

Original Research Article

<https://doi.org/10.20546/ijcmas.2021.1007.060>

Soil Ecology and Bioaccumulation of Heavy Metals by *Calotropis procera* (Ait) in Drylands of South Eastern Kenya

Festus Mbatha Mutiso^{1*}, Jacinta Kimiti¹, Alice Muchugi² and Josphert Kimatu¹

¹South Eastern Kenya University, School of Environment, Water and Natural Resources Management, P.O.Box 170-90200, Kitui, Kenya

²International Centre for Research in Agroforestry (ICRAF), P.O. Box 30677-00100, Nairobi, Kenya

*Corresponding author

ABSTRACT

Calotropis procera is a wild species that is drought-resistant and plays a number of economic and ecological uses. The species is important in soil fertility improvement, pollution control by monitoring sulphur dioxide emissions in the air and suitable indicator of exhausted soil. This study was undertaken in drylands of South Eastern Kenya to evaluate the species' soil ecology and ability to bioaccumulate heavy metals. The objectives of the research were to determine the soil chemical and physical properties for survival of *C. procera* and to determine the ability of *C. procera* in phytoextraction of heavy metals from the soil. To understand the soil chemical and physical properties for growth of *C. procera*, two sites namely a farmland and a natural stand of *C. procera* were used. In the two sites, soil samples were collected and analysed for soil pH, total N, P, K and bulk density. *C. procera* tissues (leaves) were harvested and analyzed for total N, P, K, OC, Zn, Mn, Cu and Fe. One-way ANOVA was applied to assess the significance of variations in the soil chemical properties (pH, total N, P and K), Plant tissue data (total N, P, K, OC, Zn, Cu and Fe), *C. procera* provenances and spacing variables in relation to the field plots. Pearson simple linear correlation coefficient (r) was calculated for assessing the type of relationship between the study site and the natural stand of *C. procera* in relation to the soil chemical properties. There were no significant differences in subplots soil chemical properties. Correlation analysis showed a strong positive spatial relationship (Pearson, $P < 0.01$, $r_s = 0.734$) in soil chemical properties between the artificial and the natural stand of *C. procera*. Further, there were no significant differences ($p < 0.05$) in soil pH as well as in bioaccumulation of heavy metals in both the artificial and natural stands of *C. procera*. However, Pearson correlation analysis showed a very strong relationship (Pearson, $P < 0.01$, $r_s = 0.966$) in terms of phytoextraction/phytoaccumulation of heavy metals (Zn, Mn, Cu and Fe) between the artificial and natural stands of *C. procera*. The study concluded that *C. procera* can grow in a wide range of soil pH levels and the species has the ability to bioaccumulate heavy metals in its leafy tissues. The study recommends use of *C. procera* as a remediator of soils contaminated with heavy metals (Zn, Mn, Cu and Fe).

Keywords

Calotropis procera,
Heavy metals,
Bioaccumulation,
Phytoremediation,
Phytoextraction

Article Info

Accepted:
20 June 2021
Available Online:
10 July 2021