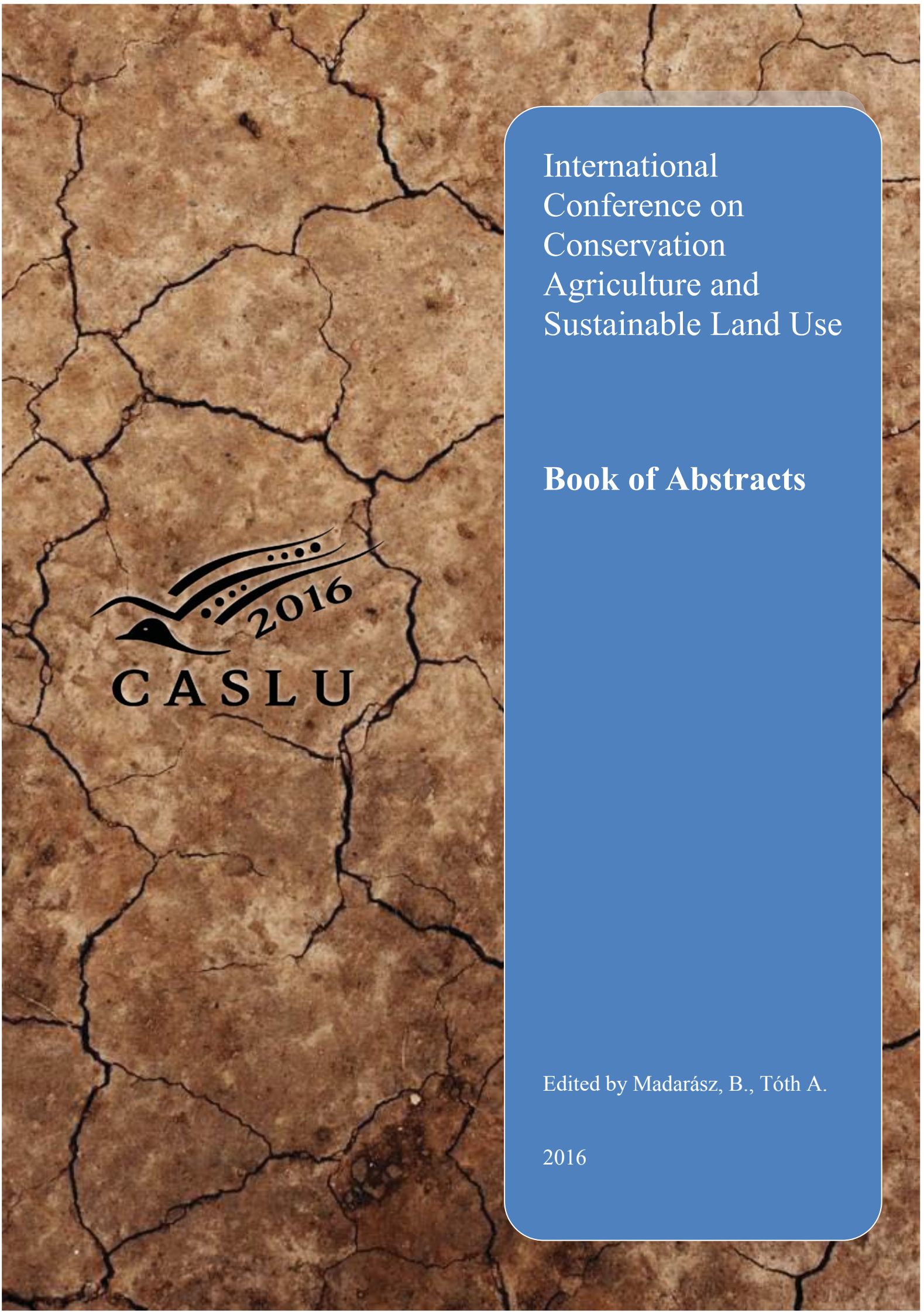

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Biochemical indexes of soil quality in olive and peach orchards managed in a sustainable way

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In the recent years, soils has been recognized to play a double role in the entire agro-ecosystem: it is important for a good production as well as for a healthy environment. In conventional agriculture, adopted by the majority of the farmers, frequent soil tillage strongly reduces the complexity and diversity of soil microbiota. For this reason, the conventional, non-sustainable, agronomic practices should evolve in a more sustainable management addressed to ameliorate the ecological networks and nutrient cycling in which soil microorganisms are involved. In this scenario, the selection of biological and biochemical indicators closely correlated with the total carbon (C) and/or total nitrogen (N) soil contents is of key importance for the quantification of soil quality and its resilience to stresses.

The main objective of this study was to analyze soil quality parameters in an olive and peach orchard, both managed under sustainable agricultural practices. In the olive orchard, plants were drip irrigated by urban wastewater, soil was not tilled and covered by spontaneous plants, and pruning material was used ad mulch. The peach orchard was managed according to EU Reg. 834/07 "Organic agriculture", including the use of compost and drip irrigation. Three soil sampling for biochemical analyses were performed during one year. For each orchard, two sampling areas were identified: row (under the emitters) and inter-row (rain-fed). The degree of soil quality has been expressed by the ratio Nc/Nk, where Nk is Kjeldahl total soil nitrogen, while Nc is a linear function of microbial biomass carbon and nitrogen mineralization capacity combined with three enzyme activities (phosphomonoesterase, β-glucosidase and urease).

The ratio Nc/Nk exhibited all the attributes of a good soil fertility indicator, showing significant differences in the different areas of each orchard (row and inter-row). Seasonal, inter-site and intra-site variation of Nc/Nk is discussed, with a particular emphasis on nitrogen soil dynamics (fixation, mineralization, immobilization, organication, nitrification and denitrification). Soil physicochemical parameters and the expression levels of some bacterial genes involved in nitrogen soil metabolism (nitrogenase, nif H; ammonia monooxygenase, amoA; nitrite reductase, nirK and nirS; and nitrous oxide reductase, nosZ) were also determined. Results revealed that sustainable soil management practices increased both soil quality and plant nutritional status.

The increase of knowledge on biochimical processes of the soil microrganism involved in C and N dynamics, that influence their availability for plants, will lead to optimize management strategies for a modern and multifunctional concept of agriculture, based on product quality, environmental protection, resource saving and promotion of human health.

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