

ASSESSMENT OF SOIL QUALITY RESTORATION IN A CRONICALLY POLLUTED AREA TREATED WITH COMPOST BY COMBINING DIFFERENT SOIL INVESTIGATION TECHNIQUES



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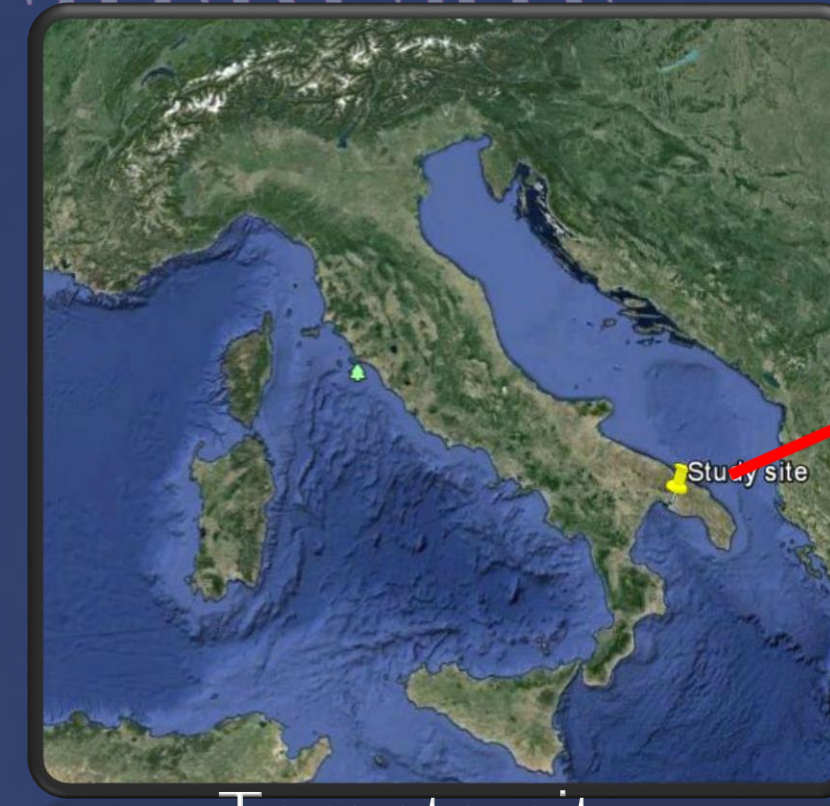
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ABOUT COMPOST:

- Enhances soil physical, chemical and biological properties and has a disease suppression effect.
- Builds up stable organic compounds through humification and reduces concentrations of organic pollutants.
- Regulates various bioremediation processes that include immobilization, reduction, volatilization and rhizosphere modification (Park *et al.* 2011).

HYPOTHESIS: Can compost addition induce a soil quality restoration process?

STUDY SITE:



Taranto city



MATERIALS & METHODS:

Three acquisition data campaigns :

C - (September 2012): characterization campaign

J - (June 2013): 1st monitoring campaign (4 months after compost treatment)

S - (September 2013): 2nd monitoring campaign (7 months after compost treatment).

Soil chemical analyses

texture, pH, organic carbon, total nitrogen, available phosphorous, carbonate and water content.

Pollutants investigations

Organic pollutants (PCBs) analyses → GC-MS (Thermo Scientific Finnigan TRACE GC ultra)

Heavy metals screenings → ICP-MS (Agilent 7700 Series).

Microbiological analyses

Bacterial Abundance (DAPI counts)

Dehydrogenase Activity (DHA).

SOIL CHEMICAL RESULTS

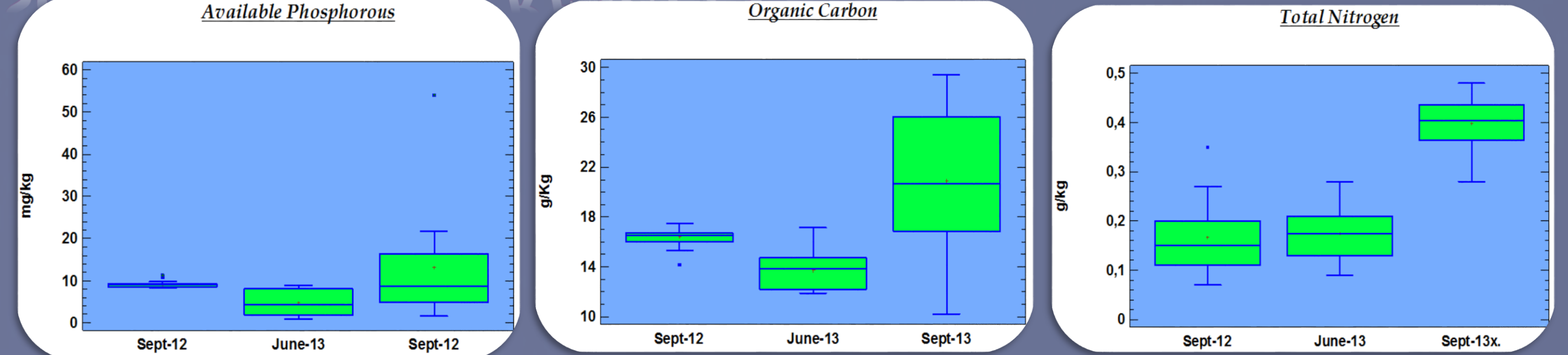
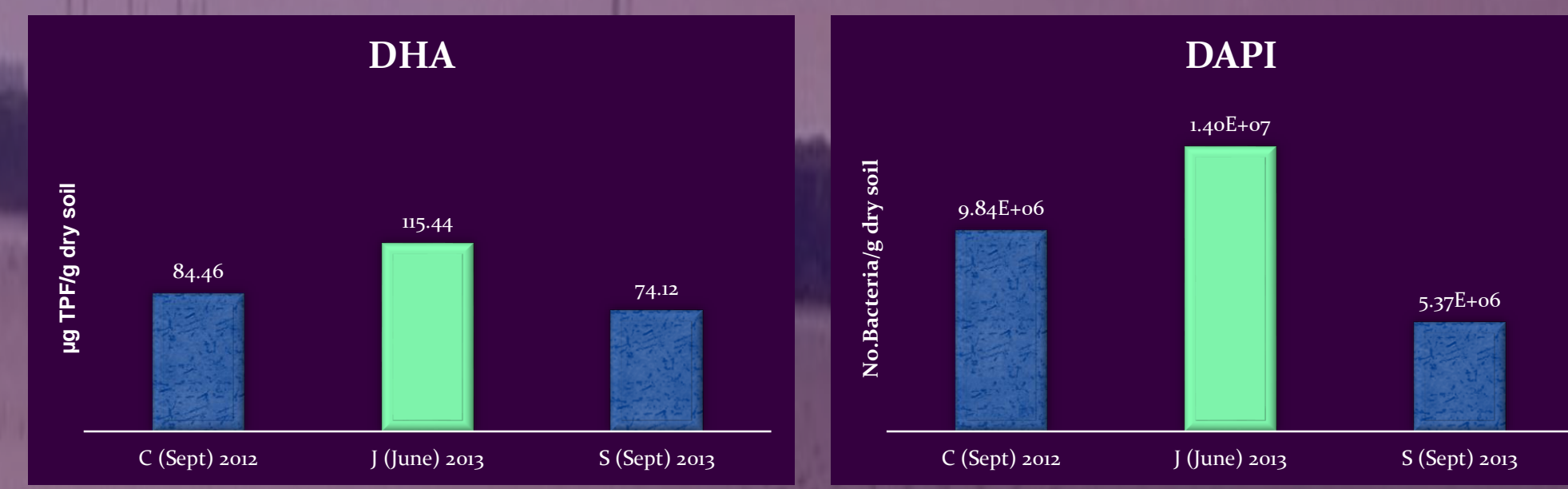


Fig.1-Box and Whisker Plots referred to the distribution of the organic C, available P and total N

Soil chemical analyses revealed a major increase of all the nutrient elements (C, N, P) after 7 months from compost treatment (Fig.1)

MICROBIOLOGICAL RESULTS



↑ Microbial Abundance (DAPI)

↑ Dehydrogenase activity (DHA)

Considerable increase of DAPI and DHA after 4 months from the recovery treatment with the organic amendment

POLLUTANTS RESULTS

Tab.1- Average concentration of pollutants determined in soil samples of the both survey campaigns.

Italia n law limit D.Lgs 152/06	Be	V	Cr	Co	Ni	Cu	Zn	As	Se	Cd	Sn	Sb	Hg	Tl	Pb	PCB
2	90	150	20	120	120	150	20	3	2	1	10	1	1	100	60	
C	3,9	130,0	221,3	17,1	96,7	45,1	263,2	23,2	14,3	0,7	78,6	18,7	1,0	0,8	147,3	235,1
J	1,7	60,3	50,8	8,0	37,8	17,8	142,7	11,4	2,0	0,3	3,8	0,9	0,4	0,5	28,2	49,2
S	1,7	59,4	48,9	7,7	35,4	19,0	143,0	11,2	1,6	0,3	5,6	1,3	0,5	0,5	32,0	-

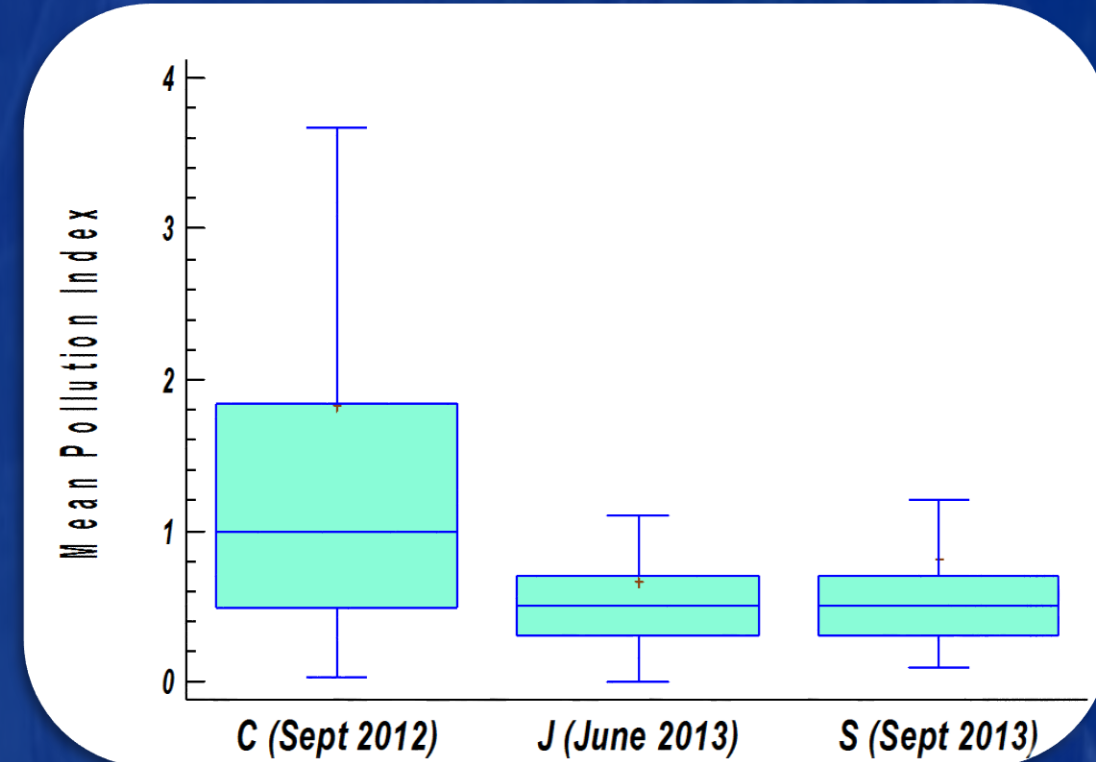


Fig.2- Mean Pollution Index

A Pollution index ($P_i = C_i / C_i^{ref}$) was calculated for each of the N metals, where C_i is i^{th} metal concentration in each sample and C_i^{ref} is the Italian law limit (D.Lgs. 152/06); then, the Mean Pollution Index (MPI) was calculated following the approach proposed by Abraham & Parker (2008), where the final index is obtained by the arithmetic average between the N metals. The Mean Pollution Index revealed that a considerable decrement of inorganic contamination was observed already after 4 months from the treatment with compost (Fig. 2)

STATISTICAL RESULTS

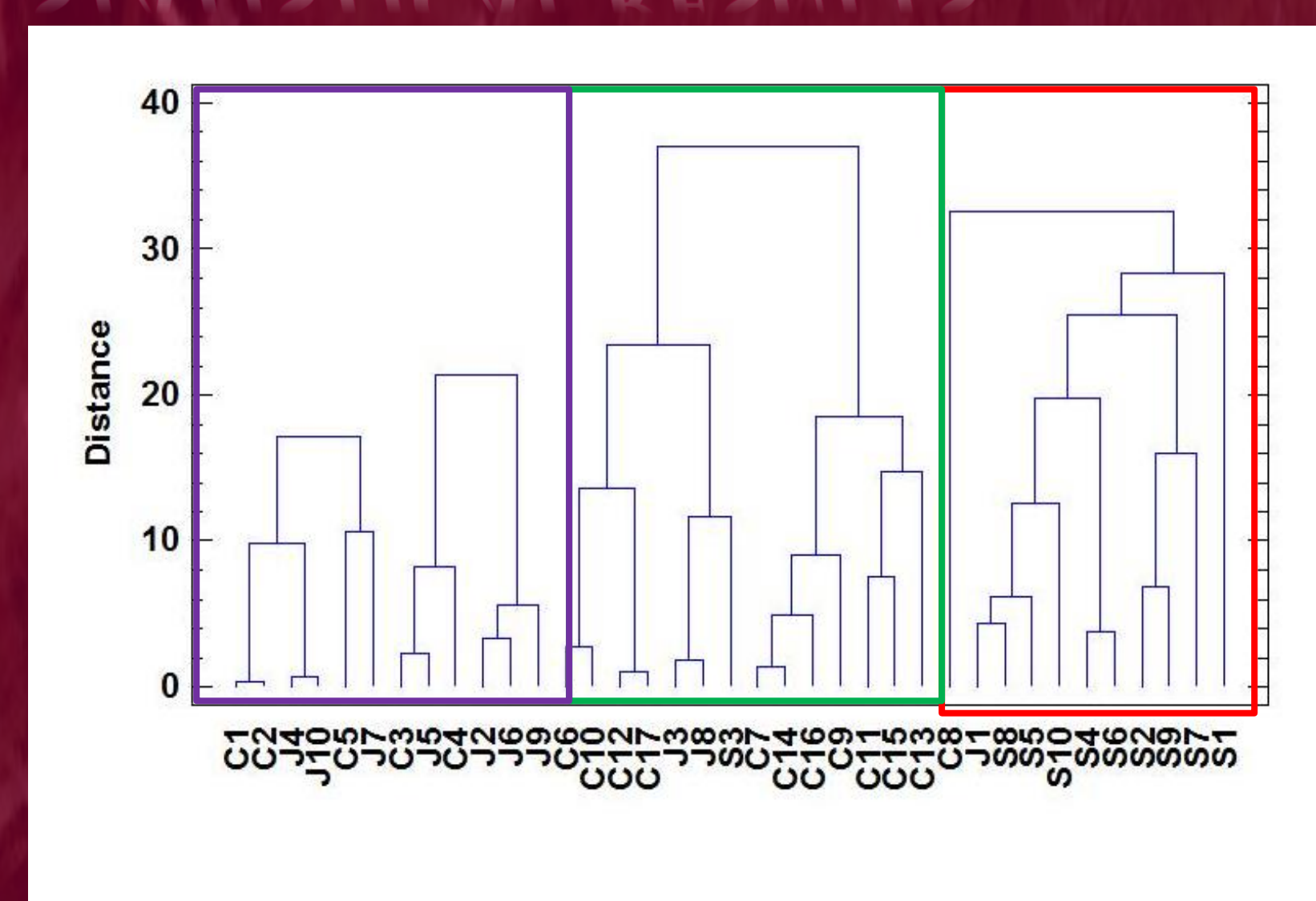


Fig.3- Cluster Dendrogram

The Hierarchical Cluster Analysis (HCA) based on Principal Component Analysis has identified four soil groups (Fig.3) in the different periods of investigation (C, J, S).

Green box: samples of characterization campaign (Sept 2012) → High pollution

Violet box: two groups of samples of 1st monitoring campaign (June 2013) → Medium pollution

Red box: samples of 2nd monitoring campaign (Sept 2013) → Low pollution

CONCLUSIONS

These statistical evaluations, according to microbial results can support our initial hypothesis even if further investigations are needed to understand the possible mechanisms that occur in the restoration of soil quality process

REFERENCES

- Abraham G.M.S. & Parker R.J. (2008)- Assessment of heavy metal enrichment factors and the degree of contamination in marine sediments from Tamaki Estuary, Auckland, New Zealand. *Env Mon Ass*, 136:227-238.
- Park J.H., Lamb D., Paneerselvam P., Choppala G., Bolan N., Chung J-W., 2011. Role of organic amendments on enhanced bioremediation of heavy metal(loid). *Journal of Hazardous Materials*, 185, pg 549-574.

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