

XIII Giornate Scientifiche della Società di Ortoflorofrutticoltura Italiana Catania 22-23 giugno 2021 Sustainable substrates for agriculture from dredged remediated marine sediments: from ports to pots (LIFE 17 ENV/IT/000347)

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### **Introduction and Objectives**

Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Sediments are dredged annually from harbors and waterways for ensuring proper and safe navigability, preventing flooding and reducing the pollution load of water bodies. In fact, sediments are a sink of inorganic and organic pollutants directly released into waters or reaching water-bodies trough leaching and leakage. The relocation of dredged sediment in horticulture for crop production appears challenging due to the possible transfer of contamination to soil, plant and humans but, at the same time, could be a strategy for reducing the intensive use of peat in soilless culture. Aim of the SUBSED project is to demonstrate that it is possible to convert a waste (the dredged marine sediment) into a supply (a commercial substrate) through the application of environmentally and economically sustainable practices.





Landfarming and matrixes used for the preparation of substrate mixtures



Treated sediments

(Port of Leghorn-IT)

Physical and chemical analysis of substrates

Monitoring rooting and vegetative growth of plants Monitoring flowering and fruiting

Morphological and chemical characterisation of plants and fruit

> Sensorial evaluation of foods Life Cycle Analysis

Comparative evaluation of vegetative and

Legal issues on sediments re-use

Commercial issues for marketing

Treated sediment preparation and packaging

Pre-commercial trials

**Dissemination - Nurseries and Fruitgrowers** 

productive parameters

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## Plant material

## **Nursery production:**

- Semi-hardwood cuttings of Prunus laurocerasus 'Novíta'
- Grafted plantlets of olive 'Frantoio'
- Plantlets of Citrus limon and C. sinensis grafted onto C. macrophylla, C. aurantium and Citrange carrizo

# **Crop cultivation:**

- Evergreen ornamental: Prunus laurocerasus 'Novíta
- Cut flower: Calla lily (Zantedeschia aethioica)
- Potted plant: Protea cynaroides 'Little Prince'
- Food crop species:

•Basil (seeds)

•Blueberry (Vaccinium corymbosum) 'Bluecrop' e 'Duke'

•Wild strawberry (*Fragaria vesca*) 'Regina delle Valli' •*Citrus limon* 'Fino 95' grafted onto 3 rootstocks

### Quality and safety of food products

- Pomological quality
- fruit fresh and dry weight, maximum diameter, fruit shape, skin color, flesh firmness
- Chemical composition and organoleptic quality
- pH, tritable acidity, total solid soluble, total polyphenols, antioxidant activity, vitamin C, organic acids, sugars
- Organic and inorganic pollutants

### Non-destructive analysis

- Plant mortality (number; percentage)
- Base stem diameter
- Maximum plant height
- Number of sprouts and flowers
- Length of primary vegetative shoot
- Number of fully expanded leaves on primary vegetative shoot
- Leaf blade, flower cluster and bracts colour (L, a, b coordinates) and chroma index  $(a^2 + b^2)^{1/2}$
- Photosynthetic activity by CIRAS-2
- Phenology (re-growth and flowering)

### Destructive analysis

- Leaf area
- Fresh and dry weight of the aerial part, stem and whole plant
- Chlorophyll content
- Malondialdehyde analysis for oxidative stress
- Heavy metal analysis



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## **Preliminary results**

Three months landfarming process was effective in homogenizing the substrate, increasing microbial activity and further reducing organic contamination, reaching physical and chemical characteristics comparable with those of a culture substrate.

First analyses of the collected morphometric data showed a significant effect of the substrate mixtures on plant growth and performance of all studied species. In general, the addition of the dredged phytoremediated sediment to the substrate resulted in reduced water requirements. Part of physiological and phytochemical analyses are still ongoing.



A = 100% PBS (control) B = 50% PBS, 50% TS (v/v)

A = 100% PBS (control) B = 50% CFBS, 50% TS (v/v)



A = 75% WFBS, 25% TS (v/v) B = 75% PBS, 25% TS (v/v)



Basil 'Valentino': A = 100% PBS (control); B = 75% PBS, 25% TS (v/v); C = 50% PBS, 50% TS (v/v)

**Legend:** PBS = Peat-based substrate: 79% peat, 12.4% pumice, 8.5% perlite v/v; TS = Treated sediment; CFBS = Coconut fiber-based substrate: 45.6% coconut fiber, 30.4% coconut pith, 24% pumice v/v; WFBS = Wood fiber-based substrate: 60% wood fiber, 40% pumice v/v