

Phytotechnologies in Degraded Soils – The Example of Borralha Mine

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INTRODUCTION

Soil is a non-renewable natural resource and due to its increasing deterioration has been considered a target of environmental concern. Mining activities are one of the main contributors of trace elements (TE) inputs to soils worldwide. Relevant mining-related TE includes cadmium (Cd), zinc (Zn), copper (Cu), arsenic (As) and lead (Pb).

The application of phytotechnologies (use of plants and associated microorganisms) in mining areas can mitigate TE contamination and dispersion, and help in soils' ecosystems restoration. Moreover, they can be integrated in phytomanagement systems (PS) that can provide relevant economic revenues by growing in those sites bioenergy crops (e.g. sunflower). The application of cropping patterns, as wintercropping, and bioinoculants, such as plant-growth promoting rhizobacteria (PGPR) and arbuscular mycorrhizal fungi (AMF) can optimize PS by enhancing plant yield, decrease plant stress and improve soil functionality.

SCOPE

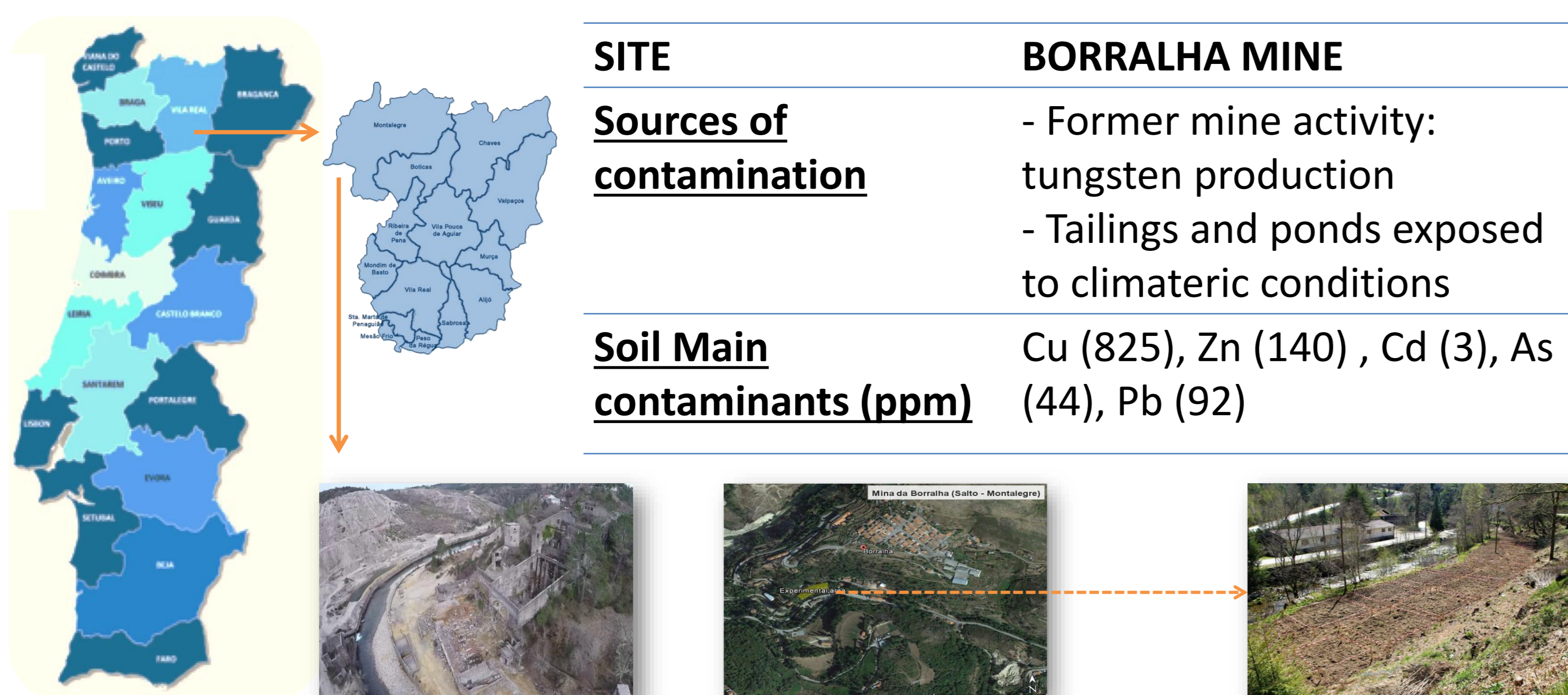
This work is harbored by **PhytoSUDOE** project that aims the management of degrading environments and their restoration through the application phytotechnologies that promote biodiversity, enhance ecosystem functionality and enable the sustainable use of resources. A transnational network contaminated sites distributed through Portugal, Spain and France was established to demonstrate the sustainability of phytomanagement options for degraded sites.

GOALS

- Evaluate the establishment and growth of sunflower
- Determine the effect of bioinoculants
- Assess the behavior of TE in the soil-plant system
- Analyze the effect of wintercropping

EXPERIMENTAL WORK

SITE LOCATION AND DESCRIPTION

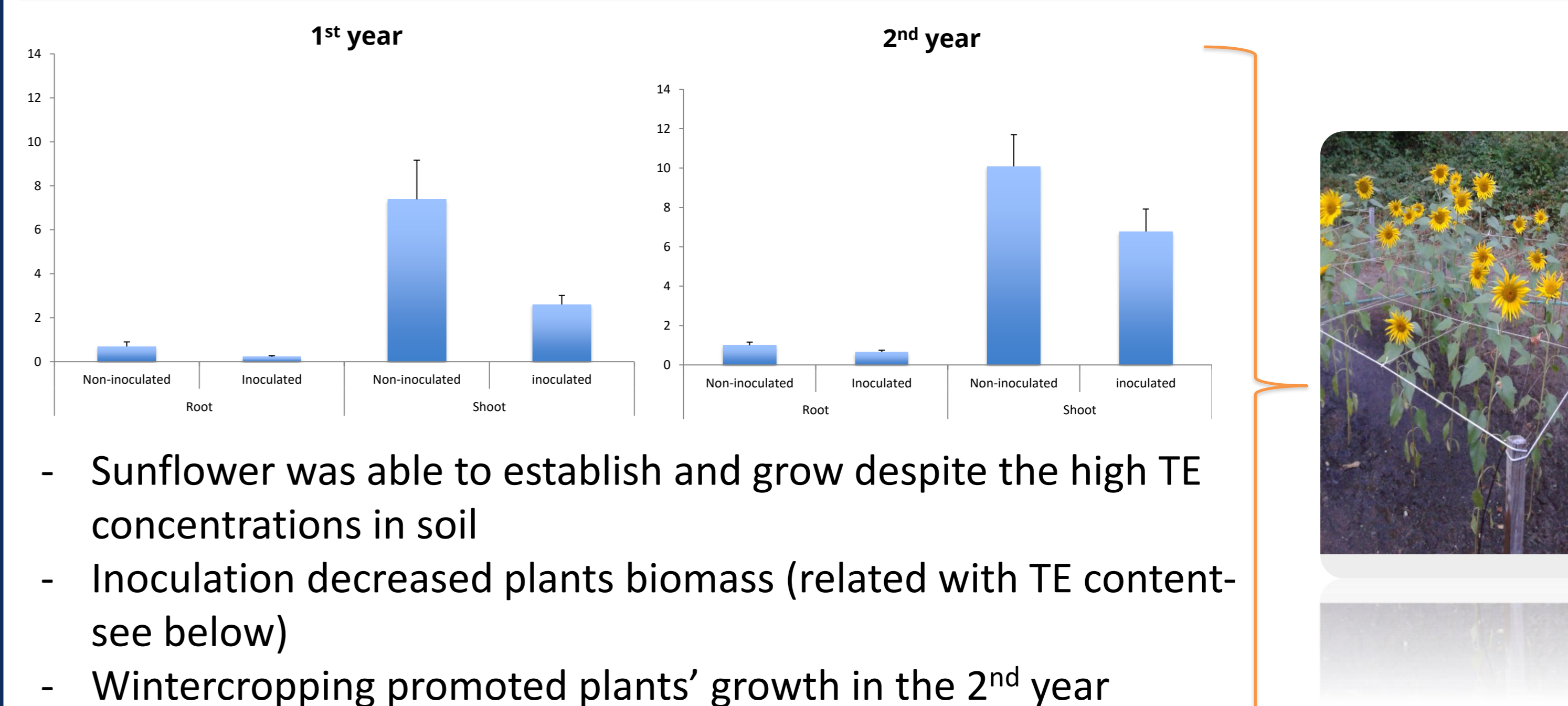


EXPERIMENTAL DESIGN

Experimental plots	24 plots (≈ 2,3 m ² each)	Crop-Pattern	Wintercropping (Alfalfa + Clover)
Phytotechnologies applied		Design	
Bioenergy Crop	Sunflower (cv. BOSFORA, Syngenta España)	Parameters	Plants' establishment Concentration of TE in plant tissues BCF/TF TE availability Plants' nutrient content
Bioinoculants	- AMF (<i>Rhizophagus irregularis</i>) - PGPR (<i>Pseudomonas</i> sp.)		

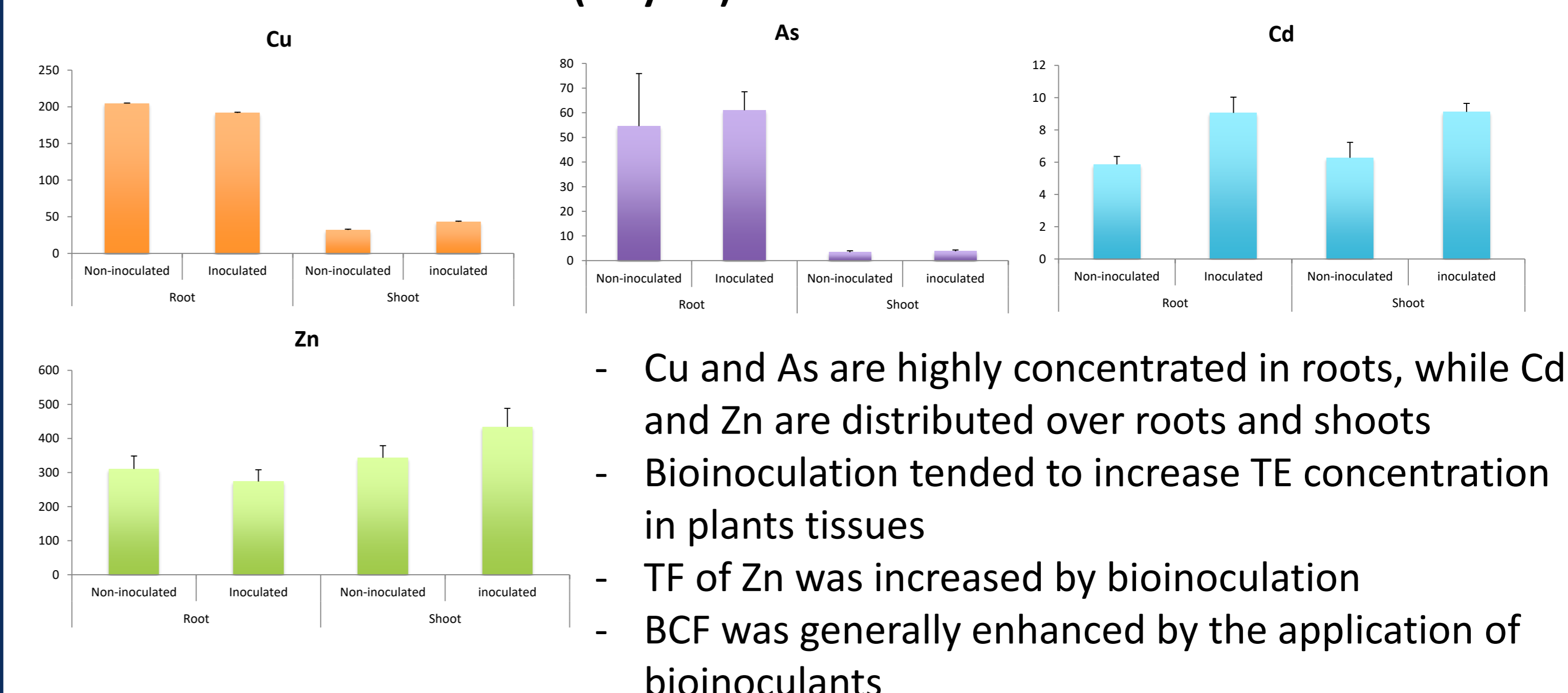
PRELIMINARY RESULTS

PLANTS' BIOMASS



TRACE ELEMENTS AND NUTRIENT CONTENT

Trace Metal Content in Plants (1st year)



Bioavailability of TE in soil

- Bioinoculation increased NH₄-Ac available fraction of Cu, Cd and Zn

N and P content in plant tissues

- Nutrient content was increased in shoot tissues of inoculated plants

DISCUSSION AND ON-GOING WORK

- The decrease of plant's biomass in inoculated plots appears to be a result of a higher TE accumulation.
- The use of wintercropping schemes may be useful to improve soil fertility and plant growth.
- Preliminary results shows that bioinoculation in contaminated areas should be taken into account when considering biomass production, and if the intended purpose is TE's phytostabilization or phytoextraction.
- Data collected from 2nd year is under analysis.

Acknowledgements

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