Title of Proposal Sustainable water reuse practices improving safety in agriculture, food and environment
Acronym: SAFE

SAFE will promote positive and practical valorization of reclaimed urban wastewater as a valuable alternative source for agricultural purposes. SAFE will provide a multi-beneficial approach with novel, unconventional and environmental decentralized wastewater solution that will be respectful of environment and biodiversity of the agro-system. SAFE will optimize the proposed water reuse strategies, ensuring their safety (both for environment and human health), their sustainability, adaptation to water scarcity, local conditions, and farms necessities, boosting the local economy.

Main specific objectives are:

- Development, test and validation of novel low cost and low energy urban decentralized wastewater treatments aimed at enhanced renewable water supply.
- Evaluation of wastewater treatments impact in plants/crops performance using modern -omics tools.
- Evaluation of local biodiversity and co-benefits.
- Promotion of environment respectful practices like pest management by biofertilizers such as Trichoderma sp., including knowledge transfer for their practical implementation.
- Safety evaluation related to the proposed approaches, including monitoring of emerging pollutants, in water, soil and produced crops.
- Development of general management models able to simulate local and decentralized agro-ecological practices in several scenarios.
- Optimization of implemented approach in terms of techno-economic analysis, environmental impact and local feasibility.
- Local promotion of the proposed solutions both in terms of farmers' acceptability and valorization of their economic value.

SAFE advanced and sustainable wastewater treatment strategies include the use of natural solutions such as constructed wetlands (UM), high rate anaerobic bioreactors (IRSA-CNR), adsorption on natural-based materials (UNIBAS), local biochar (CERTE, FSS) and pillared clays with organic and/or mineral compounds (UDL). Reuse will be ensured by a complete effluent characterization before and after any considered treatment including any parameters required by the present legislation for water reuse and even assessing emerging pollutants (UM, ICRA, CERTE), pathogens (UNIBAS, SAPIENZA, UDL). The reaction path of target compounds in the irrigation system water-soil-plant (CERTE) will be followed at macroscopic scale, focusing mainly on salt, nutrients and biodiversity evolution. In this context, SAFE partners will perform identification of genes and molecular markers (ELGO – Dimitra) linked to yield and boundary condition (such as drought or salt abiotic stresses) and promoting root branching and increasing shoot biomass by Trichoderma species (UNIBAS). An integrated water balance supported by techno-economic analysis (UNIBAS, SAPIENZA), and specific characterization of the soil (UNIBAS) will allow the optimization of the irrigation and storage strategies for the target sites (IVA Rabat). Modeling and following optimization by mean of modern tools (SAPIENZA) will conduct to the choice of the best approach suitable to be implemented. Collected data will provide a validation in a real environment of the developed SAFE methodology as a general tool suitable to be applied in other Mediterranean areas where water scarcity and climatic conditions play a strong role for agriculture practice. Environmental and human health risk assessment (ICRA) of irrigation practices will be performed based on the characterization of water (IVA Rabat), soils, and plants (tomatoes, oregano, and lettuce as reference) and tested on site (Tunisia, France, Greece and Algeria).

Multi-disciplinarity of SAFE partners gives an holistic approach (knowledge advancement and know-how transfer of innovative treatments developed, tested and on site validated) able to provide integrated procedures to increase crop yields and farmers' incomes.

The new farming system will consider the impact of proposed new practices on biodiversity and whole ecosystem (water, energy, soil fertility, crop yields).

List of participants

Participant No.	PI name	Organisation	Country
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4 Partner 3	Afroditi Tsampalla	Hellenic Agricultural Organization Institute of Plant Breeding and Genetic Resources (ELGO)	Greece
5 Partner 4	Gianluigi Buttiglieri	The Catalan Institute for Water Research (ICRA)	Spain
6 Partner 5	Serge Chiron	Université de Montpellier (UM)	France
7 Partner 6	Ali Hammani	Institut Agronomique et Vétérinaire Hassan II (IAV Rabat)	Morocco
8 Partner 7	Samia Khadhar	Water Researches and Technologies Center (CERTE)	Tunisia
9 Partner 8	Amin Nehme	Lebanese Development Network (LDN)	Lebanon
10 Partner 9	Safia Taleb	Université Djillali Liabes (UDL)	Algeria
11 Partner 10	Sourour Chaabane Elaoud	Faculté des Sciences de Sfax (FSS)	Tunisia
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