

# Soil to Flax Trace Element Transfer from Different Contaminated Soils: A Three Year Study in Real Conditions

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## INTRODUCTION

Flax oilseeds are mainly cultivated to feed animals because of their high content in Omega 3 and 6. The trace-elements (TEs) coming from soil and transferred at different rates to plants, can enter the animal or human food chain but information concerning the total soil content of TEs is insufficient for alimentary risk assessment. Therefore TEs have to be studied by their speciation in different soil phases to determine their phytoavailability.

Our study focuses on essential micronutrients (Cu, Zn, Ni) and toxic elements (Pb and Cd). Distribution profiles for each of these elements give information about their soil mobility, behaviour at the soil/plant interface, and uptake by plants.

## METHODS

Two flax varieties were tested at four development stages, in two field situations. The first plot corresponded to normal agricultural practices in which sewage sludge was applied at an agronomic rate to a silty soil. The second plot (sandy soil) was irrigated with waste water over a long period, which led to high TEs contents.

Several techniques to characterize the TE concentrations were examined to evaluate the role of chemical speciation in controlling plant uptake as influenced by various soil physicochemical factors. TE concentrations of the different parts of plants show their uptake and their distribution from roots to seeds. Elemental contents were determined by GF-AAS. Lipids and proteins analysis, germination rates, cellular (MET) and organ (EELS) localisations were also carried out.

## RESULTS AND DISCUSSION

The results enable us to better understand the transfers of TEs from soil to flax. For both sites EDTA-extractable Cu is higher than EDTA-extractable Zn, and for the very high total concentration there is a linear correlation between EDTA and HF extractions (Fig. 1). The EDTA availability assessment is limited by total soil TE contents. The results demonstrate the importance of the particulate organic matter in the mobilization of metals in the soil. On the other hand, there is practically no correlation between the physicochemical characteristics of the soils and the availability of TEs.

We show also that the mobility sequences of TEs from soil to flax organs is verified for all the plots and the years of the studies (Fig. 2). The flax seeds have contents going from 0.25 to 0.46 mg Cd /kg dry tissues.

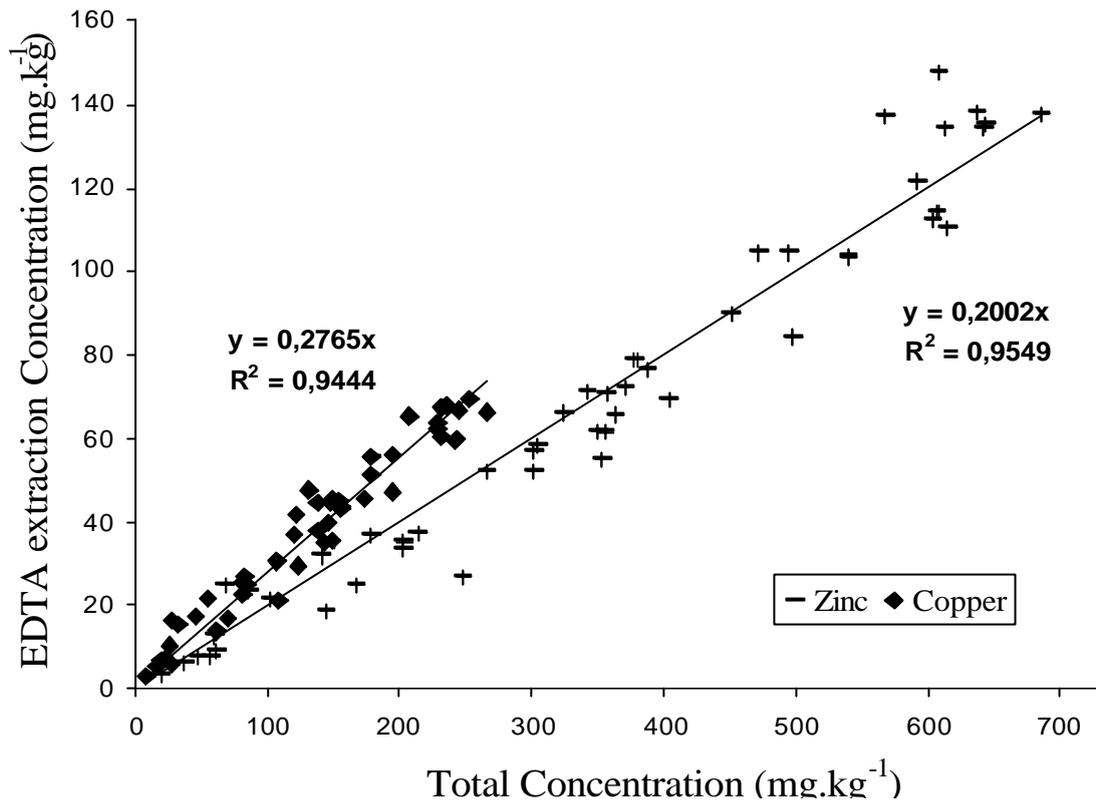


Fig. 1. Comparison of Total and EDTA-extractable contents in polluted soils. Exemple of Zn and Cu in Herblay plots. 2003 Experiments.

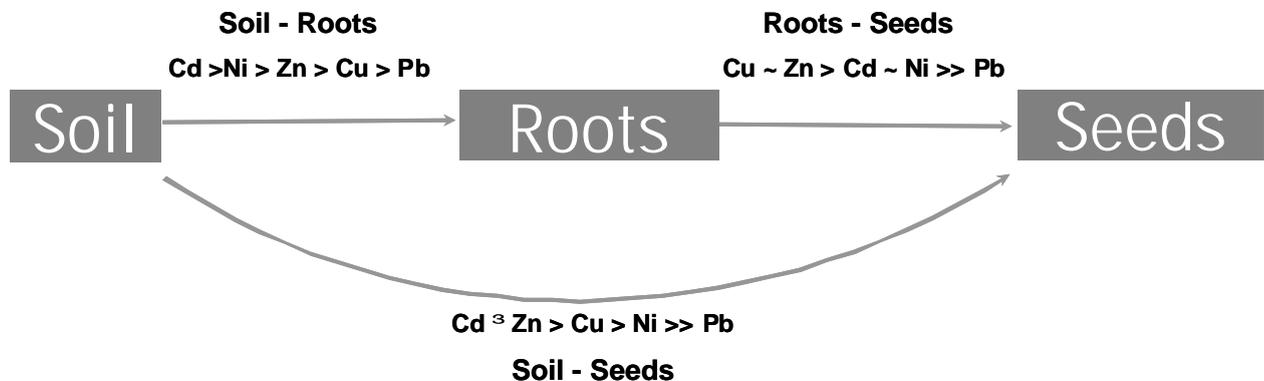


Fig. 2. Trace elements mobility sequences for flax organs. 2003 Experiments.

#### ACKNOWLEDGEMENTS

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