THEME 2

The LIFE CarbOnFarm project

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INTRODUCTION

Environmental Targets

The environmental issues of LIFE CarbOnFarm focus on the pressing problems and proposals indicated in EC reports included in the Soil Thematic Strategy (e.g. *The State of Soils in Europe; Soil organic matter management across the EU*) (http://ec.europa.eu/environment/soil/three_en.htm):

- progressive decline of SOM quantity and quality in European agricultural soils;
- intense deterioration of soil fertility and crop productivity;
- increase of soil Green Houses Gases emissions;
- raising of energetic and economic inputs.

Project strategies

❖ strengthen the agricultural valorization of available biomasses:
- Piemonte: compost from the solid residues of the anaerobic digestion of cattle slurries
- Campania: development of *on-farm* compost systems (Fig. 1) tailored on local assets (manure compost or green compost);

❖ soil amendment with high quality compost from agricultural biomasses (Fig.2);

❖ five different farming sites in Piemonte and Campania regions, with different soil types, reproducing typical cropping systems (maize, horticultural crops, orchards).

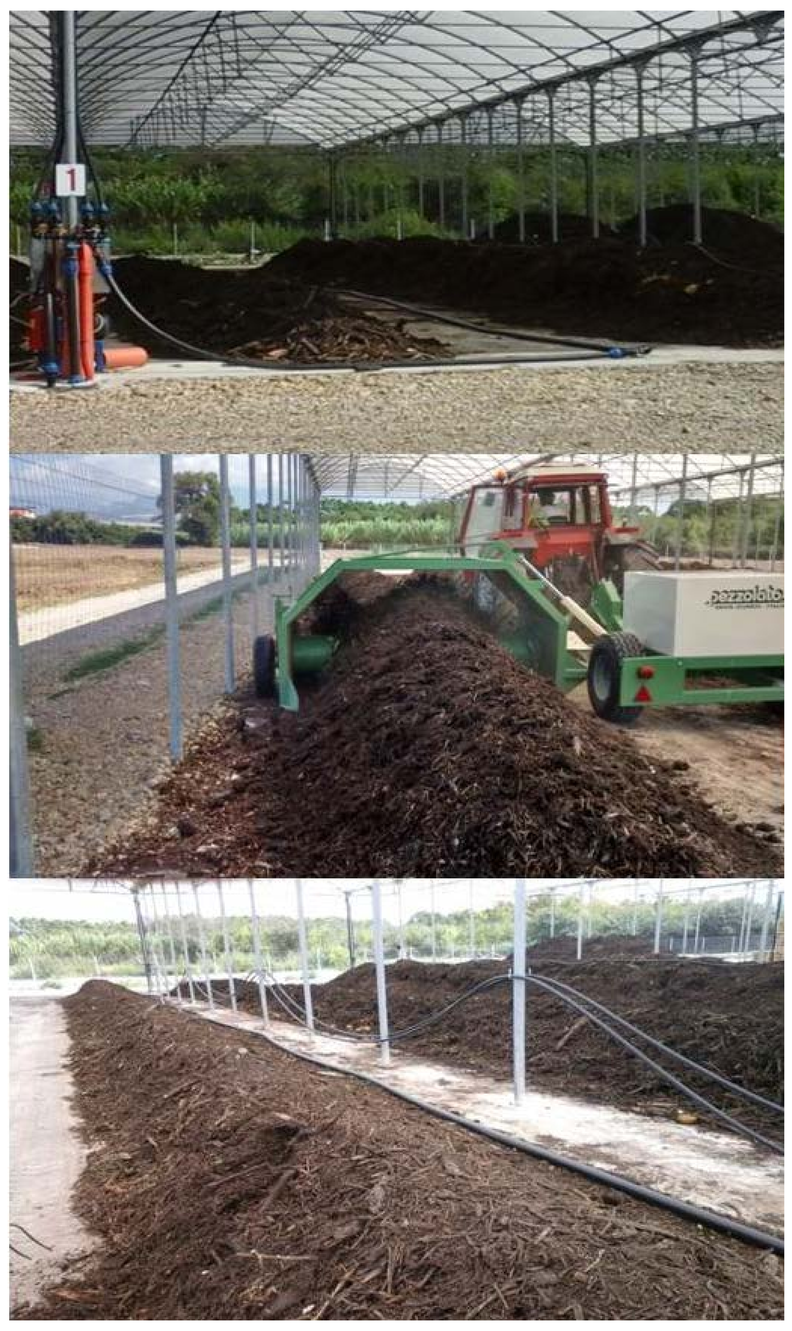


Fig. 1: On farm composting facility attained in CarbOnFarm project- 4000 m2 -12 composting lines -2000/4000 tons green compost year^{-1}

Fig. 2: Distribution of *on-farm* green compost on peach orchard

OBJECTIVES

- promote the long term SOC sequestration;
- restoration/maintenance of soil functions and fertility;
- economical & environmental valorization of local agricultural biomasses and by-products;
- improvement of crop yields with lower energetic inputs;
- reduce soil GHG emissions;
- rising awareness of sustainable SOM managements practices.

Monitoring actions

- compost quality;
- SOC stabilization (TOC, molecular composition and dynamics), physical and biological soil fertility;
- agronomical correspondence of proposed strategies;
- composts and field GHG emissions (Fig. 3);
- environmental and economical sustainability of proposed strategies.

Fig. 3: GHG field sampling system

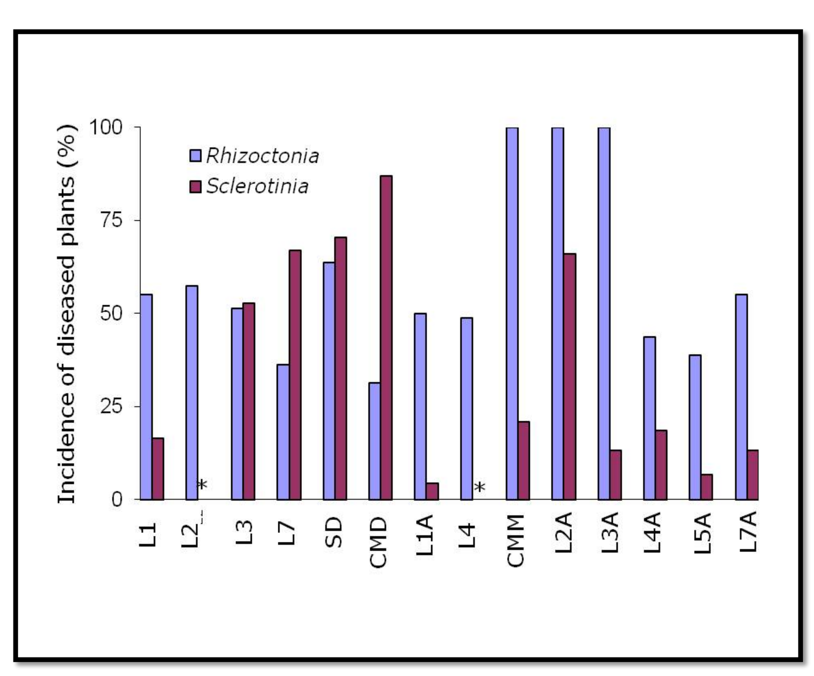
MAIN RESULTS

Intermediate findings

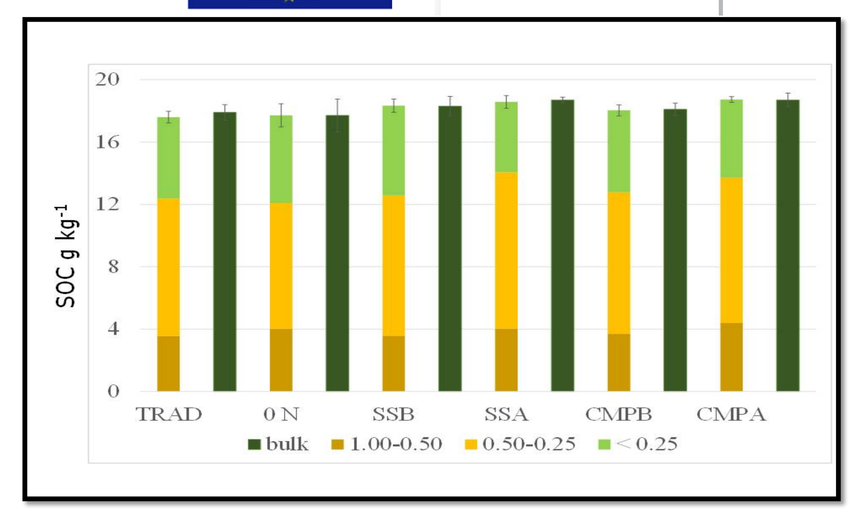
<u>*Compost*</u>: the characterization and biological assays revealed the attainment of humified mature composts with a significant suppressive, and biochemical stimulation activity (Graph 1). The LCA support the energetic and economical sustainability of composting process.

<u>*SOC*</u>: after two year of SOM managements the average improvement of SOC content found in both bulk soils and size-aggregates ranged from 0.4 to 2.0 g kg-1, depending on soil type (Graph 2). The molecular characterization showed an overall increase in the yields of both stable hydrophobic aliphatic and lignin components derived from added OM (Graph 3).

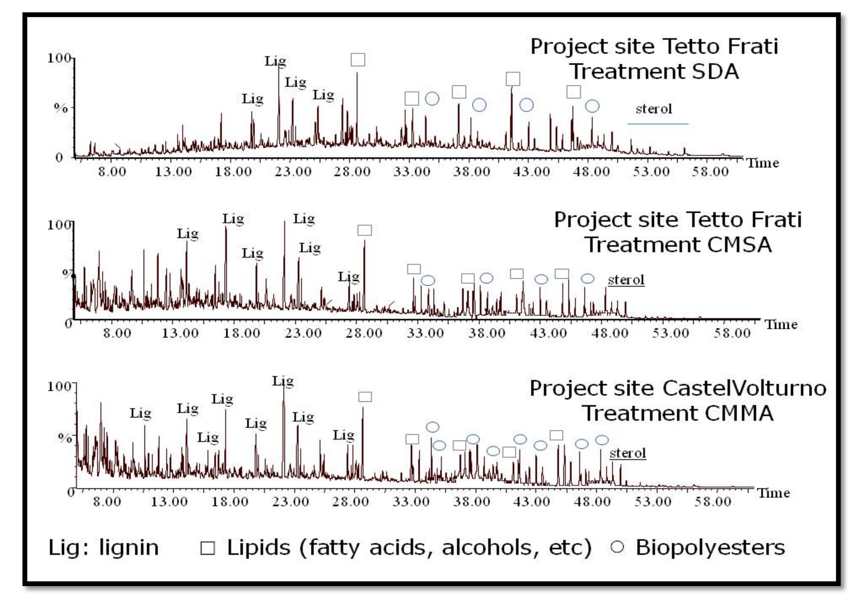
<u>*GHG emissions*</u>: laboratory incubation on sandy and silty soils (Graph 1), highlighted the decrease of GHG emission of all composts in respect to either fresh OM inputs and mineral fertilizers (e.g. urea). The slight larger field CO2 emissions found from compost treatments in bare soils, were nullified by the values found during the crop cycles.



Graph 1: Suppressive capacity of CarbOnFarm composts: **L** on farm green composts; **SD** fresh digestate; **CMD** composted digestate; **CMM** on farm manure compost (* ND)



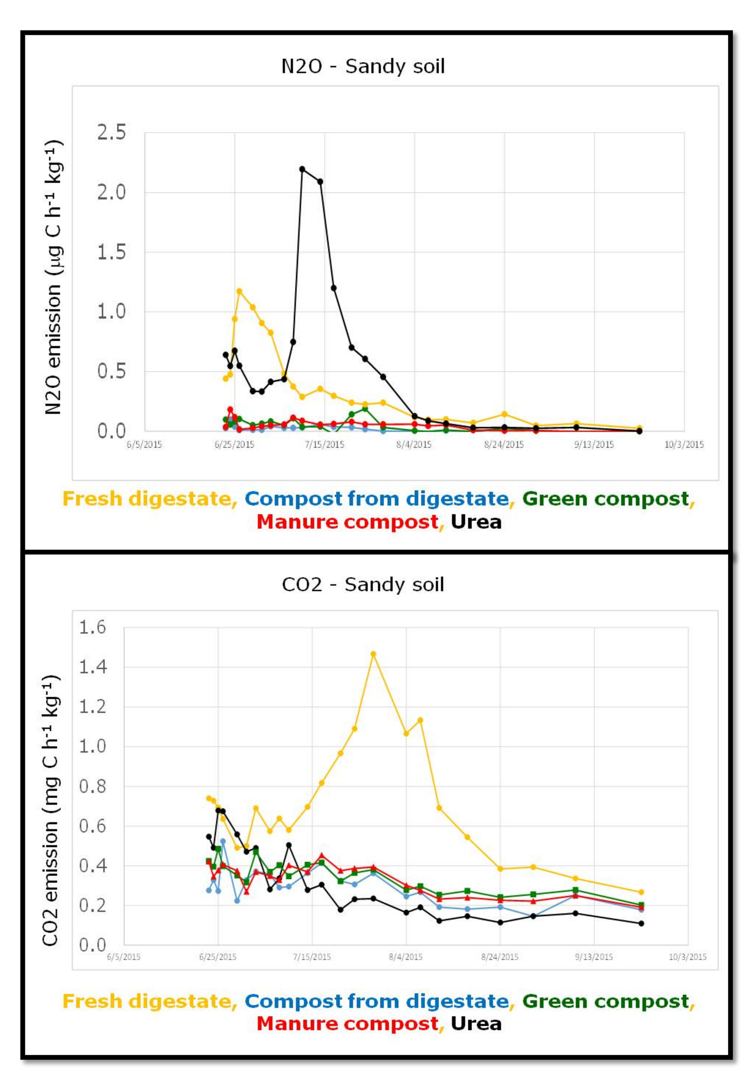
Graph 2: SOC distribution in bulk soil and size aggregates (mm) on Grandi farm project site. Soil treatments: Trad mineral fertilizers; 0N: no nitrogen; SDB/SDA: fresh digestate 1/ 2 Mg C ha^{-1}; CMDB/CMDA compost from digestate 1/ 2 Mg C ha^{-1}



Graph 3: Molecular characterization of SOM by thermochemolysis-GC-MS. Soil treatments **SDA:** fresh digestate (2 Mg C ha^{-1}); **CMDA** compost from digestate (2 Mg C ha^{-1}); **CMMA**: on-farm manure compost (4 Mg C ha^{-1})

CONCLUSION

The soil treatment with humified composts from agricultural biomasses produced the incorporation of stable exogenous OM components. After two year of SOM management, positive effect were noticed on SOC distribution, biological activity, GHG emission and crop productivity, thereby further supporting the role of mature compost as viable way to meet the requirements of sustainable development in agro-ecosystems while linking SOC management, valorization of organic biomasses and maintenance of crop yields.



Graph 4 (a+b): Laboratory measurements of GHG emissions form organic matrices