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Soil quality — Determination of the effects of pollutants on soil flora — Leaf fatty acid composition of plants used to assess soil quality

Qualité du sol — Détermination des effets des polluants sur la flore du sol — Composition en acides gras foliaires des plantes utilisées pour évaluer la qualité du sol

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Foreword

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 4, *Biological characterization*.

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Introduction

Among the more than 150 ISO standards on soil quality that have been developed, less than 40 address living organisms, and among them only five address higher plants. This is despite the importance of monitoring the adverse effects of soil quality on living organisms.

One of these five standards addresses genotoxicity[1], and four of them address emergence and/or growth inhibition[2-5]. It therefore appears that these International Standards are focused either on a very specific effect (genotoxicity), or on effects great enough to induce developmental (and, therefore, visible) phenotypes (emergence or growth inhibition of young seedlings) in soils sampled in the field. Hence, more sensitive/earlier bio-indicators of the adverse effects of pollutants on plants, such as the "Omega-3 index", are needed.

The assessment of soil contaminant effects by the Omega-3 index is based on the leaf fatty acid composition of angiosperm species grown in sites of concern. The use of the Omega-3 index has proven to be appropriate for highlighting the presence of metallic and organic contaminants (herbicides, etc.) in the soils. With this aim, physical and chemical properties (pH, N/P/K content) of soils should also be determined because plant fatty acid composition may vary as a function of nutrient content[12] and pH may influence chemical compound bioavailability. It should be noted that this bio-indicator has proved to be more sensitive (i.e. responding to lower doses of contaminants) than the biometric parameters of rate of germination and biomass[6][14]. Hence, this makes it possible to gain evidence of adverse effects of soils on plants that could not be highlighted by the rate of germination or biomass. Additionally, for in situ assessment purposes, it can be difficult to observe evident effects on the rate of germination and/or biomass of plants.

It should be noted that from a practical point of view, especially with plant species harvested in the field, and in comparison with other bio-indicators, the Omega-3 index presents several advantages.

— For fatty acid analysis, only 20 mg to 50 mg of fresh leaf tissues per sample are needed. Hence, this is not destructive for plants, and there is not a problem with getting enough tissues of one species from a given area.

— Samples of plant tissues can be stored in methanol for several days at room temperature prior to analyses.

— It is not necessary to find a particular species at a site, and that a priori any species (often chosen among the most representative) can be sampled (Clause 6).

The results of a ring test performed by six individual laboratories to assess the reproducibility and the repeatability of the method are shown in Annex A. The results obtained by the same investigator with the same sample and the same measuring instrument over a short period of time are shown in Annex B.