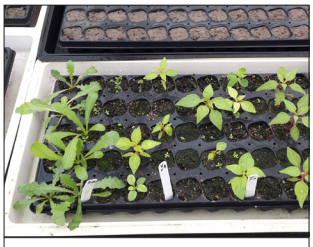
HaloSYS

INTEGRATED SYSTEM OF BIOREMEDIATION – BIOREFINERING USING HALOPHYTE SPECIES

Land affected by salinity

Soil preparation for sowing



Ongoing experiments

Native Salicornia in Lacu Sarat tested on affected land

The project started by chosing two land affected by salinity – one has natural salinity (Lacu Sarat – South-Est Region of Romania) and the other has anthropic salinity (South Region of Romania). Soil with a salinity varing from 4 to 47 dS/m has been sampled fronm affected land, prepared in the lab and distributed in experimental pots for germination and plant growth tests. On the other side, ongoing experiental work is related to studies on addaptation of spontaneous native Salicornia spp. in early stage of development on other type of soil, affected by salynity. It was found that, individual plant do not rezist, while groups of plants might show an addaptation pathway. Analysis methods involving UHPLC-MS/MS system are in development for bioactive compounds identification while tests with in-vitro induced salinity and commercial seeds of halophyte spp. are carried out inside the consortium.

1° Call:	2017
Project period:	06/2018 - 05/2021
Topic:	Sustainable intensification of non-food biomass production and decentralised transformation systems, in particular small scale multi-product biorefinery concepts
Keywords:	Soil salinity, addaptive mechanisms, biorefinery
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Total funding:	753.000 €
Website:	faccesurplus.org/research-projects-2nd-call/halosys/

FACCE SURPLUS
SUSTAINABLE AND RESILIENT AGRICULTURE FOR FOOD AND NON-FOOD SYSTEMS

HaloSYS

BACKGROUND

The dynamic development of economic activities often causes changes in the environment and human life quality. One example of such harmful changes is the extensive use of agricultural soils for dedicated biomass for biofuels (deforestation, food / feed competition, excessively use of fresh water). There is an urgent need to intervene by any means to reduce these impacts.
Soil salinization induced by natural causes and anthropic activities affects 1 to 3 mil. ha in EU. Such soils have lower or zero suitability for traditional agriculture production, influencing the decline of regional economics. To achieve the restoration of agriculture production and thus economical growth, the remediation of affected soils through efficient and economic ways is necessary. HaloSYS project addresses the challenge of using halophytes to develop integrated bioremediation and biorefining system. Specific halophyte spp. are taken into account, such as:

- Salicornia spp. with high tolerance for salinity and drought, produces seeds that contain up to 26-33% oil and up to 30% proteins (Chaturvedi, 2013; Fidler, 2004).
- Portulaca oleracea L. is able to extracts a significant amount of salt from the soil. In one growing season it can remove up to 210 kg/ha of Cl and 65 kg/ha of Na. The plant has a short vegetation period and a production all year, can allow a continuous salt removal (Hasanuzzaman, 2014, 2018; Kilic, 2008).

OBJECTIVE

- Sustainable use of unsuitable lands for any agriculture purpose;
- Bio-based products through biorefining:
    - separation of biomass major components (fibres, sugars, oils, proteins),
    - extraction, identification and characterisation of specific bioactive molecules (enzymes, phenols, alkaloids, etc.),
    - valorisation of extracted components and resulted waste from biomass processing to produce bio-based products (pharmaceuticals, 2G biofuels, biopolymers).
- Biologic carbon sequestration – following the concept of terrestrial (or biologic) sequestration, plant species like *Salicornia spp., Amaranthus spp., Suaeda spp., Festuca arundinacea L., Calamagrostis epigeios L.*, *Spartina pectinate*, etc. will contribute to CO2 capture and storing as carbon both in plants and soil.

METHODOLOGY

The project aims to develop economically feasible pathways, which couple the use of salt-affected soils for the production of halophyte biomass with advanced biorefining processes of obtained biomass, opening the opportunity for new added value bioproduct formulation and new approaches for sustainable agriculture.
The experiments will involve saline soil taken from natural sites and a study on ecological amplitude of investigated species (varieties) of plants will be performed. Further, the work will be conducted on the use of obtained biomass to develop new value chains.

RESULTS AND KEY FINDINGS

- Environmentally sustainable growth under climate changes effect and environmental pressures, and biodiversity and ecosystem services preservation;
- Intensification of agriculture through phytoremediation practices using halophytes culture systems on saline soils;
- Opportunity to develop new agriculture crops to overcome the economic losses due to continuous trend of soil aridisation.