



Impact of tillage and fertilization practices on enzymatic activities in soil particle-size fractions

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Soil enzymes have been suggested as early and sensitive indicators of soil ecological stress and restoration because of their rapid response to changes in soil management and environmental factors. In a long-term field experiment near Ancona (Marche, Italy), started in 1994, a rotation between *Triticum durum* and *Zea mais* crops was chosen as a representative site in the national project SOILSINK, to compare no tillage vs. conventional tillage at two N fertilization levels. In June 2007, 12 samples were collected (2 tillage practices x 2 fertilization levels x 3 replicates) on maize soil. Bulk soil samples were fractionated into four particle-size fractions (coarse and fine sand, silt and clay) by a combination of wet-sieving and centrifugation, after low-energy ultrasonication. All fractions were assayed for β -cellobiohydrolase, N-acetyl- β -glucosaminidase, β -glucosidase, α -glucosidase and β -xylosidase, acid phosphatase, arylsulphatase and leucine-aminopeptidase using a microplate fluorimetric assay based on MUB-substrates. Microbial biomass C, total organic carbon and total nitrogen were also determined on the soil fractions. Enzymes were mainly located in the sand fractions, whereas microbial biomass was highest in the silt fraction, which accounted for 55% of the bulk soil. Microbial biomass and soil enzyme activities in particle-size fractions were affected mostly by the type of tillage and to a lesser extent by fertilization. Enzymatic activities discriminated between the two tillage levels in the coarse and fine sand and in the clay fractions. No tillage on average doubled soil

enzymatic activities with respect to conventional tillage. This effect was larger in the coarse sand fraction where an increase of 293% on average was observed. The enzymes more responsive to tillage practices were those related to the C cycle.