DeliSoil

Delivering soil improvers from circular food production processes to boost soil health

Practice Abstract 11

Biochar from agro-industrial residues: improving soil quality through pyrolysis

Summary

Pyrolysis is a thermochemical process that converts biomass into biochar by heating it at high temperatures under limited or no oxygen. This process stabilises carbon and transforms organic residues into a valuable soil improver. This practice was developed within the Living Labs of DeliSoil in Spain and Italy, using pilot-scale pyrolysis units.

In Spain, biomass included residues from the juice industry, the solid fraction of pig slurry, and meat and fish processing industries. In Italy, feedstocks came from the tomato processing industry, viticulture residues and olive mill by-products. These materials are often difficult and costly to manage, making pyrolysis an attractive valorisation option.

The main outcome was the production of stable biochar suitable for agricultural use. When applied to soil, biochar showed potential to increase soil organic carbon and improve water retention, contributing to better soil structure and crop resilience under Mediterranean dry conditions. Biochar also supports long-term carbon storage, contributing to climate change mitigation.

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Country:

Spain (Catalonia)
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Keywords:

Biochar
Biomass
Pyrolysis

Stakeholders:

Industry
Farmers
Farmers organisations
Regional and national authorities
Science
Researchers
Civil society
Policy actors

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Practical Recommendations

Results showed clear differences among biochars depending on feedstock composition. In the Spanish Living Lab, fish bone biochar had lower electrical conductivity (lower salinity risk), while pig slurry biochar provided higher mineral nutrient levels, especially phosphorus and potassium. All biochars met microbiological safety requirements. In the Italian Living Lab, grape pomace biochar showed the strongest potential as a soil amendment due to its higherNitrogen (N), Phosphorus (P), and Potassium (K) (NPK) content, although all biochars met agronomic quality criteria.

For farmers and end-users, this practice offers improved soil quality and productivity, better management of agro-industrial residues, and support for circular economy and environmental policies. The approach is replicable with existing technologies, although scaling up from pilot to farm or regional level is needed to improve economic feasibility.

Needs addressed by the practice

Helping food producers find circular solutions to valorise their side-streams and validate the quality of biochar as soil improvers.

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About DeliSoil

The EU-funded DeliSoil project is a four-year initiative that aims to transform food industry byproducts into safe, sustainable, and tailored soil improvers. This project addresses two pressing challenges: the poor recycling of industrial food processing byproducts and the degradation of soil health.

By harnessing a circular approach, DeliSoil will contribute to improving soil health and productivity, supporting the EU Mission "A Soil Deal for Europe" and the Farm to Fork Strategy, as well as other Circular and Bioeconomy Strategies and Plans.

Funded by the European Union

Funded by the European Union under the Horizon Europe Programme, Grant Agreement No. 101112855 (DeliSoil). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them. Swiss partners (FiBL) have received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

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