

GERMINATION AND EARLY GROWTH OF TROPICAL TREE SPECIES IN HEAVY PETROLEUM SOIL CONTAMINATED: A PROMISSORY RESTORATION WAY



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Introduction

Petroleum is one of the dominant sources of energy worldwide that contributes to the economic development of a country (Mohsenzade et al. 2009). The petroleum industry has resulted in soil, water and air contamination. An option to remediate the soils is the use of tree species, which naturally establish in soils contaminated with petroleum; they are multiple-purpose species (wood, live fence, supports, shade for cattle, fuel) for the rural communities in Tabasco, Mexico (Ochoa-Gaona et al. 2011; Fig. 1).



Figure 1. Soils contaminated with petroleum and vegetate with grasses and tree species.

The species that show the best results can be used, for phytoremediation and as a productive alternative for petroleum contaminated soils.

Objective

To evaluate the germination, growth (height and biomass), and early survivals of tree species in soil contaminated with heavy crude petroleum.

Methods

The trees species that were used, are native to the humid tropics of Mesoamerica: *Cedrela odorata* (tropical cedar), *Guazuma ulmifolia* (guácimo), *Haematoxylum campechianum* (tinto bush), *Swietenia macrophylla* (mahogany) y *Tabebuia rosea* (macuilis).

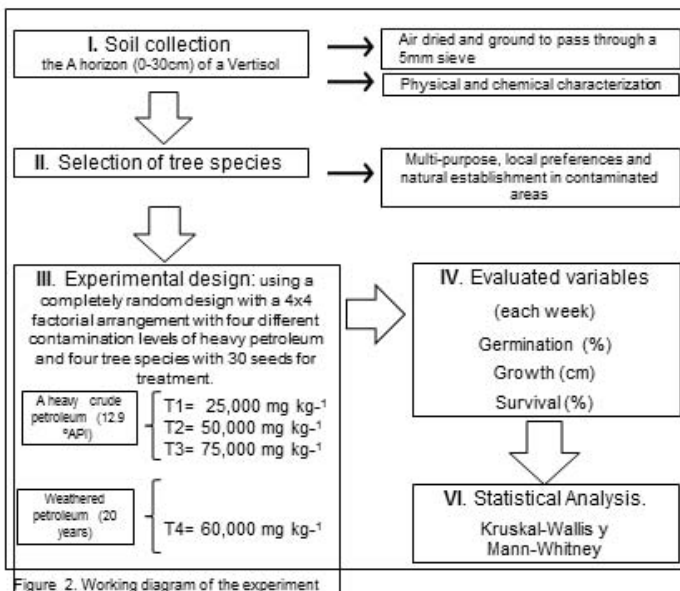


Figure 2. Working diagram of the experiment

Cited literature:

- Mohsenzade, F., Nasser, S., Mesdaghinia, A., Nabizadeh, R., Zafari, D. & Chehregani, A. 2009. Phytoremediation of petroleum-contaminated soils: pre-screening for suitable plants and rhizospheral fungi. *Toxicological and Environmental Chemistry*, 91(8) 1443-1453.
- Ochoa-Gaona, S., Pérez Hernández, I., Frías Hernández, J. A., Jarquín Sánchez, A. & Méndez Valencia, A. 2011. Estudio prospectivo de especies arbóreas promisorias para la fitorremediación de suelos contaminados por hidrocarburos. Villahermosa, Tabasco, México: Colección Bicentenario-José Narciso Rovirosa. SERNAPAM y El Colegio de la Frontera Sur.

Results

Germination: The rate of germination was between 96% y 75% in all treatments and control. *G. ulmifolia* didn't germinate. We found statistical differences for *S. macrophylla* between the control and the treatments (Fig. 3).

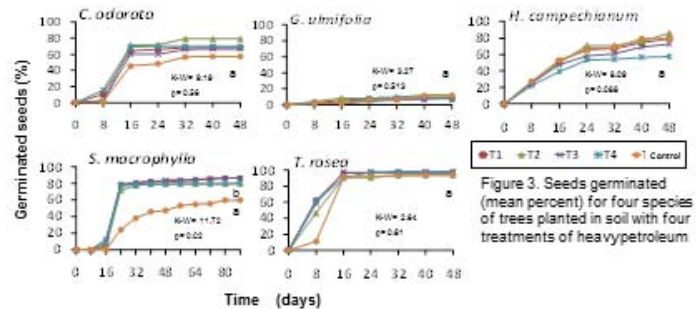


Figure 3. Seeds germinated (mean percent) for four species of trees planted in soil with four treatments of heavy petroleum

Growth: All the species showed statistical differences between treatments and control. The values for *S. macrophylla* were more similar (Fig 4).

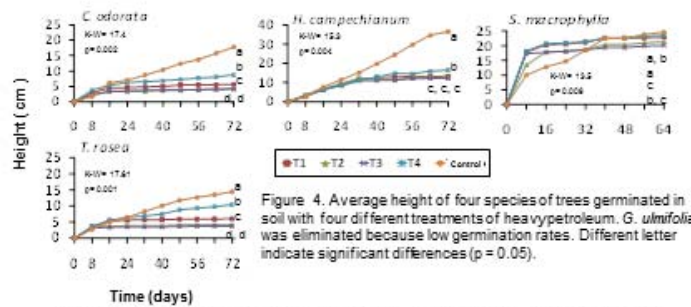


Figure 4. Average height of four species of trees germinated in soil with four different treatments of heavy petroleum. *G. ulmifolia* was eliminated because low germination rates. Different letter indicate significant differences ($p = 0.05$).

Survival: The survival of *S. macrophylla* and *H. campechianum* was not affected by petroleum at any concentration studied. On the other hand, *C. odorata* and *T. rosea* showed high mortality at all concentrations (Fig. 5).

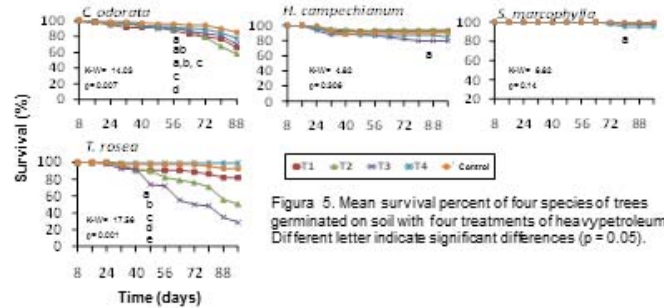


Figure 5. Mean survival percent of four species of trees germinated on soil with four treatments of heavy petroleum. Different letter indicate significant differences ($p = 0.05$).

Conclusions: * Seed germination was not negatively affected by the presence of heavy crude. * The petroleum affected the survival and growth for *C. odorata*, *H. campechianum*, and *T. rosea*. * It is recommended to run phytoremediation tests with *S. macrophylla*, since this species is tolerant to heavy crude petroleum, and thus it is important to determine its capacity with respect to the degradation of petroleum hydrocarbons in soil.