

Multifunctional Nanofibrous Systems to Control and Reduce Environmental Impacts in Agriculture

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TERRE



SISTEMI MULTIFUNZIONALI NANOFIBROSI PER CONTROLLARE E RIDURRE GLI IMPATTI AMBIENTALI NEI SISTEMI AGRICOLI



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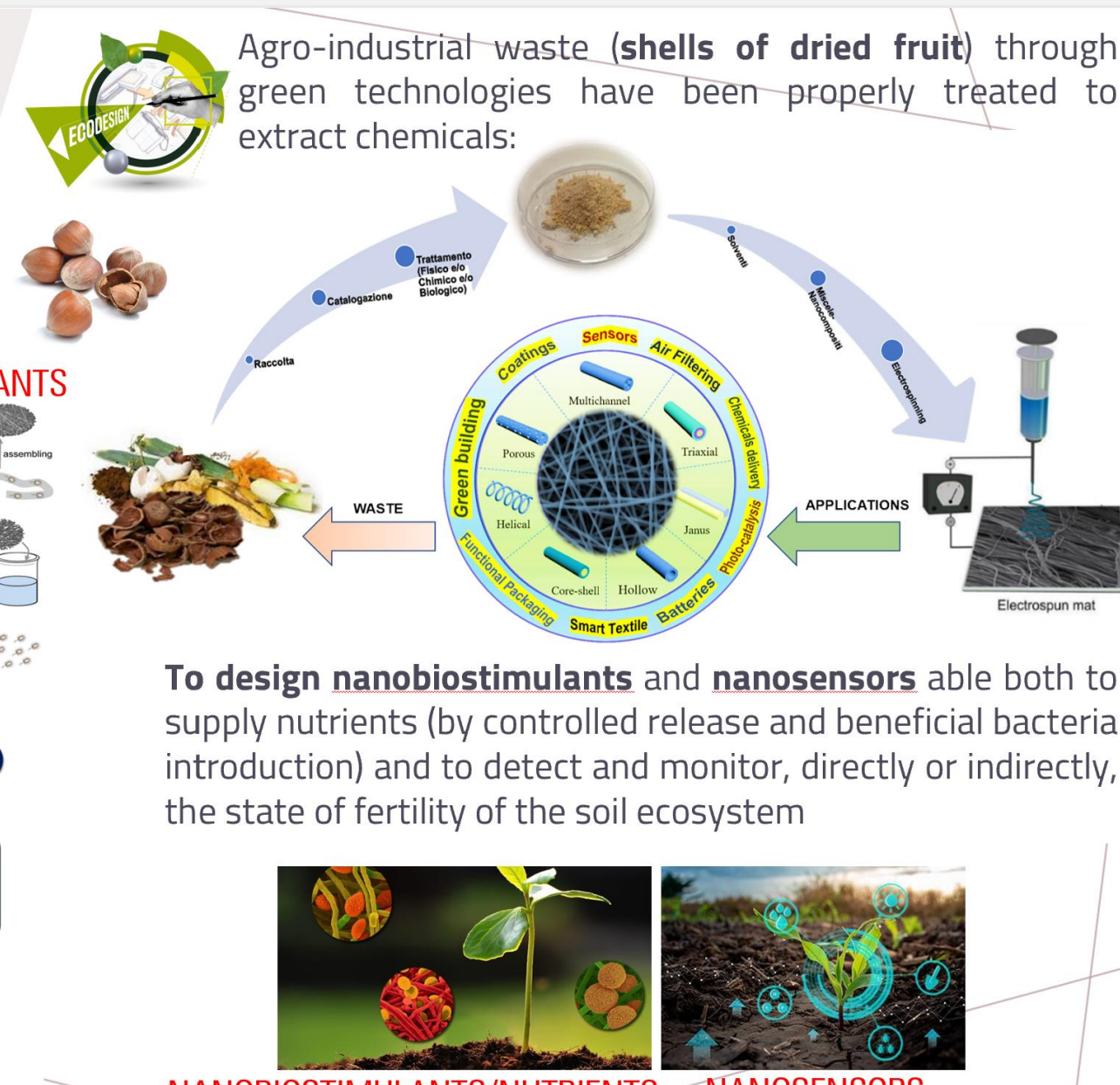
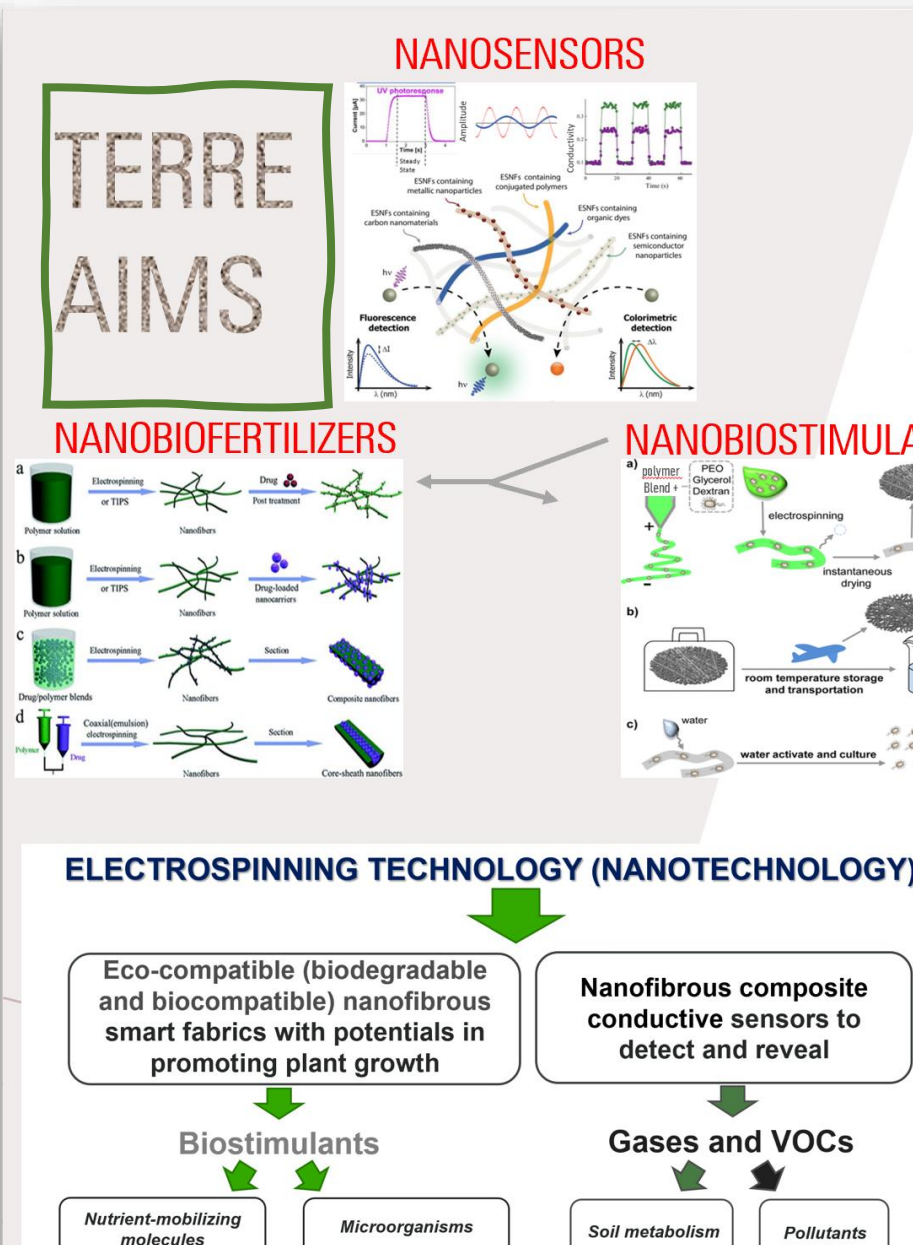
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TERRE AIMS

TERRE proposes innovative strategies to improve the technological infrastructure of agricultural practices, combining the development of new **nano-structured intelligent materials** acting as **biostimulants** of plant growth, with that of new **sensors**, both based on, with the aim of maintaining the competitiveness of crops and farms, while improving the protection of natural resources and preserving the soil ecosystem.

...by a multifunctional bioinspired model implemented with **polymeric electrospinning technology** to obtain versatile and modular nano-fibrous devices in a plethora of architectures (*gauze, fabrics, nets, pots*) and chemical combinations for applications in agricultural systems...

...falling within the mechanisms of a model inspired by nature and the principles of **circular economy** (a waste-to-wealth approach, where all products are reused, as in nature, in a circular model of waste valorization)

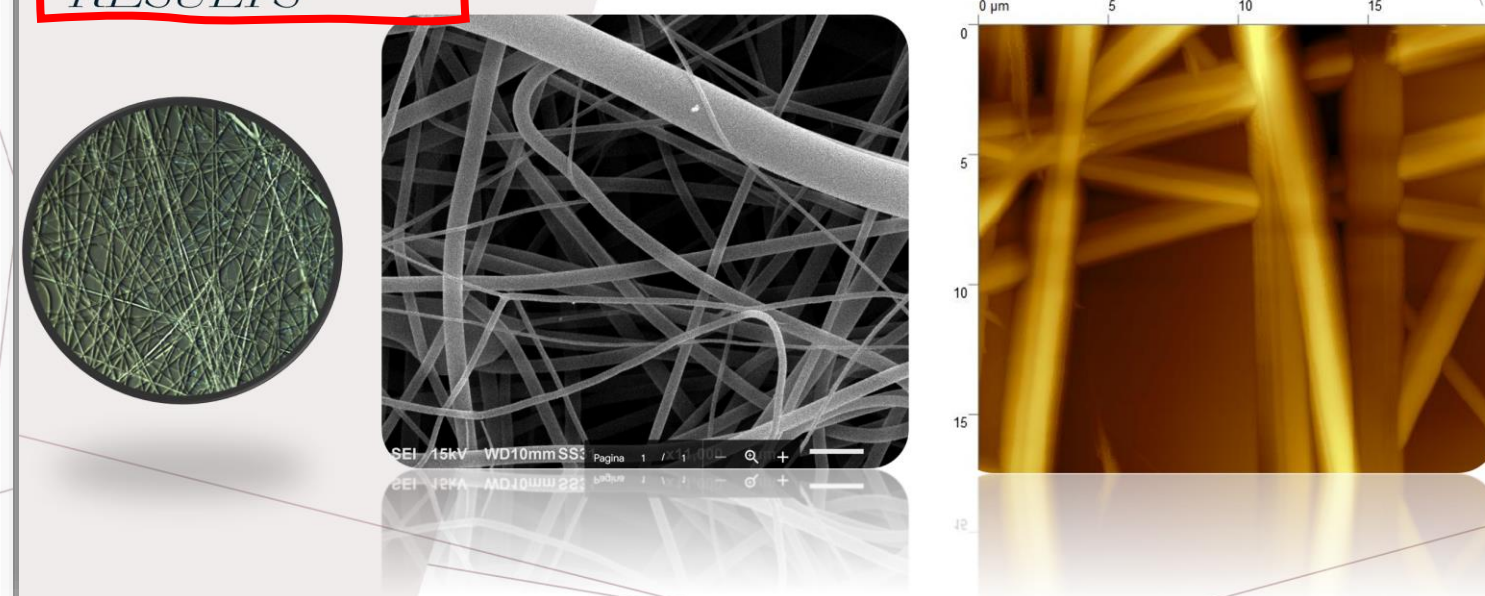


TERRE ACTIVITIES: NANOMATERIALS

The use of nanomaterials together with the flexibility of ES technology, that is capable of generating a multiplicity of 2D / 3D shapes and architectures, with varying degrees of porosity and specific surface, will allow the creation of a wide variety of NF systems for various agriculture application needs (e.g. to support nutrition, to combat damage or diseases from harmful organisms, to monitor the healthy status).



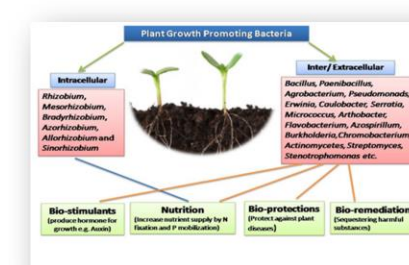
NANOFIBERS LIGNIN BASED: PRELIMINARY RESULTS



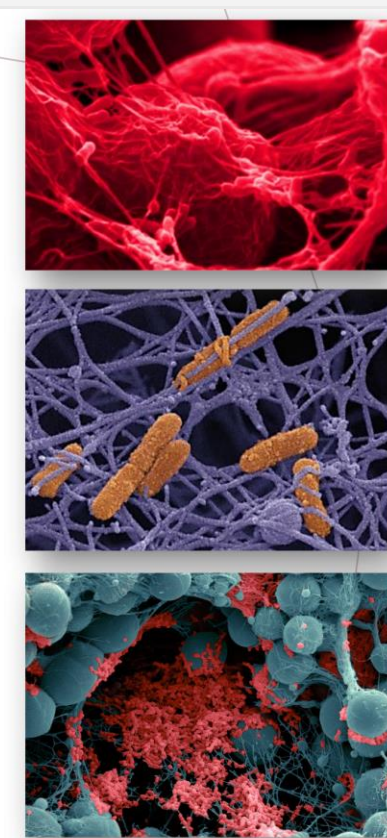
BIOPOLYMER-BASED NANOFIBERS: PRELIMINARY RESULTS FOR HOSTING MICROORGANISMS

the soil ecosystem surrounding the roots where plant, microbes and soil particles mutually interact (advantages or disadvantages) as an "interacting trinity" in:

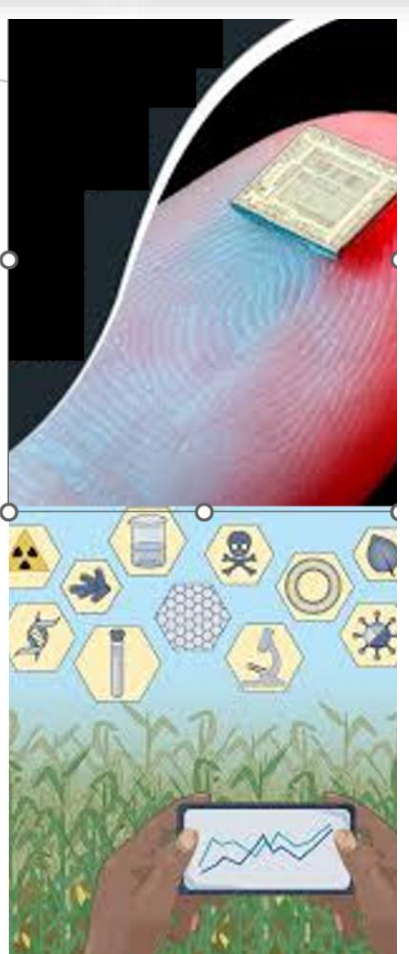
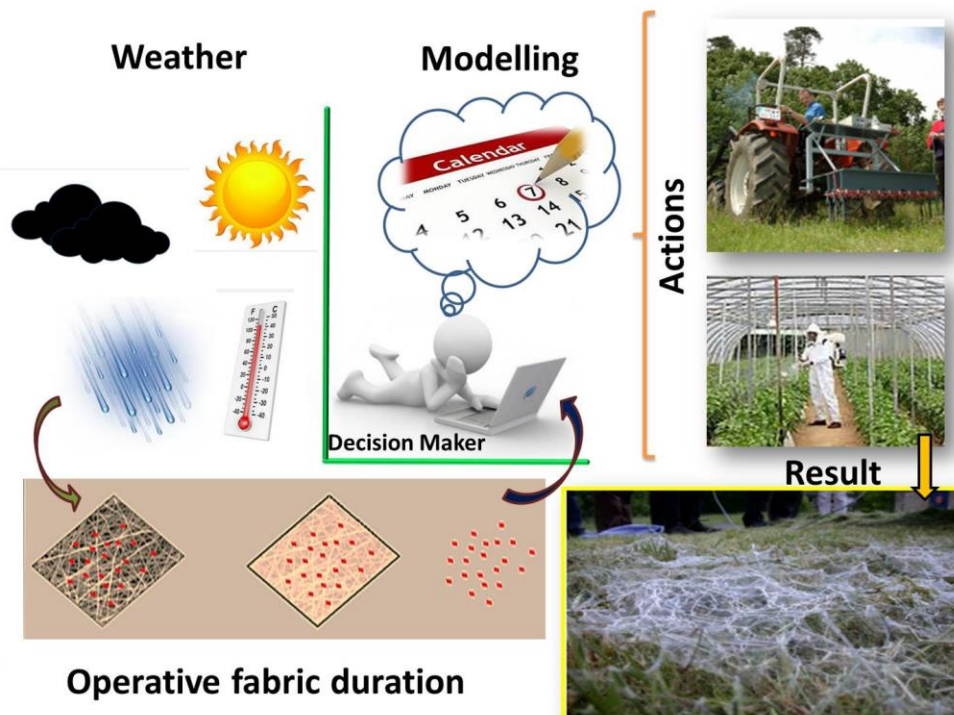
- nutrition,
- growth promotion
- defense.



A strategy model for improving crop yield using beneficial microorganism strains and biodegradable nanofibrous scaffoldings



NANOFIBROUS BIOPOLYMERS TOWARDS MULTIFUNCTIONAL SYSTEMS



You can preserve soil ecosystem through nanomaterials and nanotechnologies contributing to the transformation of actual agricultural systems towards more sustainable and competitive managements

CONCLUSIONS AND PERSPECTIVES

Electrospinning has been confirmed to be an attractive and suitable technology able to fit circular economy strategies, where natural derivatives can be easily redesigned, modulated and properly functionalized towards smart tools for agriculture

Electrospinning technology can be thought as a significant promoter of a new green revolution with reduced farming risks, low costs and smart managing

Economic and environmental impacts: more efficient practices, agrochemicals and products based on natural agents able to reduce the environmental impacts of agricultural systems, but preserve their competitiveness in crop productivity.

Coupling nano(bio)fertilizers and the nanosensors products: an integrated system capable of releasing nutrients in soil and detecting and monitoring the presence of excessive nutrients in soil ecosystems, to reduce further fertilizations and prevent the possible contamination of natural resources.

Environmental Science: Nano, 2019, 2020, COVERS (De Cesare et al.); Cover Competition Runner up – Materials Today (2016) (De Cesare et al.)

The application of such bioactive products in agriculture (but also in nurseries and gardening) could be powerful in improving crop production and consequently contributing in fulfilling the demand by human populations for healthy and safe foods and environment preservation.