

Reclaiming a Technosol Using Ficus thonningii and Domestic Wastes

Dora Neina^{1*}, Sibylle Faust²

¹Department of Soil Science, P.O.Box LG 245, School of Agriculture, University of Ghana, Legon, Accra, Ghana; *dneina@gmail.com ² Soil Biology and Plant Nutrition, University of Kassel, Germany,

1 Introduction

Aim: Inclusion of native high-value multipurpose tree species in mine land reclamation to provide ecosystem goods and services, and to

3 Results

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Tab 2. Pathogen load in sanitized* fecal matter and human urine fertilizer

support local peoples livelihood.

Ficus thonningii (Blume): multipurpose tree species native to tropical Sub-Saharan Africa.

2 Methods

Ficus thonningi (Blume) hardwood stem cuttings planted in two soils with five treatments:

- Forest soil: Lixisoil, old mine site afforested with eucalyptus > 30 yrs
- Technosol: pegmatite-rich, nutrient poor tantalum mine soil, 5:1mixture of coarse sandy pegmatite and sandy clay loam mine soil.

Treatments

- 1. Control (no amendment)
- Human urine fertilizer (100 ml/pot)
- Human urine fertilizer and wood ash (100 ml + 60 g/pot) 3.
- Fecal matter* (200 g/pot)
- Fecal matter* and wood ash (200 g + 60 g/pot) 5.

Two time intervals: Harvest of ficus plants after 5 and 7 months

- Five replicates per treatment and time of harvest
- Assessment of ficus biomass parameters

(n = 3).

Pathogenic properties	Fecal matter	Hum. urine fert.
Total aerobic mesophiles ¹	3×10 ³ cfu/ml	<1 cfu/ml
Total coliforms ²	<1 cfu/100 ml	<1 cfu/100 ml
Streptococcus ³	<1 cfu/100 ml	<1 cfu/100 ml
Bacteria RSA ⁴	44 cfu/20 ml	<24 cfu/20 ml
Salmonella, Shigella, <i>E. coli</i>	Absent	Absent

¹ 37°C, 24 h and 22°C; 72 h; ² (37°C and 44°C; each 48 h), TERGITOL-7; ³(37°C; 48 h), SLANETZ; ⁴ aerobic, 37°C; 24 h, SPS Agar. Hum.: Human; fert.: fertilizer; *dehydration, composting with rice straw, sawdust and wood ash



*Sanitation of fecal matter before application: dehydration, composting with rice straw, sawdust and wood ash

used in the pot experiment (n=4).						
Parameter	Forest soil	Techno sol	Fecal matter	Wood ash	Hu. urine fertilizer	
pH (water)	4.6	5.9	7.4	12.0	8.6	
Organic C (g kg ⁻¹)	29.1	5.1	61.9	NM	NM	
Total N (g kg ⁻¹)	2.0	0.0	0.3	NM	2.0	
Avail. P (mg kg ⁻¹)	2.8	3.9	NM	NM	NM	

NM

5400

Tab 1. Properties of the soils, fecal matter, wood ash, and human urine fertilizer

ALL MATERIAL	

Hu.: Human; NM: not measured

Total P (mg kg⁻¹)

520



11.4

NM



Fig 1. Tantalum quarry from which the Technosol was obtained. Rusumo village, Gatumba sector, western Rwanda (Neina et al. 2016a, 2016b)

Fig. 2. (A) Ficus plants in the Technosol applied with fecal matter, (B) unamended Technosol, (C) Forest soil applied with fecal matter. (D) ficus plants uprooted from Technosol showing thick and short roots.

References

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amendments. Soil Tillage Res 163, 214–223.

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Fig 3. Statistical analysis: Two way ANOVA; different letters between treatments indicate a significant difference (Tukey test, P < 0.05).

4 Conclusions

- The combination of native multipurpose ficus planting, addition of human excreta, and wood ash is a promising method for mine soil reclamation.
- Sanitized* human excreta and wood ash should be mixed with Technosols where possible, especially in planting holes before planting to enhance deep root establishment; a second application should follow because of low nutrient contents in Technosols.
- Ficus exhibited an efficient rooting system that stabilized the loose particles of the Technosol \rightarrow minimising risk of soil erosion.