ISSN 2664-4010 (Print) & ISSN 2664-6730 (Online)
South Asian Research Journal of Agriculture and Fisheries
Abbreviated Key Title: South Asian Res J Agri Fish

| Volume-3 | Issue-4 | July-Aug -2021 | **DOI: 10.36346/sarjaf.2021.v03i04.002**

Original Research Article

Comparative Effects of Contaminated Soil Media on the Early Growth of *Adansonia digitata* Seedlings

Fasawe A. O[1], Ukamyirioha Chidiebere J[2], Yakubu Christiana K[3], Shoyemi Aduratola O[4], Atsen Esther O[5], Erhabor Theophilus A[*6]

[1,2]Department of Forestry Technology, Federal College of Forestry, Jos, Nigeria
[3,4]Department of Horticulture and Landscaping, Federal College of Forestry, Jos, Nigeria
[5,6]Department of Forestry Technology, Federal College of Forestry, Jos, Nigeria

***Corresponding Author**
Erhabor TA

Article History
Received: 23.05.2021
Accepted: 29.06.2021
Published: 11.07.2021

Abstract: Spent engine oil has been known to contain heavy metals which is not only harmful to the soil and human health but to plants, their germination and survival. The comparative effects of contaminated soil media on the early growth pattern of *Adansonia digitata* was studied for a period of 8 weeks. The trial was laid out in a Randomized Complete Block Design (RCBD), with four treatments and ten replicates. The number of leaves, Collar diameter, and plant height were measured fortnightly while dry matter content was evaluated at the end of the eighth week. Plant height, number of leaves and collar diameter of *Adansonia digitata* in the spent oil contaminated soils were not significantly different ($P \leq 0.05$) from those planted in the unpolluted soil. The reductions in the growth characteristics measured can be thought to be spent engine oil dependent. Spent engine oil therefore had no pronounced effect on the germination and early growth of *Adansonia digitata*.

Keywords: Adansonia digitata, contaminated soil, early growth, germination, spent engine oil.

INTRODUCTION

The soil is very important to man's existence for various reasons especially plant growth. Contamination of soil by crude oil and its products has been a widespread environmental problem. Oil spills from flow stations, boat fuel spill, oil leakages and deliberate dumping of motor oil or other oil products into the environment. Disposal of spent lubricant into gutters, water drains, open plots and farms is a common practice especially by motor mechanics in Nigeria. This Indiscriminate discharge of spent lubricating oil (SLO) is a major source of diffuse or non-point source of oil pollution to the environment. This creates a serious monitoring and control challenge as mechanic workshops and mechanic villages spring up every day and everywhere without plan and policy for management of waste and protection of the environment. The presence of spent lubricant oil in soil increases bulk density, decreases water holding capacity and aeration propensity (Kayode et al., 2009).

These conditions generally cause unsatisfactory seed germination, growth and yield in soil contaminated with spent engine oil.

Plant based bioremediation technologies have been collectively termed as phytoremediation, referring to the use of green plants and associated micro biota for the in-situ treatment of contaminated soil and ground water (Sadowskyy, 1999). The potential characteristics of the African baobab fit for usage in this regard and this study is therefore to further support the available evidences. The African baobab (Adansonia digitata L.) is one of the eight species of baobab (Adansonia) and the only one native to mainland Africa. It belongs to the family Malvaceae. Like other baobabs, the African baobab is a massive deciduous fruit tree, up to 20-30 m high, with a lifespan of several hundred years. It is a multipurpose and widely used species with medicinal properties and numerous food uses of various plant parts. The fruits, flowers, leaves, shoots, roots of seedlings and even the tree roots are edible (Bosch et al., 2004). The leaves can be used either fresh, as a cooked vegetable, or dried and powdered as a functional ingredient (thickener) of soups and sauces.

Copyright © 2021 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

The African baobab may withstand much lower and more irregular rainfall conditions (90-1500 mm) and grow on poorly drained soils with a heavy texture, though not on deep sands probably due to the lack of anchorage (Orwa et al., 2009; Bosch et al., 2004).When the baobab sheds its leaves during the dry season, this enriches the soil by enhancing soil moisture and organic matter content. Decaying wood of baobab that has died of old age may be used as fertilizer. The ashes from shells bark and seeds are rich in K and also useful fertilizers (Orwa et al., 2009). The baobab is a pioneer species: it can withstand extreme drought and it is suitable on degraded lands where other species cannot survive (ICUC, 2002). Its thick and fibrous bark is remarkably fire resistant, and the tree continues to live and regrows even if its interior is completely burnt out.

Adansonia digitata has proven to be of good use to remediate polluted soils. According to Akintola et al. (2019) that bioconcentration factors indicated that Adansonia digitata can be used as bioaccumulation plant as it has the ability to accumulate and distribute heavy metals in its tissue parts. But investigation on germination and early stages of growth are necessary to determine the possibility of regeneration in such contaminated sites. Stomatal damage, poor germination, and eventual death have been reported in several studies on plants grown in hydrocarbon polluted soils (Vwioko and Fashemi, 2005; Omosun et al., 2008) and as such it becomes necessary to assess germination and growth performance of Adansonia digitata L. in contaminated soil and compare with soil amended with organic manure (cowdung) and determine the effect of contaminants on the test plants.

MATERIAL AND METHODS

Study Site

The study was conducted at Federal College of Forestry, Jos (latitude 9° 57^1 N and longitude 8° 54$^!$ E). The study area lies in the Northern Guinea savannah with mean annual rainfall between 1200mm and 1250mm and means temperature ranging between 23°C and 25°C. The climate of the state is cool due to its high altitude (about 118cm above sea level) and its soil is sandy-loam, light to dark in colour.

Materials

Cow dung, Poultry dropping, Seeds, Polythene bags, Nursery tools, meter rule, Thread were the materials used in the study.

Seed Procurement and pre-germination treatment

Seeds were procured at new market, Jos. Seed Viability test was carried out by floatation. Viable seeds were then scarified mechanical by cracking the larger lobe as recommended by Oboho (2014).

Experimental Design and Layout

The experiment was laid in a Randomized Complete Block design (RCBD) with four (4) treatments and ten (10) replicates. Cow dung and poultry droppings were applied at ratio 1:1 to ratio 2 of top soil. 3kg of planting mixture in polythene bag was contaminant with 50ml of spent engine oil thoroughly mixed in the soil. Spent engine oil was gotten from mechanic workshop in Farin-Gada, Jos. The media was left for a week without activity to allow it to cure. The treatments were:

- T_A: Topsoil (contaminated)+ Cow dung+ Sharp sand
- T_B: Topsoil + Contaminant
- T_C: Control (Topsoil)
- T_D: Topsoil+ Cow dung+ Sharp sand

DATA COLLECTION AND ANALYSIS

Data was collected fortnightly on seedlings of each treatment from initial germination. Parameters for growth are Plant height (cm), number of leaves and collar diameter (cm). The height was measured with a meter rule; collar diameter was measured using a thread and number of leaves counted.

All transformed data were subjected to analysis of variance (ANOVA) using SAS software package (version 9.0). Mean differences among treatments were separated using Duncan Multiple Range Test (DMRT) at P = 0.05.

RESULTS AND DISCUSSION

Effect of treatments on seedling height (cm) of Adansonia digitata

Height of seedlings recorded for each treatment increased as the age of seedlings progressed after germination from 2nd to 8th weeks. Despite the differences observed from height of seedlings at the different treatment for weeks after germination, treatment combination of TS + CD + SS exhibited highest overall value. This was followed in order of performance as TS > TS + SO + CD + SS > TS + SO (Table 1). Plant (seedling) height (cm) values recorded for each treatment were not significantly different (p>0.05) at 2nd to 8th weeks of data collection.

.

Table-1: Effect of treatment on mean seedling height (cm) of Adansonia digitata

Treatments	SEEDLING HEIGHT (cm)			
	2WAG	4WAG	6WAG	8WAG
TS + SO + CD + SS	1.47^{a}	1.64^{a}	1.76^{a}	2.11^{a}
TS + SO	1.26^{a}	1.88^{a}	1.32^{a}	1.40^{a}
TS	1.95^{a}	3.02^{a}	4.16^{a}	4.24^{a}
TS + CD + SS	3.81^{a}	5.25^{a}	6.52^{a}	6.92^{a}
SE	**0.95**	**1.19**	**1.83**	**1.94**
p-value	**0.232**	**0.145**	**0.178**	**0.196**

Mean (in the same column) with the same subscript letters do not differ significantly from each other according to the Duncan multiple range test.

WHERE: TS + SO + CD + SS: Top soil + spent oil + cow dung + sharp sand; TS + SO: Top soil + spent oil; TS: Top soil; TS + CD + SS: Top soil + cow dung + sharp sand.

The result indicates a reduction in plant height in the soil with Spent Engine Oil. Though not significantly different in mean values. To be taken note of is the margin in the plant height of contaminated soil stimulated with cowdung and the soil that is only contaminated. The stimulated treatments had plant height ranging from 1.47cm - 2.11cm while the unstimulated soil sample had a plant height ranging from 1.26cm to 1.40 cm. This agrees with Adedokun and Ataga (2007) that improvement in plant growth could be attributed to the addition of soil amendment and bio-augmentation.

The effect of soil media (treatment) on mean number of leaves of Adansonia digitata were also not significantly different (p>0.05) at 2nd to 8th weeks after germination (Table 2). Despite the change and reduction in the number of leaves recorded from 2nd to 8th weeks after germination, the highest value for each stage was obtained from poly pots with combined soil media of TS + CD + SS, and followed in order of performance as TS > TS + SO + CD + SS > TS + SO respectively.

Table-2: Effect of treatment on mean number of leaves of Adansonia digitata seedlings

Treatments	NUMBER OF LEAVES			
	2WAG	4WAG	6WAG	8WAG
TS + SO + CD + SS	0.50^{ab}	0.50^{a}	0.50^{a}	0.50^{a}
TS + SO	0.00^{b}	0.70^{a}	0.30^{a}	0.30^{a}
TS	1.50^{ab}	1.70^{a}	1.80^{a}	1.80^{a}
TS + CD + SS	1.90^{a}	2.30^{a}	1.80^{a}	1.80^{a}
SE	**0.58**	**0.73**	**0.06**	**0.63**
p-value	**0.097**	**0.275**	**0.189**	**0.189**

Mean (in the same column) with the same subscript letters do not differ significantly from each other according to the Duncan multiple range test.

WHERE: TS + SO + CD + SS: Top soil + spent oil + cow dung + sharp sand; TS + SO: Top soil + spent oil; TS: Top soil; TS + CD + SS: Top soil + cow dung + sharp sand.

Lower performance of the plants treated with spent oil at the first week of growth indicates that the plant has less resistant to pollution by spent at tender age than when it grows older. This is similar to the observation of Agbogidi et al. (2007) that there are more adverse effects on maize exposed to crude oil pollution at tender stage than at later stage.

Seedling collar diameter showed that with or without pollution Adansonia digitata had an erratic growth trend as there was an increase and decrease in collar diameter over the periods of 6 weeks (Table 3). After eight weeks, the mean collar diameter was highest for seedlings under treatment TS+SS+CD, while seedlings exposed to spent engine oil treatment without amendment recorded the lowest. There was also no significant difference (p>0.05) in the growth measured by collar diameter among the treatments.

Table-3: Effect of treatment on mean collar diameter (cm) of Adansonia digitata seedling

Treatments	COLLAR DIAMETER (CM)	
	6WAG	8WAG
TS + SO + CD + SS	0.05^{ab}	0.05^{b}
TS + SO	0.01^{b}	0.20^{b}
TS	0.09^{ab}	0.03^{b}
TS + CD + SS	0.20^{a}	0.20^{a}
SE	**0.06**	**0.09**
p-value	**0.130**	**0.060**

Mean (in the same column) with the same subscript letters do not differ significantly from each other according to the Duncan multiple range test.

WHERE: TS + SO + CD + SS: Top soil + spent oil + cow dung + sharp sand; TS + SO: Top soil + spent oil; TS: Top soil; TS + CD + SS: Top soil + cow dung + sharp sand.

CONCLUSION

Adansonia digitata can germinate, grow and survive in spent engine oil polluted soils. However, test plant performed better in soil amended with cow dung indicating that manure is suitable for treating spent engine oil polluted soil and also aids better growth of the species. The result could be different at a higher level of contamination. Therefore further studies are recommended for different levels of contamination as well as at older stages of plant growth.

REFERENCES

- Adedokun, O.M., & Ataga, A.E. (2007). Effects of amendment and bioaugumentation of soil polluted with crude oil, automotive gasoline oil and spent engine oil on the growth of cowpea (Vigna unguiculata walpl). Scientific research and Essay, 2(5); 147-149.
- Agbogidi, O.M., Eruotor, P.G., & Akparobi, S.O. (2007) Effects of Time Application of Crude Oil to Soil on the growth of Maize. Res. J. Environ. Toxicol., 1(3); 116-123
- Akintola, O.O., Aderounmu, A.F., Abiola, I.O., & Bodede, I.A. (2019). Remediation potential of Baobab (Adansonia digitata L.) Seedlings grown in sewage sludge contaminated by Heavy Metals. J. Appl. Sci. Environ. Manage, 23(9) 1691-1697
- Bosch, C. H., Sié, K., & Asafa, B. A. (2004). Adansonia digitata L. Record from Protabase. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands
- ICUC, 2002. Baobab. International Centre for Underutilised Crops, Factsheet No. 4, Southampton, UK.
- Kayode, J., O. Olowoyo., & A. Oyedeji, (2009). The effects of used engine oil pollution on the growth and early seedling performance of Vigna uniguiculata and Zea mays. Res. J. Soil Biol., 1; 15-19.
- Oboho, E.G. (2014). Silviculture for Beginners. Uniben Press, University of Benin, Ekehuan Campus, Benin City. Nigeria, 263.
- Omosun, G., Markson, A.A., & Mbanasor, O. (2008). Growth and Anatomy of Amaranthus Hybridus as Affected by Different Crude Oil Concentrations. American-Eurasian Journal of Scientific Research, 3(1); 70-74.
- Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., & Anthony, S. (2009). Agroforestree Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Kenya
- Sadowskyy, M. J. (1999). Phytoremediation: Past promises and future practices. Proceedings of the 8th International symposium on Microbial Ecology. Halifex, Canada: 1-7.
- Vwioko, D.E., & D.S. Fashemi (2005). Growth response of Ricinus communis L. in spent lubricating oil polluted soil. Journ. of Appl. Sci. and Env. Mgt., 9 (2); 73-79.

Citation: Fasawe A. O *et al* (2021). Comparative Effects of Contaminated Soil Media on the Early Growth of *Adansonia digitata* Seedlings. *South Asian Res J Agri Fish, 3*(4), 57-60.