

# ADVANTAGES OF PRE-DEPLOYMENT LABORATORY TESTING FOR A BIOLOGICAL REMEDIATION TECHNOLOGY

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Plants have a wide variety of applications in the reclamation and rehabilitation of disturbed/poor quality soil, including remediating contaminated soil and re-vegetating former work sites. Earthmaster Environmental Strategies Inc., in collaboration with the University of Waterloo, has developed PGPR (plant growth-promoting rhizobacteria) - Enhanced Phytoremediation Systems (PEPSystems™) that has been successfully deployed across Canada for treatment of soil contaminated with petroleum hydrocarbons (PHCs), salt, trace metals, and organic solvents. Often it is valuable to conduct small laboratory

trials before committing to full-scale planting for the outdoor growing season, especially when a challenging contaminant or a particularly poor-quality soil is being addressed. Laboratory trials using a variety of tools, including controlled environmental growth chambers, can provide valuable information on plant selection, a seed treatment product or microbial strain, soil additives, etc., to determine the optimum site specific PEPSystems components for field deployment.

## LABORATORY TOOLS

Laboratory studies have been used to optimize PEPSystems and tailor solutions to address a particular soil type, contaminant, or site-specific feature. Often this is done in preparation for the upcoming growing season. Earthmaster utilizes its in-house growth and laboratory facilities to tailor its PEPSystems technology to the specific needs of projects. For example, laboratory tools such as seed germination pouches and spiked agar plates permit Earthmaster to effectively test PEPSystems resilience to a particular contaminant in concentrated form. This provides for the evaluation of PGPR effectiveness using seed germination studies and bacteria plating experiments, respectively (Figure 1). Controlled environmental growth chambers can be used to mimic a four-month outdoor growing season in just four to six weeks, allowing for the completion of several consecutive growing trials in one off-season. Plant growth trials can be conducted using soil collected from a contaminated work site or

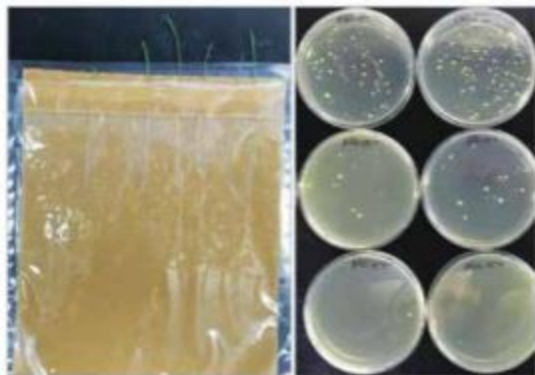


Figure 1. Seed germination studies using a rooting pouch (left) and bacteria tolerance testing using spiked agar (right).



Figure 2. PEPSystems growth trials using soil collected from a contaminated site (left) and control soil spiked with a contaminant (right).

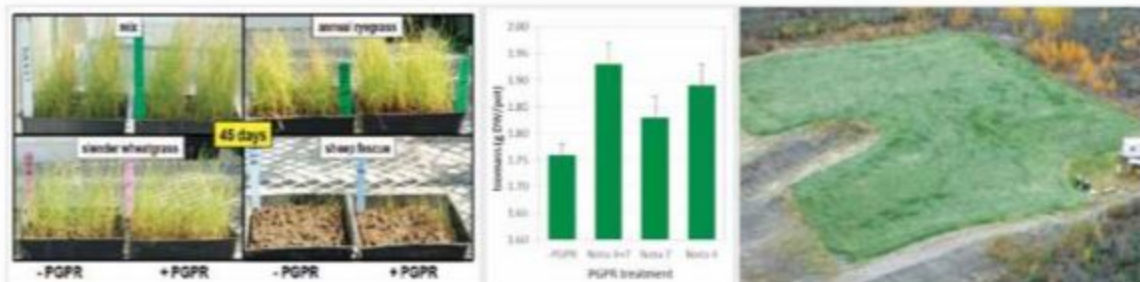


Figure 3. Laboratory studies testing bacteria and plant combinations using bacteria and soil collected from a contaminated project site (left and middle). Field deployment of PEPSystems Nota 4+7 (right).

a control soil spiked with a particular contaminant of interest such as an organic solvent or trace metal, facilitating the selection of seed/bacteria/other-amendment combinations for the outdoor growing season (Figure 2).

#### EXAMPLE

Laboratory studies were conducted using bacteria isolated from soil collected from a remote abandoned oil and gas site in Canada's far north. The studies were used to identify and purify region specific bacterial species and select the optimum plant/bacteria combination to achieve maximum growth in the project soil prior to field deployment. The bacteria/plant combination identified from laboratory growth trials was deployed at the site and both salt and PHC contaminants were successfully phytoremediated over several growing seasons (Figure 3).

#### CONCLUSIONS

A variety of complimentary laboratory tools should be used to comprehensively evaluate effectiveness of bacteria and plant combinations prior to field deployment and to minimize project field costs. Although growth chambers represent ideal growing conditions and field results can be more variable due to the uncontrolled environment, laboratory studies can be tremendously useful in providing insight into promising plant/bacteria/amendment combinations to address particular site conditions. Information gathered from these studies can accelerate site remediation and reclamation outcomes.

For a list of phytoremediation related publications, see the Earthmaster website at [www.earthmaster.ca/about-us/publications](http://www.earthmaster.ca/about-us/publications).



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