Salinity problems in dredged sediments treated by phytoremediation

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Salinity problems in dredged sediments treated by phytoremediation

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Context

Sediments and contaminants accumulate in the harbor. They both come from:
- Geological background
- Agriculture
- Industry

- Sediments need to be dredged to maintain touristic and economic activities.
- Level of heavy metals, PBC, HAP and TBT determine if dredged sediments should be brought back inland, instead of released offshore.
- Dredged sediments management faces environmental, juridic and economic issues. Nearly one quarter of them are brought to land where they must be treated as waste. Regulation calls for a strict limitation of the offshore dumping.

Material and method

- 3 sites were studied: Pérols (65%<63µm, 5 months drainage), Port Camargue (58%<63µm, 2 months drainage) and le Grau du Roi (70%<63µm, totally drained).
- Arundo Donax plants were selected

Experimental cultures were realised in Le Grau du Roi sediments (potting soil, Humic Acid, Arbuscular Mycorrhiza)

Table 1: Comparison of above ground Cl accumulation in litterature

<table>
<thead>
<tr>
<th>Species</th>
<th>2012 accumulation</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salicornia parviflora</td>
<td>70 g Cl kg DW</td>
<td>Haussmann et al. 2014</td>
</tr>
<tr>
<td>Poa annua</td>
<td>20 g Cl kg DW</td>
<td>Haussmann et al. 2014</td>
</tr>
<tr>
<td>Medicago sativa</td>
<td>25 g Cl kg DW</td>
<td>M. W. Hayman et al. 2016</td>
</tr>
<tr>
<td>Secale cereale</td>
<td>20 g Cl kg DW</td>
<td>M. W. Hayman et al. 2016</td>
</tr>
<tr>
<td>Lolium multiflorum</td>
<td>24 g Cl kg DW</td>
<td>M. W. Hayman et al. 2016</td>
</tr>
<tr>
<td>Hordeum vulgare</td>
<td>20 g Cl kg DW</td>
<td>M. W. Hayman et al. 2016</td>
</tr>
<tr>
<td>Tyrtaea latifolia</td>
<td>24 to 65 g Cl kg DW</td>
<td>M. W. Hayman et al. 2016</td>
</tr>
<tr>
<td>Arundo donax</td>
<td>20 g Cl kg DW</td>
<td>M. W. Hayman et al. 2016</td>
</tr>
</tbody>
</table>

Results

- 100% survival / 0% survival

In the long run, when facing high chloride level, Arbuscular Mycorrhiza modality shows the best results in bioconcentration and translocation in Arundo donax.

Results in accord with Poliari et al. 2018 findings on salt stress reduction by Mycorrhiza.

Conclusion

- Longer drainage should improve chloride elimination. Phytoremediation seems a good complementary technique.
- Tests realised with Arundo donax commonly used for energetic valorisation show good results in terms of uptake of chloride. Even with smaller bioaccumulation than other species, this species have more interesting biomass production and economic valorisation.
- Reptot and Arbuscular Mycorrhiza show the best result in term of Cl- extraction and bioaccumulation.

References