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Soil fertilization with composted solid waste: short term effects on lettuce production and mineral N availability

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Composting of the solid waste organic fraction would be a possible solution to the long-standing rubbish problem, limiting the amount of waste going to final disposal. Furthermore is well recognized the key-role of composted organic matter in increasing soil fertility, porosity, structural stability, moisture and nutrient availability, biological activity and root aeration. The positive effects of compost addiction on soil organic matter (SOM) humification have also been proved in different agricultural systems; it could be particularly useful in Mediterranean areas, where the degradation of SOM is accelerated by the alternance of dry-warm and humid-temperate seasons and by the high intensity and frequency of soil tillage in horticultural soils. Nevertheless the effects of compost addiction on N availability for crops are contrasting in relation to the pedo-climatic conditions.

The present work focuses on the effects of compost fertilization on soil N kinetics and on lettuce N uptake and yield. An open-field experiment was carried out in a farm in Caivano municipality (40°56'N, 14°19'E), 12 km far from Naples City, to compare the following treatments: not fertilized control (NF), mineral fertilization (MF), compost fertilization with 10 (CF10), 30 (CF30) and 60 (CF60) Mg ha^{-1} of compost from solid urban wastes. Two cultivars of iceberg lettuce (*L. sativa* var. *capitata* L.) were used, 'Audran' in the 1^{st} growth cycle and 'Sagess' in the 2^{nd} one, suitable to summer and winter cropping periods respectively. Compost fertilization was performed only before the 1^{st} cycle, while mineral fertilization with 84 kg ha^{-1} of N (ammonium nitrate) was carried out at transplant of both lettuce cycles.

The experimental design was a randomized block with 3 replicates and all the data were subjected to ANOVA, using the MSTAT-C software (Crop and Soil Science Department, Michigan State University, Version 2.0). Mean separation was made by using LSD test.

MF, CF30 and CF60 gained the highest total yield in both the growth cycles. On the average lettuce yield was lower in the winter cycle as a consequence of lower SOM mineralization and of nitrate leaching from the root layer during the rainy season. Obviously yield reduction in the winter cycle was pronounced in not fertilized plots (-40%), while it was slighter for CF60 (-16%). This difference was probably due to the mineral N release from compost between the two growth seasons, getting to the highest nitrate content in topsoil layer (0-20 cm) at the 2^{nd} lettuce transplanting (65 mg kg^{-1} and 25 mg kg^{-1} for CF60 and NF respectively).

The nitrate content of lettuce leaves, on a fresh weight basis, was much lower than 466/01 European Directive threshold (493 mg kg^{-1} on the average *vs* 4500 mg kg^{-1}) in both growing cycles, confirming the low nitrate accumulation rate in the Mediterranean area. N budget, calculated as the difference between N supplies and N uptake in the two growth seasons, showed a significantly higher value in CF60 (153 kg N ha^{-1}) and a strong N deficit in NF and CF10, whereas a balanced budget (not different from 0 kg ha^{-1}) was measured in MF and CF30.

The results achieved in the present study demonstrated the compost ability to sustain lettuce N requirements in coarse textured soils, and highlighted the need to balance the compost doses according to N requirement of cropping systems thus reducing N surplus and nitrate pollution hazard. A better understanding of N mineralization patterns of composted manures in different soils could be the best way to reach this goal.