



Tropentag, September 18-20, 2019, Kassel

“Filling gaps and removing traps
for sustainable resource management”

Phytoremediation of Petroleum Hydrocarbon-contaminated Soils with *Jatropha curcas* and *Vetiveria zizanioides*

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Abstract

Accidental oil spills during oil exploration and mineral mining operations have deleterious consequences on soils and overall ecosystem health. Environmentally benign methods of reducing hydrocarbon contamination levels in soils and ecosystems are often encouraged. However, there is scanty data on the effects of vegetation on petroleum hydrocarbon concentration in crude oil contaminated soils. The present study investigated the growth performance of two plant species on hydrocarbon contaminated soils and the effects of these plants on hydrocarbon concentration levels in soils. A $2 \times 2 \times 3$ factorial arrangement of treatments in a completely randomised design with 3 replicates was adopted. Two plant species, 2 soil contamination levels, and 3 soil amendments constituted the major treatment factors. Soil total oil and grease (TOG), total petroleum hydrocarbon (TPH), plant height, collar diameter, and number of leaves or tillers were monitored over a sixteen week period at Ghana Manganese Company Ltd.

Amending the soil with compost, *Jatropha curcas* (JC) caused up to 78.8 and 82.2% decline in soil TPH and TOG concentrations, while *Vetiveria zizanioides* (VZ) caused 51.1 and 39.7%, respectively, after 16 weeks. Compost amendments significantly reduced TOG and TPH concentrations compared to fertiliser and no amendments in both JC and VZ ($p < 0.001$). However, the effect of species on TOG and TPH concentrations were not statistically significant ($p = 0.081$).

Growth in height, collar diameter and number of leaves in JC were significantly higher in the compost amendment compared to the fertiliser and no amendment treatments ($p < 0.001$). Number of leaves ($p = 0.009$) and collar diameter growth ($p = 0.010$) were significantly lower in contaminated soils compared to non-contaminated soils but no significant differences were observed between the two with respect to height growth. Furthermore, only the number of tillers in Vertivar was significantly influenced by the soil amendments ($p = 0.003$) and the soil hydrocarbon contamination levels ($p = 0.048$).

It is concluded that phytoremediation, particularly with *Jatropha curcas*, is an alternate means to reducing soil hydrocarbon concentration levels. However, soils must be amended with compost for effective remediation and enhancement of rapid, vigorous early growth of plants.

Keywords: Collar diameter, compost, hydrocarbon, soil amendment