

Digestate, Cover crop and different soil tillage management: preliminary results on soil fertility and on maize (*Zea mays* L.) crop

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Excessive industrialization in agriculture, with high mineral fertilizer use and intensive soil tillage, reduces soil fertility and crop production. Conventional tillage determines heavy soil disturbance up to 0–25 cm depth. In contrast, no-till and minimum tillage practices, based on minimal soil disturbance, improve soil quality by preserving structure, supporting biological processes and increasing microbial biodiversity. [1]. Alternative agronomical practices are needed to minimize negative impacts while maintaining yields.

This study compared the effects of different tillage practices on soil health and maize cultivated for biomass production. Part of a long-term experiment started in 2017 at Fondazione per l'Agricoltura F.lli Navarra (Ferrara, Italy), it includes sustainable practices like digestate application and cover crops. The treatments were: Conventional tillage (CT), Minimum tillage (MT), Long-term no-tillage (ONT, 7 years), Newly implemented no-tillage (NNT, started in 2023). Each treatment was replicated three times in a completely randomized block design. The current data reported is part of the DICO_SOS project (Digestate, Cover Crops and Crop Operations to Increase Soil Organic Matter; Req. no. 5517300; PSR 2014-2020 Reg. Emilia Romagna — 16.1.01 — Focus Area 4B). Soil quality has been assessed, focusing on biochemical properties. Results highlighted that soil biochemical properties varied with soil management practices: MT and ONT showed higher microbial respiration rates than NNT and CT; NNT showed higher soil microbial biomass (SMB) and soil enzyme activities data. Reduced soil disturbance, the use of digestate and crop residues, likely increased available organic matter for decomposition, thereby boosting SMB and altering its activity [2]. Regarding the maize crop, the highest values of maize biomass was observed in CT, even if the biomass production observed in MT resulted like CT (-8%). Although the maize seed germination resulted negatively affected in both no tillage treatments (ONT and NNT), in these plots, maize plants showed higher values of ear weight and length. Preliminary results suggest that conventional agricultural techniques, while increasing production, tend to degrade soil quality. Further research is needed to close the yield gap in maize biomass production.

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[2] Sekaran, U., Sagar, K. L., Denardin, L. G. D. O., Singh, J., Singh, N., Abagandura, G. O., ... & Martins, A. P. (2020). Responses of soil biochemical properties and microbial community structure to short and long-term no-till systems. *European Journal of Soil Science*, 71(6), 1018-1033.