Use of Phytoremediation to Enhance Hydrocarbon Remediation in Landfarms

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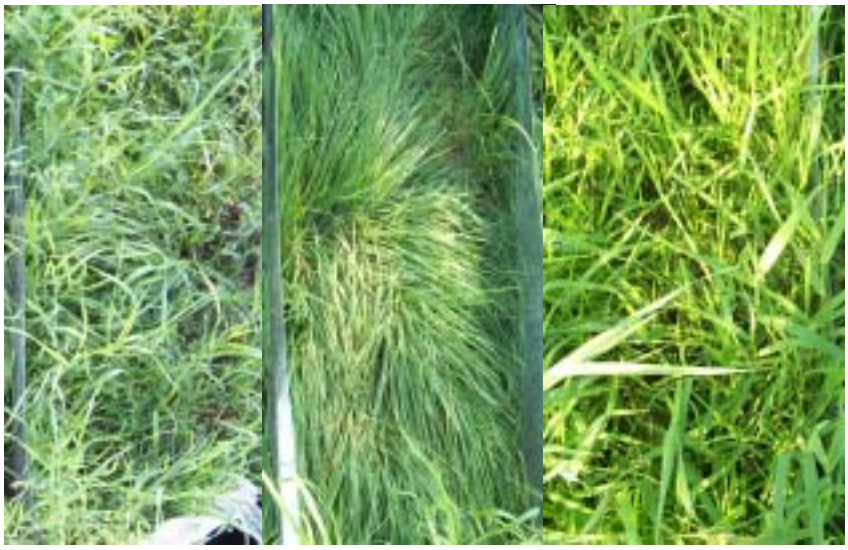
Introduction

The use of landfarms to manage hydrocarbon wastes has been an approved waste management methodology for many years that has saved industry millions of dollars in waste disposal fees. A problem with landfarms is that after multiple applications of hydrocarbon sludge, the concentration of oil and grease will gradually increase. This increase will limit the quantity of oily sludges that can be disposed of in this manner and will at times, require that the landfarm be taken out of service. In previous work (Stehmeier et al. 2001), planting of alfalfa was able to enhance the biodegradation of landfarm hydrocarbons to reduce the oil and grease concentrations back to levels seen 18 months previously, even though during the 18 months enough hydrocarbon sludge was added to more than double the oil and grease content found in the soil. This project reports on some of the results from a greenhouse study to optimize this process.

Results and Discussion

Plant Selection

Plants screened for growth in landfarm soil were sweet clover (SC) (*Melilotus officinalis cv*. Norgold), alfalfa (A) (*Medicago sativa cv*. Common), reed canary grass (RCG) (*Phalaris arundinacea cv*. Common No.1), slender wheat grass (SWG) (*Elymus trachycaulus*) cv. and hay mix (HM) consisting of brome grass (*Bromus spp*) and alfalfa (*Medicago sativa*) cv. Common. Growth in the landfarm soil is shown in Figure 1.



HM **SWG** **RCG**

Figure 1. Example of growth in landfarm soil – initial oil and grease content 6%.

Total Extractable Hydrocarbon

Each plant was seeded in the landfarm soil at commercial rates and then after the growth had formed a canopy, soil samples were taken and extracted with methylene chloride and iso-propanol. The results are shown in Figures 2.

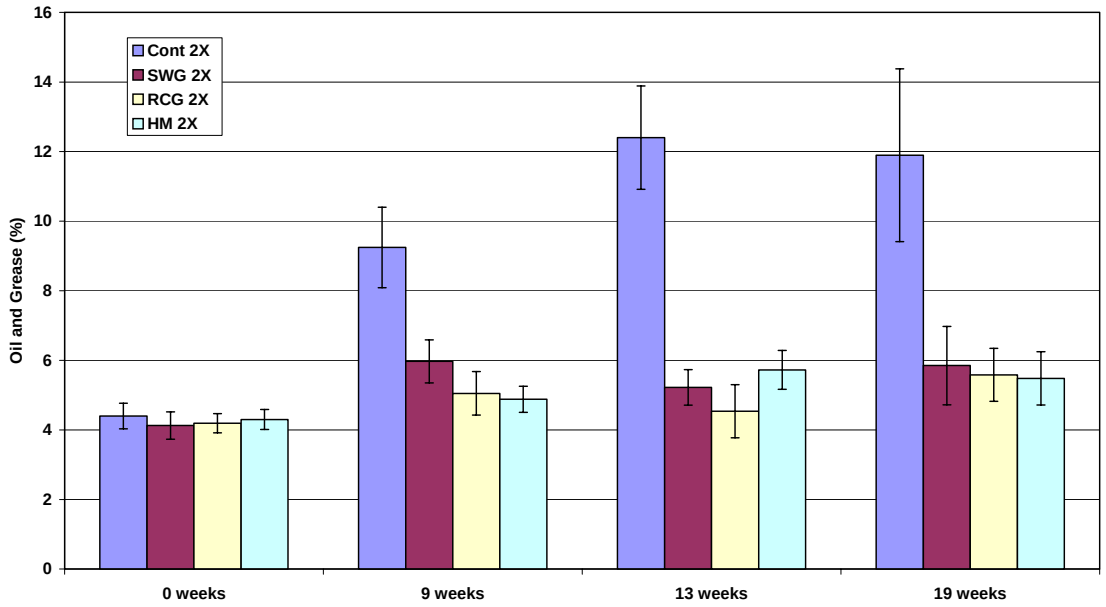


Figure 2. Total Extractable Hydrocarbon from landfarm soil plots planted with reed canary grass, slender wheat grass and hay mix. Two times the normal sludge was added 11 times in 13 weeks.

Microbial Metabolic Diversity

The metabolic diversity was measured as an indicator of the diversity of the microbial community. This was done using a method established by Slaski et al. (2002) utilizing the BIOLOG system. The highest metabolic diversity was seen with RCG (Figure 3). Metabolic diversity increased significantly from the baseline soil with the addition of oil to all of the planted microcosms. Whereas addition of oil sludge caused phytotoxicity to SWG and HM, no toxicity was seen with the microbial community.

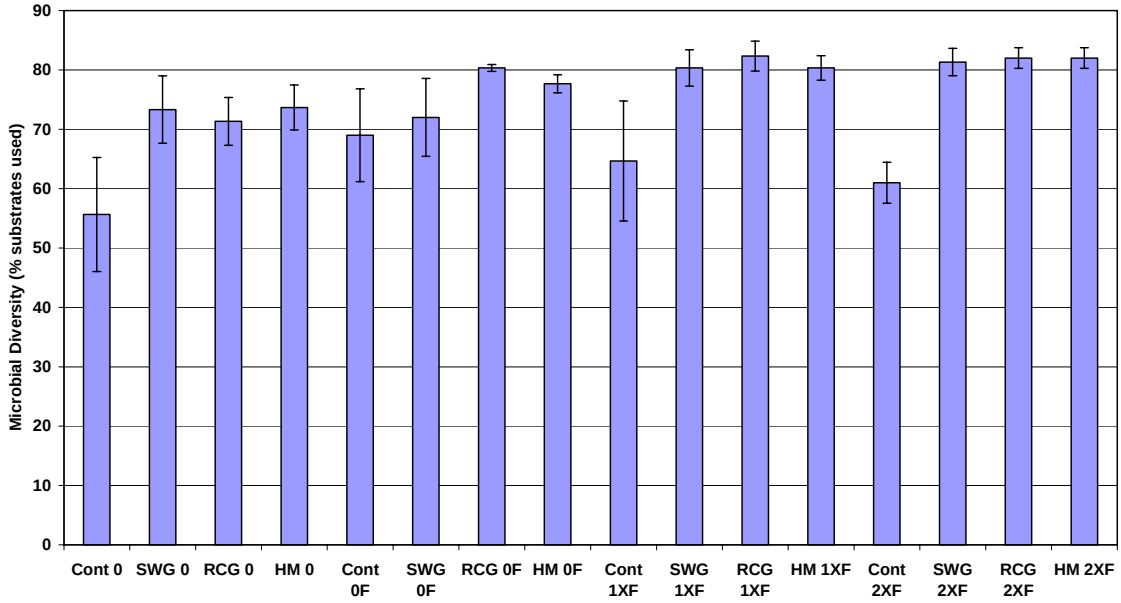


Figure 3. Microbial diversity measured by percent utilization of 96 carbon substrates.