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# Effect of organic, inorganic and bio fertilizers on the early establishment and seedling growth of *Melia dubia* CAV.

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**Abstract**

Optimization of plant growth by providing required amount of nutrients is one of the important nursery techniques in raising healthy growing stock. In this realm, a study was conducted on the effect of organic, inorganic and biofertilizers on the growth and early establishment of Malabar Neem (*Melia dubia* CAV.). The study was carried out at College of Agriculture, Raichur during the period of 2015-16 using ten different treatments in 3 replications. It was found that the use of Vermicompost @ 20g/seedling, increases the physiological growth parameters of seedlings *viz*., shoot length, root length, root to shoot ratio, root diameter, seedling dry weight and chlorophyll content. Using of Poultry manure at the rate of 20 g/ seedling too have shown better results when compared to the other treatments.

**Keywords:** *Melia dubia* CAV., vermicompost, poultry manure, growth

## 1. Introduction

The IPCC special report on the impacts of global warming puts forth that a 1.5 per cent increase in $CO_2$ level can be devastating to 800 million people in Earth (https://www.ipcc.ch). Taking into consideration, the economic and social impacts of the growing $CO_2$ level, methods have to be formulated to mitigate the long term atmospheric storage of $CO_2$ and thereby to defer global warming. Though, there are several thousand ways to capture $CO_2$ from the atmosphere, bio sequestration or biological processes of carbon sequestration by plants are the most effective (Sugandha *et al*., 2009) [10]. In such a scenario, *Melia dubia* CAV. commonly known as Malabar Neem which is a large deciduous and fast growing tree with wide spreading branches on a stout, straight tall bole acquires greater significance (Nair *et al*., 2005) [8]. Malabar Neem is naturally found in the tropical moist deciduous and semi evergreen forest of South and Central Western Ghats, Eastern Ghats and North East India upto an altitude of 1500-1800 meter and is common in moist deciduous forests of Kerala, and is becoming very popular in Southern states of India for its fast growth and wide adaptability in diverse edaphic and climatic conditions (Gupta 1993 and Mabberley, 1997) [5, 7]. But the optimum plant type and amount vary with the species due to wide differences in their nutrient requirements and with the prevailing level of soil fertility, though the plants need several essential elements *viz*., nitrogen, phosphorous and potassium are of paramount importance (Kumar *et al*., 2008) [6]. Proper nutrient management in nursery will reflect on the behaviour of crop in main field (Zambrano and Diaz, 2008) [12]. Seedling growing on good media with optimum amount of nutrients is necessary for production of healthy seedlings and development of sturdy root system (Cicek *et al*., 2009) [4]. Inexpensive and nutrient rich medium that produce healthy and vigorous seedlings which ensure early establishment are required in raising forest plantations where after care of seedlings are comparatively *viz*-a-*viz* reduces the time required for seedlings to recover in nursery thereby reduces the cost of production per seedlings (Revathi and Bharadwaj, 2013) [9]. The present study was therefore conducted to evaluate the effect of various organic, inorganic and bio fertilizers on early seedling growth and vigour of *Melia dubia* Cav.

## 2. Materials and Methods

The field experiments were conducted at the research farm of college of agriculture, Raichur, located at a latitude of $16^0$12'N and longitude of $77^0$22'E during 2015-16. The experiment was conducted in Completely Randomized Block Design with 3 replications. The treatments include $T_1$: control $T_2$: Poultry manure (20g/ seedling) $T_3$: Vermicompost (20 g/ seedling) $T_4$: Urea (1g/seedling) $T_5$: DAP(1g/seedling) $T_6$: NPK 1:1:1 (19: 19:19 @ 1g/ seedling) $T_7$: *Azatobactor* (5g/seedling) $T_8$: *Azospirillum* (5g/seedling) $T_9$: P-solubilizing bacteria (PSB) (5 g/seedling) $T_{10}$: *Azatobactor* + *Azospirillum* + PSB (5g + 5g + 5g/ seedling).

The root length between collar region and the tip of the root was measured by destructively harvesting ten plants from each replication while shoot length was measured from collar region to the apex. Further, the root to shoot ratio was calculated as root length (cm) divided by shoot length (cm) while the root diameter was measured at the base of collar region of the seedlings using digital calipers and expressed in millimetre. For Seedling dry weight ten normal seedlings from each treatment were taken in butter paper cup and dried in a hot air oven maintained at $70 \pm 2^0$ C temperature for 24 hours. Then, the seedlings were removed and allowed to cool in a desiccator for 30 minutes before weighing in an electronic balance. The average weight was calculated and expressed as seedling dry weight in milligram. The chlorophyll content of leaf was estimated using SPAD meter. The average of 5 values taken at 5 different positions of a single plant was recorded as the chlorophyll content of the seedling.

### 2.1 Statistical analysis

The data collected from the experiment were analysed statistically by SPSSv. 16. Multiple comparisons were done by post Hoc method and critical differences calculated at 1 and 5 percent level wherever F test was significant.

## 3. Results and Discussion

Significantly higher shoot length, root length, root to shoot ratio, root diameter, seedling dry weight and chlorophyll content at 45, 90 and 135 days respectively were observed in all the treatments when compared to control. Mean shoot length (Table 1) in Malabar Neem varied significantly from 45 days after planting due to the influence of organic and inorganic manures. Maximum shoot length at 45 and 90 days after planting were found to be 37.26 cm and 68.05 cm respectively in treatment $T_3$ constituting Vermicompost (20g/ seedling) followed by treatment $T_2$ constituting poultry manure 20g/ seedling (34.54 cm and 63.09 cm respectively) and differed significantly with all other treatments. The extent of increase in shoot length due to the same was found to be 23.8, 31.2, and 43.4 per cent over control at 45, 90 and 135 days respectively. The increase in shoot length may be due the presence of all essential nutrients in the media which are in readily available form. This leads to increased uptake of nutients which in turn enhances the height of seedling. Comparitive results have been presented by Atilla *et al*., (2014) [1] in Scots pine. The extend of increase in root length (Table 2) due to the treatment $T_3$: Vermicompost@ 20g/ seedling was found to be 30.8, 36.6 and 42.3 per cent over control at 45, 90 and 135 days respectively and is in support with the results published by Bharadwaj *et al*., 2014 [3] in Papaya.

In the present study, it is seen that the root to shoot ratio (Table 3) and root diameter (Table 4) were high in seedlings which received Vermicompost at the rate of 20g/ seedling. This was followed by treatment $T_2$, constituting poultry manure 20g/seedling, $T_4$ urea @ 1g/ seedling and $T_7$(*Azotobactor* @ 5g/ seedling). The probable reason for significant increase in root length and root to shoot ratio in soil media with *Azotobactor* may be due the release of growth promoting substances by these microorganisms and in urea due to the higher release of nitrogen from the media, which plays an important role in the physiological growth of the plant. Similar studies were conducted by Aseri and Rao (2005) [2], who showed that there was a significant enhancement in the growth inoculation with *Azospirillum brasilense* and *Azotobacter chroococcum.*

Significantly high seedling dry weight (Table 5) and chlorophyll content (Table 6) was observed in seedlings applied with Vermicompost at the rate of 20g/ seedling. Higher nitrogen content in Vermicompost might have influenced the increase in chlorophyll content and thereby photosynthesis which in turn led to the increase in seedling dry weight. Nitrogen plays an important role in increasing the plant height as it plays direct role in formation of proteins. It is also an integral part of chlorophyll which is primary absorber of light energy needed for photosynthesis. This may have led to the increased production of photosynthates and its distribution into root and shoot portion resulting in higher plant and leaf area production. Along with nitrogen, phosphorous may also have contributed in increasing height by maximizing photosynthesis, cell division and cell enlargement, in which phosphorous role is very much essential. This result is in conformation with findings of Swaminathan (1995) [11].

**Table 1:** Shoot length (cm)

| **Treatments** | **No of days after sowing** | | |
|---|---|---|---|
| | **45** | **90** | **135** |
| $T_1$ | 23.85 | 43.58 | 56.4 |
| $T_2$ | 34.54 | 63.09 | 81.71 |
| $T_3$ | 37.26 | 68.05 | 88.02 |
| $T_4$ | 28.39 | 51.85 | 67.09 |
| $T_5$ | 24.79 | 45.29 | 58.72 |
| $T_6$ | 34.34 | 62.79 | 81.24 |
| $T_7$ | 28.65 | 51.87 | 67.13 |
| $T_8$ | 29.12 | 53.65 | 69.39 |
| $T_9$ | 31.01 | 55.76 | 72.17 |
| $T_{10}$ | 32.04 | 57.07 | 73.93 |
| Mean | 30.39 | 55.3 | 71.58 |
| S.Em+_ | 0.26 | 0.487 | 0.9 |
| CD @ 5 % | 0.05 | 1.38 | 2.55 |

**Table 2:** Root length (cm)

| Treatments | No of days after sowing | | |
|---|---|---|---|
| | 45 | 90 | 135 |
| $T_1$ | 8.5 | 11.94 | 17.39 |
| $T_2$ | 10.16 | 14.3 | 20.84 |
| $T_3$ | 11.12 | 15.63 | 22.78 |
| $T_4$ | 8.61 | 12.1 | 17.63 |
| $T_5$ | 9.43 | 13.25 | 19.31 |
| $T_6$ | 10.19 | 14.35 | 20.91 |
| $T_7$ | 9.62 | 13.54 | 19.73 |
| $T_8$ | 9.84 | 13.84 | 20.16 |
| $T_9$ | 9.29 | 13.06 | 19.04 |
| $T_{10}$ | 9.5 | 13.35 | 19.45 |
| Mean | 9.63 | 13.54 | 19.73 |
| S.Em+_ | 0.1 | 0.175 | 0.26 |
| CD @ 5 % | 0.294 | 0.495 | 0.736 |

**Table 3:** Root to shoot ratio

| Treatments | No of days after sowing | | |
|---|---|---|---|
| | 45 | 90 | 135 |
| $T_1$ | O.27 | 0.36 | 0.42 |
| $T_2$ | 0.29 | 0.39 | 0.43 |
| $T_3$ | 0.37 | 0.5 | 0.56 |
| $T_4$ | 0.34 | 0.48 | 0.53 |
| $T_5$ | 0.33 | 0.39 | 0.44 |
| $T_6$ | 0.31 | 0.39 | 0.43 |
| $T_7$ | 0.33 | 0.44 | 0.49 |
| $T_8$ | 0.32 | 0.44 | 0.49 |
| $T_9$ | 0.28 | 0.4 | 0.49 |
| $T_{10}$ | 0.31 | 0.44 | 0.49 |
| Mean | 0.32 | 0.42 | 0.47 |
| S.Em+_ | 0.005 | 0.007 | 0.008 |
| CD @ 5 % | 0.014 | 0.019 | 0.022 |

**Table 4:** Root diameter (mm)

| Treatments | No of days after sowing | | |
|---|---|---|---|
| | 45 | 90 | 135 |
| $T_1$ | 1.45 | 1.52 | 1.7 |
| $T_2$ | 1.83 | 1.92 | 2.15 |
| $T_3$ | 2.03 | 2.13 | 2.39 |
| $T_4$ | 1.54 | 1.61 | 1.81 |
| $T_5$ | 1.53 | 1.62 | 1.81 |
| $T_6$ | 1.8 | 1.89 | 2.11 |
| $T_7$ | 1.55 | 1.62 | 1.82 |
| $T_8$ | 1.64 | 1.72 | 1.92 |
| $T_9$ | 1.64 | 1.72 | 1.93 |
| $T_{10}$ | 1.57 | 1.66 | 1.86 |
| Mean | 1.66 | 1.74 | 1.95 |
| S.Em+_ | **0.115** | 0.087 | 0.098 |
| CD @ 5 % | 0.325 | 0.246 | 0.277 |

**Table 5:** Seedling dry weight (g)

| Treatments | No of days after sowing | | |
|---|---|---|---|
| | 45 | 90 | 135 |
| $T_1$ | 0.381 | 0.442 | 0.561 |
| $T_2$ | 0.783 | 0.905 | 1.141 |
| $T_3$ | 0.911 | 1.05 | 1.335 |
| $T_4$ | 0.488 | 0.565 | 0.718 |
| $T_5$ | 0.416 | 0.482 | 0.612 |
| $T_6$ | 0.786 | 0.909 | 1.148 |
| $T_7$ | 0.481 | 0.557 | 0.708 |
| $T_8$ | 0.427 | 0.494 | 0.628 |
| $T_9$ | 0.525 | 0.607 | 0.77 |
| $T_{10}$ | 0.44 | 0.516 | 0.666 |
| Mean | 0.564 | 0.653 | 0.829 |
| S.Em+_ | 0.025 | 0.027 | 0.032 |
| CD @ 5 % | 0.07 | 0.076 | 0.091 |

**Table 6:** Chlorophyll content (SPAD value)

| Treatments | No of days after sowing | | |
|---|---|---|---|
| | 45 | 90 | 135 |
| $T_1$ | 26.41 | 24.64 | 31.13 |
| $T_2$ | 32.48 | 25.95 | 32.65 |
| $T_3$ | 33.75 | 34.01 | 35.17 |
| $T_4$ | 30.91 | 26.6 | 33.76 |
| $T_5$ | 30.3 | 29.5 | 34.76 |
| $T_6$ | 33.53 | 25.37 | 32.7 |
| $T_7$ | 30.65 | 31.11 | 33.97 |
| $T_8$ | 29 | 32.31 | 33.53 |
| $T_9$ | 27.29 | 29.93 | 31.45 |
| $T_{10}$ | 33.59 | 30.51 | 34.71 |
| Mean | 30.72 | 28.99 | 33.38 |
| S.Em+_ | 0.43 | 0.64 | 0.19 |
| CD @ 5 % | 1.21 | 1.82 | 0.53 |

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