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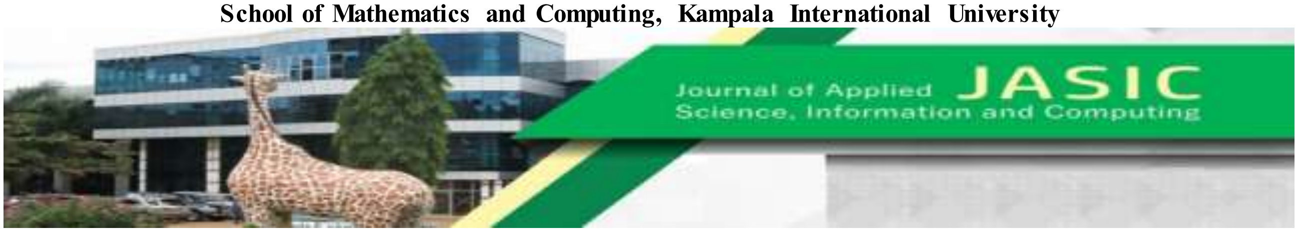

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CHLOROPHYLL EVALUATION OF *Mansonia altissima* (A Chev.) SEEDLINGS PERFORMANCE UNDER DIFFERENT LIGHT INTENSITIES AND SOIL TEXTURAL CLASSES

Iroko, O.A.[1], Asinwa, I.O.[1], Bolanle-Ojo, O.T.[1], Rufai, S.O[1] and Wahab, W.T.[1]
[1]Forestry Research Institute of Nigeria.
olayinkairoko@gmail.com

Abstract
Chlorophyll is essential for photosynthesis. It serves two primary functions which are to absorb light and transfer that light energy into chemical energy. This study assessed the chlorophyll content of *Mansonia altissima* seedlings under different light intensities (25%, 50%, 75% and 100%) and soil textural classes (Sandy, Loamy, Sandy-loam and Clay). The study was conducted in a 4 X 4 factorial experiment in a Completely Randomized Design (CRD). Interactions of the effects of light intensity and soil textural classes showed that leaves of seedlings raised under 50% light intensity with sandy soil had the highest chlorophyll a content 32.41 ± 0.04 mg/l while leaves of seedlings raised under 50% light intensity with clay soil had the least chlorophyll content with 16.18 ± 0.04 mg/l but for chlorophyll b, leaves of seedlings grown under 25% light intensity with clay soil had the highest chlorophyll b content 67.83 ± 0.01 mg/l while leaves of seedlings grown under 25% light intensity with sandy soil had the least content of 12.13 ± 0.01 mg/l. This implies that *Mansonia altissima* does not make changes in morphological characteristics due to effect of light intensities and soil textural classes but change in physiological characteristics such as biochemical change and an example is amount of chlorophyll a and b content of the leaves of *Mansonia altissima* seedlings examined in this study.

Keywords: *Mansonia altissima,* Light Intensity, Chlorophyll, Soil Textural Classes, Seedlings.

1. Introduction

Mansonia altissima is an evergreen medium-sized to fairly large tree up to 45 m tall; bole branchless up to 30 m, up to (100–150) cm in diameter, generally straight, cylindrical, sometimes with narrow buttresses; bark surface fissured lengthwise, clear brown, inner bark yellowish; crown small, ovoid, dense, with branches almost horizontal, later drooping; branch lets hairy or glabrous. The leaves are alternate, simple; stipules present, early falling; petiole 2–5 cm long, hairy; blade to orbicular, 15–30 cm × 8–15 cm, cordnate at base, rounded and sometimes short-acuminate at apex, margin slightly wavy or toothed, papery, densely hairy below, with 6–7 basal veins and 4–5 pairs of lateral veins. Inflorescence a large, stalked, terminal cyme 12–15 cm long, densely short-hairy, many-flowered. *Mansonia altissima* is characteristic of the dense semi-deciduous forest in areas with about 1600 mm annual rainfall and a pronounced dry season. The wood (trade names: mansonia, bété, African black walnut, pruno) is used for general and high-class joinery, cabinet work, furniture, turnery, decorative veneer and handicrafts. It is also used in construction for doors and windows, in railway coaches and shop fittings, and for boxes and crates.

Chlorophyll is a green pigment that helps absorbing sunlight for photosynthesis. Its molecule is made of a magnesium atom in a porphyrin ring. It is an essential plant pigments after seed germination when seedlings

have newly emerged leaves, called cotyledon V chlorophyll. Chlorophyll allows plants to absorb energy from light which is vital for photosynthesis (Carter, 1996). Chlorophyll pigments can be separated into chlorophyll a and chlorophyll b. The identity, function and spectral properties of the types of chlorophyll in each photosynthesis are distinct and determined by each other and the protein structure surrounding them.
Environmental conditions to a large extent determines the survival and growth of seedlings within a forest (Tilman, 1986). The sensitivity of plants to light quality and quantity plays a vital role in their physiological development (Aphalo and Ballare, 1995). The degree of shade created by the canopy is a key parameter that determines the amount of radiant energy available for photosynthesis in growing seedlings (Perry, 1994). Soil type is also a key parameter in seedling survival and growth because of the sensitivity of photosynthesis to water available in the soil (Jones, 1992). Hence, study will aid the selection of the most appropriate light intensity and best soil textural class that will facilitate chlorophyll content production for optimal seedling growth performance of the species. Due to the importance of this species, information on how to propagate this species could be of great value for reforestation effort in different parts of Nigeria.

2. Materials and Method

2.1 Experimental Location

The study was carried out at the Tree Improvement Nursery and Silviculture Nursery of the Department of Sustainable Forest management, Forestry Research Institute of Nigeria, Jericho Hill, Ibadan, Nigeria (FRIN). FRIN is located within longitude $07^0$23'18''N to $07^0$23'43"N and latitude $03^0$51'20"E to $03^0$51'43''E. Mean annual rainfall is about 1548.9 mm, falling within approximately 90 days. The mean maximum temperature is 31.9^0C, minimum 24.2^0C while the mean daily relative humidity is about 71.9%. Ibadan is the capital of Oyo state, Nigeria. It is in the sub – humid agro ecological zone of Nigeria. There are two distinct climatic season which are the dry season (from November to March) and rainy season (April to October). Ibadan is characterized by two peak of rainfall.

2.2 Experimental Design

The experimental design used for this study was 4 × 4 factorial experiment in completely randomized design. Factor A: 4 light intensity and Factor B: 4 textural classes of soil (Sandy, Loamy, Sandy-loam and Clay) which constituted the treatments. Each textural class of soil was replicated 10 times.

For chlorophyll extraction, the sample of leaves were collected from each treatment and prepared to determine their chlorophyll content. This was determined by the method of Bolanle-Ojo *et al*. (2018). 1.5 g was removed from the leaves collected from each treatment with the aid of a weighing balance. The leaf samples were grinded with 80 % methanol (Bolanle-Ojo *et al.,* 2018) with the aid of pestle and mortar. The residue was removed from the liquid with the aid of a filter paper. Methanol (80 %) was used to blank the meter after which the extract was introduced into the spectrophotometer. The readings from the meter were used to determine the chlorophyll concentrations using the following equations formulated by Arnon (1949) in Bolanle-Ojo *et al*. (2018);

Ca = $12.7A_{663} - 2.69A_{645}$
Cb = $22.9A_{645} - 4.68A_{663}$
D645 = Absorbance at 645nm (chlorophyll a)
D663 = Absorbance at 663nm (chlorophyll b)

2.3 Data Analysis

Data collected were subjected to Analysis of Variance (ANOVA) and means found to be different were separated using Duncan Multiple Range Test procedure.

3. Results

Table 1: Mean Separation for the Effect of Light Intensities on the Chlorophyll a and b of Leaves of *Mansonia altissima* Seedlings

Light Intensity	Chlorophyll a	Chlorophyll b
100%	21.43 ± 0.02^b	19.63 ± 0.01^d
75%	20.05 ± 0.02^a	26.97 ± 0.01^b
50%	21.01 ± 0.02^b	21.82 ± 0.01^c
25%	19.01 ± 0.02^a	36.00 ± 0.01^a

Means*±SE *with same alphabet in each column are not significantly different (p≤0.05)

Table 2: Mean separation for the Effect of Soils on Chlorophyll a and b of Leaves of *Mansonia altissima* Seedlings

Soils	Chlorophyll a	Chlorophyll b
Clay	18.83 ± 0.02^e	39.01 ± 0.01^a
Sandyloam	19.23 ± 0.02^c	31.23 ± 0.01^b
Sandy	20.09 ± 0.02^a	12.91 ± 0.01^e
Loam	19.00 ± 0.02^d	23.11 ± 0.01^c

Means*±SE *with same alphabet in each column are not significantly different (p≤0.05)

Table 3: Mean Separation for the Interaction Effect of Light Intensities and Soils on the Chlorophyll a and b of Leaves of *Mansonia altissima* Seedlings

L * S	Chlorophyll a	Chlorophyll b
L1S1	21.52 ± 0.04^{f}	18.06 ± 0.01^{k}
L1S2	19.90 ± 0.04^{f}	15.81 ± 0.01^{l}
L1S3	17.61 ± 0.04^{b}	14.94 ± 0.01^{kl}
L1S4	18.51 ± 0.04^{gh}	12.20 ± 0.01^{m}
L2S1	20.04 ± 0.04^{c}	33.63 ± 0.01^{f}
L2S2	20.92 ± 0.04^{de}	37.32 ± 0.01^{d}
L2S3	19.04 ± 0.04^{h}	21.99 ± 0.01^{i}
L2S4	17.92 ± 0.04^{h}	16.11 ± 0.01^{n}
L3S1	16.18 ± 0.04^{i}	52.52 ± 0.01^{b}
L3S2	17.67 ± 0.04^{g}	17.31 ± 0.01^{l}
L3S3	32.41 ± 0.04^{a}	16.70 ± 0.01^{n}
L3S4	25.28 ± 0.04^{c}	28.69 ± 0.01^{h}
L4S1	17.63 ± 0.04^{f}	67.83 ± 0.01^{a}
L4S2	18.99 ± 0.04^{f}	59.71 ± 0.01^{a}
L4S3	18.08 ± 0.04^{gh}	14.31 ± 0.01^{o}
L4S4	21.22 ± 0.04^{ef}	56.71± 0.01^{c}

Means*±SE *with same alphabet in each column are not significantly different (p≤0.05)

4. Discussion

Effect of light intensities on chlorophyll a and b of leaf of *Mansonia altissima* seedlings

Leaves of seedlings placed under 100% Light intensity (LI) had the highest chlorophyll a content 21.43±0.02mg/l while leaves of seedlings placed under 25% LI had the least with 19.01 ±0.02mg/l but for chlorophyll b, leaves of seedlings placed under 25% Light intensity (LI) had the highest chlorophyll b content 36.00 ±0.01mg/l while leaves of seedlings placed under 100% LI had the least content of 19.63 ±0.01 mg/l (Table 1).

Effect of soil textural classes on chlorophyll a and b of leaf of *Mansonia altissima* seedlings

Leaves of seedlings raised with sandy soil had the highest chlorophyll a content 20.09 ± 0.02mg/l while leaves of seedlings raised with clay soil had the least chlorophyll content with 18.83 ± 0.02mg/l but for chlorophyll b, leaves of seedlings grown with clay had the highest chlorophyll b content 39.01 ± 0.01mg/l while leaves of seedlings grown with sandy soil had the least content of 12.91 ± 0.01 mg/l (Table 2).

Effect of interaction of light intensities and soil textural classes on the chlorophyll a of leaf of *Mansonia altissima* seedlings

Leaves of seedlings raised under 50% light intensity with sandy soil had the highest chlorophyll a content 32.41 ± 0.04mg/l while leaves of seedlings raised under 50% light intensity with clay soil had the least chlorophyll content with 16.18 ± 0.04mg/l but for chlorophyll b, leaves of seedlings grown under 25% light intensity with clay soil had the highest chlorophyll b content 67.83 ± 0.01mg/l while leaves of seedlings grown under 25% light intensity with sandy soil had the least content of 12.13 ± 0.01mg/l (Table 3).

Where: L1 = 100%, L2 = 75%, L3 = 50%, L4 = 25%, S1 = Clay, S2 = Sandy-loam, S3 = Sandy, S4 = loamy

5. Conclusion

Chlorophyll a and b content of leaf of *Mansonia altissima* seedlings under low light intensities were higher compared to the leaf of seedlings under 100 % light intensity. This is in correlation with the work of Bolanle-Ojo (2014) who report that low light intensities increased the chlorophyll a and b content of leaf of *A. heterophyllus* seedlings after four (4) months of exposure to different light intensities. Chlorophyll a was higher in other soil textural classes expect for clay that had the lowest while chlorophyll b was higher in clay soil compared to other soil types.

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