

Annex 2. EJP SOIL call topics

Topic: Sustainable production (SP)

SP2 - The use, processing and application of external sources of organic matter to mitigate climate change and improve soil health

Rationale/Specific challenge: Encouraging the recycling of organic wastes into renewable fertilizers or amendments and promotion of shorter value chains and circular (bio)-economy to improve soil health is a priority in the EU agenda (Farm to Fork Strategy, Green Deal, Mission Board for Soil Health and Food, Horizon Europe). The Green Deal increased Europe's ambitions regarding climate change mitigation with an objective of zero net GHG emissions by 2050 (European Commission, 2019)¹. There will be the need to use the full potential of European Soils for mitigation and adaptation strategies, in particular by increasing the soil organic carbon pool in agricultural soils by implementing sustainable soils management practices (Montanarella and Panagos, 2021)¹. Adding external sources of organic matter to soils as fertilizers or amendments is a sustainable management option (FAO, 2017)². Adding manures and composts has been considered in several previous EU projects as part of soil improving cropping systems and best management practices. An increasing diversity of new organic resources are becoming available for farmers (biochars, digestates, human wastes derived fertilizers) besides more traditional ones (composts, manures). Yet, these resources remain insufficiently studied in terms of SOC storing capacities, GHG balance, improvement of the capacity of soils to infiltrate and retain water, fertilizing values and nutrient losses and environmental safety due to the potential presence of contaminants. More generally, the characterization of organic wastes is insufficiently developed to guide their use for selected objectives such as climate change mitigation. This lack of knowledge hinders the optimal integration of organic wastes in farming systems for climate change mitigation and sustainable production. Increasing organic waste valorization under a circular approach brings also new questions at the territory level, as related to the organizational links between arable crops and animal farming, urban and rural areas, agriculture and waste recycling sectors.

Scope: The aim is to gain knowledge on the use, processing and application of external sources of organic matter to mitigate climate change while maintaining sustainable production and improving soil health. The project will address following research questions:

- What is the impact of resource quality of the range of potential external organic matter sources on SOC storage and stabilization?
- What is the impact of climatic conditions, soil characteristics and initial soil organic matter contents (pedo-climatic zones) on the expected life time of organic C additions across soils?
- What - if any - restrictions apply to the amount of exogenous organic matter that can be added safely (no loss of soil quality) and effectively in terms of climate

¹ European Commission,, 2019. The European Green Deal COM/2019/640 final.

² FAO, 2017. Voluntary Guidelines for Sustainable Soil Management.

change mitigation (*net* gain of SOM and *net* reduction of GHG emissions without trade-offs)?

- What are preferred management options in terms of how and when to amend exogenous organic matter considering soil depth, ploughing, fertilization, irrigation, and accounting for approved standards for safe and effective use of organic amendments?
- What processing options before returning organic matter to soils are available and effective to enhance formation of stable organic matter in soils as compared to direct return and how can technologies be evaluated? The project should determine what is the C budget and the impact on GHGs and nutrient release during processing and storage and after soil application. Potential trade-offs and thresholds between short-term nutrient release and long-term C sequestration should be analyzed.

The project should carry a synthesis of existing knowledge, integrate information from on-going experiments (including EJP SOIL long-term experiments) and perform targeted new studies on the short- and long-term effects of organic resources for different pedo-climatic conditions and cropping systems. The knowledge gained will be used to refine existing decision support tools for selecting suitable and cost-efficient strategies at the territorial level to make the best use of the local organic resources accounting for agro-pedo-climatic characteristics, crop and farming systems, organic resource availability, production and transport costs. The aim is to include in such decision support systems several criteria and soil functions (carbon sequestration and GHGs emission, nutrient cycling, soil structure, soil biodiversity) and to lead to recommendations of standards for safe and effective use of organic resources that allow for climate change mitigation (targeting farmers and also the waste recycling sector).

Expected outcomes:

- Improvement of knowledge of the capacity of traditional and new external organic resources to mitigate climate change, while maintaining sustainable production and soil health.
- Better capacity (knowledge and proposed tools) to make the best use of local organic resources, considering the advantages/ drawbacks of processing options before adding the organic resources to soil and considering organic resource availability at the territory scale.

Expected impacts:

- EJP SOIL EI1: Fostering understanding of soil management and its influence on climate mitigation and adaptation, sustainable agricultural production and environment.
- EJP SOIL EI2: Understanding how soil carbon sequestration can contribute to climate change mitigation at regional level including accounting for carbon.
- EJP SOIL EI6: Developing region-specific fertilization practices considering the local soil, water and pedo-climatic conditions.

Project Type: Medium size research project (up to 2M€).