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Contribution of anthropic coarse materials of urban soils to plant nutrition and growth

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Background and Objectives

Should the **soil coarse fraction** be considered a key element in the functioning of **highly anthropized soils**, especially regarding risk associated to **contaminants**? **Soil quality diagnosis systematically dismiss it as inert** for not contributing to the soil's nutritional potential or contaminants in the short term. However, in forest context, it can contribute significantly to **the assimilation of essential nutrients by plants**. Yet, insufficient research has been done to understand its influence in terms of physicochemical fertility and contribution to toxicity in the context of highly anthropized soils.

In these contexts, **coarse materials** are found in **various quantities and natures** and can constitute in some cases the main source of **pedogenetic evolution** of these systems. This raises the questions of the evolution of the properties of the soil coarse fraction constituents as a function of their size, and the intensity of their contribution to the fertility and toxicity of highly anthropized soils.

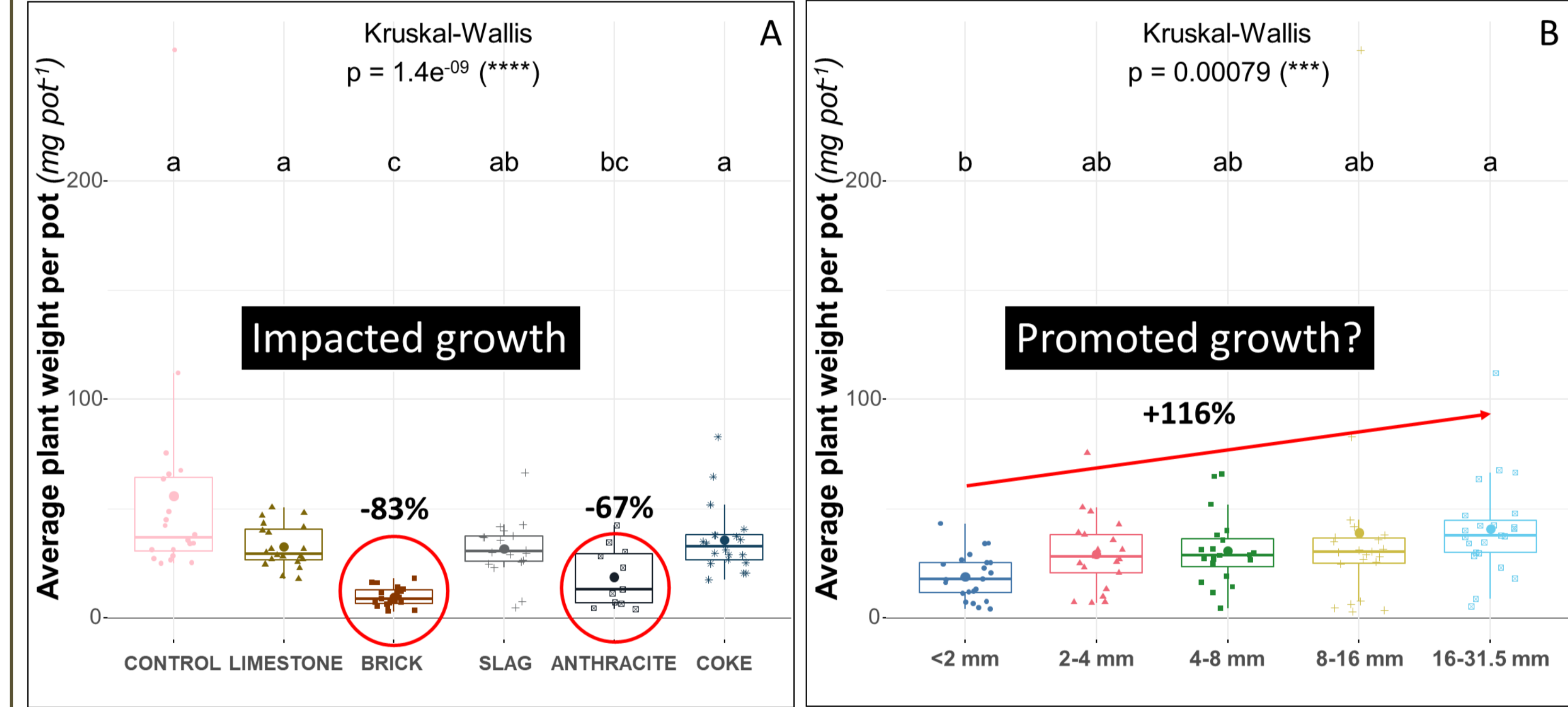
Aims

1. Evaluating the role of the size and the type of the materials regarding their contribution to substrate's fertile and toxic properties
2. Assessing the overall contribution of the coarse fraction to plant growth

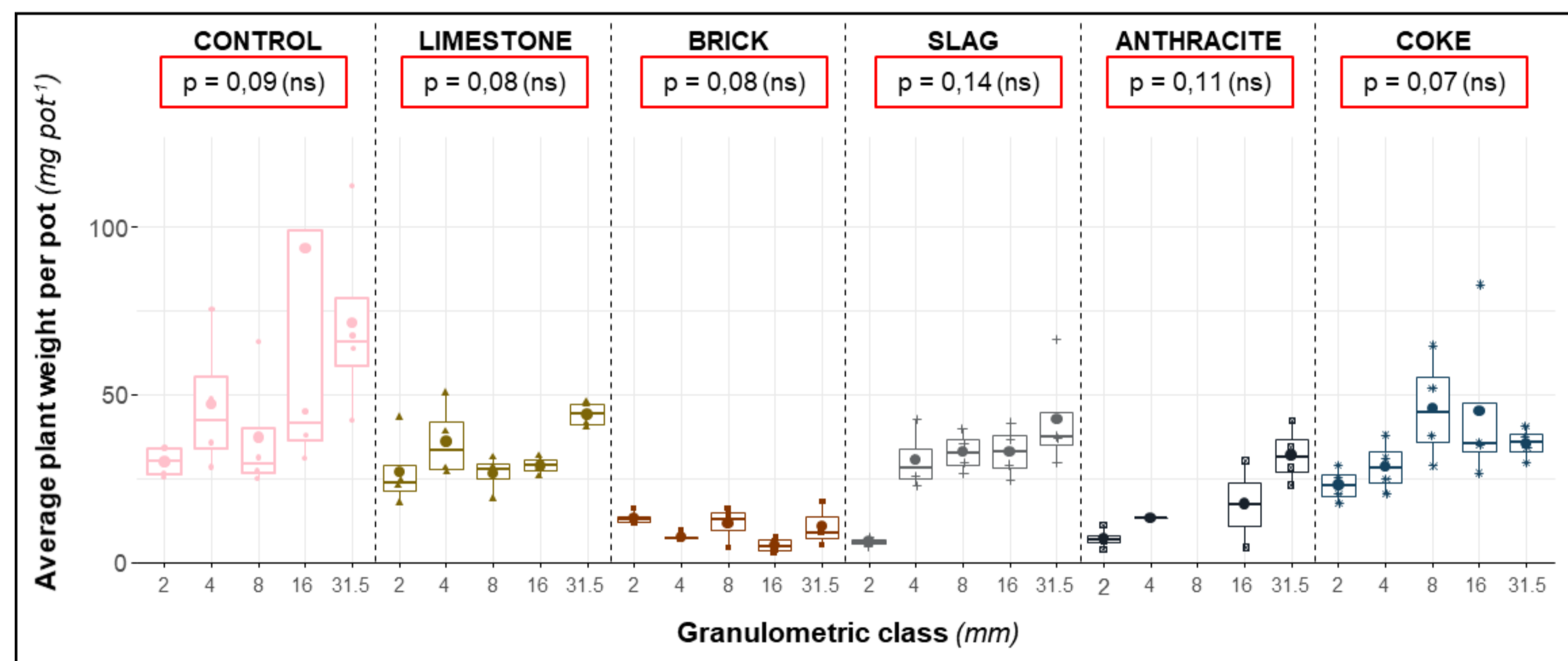
Results & Discussion

Effect of materials regardless of particle size

Effect of particle size regardless of the type of material



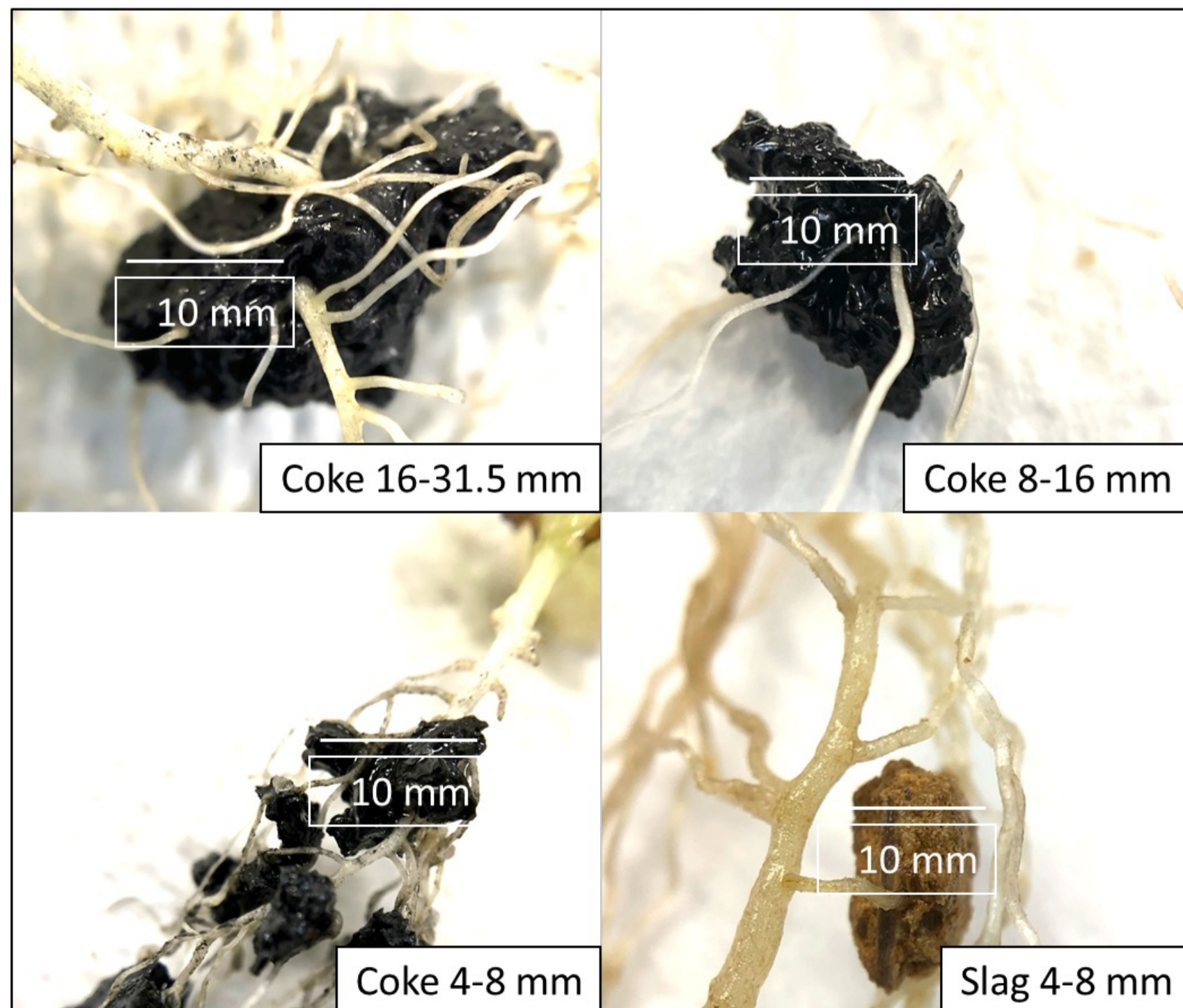
Effect of particle size and the type of material



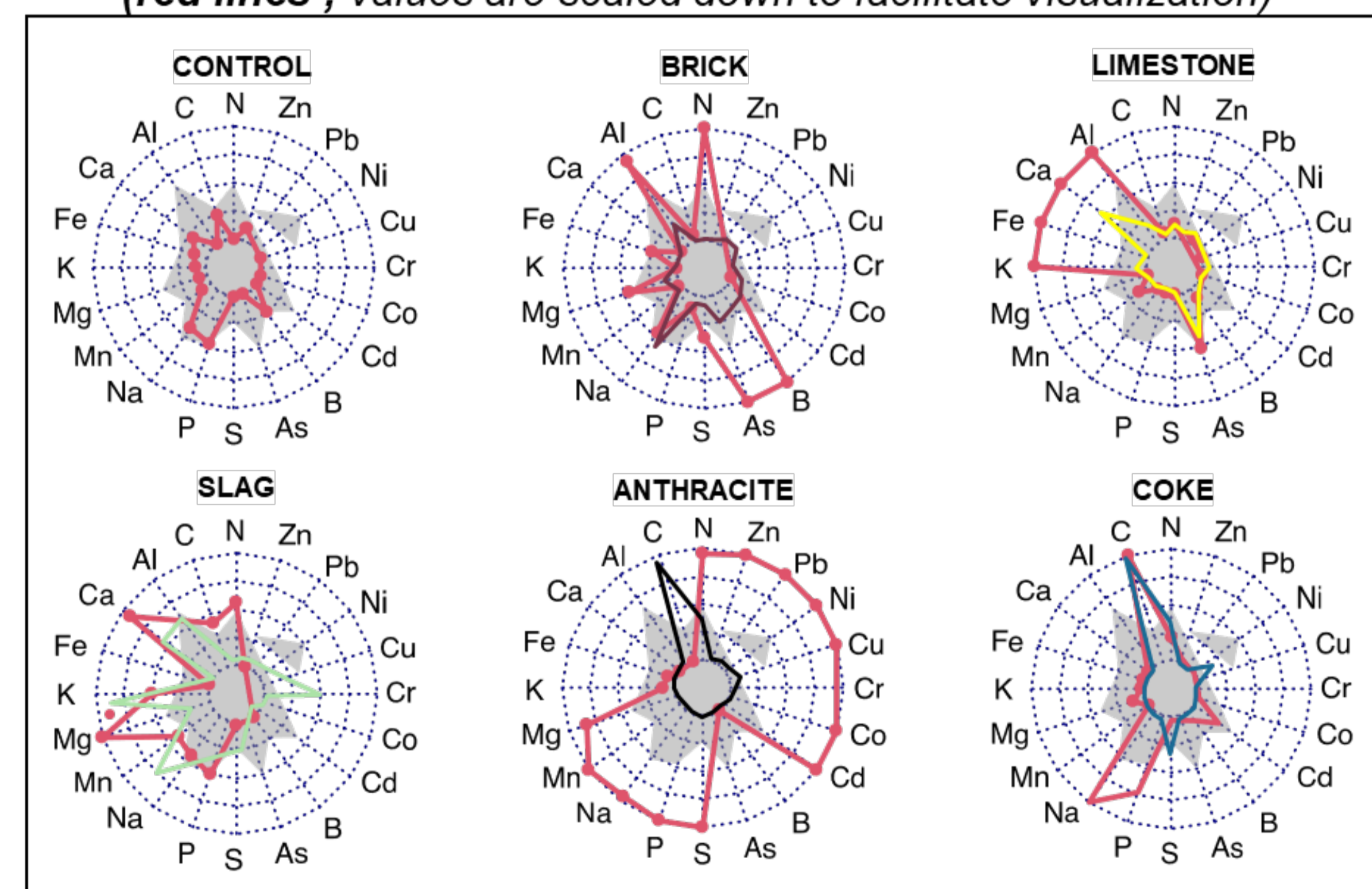
- The **elemental composition** of plants is **influenced** by the **nature of the materials**
- **LIMESTONE** and **SLAG** have a **direct contribution** to the **mineral nutrition** of plants regardless of the size of the particles (Ca and K)

- Overall, **particle size does not affect plant development**
- Coarse fraction of **LIMESTONE, SLAG** and **COKE** performed as well as the control (**CRUSHED GLASS**)
- Overall, **BRICK** and **ANTHRACITE** have the **most negative impact** on plant physiology

Root growth within the porosity of different materials (coke and slag)



Profiles of plant elemental composition according to growth medium (red lines ; values are scaled down to facilitate visualization)



Brown, yellow, light green, black and blue lines represent the elemental composition profiles of : brick, limestone, slag, anthracite and coke respectively

Conclusions & Perspectives

- **Original** experiment with coarse fraction and contrasted materials
- **Coarse fractions are not inert** and **contribute** in a limited way to the **release of major elements**, and do **contribute** to **plant nutrition** via **weathering**
- Coarse materials can be **beneficial to plant development** in the **short term** and could constitute **supplementary nutrient resources** in highly anthropized soils. Moreover, this study sheds new light on the role of the soil coarse fraction to **promote plant growth**, thus highlighting the **interest of taking it into account in derelict land reclamation strategies**

- **Physico-chemical** (leaching and lixiviation) and **biological weathering** phenomena are **stimulated by the presence of water** in the system, which can be stored, run off and promote the release of various elements (nutrients or pollutants)
- Depending on the physico-chemical conditions of the medium, the **interactions between fine and coarse fractions** and the **plant root system** contribute to the **expression of the vegetation support function** in the soil