

SOURCE OF POLLUTION

A long-term multi-metal contaminated site due to ancient (3000-200 B.C.) and more recent (1864-1982 A.D.) mining and metallurgical activities, primarily of Ag and Pb ores.



Lavreotiki, Greece

TRIAL CROPS



SORGHUM



HEMP



MISCANTHUS

TREATMENTS APPLIED

- Control
- Mycorrhizal fungi
- Fulvic/humic acids X mycorrhizal fungi

All three crops could tolerate elevated soil pollution to a certain extent. However, their growth and yields were smaller than usual.

SUMMARY

Hemp concentrated more Ni, Cu, Pb, and Sb in the aerial biomass, while sorghum concentrated more Cd and Zn.

Miscanthus concentrated the metals in the following order: Zn > Pb > Cu > Sb > Cd > Ni

For hemp, the higher yields were observed in the control plots, indicating that the applied treatments did not effectively impact this crop

RESULTS

For sorghum and miscanthus, the highest yields were measured in the plots treated with a combination of mycorrhiza and fulvic/humic acids

In the second year the yields were higher than in the first year

The yields did not differ significantly among treatments, apart from hemp in 2023



SOURCE OF POLLUTION

Lignite mining site of METE company, covering an area of 2.7km²



Kozani, Greece

TRIAL CROPS



SORGHUM



SWITCHGRASS



MISCANTHUS

TREATMENTS APPLIED

- Control
- Mycorrhizal fungi X protein hydrolysates
- Mycorrhizal fungi X fulvic/humic acids

RESULTS

The yields of the perennial grasses (switchgrass and miscanthus) were increased in the 2nd year compared to the establishment year (double for switchgrass and more than 4 times higher for miscanthus).

Not only the highest biomass yields were recorded in the plots received Mycorrhiza x protein hydrolysates but also the biomass collected from these plots had the highest Ni percentage.

Among the three under study lignocellulosic crops the highest Ni concentration was measured for switchgrass, followed by miscanthus and sorghum. The highest Ni uptake (Ni percentage X yields) was estimated for sorghum, followed by miscanthus and switchgrass.



SOURCE OF POLLUTION

An old metalliferous waste dump, created at end of the 19th century, were the wastes from a mining and metallurgy plant of Zn-Pb were deposited.



Silesia, Poland

TRIAL CROPS



SORGHUM



HEMP



MISCANTHUS

TREATMENTS APPLIED

- Control
- Fulvic/humic acids
- Fulvic/humic acids X mycorrhizal fungi

SUMMARY

In spite of high Zn, Pb and Cd concentrations in soil there was no sign of phytotoxicity

The highest Zn and Cd concentrations were found in sorghum, while hemp had highest Pb concentrations

In the second year lower metal concentrations were accumulated in plants

RESULTS

Sorghum was characterised by the highest biomass production followed by hemp and miscanthus

Biostimulant application increased yield of sorghum but not of other crops

Sorghum appears to be the most efficient in metal removing from the polluted soil



SOURCE OF POLLUTION

The Chiarini 2 site is located in the surroundings of Bologna (44° 50' N, 11° 28' E). It is part of a former **illegal landfill**, subject since the end of World War II to **dumping** and deposits of **waste of various origins** (war residues, stockpiles, artisanal waste, raw materials, industrial waste).



Bologna, Italy

TRIAL CROPS



SORGHUM



HEMP



MISCANTHUS

TREATMENTS APPLIED

Control and humic/fulvic acids x mycorrhizae are common to all crops, the third treatment is specific for each crop:

- Humic and fulvic acids for miscanthus
- Protein hydrolysates for hemp
- Protein hydrolysates x mycorrhizal for sorghum

SUMMARY

Cu (copper) and Zn (inc) were detected in the above-ground biomass of all the three crops.

In the second year lower concentrations and accumulations were detected

RESULTS

Treated plots produced higher yields than control ones in sorghum in both year

No treatment positive effect recorded for hemp

Treated plots produced higher yields than control ones starting from the second year in miscanthus



SOURCE OF POLLUTION

A site polluted by the past metallurgical activities of the lead and zinc smelter METALEUROP Nord (1894 to 2003). Contaminated mainly by Cd, Pb and Zn, covers an area of 120 km²



Lille, France

TRIAL CROPS



SORGHUM



HEMP

TREATMENTS APPLIED

- Control
- Fulvic/humic acids
- Fulvic/humic acids X mycorrhizal fungi

SUMMARY

These results demonstrate the potential of sorghum for Cd and Zn phytoextraction

The increment of biomass yields and shoot metal uptake in year 2 may be indicating an improvement in soil conditions with these phytomanagement practices

RESULTS

Sorghum showed significantly higher shoot concentrations of Cd and Zn, compared to hemp

The biomass yield of both sorghum and hemp in year 2 was higher than in year 1

The shoot uptake of Cd, Pb and Zn in year 2 was generally higher than in year 1

