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Biodynamic management practices improve soil structural and functional diversity of vineyard soils in central Italy

R. Marabottini¹, S.R. Stazi¹, M.C. Moscatelli¹, R. Papp¹, K. Carbone²
¹University of Tuscia, Italy, ²Fruit Tree Research Centre, Italy

In recent years, the biodynamic viticulture has received increasing attention. In addition to the common tools of organic agriculture, it makes use of specialized preparations in compost and in field sprays, which are added in very low doses to the composting organic material. Biodynamic preparations are supposed to stimulate the processes of nutrient cycling and energy flow, hasten decomposition and improve soil and crop quality, without adding nutrients.

The present study aimed to compare soil quality in biodynamically and conventionally managed vineyards. In both management systems, the cultivated varieties were: Passerina del Frusinate (*Vitis vinifera*, L.; white grapes), and Cesanese del Piglio (*Vitis vinifera*, L.; red grapes). Biodynamic vines (seven years old converted) were Demeter certified.

Soils were sampled at Piglio (FR; (41°49'0" N latitude - 13°07'60" E longitude)) on March 2013 at 0-20 cm depth in triplicate. Total organic C, total N, pH, inorganic N (NO₃ and NH₄), soluble P, microbial biomass C and N, basal respiration, eight enzyme activities, ester linked fatty acids profiles (EL-FAME), CLPP-MicroResp were determined. Shannon diversity index (H') was calculated using enzyme activities, MicroResp and EL-FAME data.

All chemical and biochemical indicators determined were significantly and positively influenced by the biodynamic treatment, some of these effects being more evident for white wine variety than for red wine variety (TOC, NH₄, H' for enzymes).

In particular, biodynamic management improved soil organic matter in terms of total C and N, reduced nitrates and soluble phosphorus, increased microbial biomass content both as bacteria and fungi. Enzyme activities, microbial basal respiration and CLPP-MicroResp were increased indicating higher metabolic activities and capabilities to use different soil C sources, even the most recalcitrant ones (phenolics). EL-FAME data reported higher content of protozoa, a decreased ratio of Gram+ to Gram- bacteria and reduced stress indices (S/M and cy/pre) which indicate equilibrium conditions for soil microorganisms under biodynamic treatment.

Keywords: stress indices, biodynamic management, soil quality, soil microorganisms