Organic residues engineering to increase organic matter in agricultural soils

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Motivation

In the European Union, 970 Tg of soil is lost annually [1]. Despite the policy interventions, such as the “Common Agricultural Policy” and “Soil Thematic Strategy”, soil erosion rates are 1.4 higher than soil formation rates [1, 2]. One of the most important driving factors of soil erosion is organic matter decline [3]. Ironically, only about one third of the total bio-waste is used to replenish the organic carbon losses [3]. By using organic residues engineering, we could use these residues to produce organic amendments (OA) to improve specific soil functions according the requirements of each specific case.

Technological challenge

Most of OA research and production has been done using an empirical/experimental point of view. The research focused on chemical composition by studying transitional pools and their stability, liability among other chemical characteristics. New insights on OA engineering are required to increase its efficacy, efficiency and effectivity. For example, assessing the fate of OA organic matter in soils will most likely enable the identification of key organic compounds that affect soil properties. OA composition might be modulated considering ecological stoichiometry principles to influence soil microbial activity. In this way, we may induce specific pathways of organic matter formation thereby increasing soil organic matter and associated soil properties.

The main technological challenges will be to:

1. Assess the influence of engineered OAs on soil properties.
2. Identify potential improvements for the design of OAs.
3. Modify operational parameters or/and system configurations to produce the designed OAs.
4. Identify strategies that involve engineered OAs to steer specific groups of microorganisms. This will be done by applying ecological stoichiometry principles towards the production of compounds leading to stable organic matter formation.

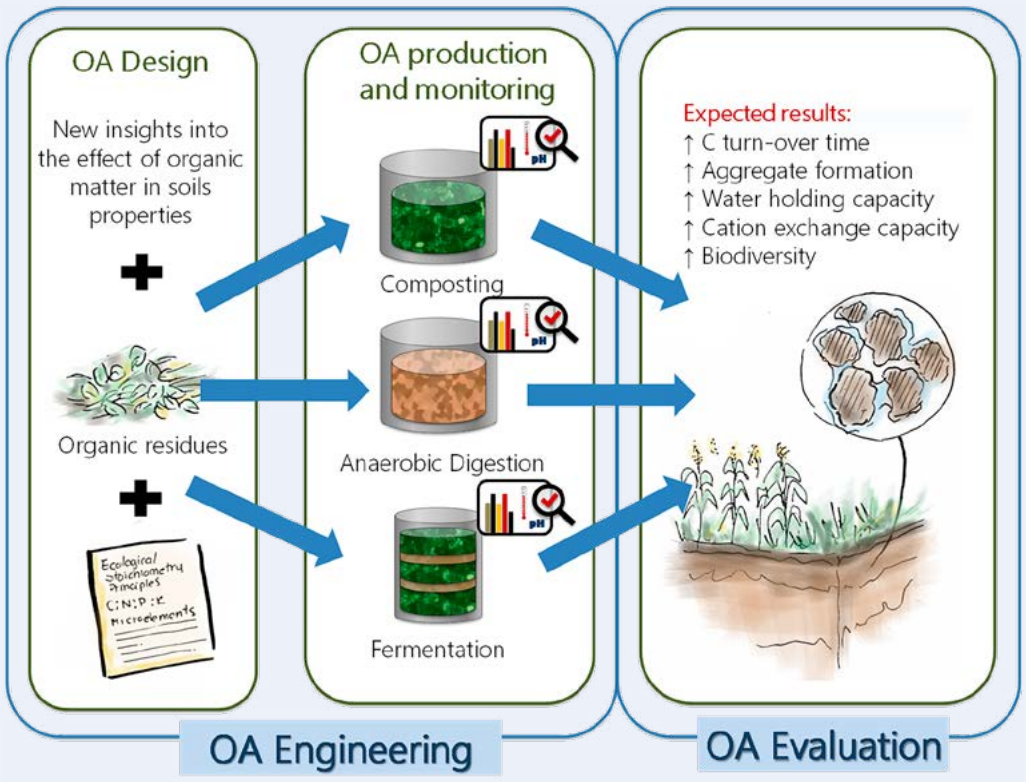

Fig.1 Research graphical abstract. Changes in engineered organic amendments (OAs) will be evaluated by monitoring specific soil properties.

Research goals

The research (Fig 1) will focus on engineering of OAs to increase the formation of stable soil organic matter improving associated soil functions. The OAs will be produced by using three technologies i.e. composting, fermentation and digestion. Specific objectives of this project are:

- Study how different technologies affect the physicochemical characteristics of the OAs.
- Study the relationship between physicochemical characteristics of OAs and its effect on specific soil properties and carbon pools.
- Identify key physicochemical characteristics of OAs that influence conversion of organic matter pools and its relation to soil properties.

[1] Panagos, P., & Borrelli, P. (2017). Soil erosion in Europe: Current status, challenges and future developments | EU Science Hub. Retrieved January 15, 2019
[2] Verheijen, F. G. A., Jones, R. J. A., Rickson, R. J., & Smith, C. J. (2009). Tolerable versus actual soil erosion rates in Europe. Earth-Science Reviews, (94), 23–38.
[3] Middleton, N., & Thomas, D. S. G. (1997). World Atlas of Desertification. United Nations Environment Programme (UNEP) - University of Sheffield, UK (Vol. 2).

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