



Influences of Light Intensity, and Soil Type on the Growth and Performance of the Indigenous Tree Seedling Species (*Leptadenia pyrotechnica*)

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Received; 18 Nov.2025 Accepted; 12 March 2028 published; 20 April2026

Abstracts

Forest rehabilitation has a great role to play in the desert region of Sudan in terms of production and protection, one of the main causes of the degradation in the area is deforestation which leads to soil degradation and soil erosion especially by wind speed so this area needs stabilization by planting tree seedling. The experiment was carried out at the nursery of Hudieba Research Station in River Nile State in September 21Th 2022. The objective of this study was to examine the effect of light intensity and soil type on growth and development of (*Leptadenia pyrotechnica*). Murkh seedling. The treatments tested were arranged in spilt plots design with three replications. The studied factors were light intensity (50% under plastic net, 100% under direct sun light) and soil type's (sand, sand & clay, and clay). The measurements were taken within the first to the second weeks and after three months for germination and different parameters of seedlings, respectively. Results showed that, germination percentage of *Leptadenia pyrotechnica* seeds was high in 50% sand soil type and similarly in 50% and 100% in sand & clay 1:1, however it was better in 100% than 50% light intensity in clay soil type compared to the other treatments. Also Highly significant effect were observed between treatments on plant height at different stage of growth seedling growth in (first, second and third months), and in fresh and dry weight of roots, shoot (stem and levees) and length of root in different light intensity and soil type, respectively. Fresh and dry weight of root and shoot and roots length were better in 100% light intensity in clay and sand & clay 1:1 soil type. The interaction between different treatments showed significant differences in plant hight at various stages, as well as in the fresh and dry weight of roots and shoots. Moreover, seedlings grown under 100% light intensity in clay and sand & clay 1:1 soil type recorded high fresh and dry weight of root and shoot than those in other treatments three

Introduction

The northern region of Sudan consists of desert and semi-desert climate which is prone to low rainfall, poor agricultural productivity and desertification resulting in continual decline in cultivated land. Desertification is the greatest environmental hazard that hinders the development of agriculture in the area, planting woody trees has protective and productive role in the region (Bouda *et al.*, 2013). Because one of the main causes of desertification in the area is deforestation, which leads to soil degradation and soil erosions especially by wind and water, the most degraded zones were the arid and semi- arid zones where about 76% of the human population of the Sudan live. Wind erosion is the most widespread soil degradation type in the arid zone, while water erosions was dominant in the semi-arid zone, so Sudan forest considered the most important natural resources (FAO, 2021). This area requires the propagation of tree seedling. Indigenous trees are suitable for reducing sand movement and improvement diversities of vegetation cover. There for the objective of this study was to examine the effect of light intensity and soil type on the growth of *Leptadenia pyrotechnica*, (local name murkh) seedlings.

Materials and Methods

The experiment was conducted at Hudieba Research Station northern Sudan (17.57 N and 33.8 E). The investigated indigenous tree species was *Leptadenia pyrotechnica* (local name murkh), the experiment was carried out in September 21Th 2022. The experimental design was split plot with three replications. The main plots were assigned to light intensity factor as 50% (under plastic net) and 100% (under direct sunlight), and the sub-plots were assigned to soil types (sand, sand and clay 1:1, and clay). The seeds used were collected from Abu dom near New hamdab Research Station-northern Sudan. They were sown at the rate of two seeds per polythene bag (15x20 cm size) with watering interval of every 3 to 4 days. Five seedlings were chosen randomly from each treatment in each replication, the seedlings sample were freed carefully from the polythene size bags using water for further measuring of shoot and root length and then dried in an oven set at 65 C° for 24 hours to determine the dry weight of each component.

Results and discussion

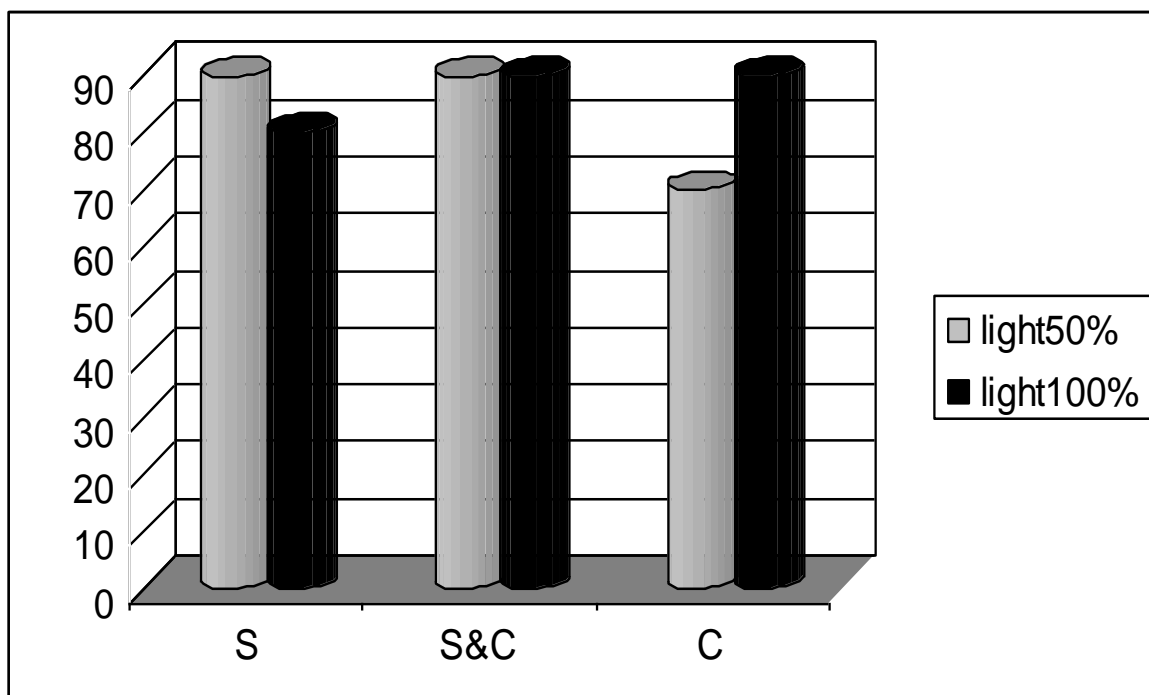
As shown in Fig 1, the germination of *Leptadenia pyrotechnica* after two weeks was better and similar under 50% light intensity on sand, and sand & clay (1:1), while under 100% light intensity was better on sand & clay, and clay soil types respectively. Seedling survival percentage for the tree species under 50% and 100% light intensity in different soil type ranged between (75-97 and 86-97%), respectively. A highly significant effect was observed between light intensity and soil types on plant height, fresh and dry weight of root and shoot and on root length. Plant height under 50% was better than under 100%, and better in clay soil than others soil type as recorded by the first, second- and third-month readings. On the other hand, significantly higher fresh and dry weight of root, shoot and root length, under 100% were observed than those under 50% light intensity and in clay and sand and clay 1:1 than in sand soil type (Table 1). The mean values of fresh and dry weight of root and shoot, as well as root length, under 100% were significantly higher than those under 50%, and the values in the clay and sand and clay (1:1) were better than in sand soil type (Table 1).

Germination of many species require specific light conditions, with species responding to slight variations in the light spectra associated with the season or shaded habitat, triggering or inhibiting germination (Fenner and Tompson 2005). The successful afforestation requires planting quality seedling with optimal potential for high rate of survival and growth height and basal diameter over time (Grossnickle and MacDonald 2017). Light availability is a major ecological factor influencing seed germination, seedling survival and establishment (Guenni *et al.*, 2018).

Generally, the interaction between different treatments showed that significant differences in height in the third month, and in fresh and dry root, shoot weight were observed. Significantly better fresh root, shoot and dry shoot weight under 100% in clay and sand & clay (1:1) soil type obtained compared to that under 50% light intensity in other soil type (Table 2). NeSmith, *et. AL.*, (2001) reported that plantable height, which is generally about 20 cm tall, and preferably 30 cm usually resulted in better survival. Therefore, clay soil under 100% light intensity was much better than the other soil type under 50% and 100% light intensity.

Recommendations

More research is needed on the physiology and growth of indigenous trees to afforestation and establishment. The natural forest vegetation performance in the semi-desert region particularly in Sudan, is especially prone to desertification. The study recommends the following combination of treatments for raising well established nursery seedlings of *Leptadenia pyrotechnica* local name (murkh) to be sown under full sun shine (100% light intensity) in clay and sand and clay soil types.



S = sand, S&C = sand and clay 1:1, C = clay

Fig1. Germination, 50% & 100% light intensity of *Leptadenia pyrotechnica* in different soil type.

Influences of light intensity, and soil type on the growth and performance of the indigenous tree seedling

Table (1) Effect of light intensity and different soil type on plant height, fresh and dry weight of root and shoot and root length of *Leptadenia pyrotechnica*

Parameters	Height (cm)			Fresh weight (g)		Dry weight (g)		Length root (cm)	
	Treatments	First month	Second month	Third month	Root	Shoot	Root		shoot
50%		14.4	41.4	63.2	0.33	3.21	0.10	0.74	13.8
100%		8.4	29	50.8	0.62	5.21	0.24	1.6	21.4
Sig.L		**	**	**	**	**	**	**	**
S.E±		0.14	1.02	1.61	0.03	0.14	0.02	0.02	0.96
	l.sd	0.82	6.22	9.8	0.20	0.88	0.11	0.13	5.8
Sand		9.5	28	54.3	0.16	2	0.06	0.5	16.5
Clay&Sand		12	38.17	55.5	0.38	3.7	0.16	1	19
Clay		12.8	39.50	61.2	0.88	7	0.29	1.9	17.5
Sig.L		**	**	**	**	**	**	**	*
S.E±		0.18	0.65	1.5	0.05	0.26	0.02	0.08	1.03
	LSD	0.59	2.13	5	0.17	0.88	0.06	0.27	3.4
	C.V%	2.1	5	4.9	12.2	5.9	4.9	3.1	9.4

Table (2) The interaction effect of light intensity and different soil type on, plant height, fresh and dry weight of roots and shoot and root length of *Leptadenia pyrotechnica*

Parameters Treatments	Height (cm)			Fresh weight (g)		Dry weight (g)		Length root (cm)
	First month	Second month	Third month	Root	Shoot	Root	Shoot	
50%\times S	13.7	38.3	62.3	0.13	1.7	0.013	0.40	13
50\times S&C	14.3	42.3	62	0.19	3.6	0.07	0.87	15
50\times C	15.3	43.8	65.3	0.6	4	0.22	0.97	13
100%\times S	5.3	17.7	46	0.19	2.3	0.10	0.6	20
100\times S&C	9.7	34	49	0.6	4	0.24	1.2	22.6
100\times C	10.3	35.3	57	1.1	9.7	0.35	2.9	21.6
Sig.L	**	**	*	**	**	*	**	NS
S.E\pm	0.25	1.27	2.4	0.07	0.3	0.03	0.1	1.5
LSD	0.79	4.8	7.98	0.21	1.1	0.09	0.32	4.96
C.V%	3.9	4.5	6.6	18.7	15.3	19.5	17.8	14.3

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