P0381

ENVIRONMENTAL RECYCLING OF CO-COMPOSTED SEDIMENTS

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Introduction

The **European waste policy** encourages the application of circular economy in **waste management** to reduce the negative impact of waste materials on environment and human health. In Europe, only 1% of the one million tons, yearly dredged, of **river sediments** is recycled and some green wastes, as **pruning residues**, have limited use for their variability in composition. The valorisation of dredged sediments and pruning residues as valuable raw material is needed.

In the **LIFE AGRISED project** dredged sediments were co-composted with pruning residues for the production of **growing media** for plant nursery and **technosol** for soil rehabilitation.

Materials and Methods

The **co-composting** processes were carried out in Czech Republic and in Italy.

brackish sediments

- ✓ high sand content (greater porosity, air and drainage).
- ✓ low content of heavy metals
- ✓ low salinity.

Navicelli channel (Pisa)

Agricultural canal (Kunice)

Green waste

Carbon and nutrient source that stimulate the microbial activity and improve the physical structure.

grass
corn cob
wood chips
wood
leaves

Co-Composting Sediments (S) and Green wastes (G) mixed in three ratios (*w:w*): 1S:1G; 3S:1G; 1S:3G

Technosol

Lysimeter compositions

T1: Dredged sediment
T2: Degraded soil
T3: Degraded soil + dredged sediment + sewage sludge
T4: 1S:1G
T5: 1S:1G + degraded soil
T6: 1S:1G + degraded soil + sewage sludge
T7: 1S:3G
T8: 1S:3G + degraded soil
T9: 1S:3G + degraded soil + sewage sludge
T10: 3S:1G
T11: 3S:1G + degraded soil
T12: 3S:1G + degraded soil + sewage sludge

Plant nursery

Substrate compositions

S1: Peatmoss – pumice (1:1) as control
S2: 60% Peatmoss – pumice (1:1) + 40% compost (1S:3G)
S3: 60% Peatmoss – pumice (1:1) + 40% compost (1S:1G)
S4: 60% Peatmoss – pumice (1:1) + 40% compost (3S:1G)
S5: Co-compost (1S:3G)
S6: Co-compost (1S:1G)
S7: Co-compost (3S:1G)

Viburnum tinus

Photinia x fraseri

Composting results

The compost **stability** and **maturity** were reached after **8** and **6 months** in Cezch (CZ) and in Italy (IT), respectively, by the decrease and stabilization of organic matter content, electrical conductivity, microbial activity, and the increase of humification rate. In addition, a germination index, higher than 60%, and the reduction of hydrocarbons (C >12) indicated the absence of toxic elements.

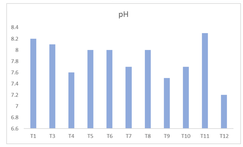
		Czech Compost (CZ)			Italian Compost (IT)			CZ legislation Decree No. 257/2009	IT legislation D.Lgs.75/2010
		3S:1G	*1S:1G*	*1S:3G*	*3S:1G*	*1S:1G*	*1S:3G*	**Sediment reuse in agriculture**	**Growth substrate**
pH	%	8.12	8.12	8.18	7.4	7.5	7.3		4.4-8.5
Bulk density	*g/cm³*	1.00	0.81	0.75	0.88	0.69	0.58		<0.95
Conductivity	*dS/m*	0.86	0.78	0.75	2.7	2.4	1.2		<1
Total C_{org}	%	3.02	3.04	5.04	1.66	3.54	9.39		>4
Total N	%	0.26	0.31	0.50	0.15	0.31	0.58		>2.5
IPA	*mg/kg*	0.45	0.41	0.40				<6	
PCB	*mg/kg*	<0.01	<0.01	<0.01				<0.2	

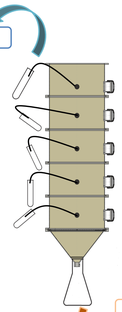
- Both CZ and IT composts respected the limits for heavy metals.
- CZ composts were completely in line with the legislation on sediment reuse in agriculure (Decree No. 257/2009).
- The Italian compost generally were within the Italian thresholds for growth substrate (D.Lgs. 75/2010), particularly **1S:3GW**, except for conductivity and total organic carbon for 3S:1G and 1S:1G.

Technosol results

The **Technosol** derives from a **chemical-mechanical treatment**, applied to degraded soil mixed with waste matrices (sludges, sediments, co-composting sediments) into lysimeters, that produces a breakdown of the lignocellulosic components and incorporates the organic fraction into the mineral particles.

Soil extract analysis





leachate analysis

The analyses of leachates revealed the **limited release** of total **trace elements** from each technosol

Recostructed soil	As	Cd	Cr	Hg	Pb	Cu	Zn
	µg L^{-1}						
T1	<1	<1	1.1	<0.1	<1	0.1	1.0
T2	<1	<1	3.0	<0.1	<1	0.0	0.1
T3	<1	<1	<1	<0.1	<1	0.0	0.5
T4	1.2	<1	8.0	<0.1	<1	0.0	0.0
T5	2.0	<1	5.0	<0.1	<1	0.0	0.2
T6	5.0	<1	<1	<0.1	<1	0.0	3.7
T7	4.0	<1	<1	<0.1	<1	0.0	1.6
T8	7.0	<1	3.0	<0.1	<1	0.0	0.1
T9	6.0	<1	<1	<0.1	<1	0.0	2.6
T10	5.0	<1	10.0	<0.1	<1	0.0	0.2
T11	3.0	<1	6.0	<0.1	<1	0.1	0.2
T12	3.0	<1	9.0	<0.1	<1	0.0	0.1

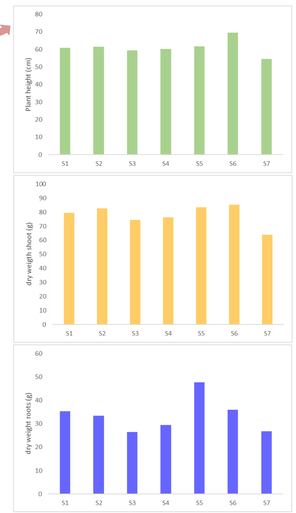
- The **pH** values were in line with the Italian thresholds (4.4 – 8.5; D.Lgs. 75/2010) for each technosol.
- The **conductivity** decreased in tecnosols with co-composts, compared to one derived from dredged sediments.

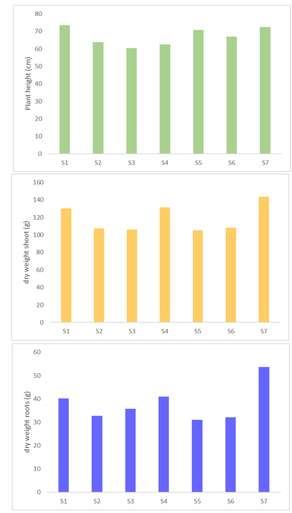
Nursery results

The **CZ compost** was used as component for growing media and compared with the traditional substrate (S1), containing peatmoss and pumice. For each type of substrate basacote® was added as fertilizer.

		Substrates							IT legislation D.Lgs.75/2010
		S1	*S2*	*S3*	*S4*	*S5*	*S6*	*S7*	**Mixed media**
humidity	%	8.1	6.1	4.9	4.7	10.5	5.2	3.2	
volatile soil	%	26.9	20.3	12.7	8.9	13.8	10.6	7.6	
pH		4.8	6.4	7.0	7.0	7.5	7.6	6.9	4.5-8.5
Bulk density	g cm^{-3}	0.3	0.3	0.6	0.5	1.0	0.8	0.7	<0.95
conductivity	dS/m	0.3	0.5	1.0	1.0	1.6	1.5	1.6	<1
Total organic carbon	%	13	10	7.7	3.7	6.6	4.5	2.4	>4
Total Nitrogen	%	0.4	0.5	0.5	0.3	0.7	0.4	0.3	<2.5
N-NH_3	mg/kg	50.8	59.3	20	11	12	12.4	12.1	
N-NO_3	mg/kg	68	320.3	236.6	40.9	156	133.9	126.4	
CSC	meq/100g	42.6	45.5	38	26	45.7	44	28.8	

All tested substrates revealed physical and chemical properties **suitable** for **plant growth**, for Italian legislation (D.Lgs.75/2010)





- After 5 months of growing, **plant parameters** did not show statistical differences amongst substrates in both varieties.
- All the plants, grown on the different substrates, had **similar heights** and **dry matter increases**.

Conclusion

The preliminary results are showing that sediment and green waste composts resulted suitable for their application as substrate components in nursery as well as for the soil reconstruction for degraded soil rehabilitation.

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