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Effect of aggregation on soil organic carbon content for different aggregate size fractions of cultivated sandy soil

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Different inputs of mineral and organic fertilizers are mainly responsible for increasing yield of crop coupled with an increase in the amount of crop residues. Transformation of the crop residues into soil organic C is an important factor improving soil fertility and aggregation. Apart from long-term organic matter influence, aggregation is also promoted by soil bacterial and fungal biomass. These effects on soil aggregation in relation to soil organic C content have not yet been well investigated. We studied the long-term effects of 20-years application of mineral and organic fertilizers in an intensive horticultural crop rotation. Treatments: without fertilization or manuring (control soil), nitrogen applied by mineral fertilizer (N), and manure with low or high application rates (M and 2M). The short-term effect on soil aggregation was simulated by addition of K-polyacrylate to the soil and incubation for 2 weeks.

Long-term fertilization led to increase of soil organic C content by (42-73) %. This corresponded to the highest portion of small macroaggregates (1-0.25 mm) instead of large macroaggregates (1-2 mm) in fertilized soil compared to control soil. On contrary, K-polyacrylate induced short-term aggregation, appreciably (14-18%) improved large macroaggregates proportion of soils independent on fertilization. Long-term fertilization accelerated the rate of soil organic C (SOC) decomposition in the initial days of laboratory incubation. The CO2 emission rate became almost static for all soils after 21 days of incubation. Cumulative CO2 efflux was high (4.2-5.2% of SOC after 80 days of incubation). Short-term aggregation by K-polyacrylate slowed down the rate of mineralization of labile pools of SOC and allowed greater protection of SOC against decomposition.