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

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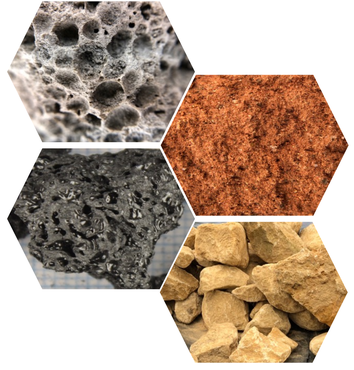

Contribution of anthropic coarse materials of urban soils to plant nutrition and growth

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Background and Objectives

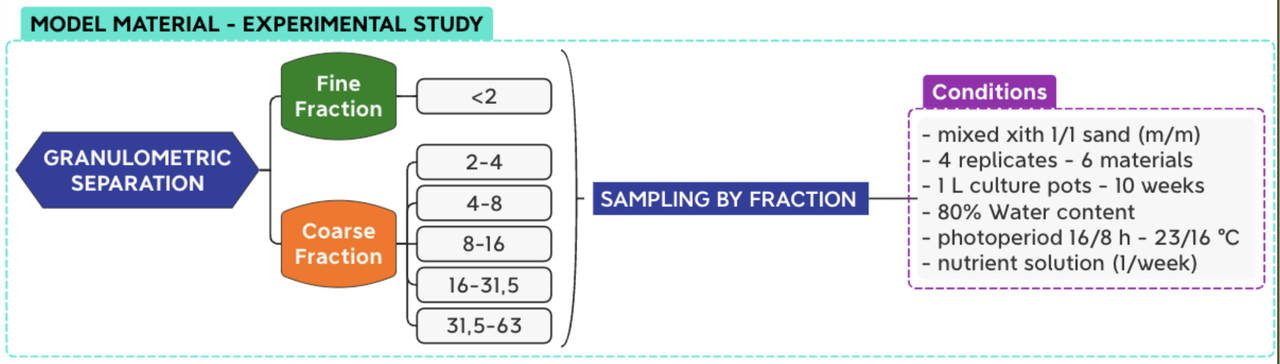
Should the **soil coarse fraction** be considered a key element in the functioning of **highly anthropized soils**, especially regarding risk associated to **contaminants**? **Soil quality diagnosis systematically dismiss it as inert** for not contributing to the soil's nutritional potential or contaminants 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**

Material and Methods

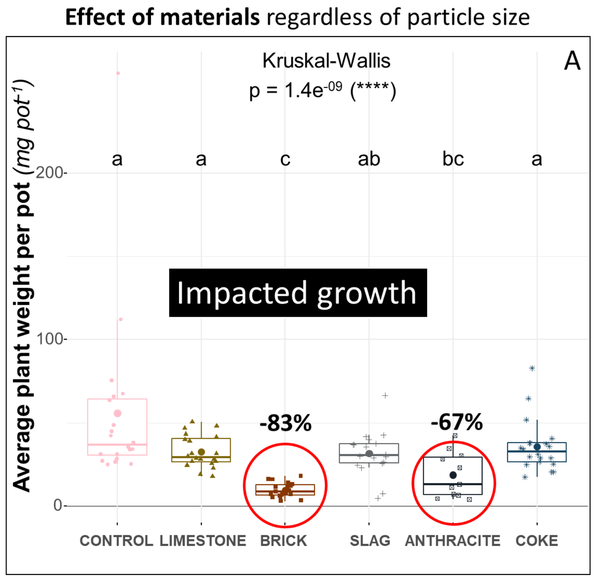


Nature	mineral				organic	
Origin	technogenic	natural	technogenic	technogenic	natural	technogenic
Material	glass (physically & chemically inert)	limestone	brick	blast furnace slag	anthracite	petroleum coke

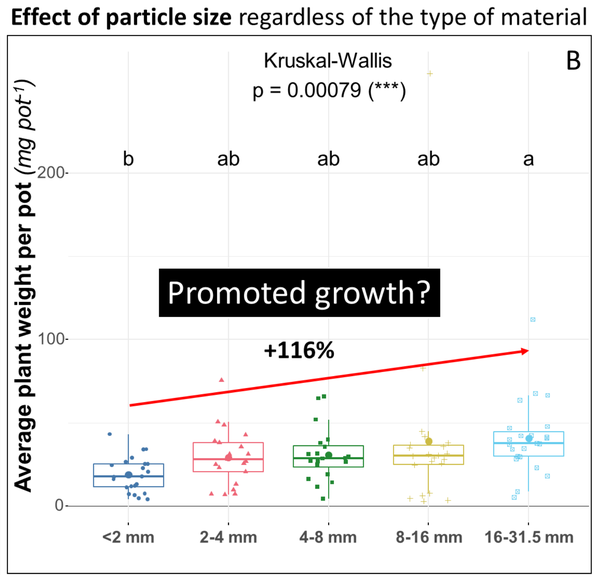
- **Characterization** : biomass, root length and diameter, water content by weight, elemental composition

Results & Discussion

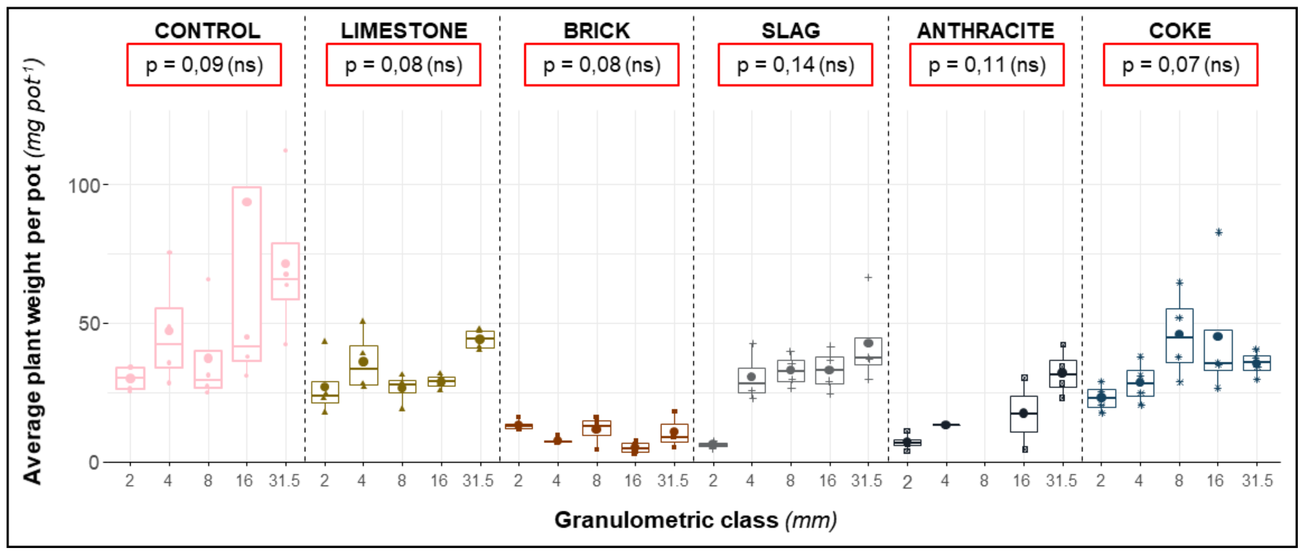
Effect of materials regardless of particle size



Effect of particle size regardless of the type of material



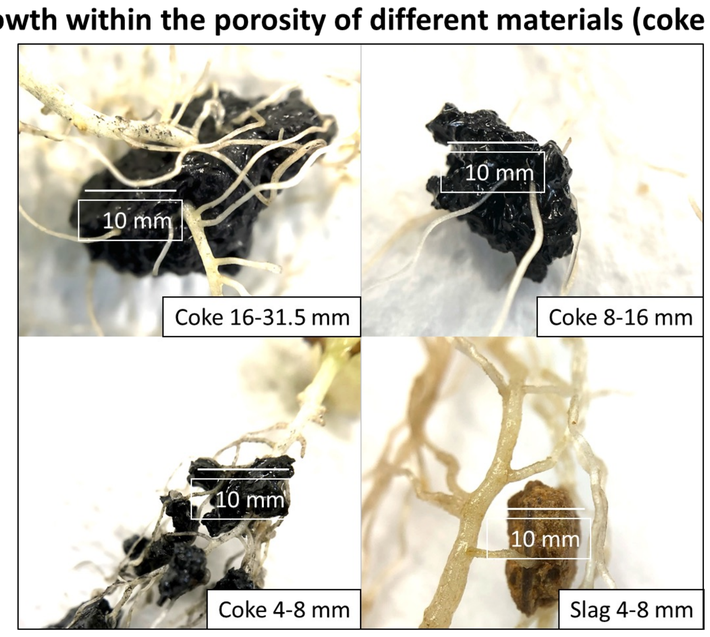
Effect of particle size and the type of material



- 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)

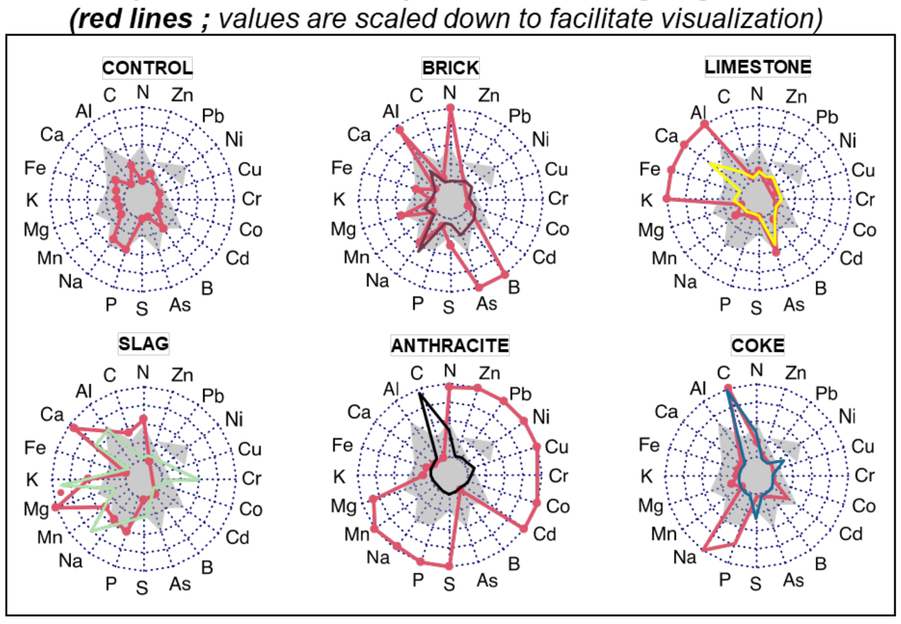
- Overall**, particle size does not affect plant development**
- Coarse fraction of **LIMESTONE, SLAG** and **COKE performed as well as the control (CRUSHED GLASS)**
- Overall**, BRICK** and **ANTHRACITE** have the **most negative impact** on plant physiology

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**