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Effect of Different 'N' Dosages on the Bio-chemical Indices in *Swietenia macrophylla* (King.) & *Swietenia mahogany* (L.) Jacq.

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

The research experiment was carried out to evaluate the effects of various nitrogen sources combination on biochemical indices in *Swietenia macrophylla* and *Swietenia mahogany* at Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam. The study consists of ten different types of nitrogen fertiliser combinations (Organic and inorganic sources) includes control (without any fertilisers application) to compare the treatment effect in two tree crops. Research experiment was laid out in Randomized Block Design (RBD) with three replications. *Swietenia macrophylla* T2 (Urea + sheep manure) combined application shows statistically significant differences in bio chemical indices (Chlorophyll a and b) after the fertiliser application during the research experiment. In *Swietenia mahogany* T2 (Urea alone) shows the statistically significant difference in biochemical indices (Chlorophyll a and b) during the experimental research period. In both tree, crops did not explain any statistically significant differences in Carotenoids content due to fertiliser application at the time of research experiment.

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1. INTRODUCTION

The method which is used to describe the health in plants is Colour of health which means the green colour which is most popularly used to illustrate verve or live condition of the plants. By most of the scientists and research people dark green indicates sound and healthy plants and pale green or pale yellow which instances unhealthy. Chlorophylls as acquired a theatrical role in photosynthetic litigates which has happening in the leaves as the green components of plants. Chlorophyll content was a bare appraise by which to assess site quality, growth performance and nitrogen status of trees [1]. Chlorophyll content signifies photosynthetic activity as well as growth, metabolic activities, nutrient uptake, development of plant biomass [2]. Nitrogen is a limiting factor for plant yield and productivity in temperate and boreal forest ecosystems [3,4] Nitrogen is an important constituent in proteins, nucleic acids, chlorophylls, many secondary metabolites and growth regulators production in many plants [5,6]. Hence it capers substantive role in enzymatic activities of photosynthetic processes in plants. Chlorophyll content is a non specific indicator of plant condition which varies from plant to plant within the field and is dissembled by many biotic and abiotic factors of plant environment [7]. Forest plantations are established majorly on poor soils which are low in nitrogen content. In order to carry over the amount of low nitrogen high amount of nitrogen fertilizers applied in field to increase yield and reduce the rotation age of the plantations. The different schemes and combination of nitrogen acquirement will forthwith affect the comparative power of trees to thriving base in contrastive edaphic biota. Even if the various (organic and inorganic N) preferences of tree species which dwell tree communities are stillness unwell understood. This present paper investigates the usefulness and effect of inorganic, organic, combined N sources and prescription of optimum dosage for effective growth.

2. MATERIALS AND METHODS

2.1 Experimental Site

The field research trial were conducted in order to study the effect of different 'N' on biochemical indices of *Swietenia macrophylla* and *Swietenia mahogan*y under field condition at Forest College and Research Institute, Mettupalayam, located at 11°19'N latitude and 77°56'E longitude and having an altitude of 300 M above mean sea level. The soil used for the experiment in the field was non - calcareous, red sandy loam (*Typic ustropept*), low in nitrogen, medium in phosphorus and potassium.

2.2 Experimental Materials

Swietenia macrophylla and *Swietenia mahogan*y leaves were used in this experiment and it was planted already on November 2016 at Precision Silviculture Field in Forest College and Research Institute Mettupalayam (Tamil Nadu, India).

2.3 Experimental Design

Eighty one seedlings of two species namely *Swietenia macrophylla* and *Swietenia mahogan*y with 1 year old tree leaves were used. A randomized block design was used. There were 10 treatments was prepared in three replicates. The treatments were as follows; T1(100% N in:40:40:40 NPK kg/ha), T2 (125 % N in 40:40:40 NPK kg/ha), T3(75 % N in 40:40:40 NPK kg/ha), T4(T1 + 5 kg of vermicompost), T5 (T1 + 5 kg of vermicompost), T6(T1 + 5 kg of vermicompost), T7(T1 + 5 kg of sheep manure), T8 (T2+ 5 kg of sheep manure), T9 (T3+ 5 kg of sheep manure) and control (unfertilized trees).

2.4 Analysis of Plant Material

The chlorophyll was estimated adopting the method of Yoshida et al. [8] and expressed as mg per gram (mg g^{-1}) of fresh weight. Recently matured fresh leaf samples of 250 mg at 3 months after imposing the treatments were collected, washed in distilled water and then ground with 10 ml of 80 percent acetone using pestle and mortar. The homogenate solution was centrifugated at 5000 rpm for 10 minutes. The supernatant was collected and the volume was made up to 25 ml using 80 percent acetone. The optical density of the content was measured at 663, 645, 510 and 480 nm. The chlorophyll a, chlorophyll b, Carotenoids were calculated using the following formula.

$$\text{Chlorophyll a content (mg g}^{-1}) = \frac{12.7 \times \text{OD at 663} - 6.29 \times \text{OD at 645} \times V}{1000 \times W}$$

$$\text{Chlorophyll b content (mg g}^{-1}) = \frac{22.7 \times \text{OD at 645} - 4.68 \times \text{OD at 663} \times V}{1000 \times W}$$

$$\text{Carotenoids content (mg g}^{-1}) = \frac{7.6 \times \text{OD at 480} – 1.49 \times \text{OD at 510}}{1000 \times W}$$

Chlorophyll 'ab' ratio

Where,

V = Volume made (25 ml)
W = Weight of fresh sample taken (250 mg)

2.5 Statistical Analysis

All collected data were statistically auctioned by analysis of variance (ANOVA) applying the SPSS software tool version 16.0 for suitable of windows. All the ten treatment means were equated using Duncan's Multiple Range Test (DMRT) at 5% significance level.

3. RESULTS

The actual Meta-analysis and the concomitant biochemical traits analysis intimated that various dosages of nitrogen sources combinations induced distinct modifications of these traits in both plants. The analysis concentrated on the changes accelerated through N fertilization since this was the solitary nutrient for which a adequate puddle of studies was usable to derive authentic inferences. Fertilization with the various amount of nitrogen compared to rise in chlorophyll a and b, chlorophyll ab ratio, Carotenoids contents in both tree crops and at the same time a statistically substantial correlation was also noted in all growing seasons of both tree crops. (90 DAYS, 180 DAYS, 270DAYS). Table 1 shows that the mean biochemical traits values of *Swietenia macrophylla*. In *S. macrophylla* the various nitrogen dosages statistically found significant differences were found in chlorophyll 'a' and Chlorophyll 'b' with the highest mean value of chlorophyll 'a' (2.5167 mg/g^{-1}), chlorophyll 'b' (0.9467 mg/g^{-1}) and there was no statistically significance difference found in Carotenoids in this research trial during the experimental period (Fig. 1). Table 2 show that the mean biochemical traits values of *Swietenia mahogany*. In Swietenia mahogany the different amount of nitrogen statistically chanced significant variations were found only in T2 (Urea alone) with a highest mean value of chlorophyll a (2.3133 mg/g^{-1}), chlorophyll b (1.1267 mg/g^{-1}). All other biochemical traits exhibit statistically significant difference after the fertiliser application except Carotenoids. There was no statistically significant difference found in Carotenoids content during the research investigation in both tree crops (Fig. 2).

4. DISCUSSION

The fertilisers both organic and inorganic applied to soil provides various macro and micronutrients to soil which has saved by plants and used for multiple growth and metabolic activities to synthesise chlorophyll, plant hormones and growth regulators and their standard developments [9]. In this present research investigation planned to study the various effects caused by different of 'N' fertiliser combinations on biochemical indices of two tree crops. Chlorophyll content value increases in all the treatments than control. In Swietenia macrophylla, the plants treated with the T8 (Urea + sheep manure) recorded highest mean chlorophyll 'a', chlorophyll 'b'. These findings also cope up with the results of Amujoyegbe et al. [10]. He reported that the plant exhibits its highest chlorophyll a and b content when they were treated with chemical fertilisers and poultry manures in maize and

Table 1. Effect of different N dosages on chlorophyll content of *Swietenia macrophylla* during the experimental period (0 - 270 DAYS)

S. no	Treatment details	*Swietenia macrophylla*											
		Chlorophyll a				*Chlorophyll b*				*Carotenoids*			
		0 DAYS	90 DAYS	180 DAYS	270 DAYS	0 DAYS	90 DAYS	180 DAYS	270 DAYS	0 DAYS	90 DAYS	180 DAYS	270 DAYS
1.	T1	0.6833	1.2133	1.4833	1.8200	0.2800	0.4833	0.6633	0.8567	0.4767	0.5567	0.7467	0.8467
2.	T2	0.6333	1.3200	1.7567	2.0867	0.3200	0.5000	0.7300	0.9000	0.2567	0.3467	0.4333	0.5033
3.	T3	0.6800	1.4467	1.8367	2.4600	0.2900	0.5333	0.8467	1.0800	0.3233	0.4000	0.5700	0.7100
4.	T4	0.6733	1.0467	1.5567	1.9067	0.2633	0.6000	0.8133	1.2000	0.2600	0.3967	0.4933	0.6333
5.	T5	0.6867	1.1033	1.6167	2.0900	0.2600	0.5567	0.8233	1.0500	0.2100	0.3167	0.4633	0.5833
6.	T6	0.6700	1.3633	1.8300	2.3967	0.2500	0.5467	0.6933	1.0833	0.2467	0.3500	0.5200	0.6533
7.	T7	0.6800	1.1333	1.5133	1.8500	0.2200	0.4933	0.8333	1.0933	0.2433	0.4100	0.5300	0.6667
8.	T8	0.7000	1.4567	1.9467	2.5167	0.2667	0.6533	0.9467	1.4233	0.2600	0.3933	0.5167	0.7000
9.	T9	0.6567	1.2467	1.8767	2.3133	0.2433	0.5433	0.8433	1.1300	0.2267	0.3633	0.4800	0.5667
10.	Control	0.4933	0.5633	0.6200	0.6800	0.2267	0.3267	0.3833	0.5567	0.1767	0.2400	0.3333	0.4467
	Total Mean	0.6557*	1.1893*	1.6037*	2.0120*	0.2620*	0.5237*	0.7577*	1.0373*	0.2680*	0.3773*	0.5087*	0.6310*
	SD	0.1174	0.2658	0.3770	0.52141	0.0471	0.0983	0.1635	0.2411	0.0884	0.0870	0.1131	0.1277

**Indicates 5% significance level*

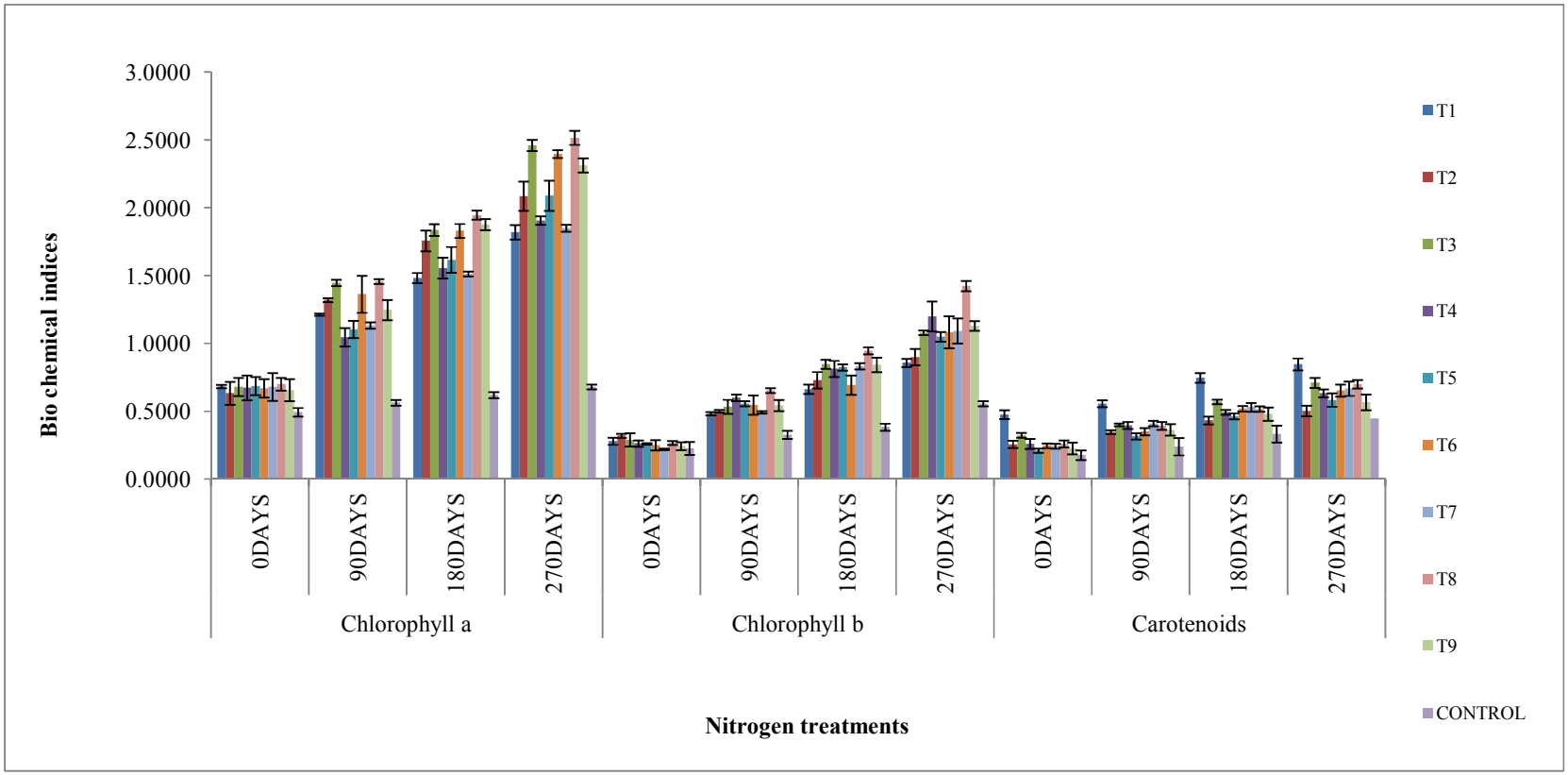

Fig. 1. Effect of different 'N' dosages on biochemical indices in *Swietenia macrophylla*

Table 2. Effect of different N dosages on chlorophyll content of *Swietenia mahogani* during the experimental period (0 - 270 DAYS)

S. no	Treatment details	*Swietenia mahogani*											
		Chlorophyll a				*Chlorophyll b*				*Carotenoids*			
		0 DAYS	90 DAYS	180 DAYS	270 DAYS	0 DAYS	90 DAYS	180 DAYS	270 DAYS	0 DAYS	90 DAYS	180 DAYS	270 DAYS
1.	T1	0.8000	1.2433	1.5433	1.8667	0.2600	0.5433	0.6867	0.8900	0.3300	0.5300	0.5700	0.6200
2.	T2	0.6733	1.3400	1.8233	2.3133	0.2833	0.6067	0.9100	1.1267	0.3500	0.4300	0.5267	0.5900
3.	T3	0.8167	1.3133	1.7000	2.0033	0.3000	0.4867	0.7000	0.8933	0.5033	0.7000	0.8067	0.8467
4.	T4	0.6800	1.0933	1.4033	1.6767	0.2967	0.4700	0.6367	0.8133	0.4133	0.5167	0.6200	0.7033
5.	T5	0.6000	0.9333	1.2233	1.5000	0.2867	0.4433	0.5967	0.8367	0.4633	0.5633	0.6833	0.7400
6.	T6	0.6700	0.9800	1.3667	1.6967	0.1767	0.3467	0.5900	0.7767	0.4633	0.6633	0.7233	0.7867
7.	T7	0.8267	1.2900	1.6133	1.8767	0.2800	0.5433	0.8333	1.0967	0.5567	0.6333	0.7067	0.7933
8.	T8	0.6600	1.2100	1.5200	1.7367	0.2400	0.4733	0.7900	1.0033	0.5133	0.6633	0.7567	0.8533
9.	T9	0.6400	1.2233	1.4167	1.6600	0.2333	0.4633	0.6900	0.8933	0.5700	0.6633	0.7400	0.8033
10.	Control	0.5900	0.6900	0.7767	0.9600	0.1767	0.2867	0.3633	0.4033	0.3533	0.4400	0.5133	0.6067
	Total Mean	0.6957*	1.1317*	1.4387*	1.7290*	0.2533*	0.4663*	0.6797*	0.8733*	0.4517*	0.5803*	0.6647*	0.7343*
	SD	0.1240	0.2190	0.2910	0.3491	0.0631	0.1116	0.1606	0.2205	0.0877	0.1054	0.1088	0.1059

Indicates 5% significance level

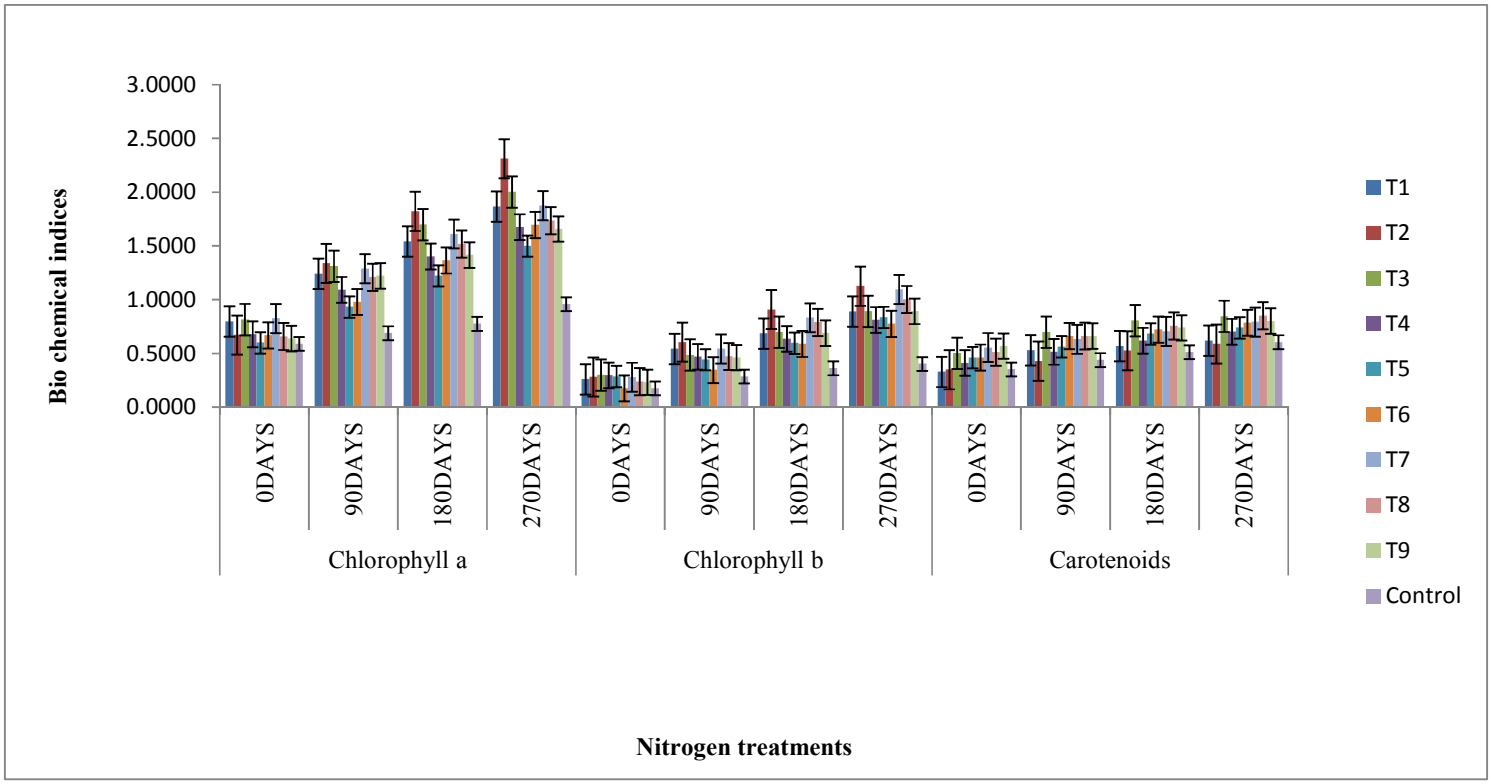

Fig. 2. Effect of various 'N' dosages on biochemical indices in *Swietenia mahogani*

sorghum. Bilijana and Aca [11] reported that the significantly higher chlorophyll content of maize leaves found with poultry manure and sheep manure due to differences in the amount of nitrogen in organic manures. From these findings, animal manure is the best suit alternative for chemical fertilisers which are regularly release the nutrients at obtuse rates from his pool into the soil which can be easily derived by the plants and used for its various growth and development activities.

In Swietenia mahogany the plants treated with the T2 (Urea alone) records highest Chlorophyll 'a', Chlorophyll 'b' content. This shows the amount of nitrogen increases the amount of chlorophyll content also increases. These findings also correlated with other scientist's research findings. Hazrati et al. [12] reported that highest levels of chlorophyll 'a' and 'b' were found in the highest level of Nitrogen. Pokharel and Chang [13] found that High amount N fertiliser application leads to significant amount of N allocated to metabolically active tissues like as leaves and stems by increasing Leaf Area Index and Chlorophyll concentration of leaves which is responsible and supports the better plant growth.

Physical and visual observations were carried out during the experiment by the observer. It demarcated the colour of leaves was high dark green in all the treatment combination of fertiliser application. The plants those got combined application of fertilisers (Organic + inorganic) recorded high leaf roughness and length.

5. CONCLUSION

The colour of plant leaves is decided by a considerable amount of biotic and biotic factors. Thus chlorophyll content in leaves cannot be used as an index to evaluate the growth rate in field condition. However, one single factor of plant condition is merely as providing as assaying to find the bookmen's gemstone. In comparative research experiments, chlorophyll content is one of the best indicators for comparing the different effects caused by different fertiliser treatments.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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