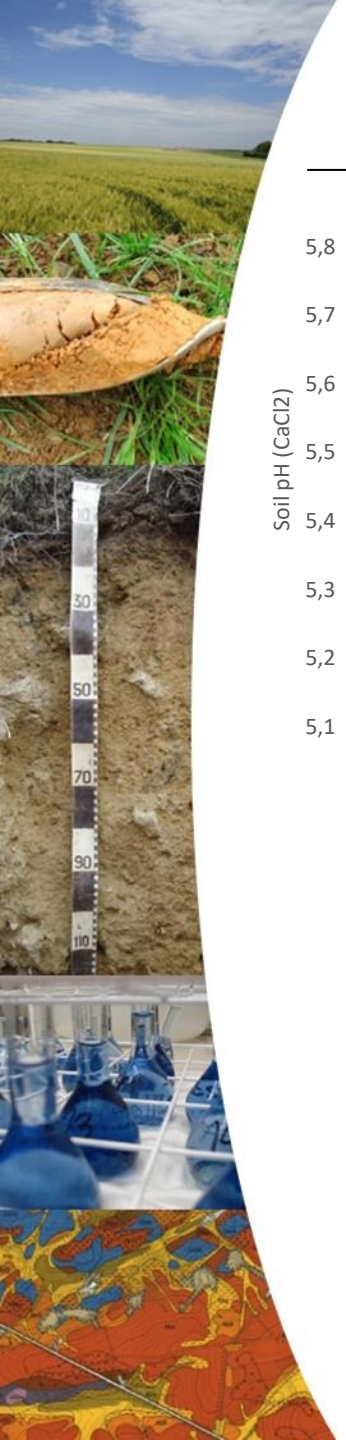
Field experiment

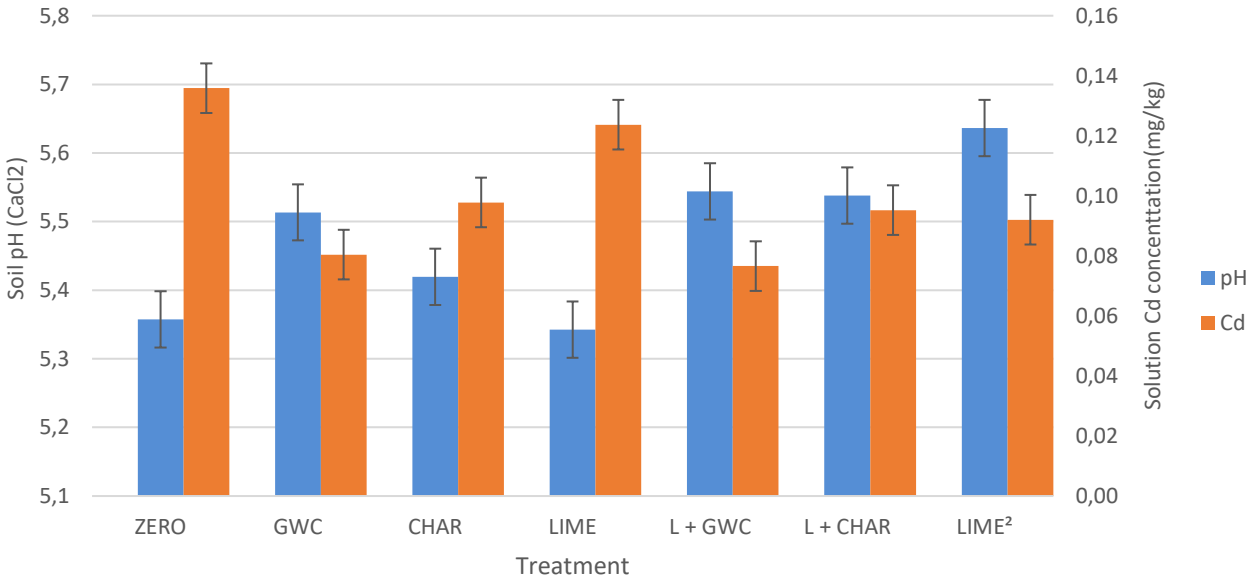
8 market gardens

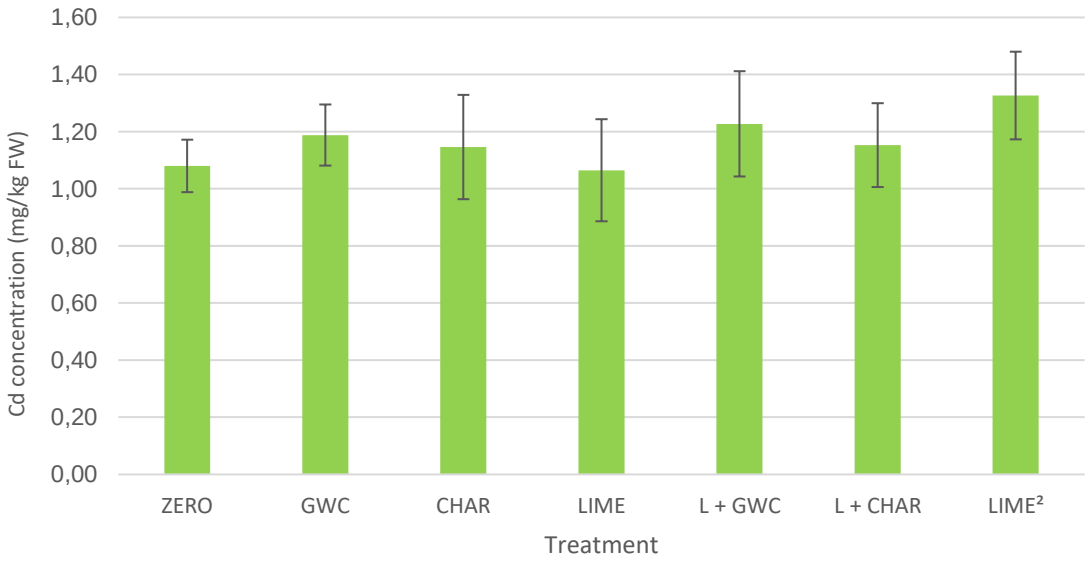
Application of biochar, green waste compost and lime

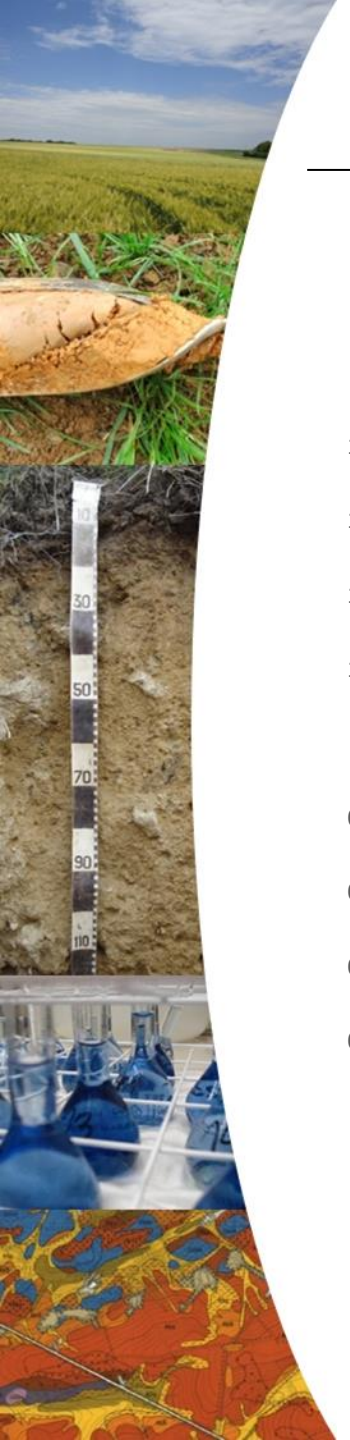
Lettuce and Swiss chard culture

Field experiment



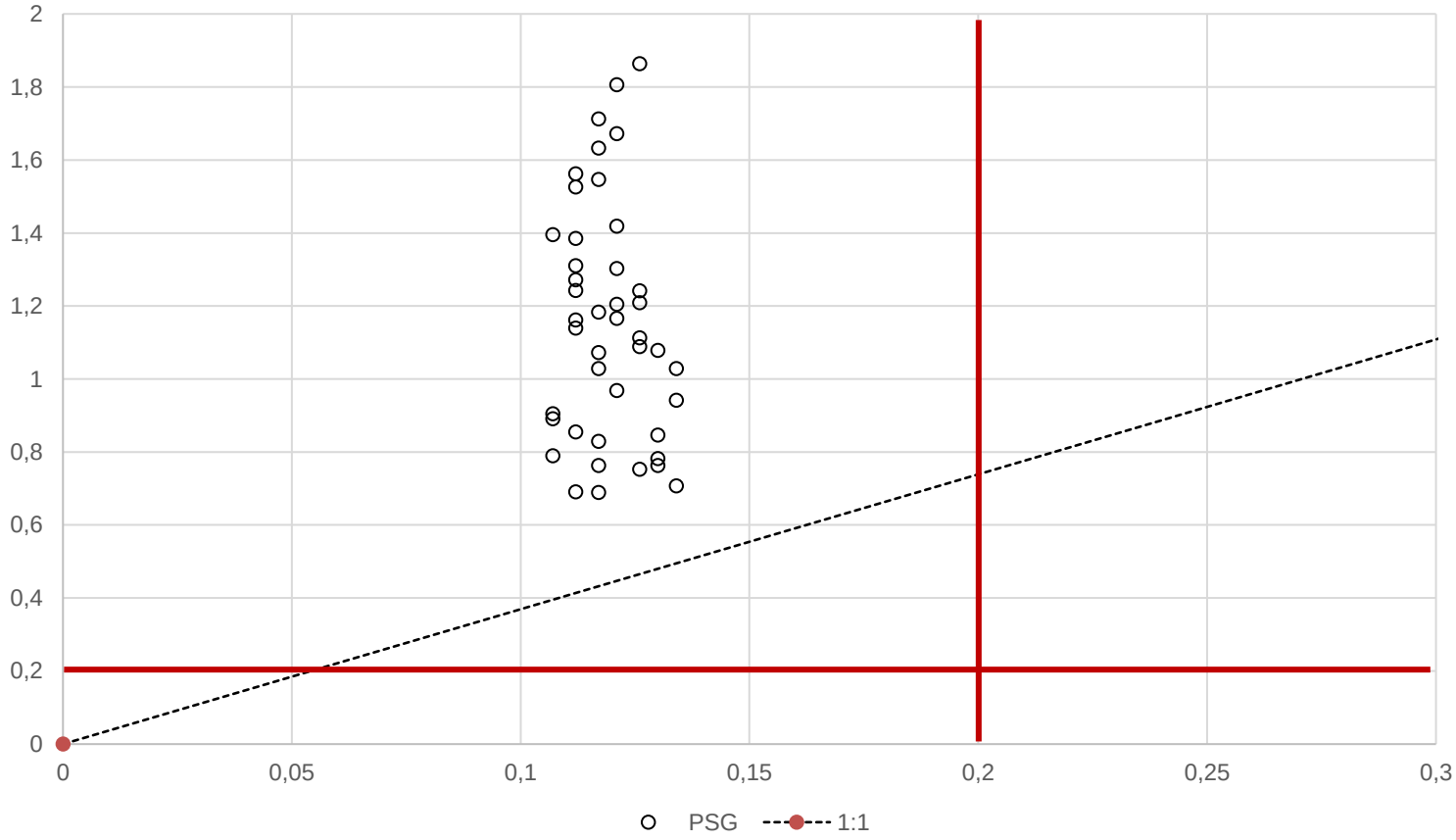






Field experiment

Comparison of measured values in field with the SANISOL model predictions

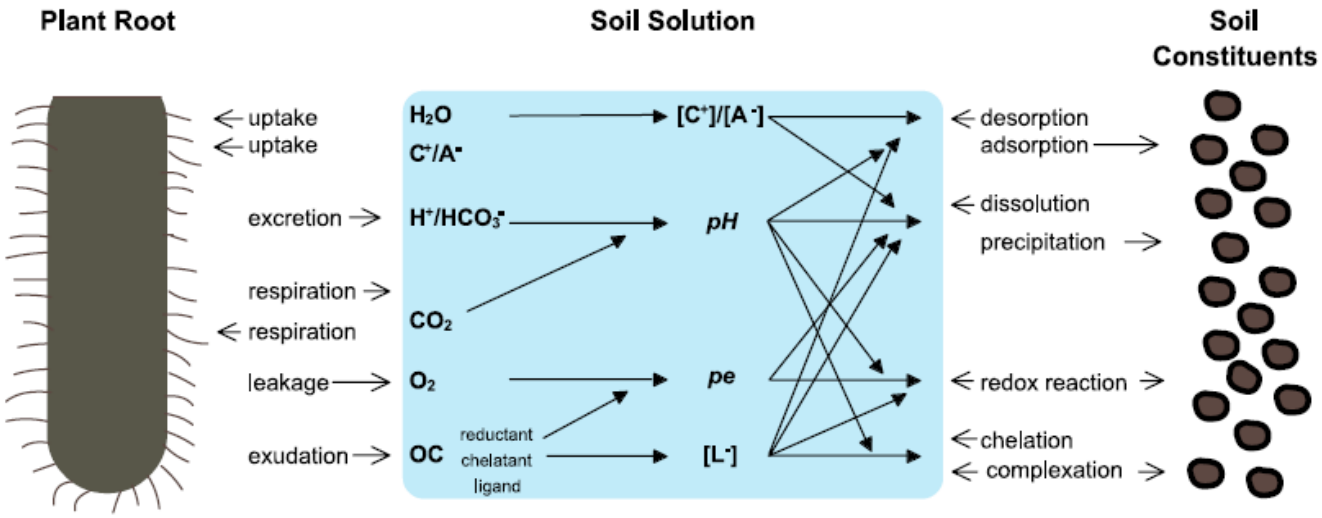


Cadmium concentrations in Swiss chard predicted with reference model (SANISOL) compared to observed cadmium concentrations in field-grown Swiss chard.

Conclusions & perspectives

Lessons from the pot experiment :

- Most important effect occured after the second application of amendments
- Soil pH confirmed as one of the main levers to control Cd mobility
- Differences in plant growth between pot and field experiments to be considered



Schematic of the rhizosphere, showing the various exudates and how they can influence abiotic factors and mechanisms in the soil–solution interface. Legends: OC = organic carbon; C^+ = cation; A^- = anion; L^- = ligand; pe = redox potential. Modified from Hinsinger (2001).

<u>Perspectives</u>:

Need for long-term field trials

Geochemical modelling to improve cadmium bioavailability predictions

LIÈGE université
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Thank you for
your attention !