RE-VEGETATION OF POOR QUALITY SOILS AND SALINE EFFLUENT MANAGEMENT IN A COMMERCIAL SETTING USING PEPSYSTEMS® TECHNOLOGIES

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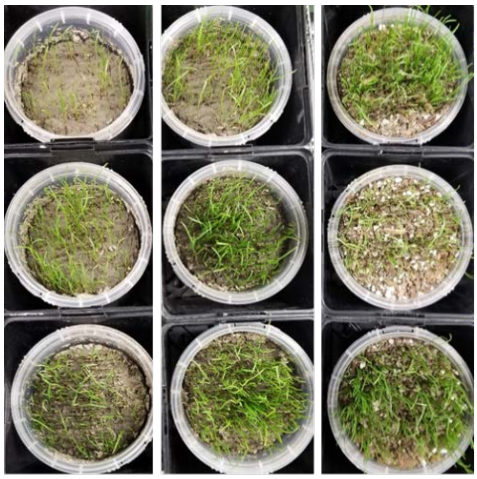

Figure 1. Plant growth of grass seed planted on poor quality subsoil collected from the site +/- additional organics (Promix). Seed was untreated or was coated with salt tolerant PGPR prior to sowing. Images were collected on day 6 post seeding.

Figure 2. Field trial #1 site photograph showing soil conditions and plant growth six weeks after sowing (August 28, 2019).

Figure 3. Field trial #2 site photograph showing plant growth six weeks after sowing (June 17, 2020).

Earthmaster was asked to reclaim very poor quality soil on a former construction site and to provide a salt tolerant vegetated area capable of being irrigated with effluent regularly produced from a reverse osmosis water system. The business on-site was a brewery producing large amounts of effluent which the owner wanted to dispose in a sustainable way that did not require the town sewer system. Revegetation of disturbed soils arising from construction related activities can be challenging, especially when surface soil is of poor quality, devoid of organic matter, and is extremely compacted. Earthmaster has developed PGPR (plant growth promoting rhizobacteria) Enhanced Phytoremediation Systems (PEPSystems®) which have been successfully deployed across Canada for treatment of soil contaminated with petroleum hydrocarbons (PHCs), salt, trace metals, and organic solvents. PEPSystems is being adapted for reclamation applications; therefore, Earthmaster conducted laboratory and field trials to assess the ability of PGPR to assist in revegetation of this construction site to assist with on-site effluent management.

LABORATORY TRIAL

A small laboratory study was conducted using subsoil collected from the site to determine if PGPR treated seed offered an advantage to plant growth and to assess the benefit of organics being added to the subsoil. The site was devoid of topsoil and the subsoil had no organics. The species

of PGPR was selected based previous work confirming its ability to facilitate plant biomass production in saline conditions. Results from the laboratory study are shown in Figure 1. Observations indicated the PGPR treated seed showed higher shoot density when compared to untreated seed. The addition of organics to the subsoil did not lead to any observable differences in plant growth; therefore, they were not applied in the field trials.

Figure 4. Field trial #2 site photograph showing plant growth at the end of the growing season following 25 weeks of growth (October 30, 2020)..

FIELD TRIALS

To fully challenge the PEPSystems technology, initial field trials were conducted with no soil preparation and PGPR treated seed being broadcast planted mid-summer during drought conditions. Despite being irrigated, this trial resulted in only partial re-vegetation (Figure 2). The exposed subsoil remained extremely hard; therefore, a follow up field trial was conducted in which the soil was cultivated prior to seeding to break up the compacted surface.

The grass seed was treated using PGPR and was sown early in the growing season. The site was irrigated regularly using the stored on-site reverse osmosis effluent. Plant growth six weeks after seeding is shown in Figure 3. Plant growth was good and required mowing 10 weeks post seeding. Herbicide was sprayed on the site to control thistle growth. The successfully re-vegetated sites end of season plant growth on the site is shown in Figure 4.

CONCLUSIONS

Despite the site containing very poor quality subsoil with no organics, PEPSystems was successfully able to re-vegetate the site without the addition of organics. The business owner was concerned that continued use of the effluent to irrigate the site would lead to the buildup of salts on the site and eventually kill the vegetation. By using salt tolerant PGPR to treat the grass seed, the grass will be able to grow if salinity increases in the soil. Using previous commercial salt remediation data, the grassy area has the potential to remove approximately 3 kg of sodium and 8 kg of chloride per season if the grass is mowed and removed from the site. If the lawn is mowed and clippings removed, the owner will never have to worry about salt accumulation in soil from the effluent used for irrigation.

For a list of PEPSystems related publications and presentations, see the Earthmaster website at www.earthmaster.ca and click on the ‘About’ tab.