



LIFE17/ENV/IT/269

Use of dredged sediments for creating innovative growing media and technosols for plant nursery and soil rehabilitation

**CNR-IRET Activities
April-September 2019**



Length: 17 km
Width: 30 m
Depth: 3 m



Navicelli Canal (Pisa), a navigable canal that connects Pisa to Livorno and flows into the sea



NAVI A



NAVI B

About 20 000 m³/year

B1 Action. Sediment collection

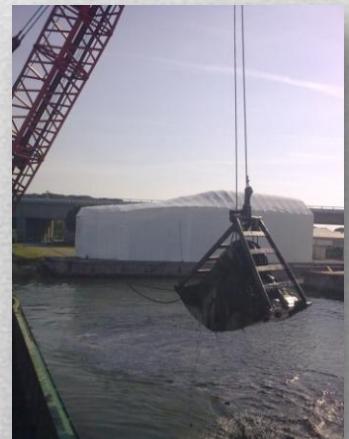
NAVI A: on 4th February 2019

NAVI B: on 15th May 2019

NAVI A:
N 43°35'38,16
E10°19'38,53

NAVI B:
N 43°38'56,6
E10°21'34,1

The dredging of the Navicelli canal is aimed at allowing navigability



B1 Action. Sediment collection

Sediment from **Czech Republic- EPS:** on 23th September 2019



Smaller regulated stream located in the agricultural area

B1 Action

Sediment characterization by CNR

- **Physical analysis:** Texture, Bulk density, water retention curve
- **Chemical analysis:** pH, Electrical Conductivity, Nutrients Total content and Availability (C, N, P, Ca, Mn, K, Fe, Mg), Cation Exchange Capacity
- **Inorganic Contaminants :** Total heavy metals and available heavy metals (Zn, Cd, Pb, Cu, Cr, Ni)
- **Biochemical analysis:** Hydrolitic and oxidoreductase enzyme activities **(to be terminated)**
- **Toxicity analysis:** germination and root elongation tests

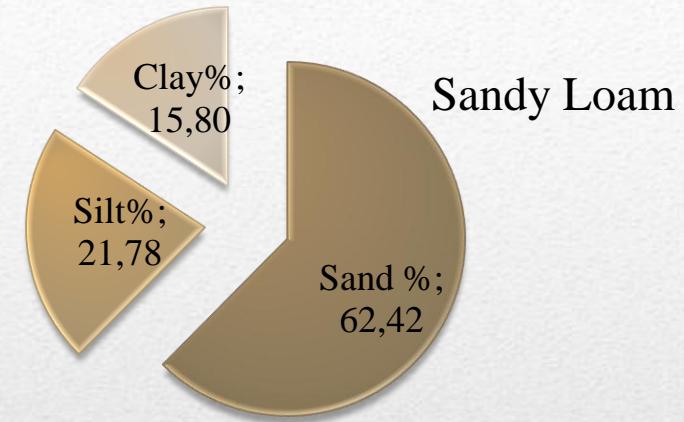
NAVI A



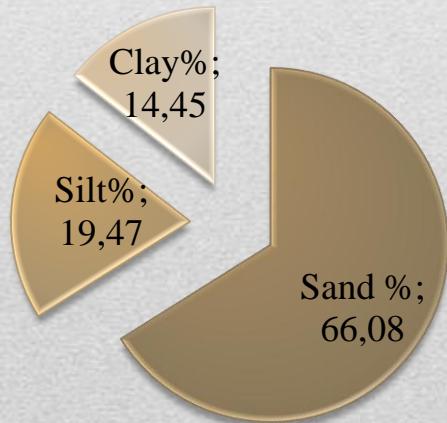
B1 Action

Sediment characterization

NAVI B

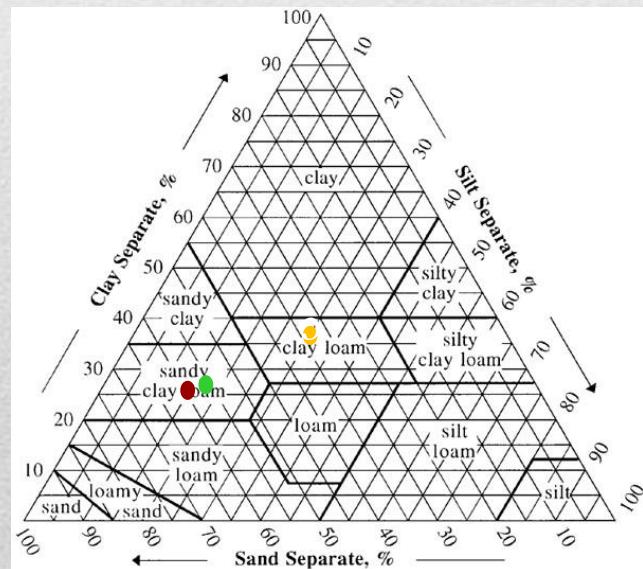
**Texture**

EPS



Sandy Loam

Loam



B1 Action: Sediment characterization

NAVI A

pH	8,08	$\pm 0,04$
C.E. dS/m	<u>7,64</u>	$\pm 0,02$
C.E.C.		
meq/100g	18,8	$\pm 1,20$
TOC%	1,47	$\pm 0,08$
TN %	0,12	$\pm 0,01$
C/N	12,3	
TP %	0,07	$\pm 0,02$
Psol mg/kg	0,00	$\pm 0,00$
N-NO ₃ mg/kg	7,57	$\pm 0,92$
N-NH ₄ mg/kg	1,71	$\pm 0,64$

NAVI B

pH	7,68	$\pm 0,04$
C.E. dS/m	<u>4,20</u>	$\pm 0,02$
C.E.C.		
meq/100g	21,5	$\pm 3,30$
TOC%	1,41	$\pm 0,03$
TN%	0,18	$\pm 0,01$
C/N	7,83	
TP %	0,06	$\pm 0,01$
Psol mg/kg	0,00	$\pm 0,00$
N-NO ₃ mg/kg	11,5	$\pm 0,9$
N-NH ₄ mg/kg	1,93	$\pm 0,16$

EPS

pH	7,84	$\pm 0,02$
C.E. dS/m	0,92	$\pm 0,02$
C.E.C.		
meq/100g	15,8	$\pm 3,20$
TOC%	1,30	$\pm 0,08$
TN%	0,12	$\pm 0,01$
C/N	11,3	
TP %	0,07	$\pm 0,00$
Psol mg/kg	0,00	$\pm 0,00$
N-NO ₃ mg/kg	3,64	$\pm 0,11$
N-NH ₄ mg/kg	2,11	$\pm 0,03$

similar
to a soil

B1 Action

Sediment characterization:

**NAVI A and B very similar content
Under the Italian legal limits 152/2006 and 75/2010**

**Very low
metal
content**

NAVI A

Total Heavy metals

Cu	mg/kg	73,0	±8,5
Zn	mg/kg	115	±5,3
Cd	mg/kg	<LOD	
Ni	mg/kg	47,3	±2,4
Pb	mg/kg	22,5	±0,1
Cr	mg/kg	77,6	±3,6

NAVI B

Total Heavy metals

Cu	mg/kg	56,6	±4,7
Zn	mg/kg	108	±1
Cd	mg/kg	<LOD	
Ni	mg/kg	50,8	±1,0
Pb	mg/kg	16,6	±0,7
Cr	mg/kg	58,5	±5,6

EPS

Total Heavy metals

Cu	mg/kg	46,6	±5,5
Zn	mg/kg	68,7	±7,0
Cd	mg/kg	<LOD	
Ni	mg/kg	21,0	±1,4
Pb	mg/kg	15,2	±1,3
Cr	mg/kg	22,4	±3,0

Available Heavy metals

Cu	mg/kg	0,22	±0,02
Pb	mg/kg	0,05	±0,01
Zn	mg/kg	<LOD	
Cd	mg/kg	<LOD	
Ni	mg/kg	<LOD	
Cr	mg/kg	<LOD	

Available Heavy metals

Cu	mg/kg	0,54	±0,01
Pb	mg/kg	<LOD	
Zn	mg/kg	<LOD	
Cd	mg/kg	<LOD	
Ni	mg/kg	<LOD	
Cr	mg/kg	<LOD	

Available Heavy metals

Cu	mg/kg	0,27	±0,00
Pb	mg/kg	<LOD	
Zn	mg/kg	<LOD	
Cd	mg/kg	<LOD	
Ni	mg/kg	<LOD	
Cr	mg/kg	<LOD	

B1 Action

Sediment characterization

NAVI A

Total Nutrients

Mg mg/kg	10982	± 3
Ca mg/kg	27303	± 2520
Fe mg/kg	28177	± 874
K mg/kg	7681	± 667
Mn mg/kg	355	± 5

Available Nutrients

Mg mg/kg	533	± 21
Ca mg/kg	360	± 25
Fe mg/kg	<LOD	
K mg/kg	408	± 31
Mn mg/kg	<LOD	

NAVI B

Total Nutrients

Mg mg/kg	8535	± 382
Ca mg/kg	23985	± 1169
Fe mg/kg	24049	± 367
K mg/kg	4641	± 987
Mn mg/kg	211	± 6

Available Nutrients

Mg mg/kg	356	± 29
Ca mg/kg	882	± 137
Fe mg/kg	1,75	$\pm 0,12$
K mg/kg	261	± 26
Mn mg/kg	0,51	$\pm 0,05$

EPS

Total Nutrients

Mg mg/kg	7614	± 388
Ca mg/kg	32962	± 1380
Fe mg/kg	15453	± 197
K mg/kg	2329	± 295
Mn mg/kg	401	± 1

Available Nutrients

Mg mg/kg	162	± 1
Ca mg/kg	606	± 14
Fe mg/kg	1,60	$\pm 0,47$
K mg/kg	46,5	$\pm 11,3$
Mn mg/kg	0,20	$\pm 0,05$

Similar to natural soils. Fe and Ca slightly higher than a soil

NAVI B slight lower content in nutrients than NAVI A

EPS higher Ca and Mn content than NAVI, lower Mg, Fe, K

B1 Action

Sediment characterization

Water retention curve

NAVI A

Bulk density g/cm³	1,14	±0,05
Particle density g/cm³	2,58	±0,01
Porosity %	55,9	±0,05
Air capacity %	0,00	0,00
Water capacity%	78,0	2,35
Available water %	7,00	±0,01

NAVI A

Bulk density g/cm³	1,15	±0,03
Particle density g/cm³	2,52	±0,01
Porosity %	54,2	±0,09
Air capacity %	0,62	±0,05
Water capacity%	53,6	±1,25
Available water %	10,4	±0,10

similar
to a soil

EPS

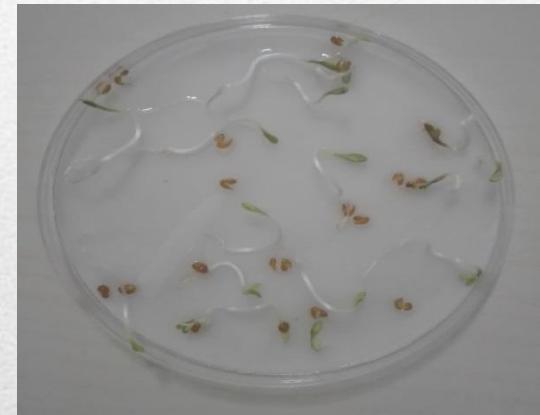
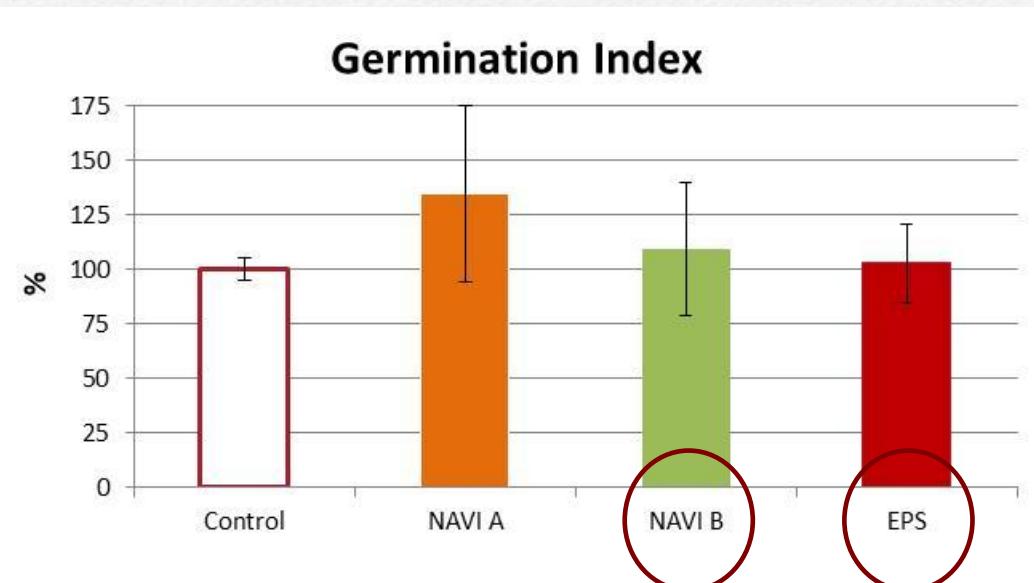
Bulk density g/cm³	1,14	±0,00
Particle density g/cm³	2,56	±0,00
Porosity %	55,5	±0,17
Air capacity %	7,11	±0,73
Water capacity%	48,4	±0,90
Available water %	11,3	±0,56

B1 Action

Sediment characterization: Toxicity analysis

Phytotest: *Lepidium sativum* (crescione)

It is not the phytotest reported in the project



No toxicity!!!



Thanks for your attention

