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Effects of Manure Quality and Application Forms on Soil C and N Turnover in a Subtropical Mountain Oasis — A Laboratory Simulation of Agricultural Practices

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Abstract

Our knowledge of the agricultural sustainability of the millennia old mountain oasis in northern Oman is restricted in particular with respect to C and N turnover. For this reason, a laboratory study was conducted to analyse the effects of rewetting and drying on microbial biomass and activity after adding organic fertilisers, to investigate the effects of a local practice where organic fertilisers are initially mulched and later incorporated into the soil, and to evaluate the relationships between C and N mineralisation rates and quality indices for different age types of manure. During the first 9 d “mulch” period, the content of extractable organic C decreased by approximately 40 % in all 4 treatments. During the second 9 d “incorporation” period, this fraction decreased insignificantly in the NIL and old manure treatment and by a further 10 % in the young manure and faeces treatment. The NIL and the old manure treatment form the first pair with a low percentage (0.3 % in 18 d) of organic C evolved as CO₂ and a considerable percentage of total N mineralised as NH₄ and NO₃ (1 % in 18 d), the young manure and faeces treatment form the second pair with a high amount (0.5 % in 18 d) of organic C evolved as CO₂ and no net N mineralisation. During the first 9 d period, the microbial biomass C content increased by approximately 150 % in all 4 treatments. During the second 9 d period after incorporation of the organic fertilisers, no further increase was observed in the NIL and young manure treatments and a roughly 30 % increase in the other two treatments.

Keywords: CO₂ evolution, drying and rewetting, microbial biomass, N^o=mineralisation, substrate quality