



## Chromium in soil: environmental issues

Sequi, P.; Ciavatta, C.\*

CRA-Experimental Institute for Plant Nutrition, via della Navicella 2/4, I-00184 Roma, Italy.  
E-mail: paolo.sequi@entecra.it

\*Department of Agro-Environmental Science & Technology, Alma Mater Studiorum  
University of Bologna, viale G. Fanin n. 40, I-40127 Bologna, Italy.

E-mail: claudio.ciavatta@unibo.it

Chromium (Cr) is a unique element in soil, because of (i) essentiality to human and animal life and non-essentiality for the vegetable kingdom and (ii) its possible presence in two main oxidation forms, trivalent (CrIII) and hexavalent (CrVI), which show opposite properties. The two forms have completely different effects on living organisms: the first (CrIII) is apparently useful or harmless at reasonable concentrations, while the second (CrVI) is extremely toxic. In addition, CrIII is not mobile in soil, therefore the risks of leaching are negligible, while CrVI, mainly present in the forms of chromates ( $\text{CrO}_4^{2-}$ ) and dichromates ( $\text{Cr}_2\text{O}_7^{2-}$ ), is generally mobile and often is part of crystalline minerals (ophiolites, serpentines).

Chromium-rich soils are common in many countries, where Cr minerals are diffuse and its content in natural soils (i.e. serpentine soils) may easily exceed 10,000 mg/kg. Conversion of CrIII to CrVI has been shown in some particular soils: rich in manganese (Mn) oxides, poor in organic matter and high redox potential. On the contrary, the reverse transformation of CrVI to CrIII is very common and easier, so that it is difficult to find hexavalent chromium forms in soil solution or in leaching waters.

Chromium shows a soil-plant transfer factor (F) ("F" indicates the amount of metals that passes from the soil to the plants) very low (normally less than 5), so that Cr belongs to the less mobile elements of the soil-system. The main barrier to the income of Cr in plants is represented by the roots. CrIII is fixed on the roots and the amount that cross the cellular wall is negligible.

The problem of Cr enrichment in soil has been often discussed not only in relation

to the discharge of tannery wastes, but also to the possibility of Cr presence in soil amendments, mainly organics, and to the existence of excellent organic fertilizers produced from leather residues or wastes.

Environmental or safety issues are often cited fearing the use of such fertilizers, generally without scientific support. As a matter of fact, the United States Environmental Protection Agency has withdrawn any limit to the presence of Cr in biosolids.

The main aim of this session is to discuss updated positions of this problem, gathering the contribution of scientists who have devoted their study to chromium in recent years.