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Editorial

Sustainable Agriculture and Soil Conservation II

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The use of sustainable soil conservation practices has become more and more widespread in recent decades due to the growing awareness that soil, a non-renewable resource delivering multiple ecosystem services, is increasingly being menaced by various processes, such as erosion, pollution, loss of organic matter, desertification, salinization, loss of biodiversity, and many others. The development of innovative and sustainable soil management practices, capable of improving soil quality and ensuring high crop yields at the same time, requires every effort by the scientific community to acquire new knowledge about the complex functioning of agroecosystems, and to transfer the acquired knowledge to technicians and farmers so that it can be applied in real field conditions. A decisive role is also played by governments, whose support is necessary to reach the objectives fixed by the European Green Deal and by the ambitious European mission "Caring for soil is caring for life" [1].

This Special Issue (SI), in continuity with the previous version [2], aims to collect innovative research in the field of sustainable agriculture and soil conservation, in order to implement the divulgation of basic knowledge in this study area and favor its application on a real scale. A summary of the articles published has been reported in the following section.

This SI collects seven original articles which focus on a number of key issues of sustainable and conservative agriculture, namely soil quality assessment, prevention of soil erosion, carbon sequestration, nutrient cycling, sustainability assessment, monitoring of soil organic and inorganic pollution, waste recover, and ecological engineering. Three papers are methodological works [3–5], while the remaining are case studies.

Stellacci et al. [3] contributed, with a methodological work, valuable information on the use of combined statistical approaches (including principal component analysis, PCA; stepwise discriminant analysis, SDA; and partial least squares regression with VIP statistics, PLSR) to identify the soil quality indicators most capable of discriminating between two different soil management strategies (minimum tillage vs. no tillage). This combined approach was applied to a multivariate dataset consisting of twenty chemical, physical, and biological indicators of soil, which were measured in a long-term field experiment with *Triticum durum* Desf. Their results revealed that the combined application of the three methodologies, compared with the use of each methodology taken singularly, allowed them to reduce the number of the selected variables, and modified their ranking. The variables best suited to discriminate between the two soil management systems were total and extractable organic carbon, Olsen phosphorus, water extractable nitrogen, relative field capacity, macroporosity, and air capacity. The methodology proposed in this paper was successful in summarizing the information of a multivariate dataset and improving the understanding of the system investigated.

Leone et al. [4] proposed a new method based on the combination of visible-near infrared (vis-NIR) reflectance spectroscopy and PLSR analysis to evaluate the extent of contamination by polychlorinated biphenyls (PCBs) in soil. This innovative methodology is rapid, cost effective, non-destructive, and not reagent consuming; therefore, its application

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for PCB-contaminated sites may be of great interest during the monitoring and remediation plans. Spectral measurements were performed on 28 soil samples collected in a highly contaminated area, previously characterized for several chemical parameters using conventional laboratory analyses. In more detail, 18 PCB congeners, their sum ($PCBs_{18}$), and extractable organic halogen content (EOX) were determined. The PLSR analysis, adopted to calibrate their method, revealed significant relationships between the predicted and the measured values of $PCBs_{18}$, EOX, and the percentage of several PCB classes. The methodology proposed by these authors may be promising in predicting PCB contamination in soil; although, a larger number of samples is required to validate this method.

Jiang et al. [5] proposed an original methodological work, based on the development of a 3D model to evaluate the capability of living stumps in enhancing the stability of slopes and preventing landslides. Planting living tree stumps can be a valid and sustainable alternative to the common engineering practices, which are often inadequate to prevent the deep landslides. Through the use of embedded beam elements, their model-simulated elm tree roots consisted of one taproot and six lateral roots. Six rows of model roots were arranged in the model slope, and each row was made up of three roots. Different taproot lengths and distinct stress and strain conditions of the soil were also simulated. The strength reduction method was used to calculate the safety factor of the slope. Results revealed that long taproots increase the stability of the slope. The taproots in the middle and lower parts of the slope were determined to be the most effective in exerting the tensile strength and anchoring the soil; thus, planting living stumps in the middle and lower parts of the slope is highly recommended in the context of ecological engineering.

Domínguez-Haydar et al. [6] contributed to this Special Issue with a study on the effect of the ant species *Pheidole fallax* on the restoration of soil quality in a coal mine located in Colombia, after 16 and 20 years of rehabilitation. Soil sampling was performed both at the nest site and at the external refuse pile, as well as in a control area not occupied by nests. Soil samples were analyzed for their main chemical properties and using near-infrared spectroscopy (NIRS). Samples collected after 20 years of rehabilitation presented a higher content of organic debris compared to samples collected after 16 years. Chemical analyses revealed no significant difference between the nest soil and control soil, whereas significant differences existed between these two soils and refuse pile soil after 20 years of restoration. The NIRS analysis allowed these authors to distinguish the three types of soil. Nest volume was estimated, and the nest inner structure was investigated in order to assess the potential implications of these formations on the soil hydrological properties. The results revealed that ant activity plays a key role in the reestablishment of ecological and hydrological soil processes.

The paper presented by Jez et al. [7] evaluated the effect of the soil management system (conventional vs. organic) on copper (Cu) bioavailability and mobility in vineyard soils under climate change-induced stresses. The aim was to verify whether the organic management was more resilient to temperature and moisture stresses in comparison with conventional management. Namely, several soil chemical properties, including Cu speciation, bioavailability, and leaching, were monitored on an acid and on a calcareous vineyard soil, conventionally or organically managed, after 6 months of exposure to temperature or moisture stress, or to the combination of both stresses. The temperature stress reduced the amount of organic carbon, and dissolved both organic carbon and available ammonium, while it increased the levels of nitrate. Conversely, the moisture stress tended to mitigate some of these changes. Despite these findings, the results revealed no significant influence of the soil management system (conventional vs. organic) on the Cu mobility and bioavailability under climate change conditions.

Sosulski et al. [8] monitored CO_2-C emissions in a long-term field experiment with *Secale cereale* L. comparing two different fertilization strategies: (i) mineral fertilization with N, P, K, and Ca; and (ii) fertilization with cattle manure and Ca. The authors hypothesized that sandy soils have a low C storage potential; thus, organic C added into the soil may increase CO_2-C emissions into the atmosphere. Results revealed that fertilization with manure doubled the soil organic C content but reduced the grain yield by approximately 20%, compared to the mineral fertilized treatment. Obviously, CO_2-C emissions in the manure fertilized soil were higher than in the mineral fertilized soil, but the overall C balance was positive; indeed C stored in the soil doubled in only two years of experimentation. The study revealed the importance of monitoring CO_2-C emissions during soil manuring and considering the possibility of alternating organic and mineral fertilization to avoid plant yield reductions.

Petkova and Shilev [9] performed a metagenomic study to evaluate the fungal diversity during the thermophilic and mesophilic phases of sewage sludge composting. Understanding the interactions between microorganisms during composting and the composition of microbial populations can be of great importance to improve the biotransformation process and, consequently, to obtain compost of better quality. This is necessary, especially when sewage sludge is used as starting material, due to the low-quality characteristics of this matrix. To uncover the fungal diversity, a metagenomic approach and next-generation Illumina HiSeq2000 were adopted. Results revealed that a higher microbial activity characterized the thermophilic phase, whereas a higher fungal diversity characterized the mesophilic phase. At the genus level, *Psathyrella*, *Chaetomidium*, *Mortierella*, and *Cheilymenia* represented 85% of the mesophilic fungi, while *Mortierella* and *Thielavia* represented 78% of the thermophilic fungi, respectively.

The scientific papers presented in this SI contribute to improve the basic and applied knowledge in the field of sustainable agriculture and soil conservation, also highlighting the interconnections between soil conservation practices and climate change. Several of these contributions also provide innovative methodologies that can be easily transferred to real-life contexts and are useful for the investigation of complex sites interested by different soil management systems, soil pollution, or deep erosion processes.

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