Società Italiana di Agronomia
50° Convegno Nazionale

Evoluzione dei sistemi agronomici in risposta alle sfide globali
Udine, 15-17 settembre 2021

Tolerance Of Giant Reed To The Cultivation In Heavy Metal Polluted Soil

Barbara Rachele Ciaramella[1], Sebastiano Andrea Corinzia[1], Danilo Scordia[1], Cristina Patanè[2], Salvatore Luciano Cosentino[1], Giorgio Testa[1]*

[1]Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università degli Studi di Catania, via Valdisavoia 5, 95123 Catania, Italy, gtesta@unict.it

[2]CNR-Istituto per la BioEconomia (IBE), Sede Secondaria di Catania, Via P. Gaifami 18, 95126 Catania, Italy.

Introduction

The cultivation of energy crops in heavy metal polluted soil is an alternative that improves the production of a renewable and sustainable feedstock for energy while promoting soil remediation the soil.

In this scenario *Arundo donax* L., a perennial drought-tolerant grass specie capable of grown in stressful conditions, was tested in contaminated soil with different zinc, cadmium, lead, and nickel concentrations, seeking the physiological response and the stem yield.

Materials and Methods

Giant reed (*Arundo donax* L.) rhizomes collected at the Experimental Farm of the University of Catania, Italy (10 m a.s.l., 37°25' N lat., 15° 03' E long.), were grown in a contaminated pot of 12 kg, in a completely randomized design with three replications, previously contaminated with four heavy metals in two different levels:

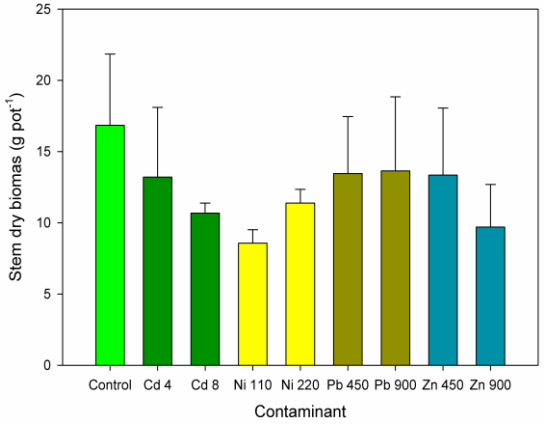
- cadmium (4 - 8 mg kg^{-1})
- zinc (450 - 900 mg kg^{-1})
- nickel (110 - 220 mg kg^{-1})
- lead (450 - 900 mg kg^{-1})

Heavy metal concentration in the soil was applied followed EU guidelines for contaminated soil.

Clonal rhizomes of giant reed were weighted and size reduced as homogeneous as possible and transplanted in the pots two months after the soil contamination.

The irrigation was kept in optimal conditions for the whole crop cycle. During the growing season, the gas exchange between plant and atmosphere were measured.

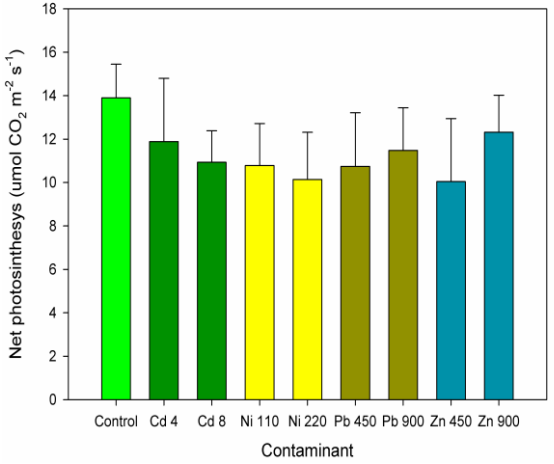
Results



Productivity of dry stem biomass in heavy metal contaminated soil express in g pot^{-1}.

- The productivity in heavy metals contaminated soils is lower than the control.
- In the treatments Cd4, Pb450, and Zn450 a slight reduction of dry stem yield was observed.
- The increase in the contamination levels of cadmium (Cd8) and zinc (Zn900) leads to a higher reduction in stem productivity.
- The biomass reduction in the treatment Ni220 was mitigated by the higher content of nitrogen respect to the Ni110 treatment.
- The increase in lead concentration (Pb 900) does not affect biomass productivity compared to the lower level highlighting a high tolerance of giant reed to the presence of this metal in the soil.

- In **cadmium** treatment, the net photosynthesis rate showed a reduction with the increase of the contamination (12.5 µmol CO_2 m^{-2} s^{-1} and 11.5 µmol CO_2 m^{-2} s^{-1} for Cd4 and Cd8), the same trend was observed also for **Nickel** treatments.
- **Lead** and **Zinc** treatment, showed lower photosynthetic rate values than the control, the net photosynthesis was higher in the highest contamination level probably due to the presence in the soil of a higher concentration of nitrogen applied with the contaminant (10.0 and 12.3 µmol CO_2 m^{-2} s^{-1}, respectively for Zn450 and Zn900).



Net photosynthesis rate (µmol CO_2 m^{-2} s^{-1}) of Giant reed cultivated in heavy metal polluted soil

Conclusions

The present study highlights the ability of *Arundo donax* L. to grow in marginal land and in particular in soil polluted by heavy metals. Among the different heavy metal evaluated in this study the presence of lead could be tolerate by giant reed with a very little reduction in biomass yield.

Acknowledgments: This paper is part of a project that has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement N° 727698, project MAGIC (Marginal lands for growing industrial crops: turning a burden into an opportunity.