UNIVERSITÀ DEGLI STUDI DELLA TUSCIA | DIPARTIMENTO DI SCIENZE AGRARIE E FORESTALI

Dottorato di Ricerca in Scienze delle Produzioni Vegetali e Animali
PhD Programme in Plant and Animal Science
Codice del Corso di dottorato/PhD code: DOT1335834
Coordinatore/Coordinator: Prof. Roberta BERNINI

Piano di attività/Activity plan

Data/Date **15/01/2024**

Ciclo/Cycle **39° Ciclo**

Dottorando/PhD student **Nolfi Lorenzo**

Posizione/Position

X Con borsa di studio/With scholarship

☐ Senza borsa di studio/Without scholarship

☐ Riservata a dipendenti di enti di ricerca/Reserved for research center employees

☐ Dottorato industriale/Industrial PhD

☐ Altra tipologia/Other typology

Tutor/Supervisor

Prof. Roberta Benini/Dr. Annamaria Bevivino

Affiliazione/Affiliation

Dipartimento di DAFNE - Dipartimento di Scienze Agrarie e Forestali, Università degli Studi della TUSCIA/ Dipartimento di Sostenibilità, Divisione Biotecnologie e Agroindustria, ENEA (Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile), Roma (Italia)

Co-Tutor

Dr. Luciana Di Gregorio

Affiliazione/Affiliation

Dipartimento di Sostenibilità, Divisione Biotecnologie e Agroindustria, ENEA (Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile), Roma (Italia)

Sede prevalente dell'attività di ricerca/ Main place of research

ENEA (Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile), Roma (Italia)

Titolo dell'attività di ricerca/Research title

Assessment of Interactions among Climate Change, Biodiversity, and Food Security: Climate Change Mitigation through Utilization of Organic Fertilizers from Food Industry Residues within a Circular Bioeconomy Approach

Breve descrizione dell'attività di ricerca/Short description of the research activity

(Max 10.000 caratteri, spazi inclusi/Max 10000 characters, included spaces)

The research activity focuses on the investigation of relationship between climate change, biodiversity, and food security and mitigation of climate change using organic fertilizers from food industry waste according to a circular bioeconomy approach. On one hand, it involves analysing and aligning data related to climate change (CC), biodiversity (BD), and food security (FS) with EU policies. On the other hand, it employs organic fertilizers derived from food industry residues within a circular bioeconomy framework. This approach aims to reduce waste, promote the reuse of by-products, and minimize the environmental impact of production activities.

In the first year of the Ph.D. program, the research will focus on connecting data with the CAP (Common Agricultural Policy), Green Deal, and other key European policies related to CC, BD, and FS, identifying the most suitable knowledge synthesis method(s) to best link data and knowledge with policy needs and predicted outcomes. By examining the most important European policy documents on climate change, biodiversity, and food security, the research aims to highlight the essential elements of regulations, directives, legislative proposals, and communications. It analyses the gaps and connections with data to provide tools for improvement towards a sustainable transition resilient to climate change and biodiversity loss. Furthermore, with the aim to apply circular bioeconomy approaches to improve soil health across Europe, the research aims at mapping food processing residues at Italian level. This will serve as a foundation for understanding the current state of food processing residues, including production, recycling, and reuse technologies and practices, to establish a baseline

scenario for future recycling potential. By-products of the food industry are valuable raw material, containing ingredients like nutrients, minerals, and trace elements. Impure fractions often end up as fertilisers. Selected residue streams could be used as soil improvers as organic matter rich soil amendments (e.g., digestate after anaerobic digestion), with their characterization being carried out in accordance with standard procedures and considering international certifications. The research activity will be focused on molecular analysis of raw waste and end products of different (soil improvers) to evaluate the ability of environmental technologies to inactivate relevant biological hazards through analysis and monitoring in raw wastes and end products (soil improvers) of intrinsic indicator microorganisms. Due to the difference in matrix composition (different soil improvers/raw wastes), the DNA extraction will be tested and optimized, to have a reliable yield in terms of quantity and quality of DNA extracted. These preliminary activities will permit to define some Standard Operational Procedures (SOPs) to extract microbial DNA from these matrices. In the second year, the research will focus on metagenomic shotgun sequencing and bioinformatic analysis of representative samples of wastes and end products to determine the occurrence of some hazards; i.e., the presence of microbial pathogens (intrinsic indicators) and antibiotic resistance genes that could be spread into the soil. Also, phytotoxicity bioassays (seed germination tests) will be performed in order to evaluate environmental risks and potential toxicity of soil improvers before they are applied to agricultural soils. In the third year of the PhD program, the research will evaluate the stability and biosafety of the soil improvers by the analysis of the products following soil incubations in mesocosms under different conditions of temperature and moisture to define the correct method to maintain stabilised formulations. The identification of driving factors governing soil health will permit to determine a set of standardised effective soil indicators, adaptable to different soils and environments.

Attività formative/Training activities

Attività programmate dal Collegio dei Docenti

Firma (Tutor)/Signature (Supervisor)

Firma del Dottorando/Signature (PhD student)