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Soil Quality Assessment after 25 Years of Sewage Sludge vs. Mineral Fertilization in a Calcareous Soil

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This study identified the most sensitive soil quality indicators to assess soil quality in the framework of a long-term application of sewage sludge (SS) and conventional mineral fertilization for rainfed cereal production in a sub-humid Mediterranean calcareous soil. The SS treatments (at different doses and frequencies) were compared with a mineral fertilization (MF) treatment and with a control treatment (no fertilization). Twenty-five years after the onset of the experiment, 37 pre-selected soil physical, chemical and biological parameters were measured, and a minimum data set was determined. The indicators significantly affected by treatment and depth were selected as sensitive.

A principal component analysis (PCA) was performed for each studied depth. At 0-15 cm, three factors (F1, F2 and F3) and at 15-30 cm, two factors (F4 and F5) were identified and explained 71.5% and 67.4% of the variation, respectively, in the soil parameters. The most sensitive indicators were related to nutrients (P and N), organic matter, and trace elements (F1 and F4), microporosity (F2), earthworms' activity (F3), and exchangeable cations (F5). Only F3 correlated significantly (and negatively) with yield. This study demonstrated soil quality can be affected in opposite directions by SS application, and that a holistic approach is needed to better assess soil functioning under SS fertilization in this type of agrosystems.