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Full Length Research Paper

Effects of Pre-sowing Seed Treatments on Germination and Seedling Growth Performance of *Melia dubia* CAV: An Important Multipurpose Tree.

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Abstract

Melia dubia Cav. is a species of high medicinal and industrial economic value commonly referred as Malabar Neem Tree. Recently this species is gaining more popularity for its fast growth. The natural germination through seeds is less than 25%. So there is need to find out appropriate pre-sowing treatment. With this information the study was conducted to explore the effects of different seed treatments on germination and seedling growth parameters of a multipurpose plant, *Melia dubia* in the College of Forestry, Ponnampet nursery during 2010-2011. Seeds were subjected to seven pre-sowing treatments. The results showed that cow dung slurry treatment for seven days had significantly enhanced germination and seedling growth. Seed germination started 32 days after sowing and continued up to 66 days. The highest germination percentage (34.3 %) was observed in the soaking of seeds in cow dung slurry for seven days (T_4) followed by (31.5 %) 100 ppm Gibberlic acid for 24 hours (T_7). The lowest germination percentage (18.7 %) was obtained from control (T_0). The highest germination value (2.2) and germination energy (25) was also obtained in T_4, which was significantly ($p<0.05$) different from the control and other treatments. Shoot length, root length, collar diameter and leaf number followed the same trend of higher value for T_4 and T_7 respectively. Similar trend was also observed in shoot, root and total seedling dry weight. Therefore, pre-sowing treatment, T_4 was more effective in germination and production of quality seedling of *Melia dubia* in the nursery.

Key words: *Pre-sowing treatment, imbibition period, germination value, germination per cent, germination energy.*

Introduction

Increasing population and rapid decrease in the forest cover, poor increment, low sustainable yield and increasing demand lead to shortage of timber and fuel wood in the country. Fuel wood need is partly being met from agricultural residues, agroforests and largely through unregulated and unsustainable extraction from the forests. Modernization, growth and expansion of wood based industries have suffered for demand for sustainable supply of industrial round wood at reasonable price resulting in import of newsprint paper and wood products (Lal, 2008). The annual productivity of Indian forests is 1.36 m^3/ha compared to the world average of 2.5 m^3/ha. It is estimated that around 149 million m^3 timber wood is required annually in India against the projected production of 41.5 million m^3 by 2020 (Pachauri and Mehrotra, 2002) and there would be huge gap between demand and supply in future.

In order to meet ever increasing demand of wood some of the short rotation fast growing species like *Eucalyptus*, *Acacia* and *Casuarina* species are being promoted by wood based industries. Large scale plantations are being raised on degraded forest lands, farm lands, community lands and road, rail, canal strips in India. These plantations have created very useful resources for timber, poles and fuel wood. However, most of these earlier plantations have very low productivity ranging from 6 to 10 m^3/ha/yr and poor returns (Kulkarni, 2002) with long rotation periods, and pests and diseases problems. To address these concerns, study was conducted to explore the potential of indigenous trees as alternate sources of raw materials for pulp and paper and one of such species is *Melia dubia.*

Melia dubia being one of the broad leaved species is commonly known as Malabar Neem and is the best known representative of family meliaceae after *Azadirachta indica* (Neem). It is a deciduous tree growing from 6 to 15 m in height. It occurs in the tropical moist deciduous forests of the Sikkim Himalayas, North Bengal and upper Assam, N. Circars, Deccan and the Western Ghats. It grows on variety of soils, however, deep fertile sandy loam soils shows optimum growth, while shallow gravelly soils shows stunt growth. Its wood is used for packing cases, cigar boxes, ceiling planks, building purposes, agricultural implements, pencils, match boxes, splints musical instruments, tea boxes plyboard and fuel wood (Calorific value, 5.043 - 5,176 cal.). Even though, forest tree seedling production system has been revolutionized in many countries, production of planting stock is still largely dependent upon conventional methods in India. Forest nurseries play a vital role in getting success in all aforestation programmes. Raising quality seedling requires technical skills including careful planning for selection of quality seeds, appropriate growing media, containers, nursery hygiene and protection. With *Melia dubia* gaining more importance, its systematic cultivation has also become more crucial. But, there is only sparse information available for scientific management of this species; hence, it was intended to take up the present study.

Materials and Methods:

Study site and growing media: The present study was carried out during 2010-2011 in nursery at College of Forestry, Ponnampet, Kodagu district of India. Ponnampet is situated at 12".20^0 N latitude and 75".56^0 E longitudes and at an altitude of 867 MSL. Matured seeds were collected from the matured *Melia dubia* trees and uniform sized seeds were used to reduce non-treatments variation. Then the seeds were imposed with different treatments and sown in raised bed with the growing media of Soil: Sand: FYM (3:1:1).

Experimental design and treatment combinations: A Randomized Complete Block Design (RCBD) was adopted for the study. There were seven treatments including control and 4 replications for each treatment. For each replication hundred seeds were sown to explore the effect of pre-sowing treatments on germination. After germination, seedlings were allowed to growing for assess initial growth performance. The pre-sowing seed treatments details used in the experiment are furnished below:

T_1: Control
T_2: Cold water (24 hrs)
T_3: Hot water (60-80 ^{0}C 6 hrs)
T_4: Cow dung (7 days)
T5: Cow dung (10 days)
T_6: Gibberlic acid (50 ppm, 24 hrs)
T_7: Gibberlic acid (100 ppm, 24 hrs)

Assessment of seed germination pattern and percentage: The effects of pre-sowing seed treatments were evaluated by daily counting of germinated seeds. The germination pattern was recorded from the date of sowing to the end of germination. Daily germination percentages were summed up to obtain cumulative germination percentage for each treatment on each measurement date. Then seedlings were allowed to grow altogether under same environmental condition.

Germination phase, germination energy and Germination value: The imbibition period (number of days from sowing to commencement of germination) was recorded. The germination energy, defined as the germination percentages when the mean daily germination (cumulative germination percent divided by the time elapsed since sowing date) reached its peak, was also determined. Germination energy is also a measure of the speed of germination and hence, it was assumed as a measure of the vigor of seedling it produced. In addition, the germination value (GV) was computed following the method of Djaranshir and Pourbeik (1976).

Growth performance: At the end of the experiment, all seedlings were measured for total height, collar diameter and total number of leaves. Randomly five seedlings from each replication were uprooted very carefully and roots were washed with water to remove adhering soil particles and to estimate the seedling biomass. The uprooted seedlings were then were cut at collar region to divide them into shoot and root and were oven dried until the constant weight was obtained for analyzing biomass productions in different pre sowing treatments.

Statistical Analysis: Data were statistically analyzed by using computer software Microsoft Excel to explore possible treatment variations. The Analysis of Variance (ANOVA) and AGRISTAT software were used for the analysis as described by Panse and Sukhatme (1967).

Results

Melia dubia is a multipurpose tree with huge medicinal and commercial value. Germination of seeds in nature is very difficult, but once germinated, is a fast growing tree.

Seed Germination:

Germination period: Seed germination started 32 days after sowing and continued up to 64 days. Different treatments significantly affected the germination period of the species. The fastest germination e.g. least imbibition period (32 days) was observed in T_4, T_5,$T_6$and T_7 and delayed germination e.g. highest imbibition period (36 days) was found in T_2 & T_3 (Table 1).

Table 1: Imbibition period, germination period, germination percentage, germination value and germination energy of *M. dubia* seeds under different pre-sowing treatments.

Variables	Treatments						
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
Imbibition period (day)	36a* ±2.0	36a ±1.5	34b ±1.0	32bc ±0.1	32bc ±0.2	32bc ±0.1	32bc ±0.2
Total germination Period (day)	64a ±2.02	62a ±2.22	58b ±3.75	62a ±1.92	62a ±2.02	62a ±2.77	64a ±3.2
Germination (%)	18.7a ±2.0	19.0a ±1.2	20.5a ±2.2	34.3b ±0.8	24.7b ±1.5	27.2bc ±1.8	31.5bc ±1.2

Germination Value	0.6	0.6	0.8	2.2	1.7	1.3	1.9
Germination Energy (%)	13.75	15.25	16.25	25.00	17.75	20.25	23.25

*Note: * the same letter (s) are not significantly different at p<0.05. ± indicates the standard error of mean.*

Germination percentage: Perusal of results presented indicates that the significantly highest germination percentage (34.25 %) was observed in T_4 (soaking of seeds in cow dung slurry for seven days) followed by (31.50 %) T_7 (100 ppm gibberlic acid for 24 hours), which were significantly higher than control (T_1). The lowest germination percentage (18.75 %) was recorded from control treatment (Table 1). Whereas, T_5 and T_6 treatments were found on par with each other.

Germination value and germination energy: Germination value varied from 0.6 to 2.2 among the treatments. The highest germination value was found in T_4 (2.2) followed by T_7 (1.9) and lowest was in T_1 (0.6). Similarly, the highest germination energy (25%) was in T_4 followed by (23.25 %) T_7 and lowest (13.75) was in T_1 (Table 1).

Germination pattern: Mean daily germination percent varied in different days in different treatments for *M. dubia* seeds. The highest mean daily germination percentage was observed 56 days after sowing in T_1 and T_3, 52 days in T_5 58 days in T_2, T_4, T_6 and T_7 (Fig. 1). Seed germination started 32 days after sowing and continued up to 66 days (Fig. 2). The cumulative germination percent in treatment T_4 rose sharply from 32 day to 62 days after sowing the seeds and remained constant up to the end of germination test (66 days).

Growth performance: The mean shoot length of the seedlings under various treatments was highest (112.5 cm) in T_4 followed by T_7 (109.4 cm), which was significantly higher than that of control and T_2 (Table 2). Mean root length of the seedlings was found highest (129.3cm) in T_4 followed by T_7 (121.5) and least was observed in control (83.2). Highest collar diameter of *M. dubia* seedlings was found in T_7 (6.77 mm) followed by T_4 (6.47) and lowest was in T_1.

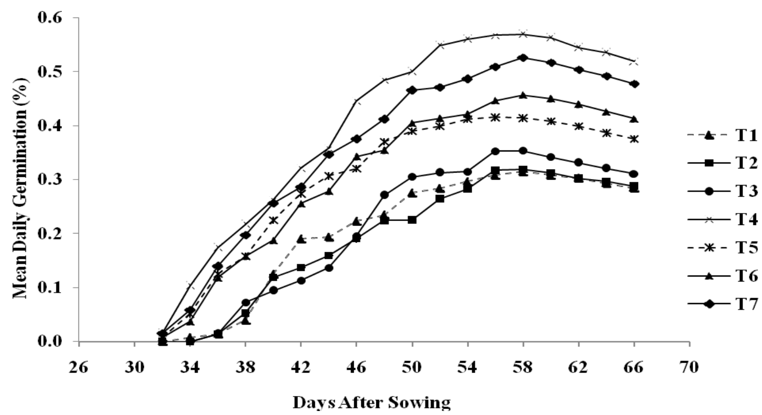

Fig. 1: Mean daily germination percent of *M. dubia* seeds under different treatments.

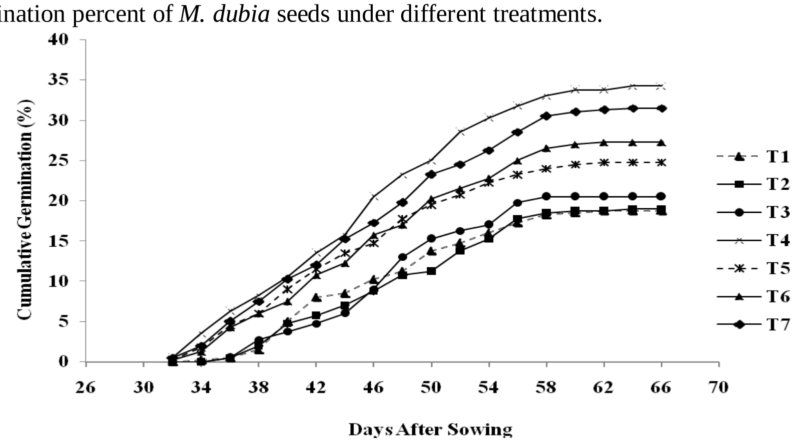

Fig. 2: Cumulative germination percent of *M. dubia* seeds under different treatments.

Table 2: Shoot, root, total length, number of leaf, collar diameter and vigor index of *M. dubia* seedlings grown under different treatments five months after sowing the seeds in poly bags.

Variables	Treatments						
	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Shoot length (cm)	87.31a* ± 5.5	91.7a ±7.73	94.3a ±6.81	112.5b ±16.66	97.6c ±9.76	102.2ac ±11.22	109.4b ±14.55
Root length (cm)	83.2a ±5.24	83.4a ±7.02	96.2b ±6.95	129.3c ±16.07	102.6bd ±10.26	113.4d ±12.45	121.5c ±14.58
Total length (cm)	170.5a ±10.74	175.2a ±14.75	190.5b ±13.76	241.8c ±29.98	200.2b ±20.02	215.6d ±23.67	230.9c ±27.71
Leaf number.	299.6a ±15.6	309.9a ±23.4	320.7a ±23.2	361.4b ±40.1	330.3c ±30.4	338.8c ±37.2	347.9b ±38.3
Collar diameter (mm)	5.91a ±0.86	6.03a ±1.46	6.25a ±1.42	6.47b ±2.7	6.38c ±1.9	6.42b ±2.4	6.77b ±2.5

*Note: * the same letter (s) are not significantly different at p<0.05. ± indicates the standard error of mean.*

The leaf number significantly varied due to the treatments and found highest in T_4 (361.4) followed by T_7 (347.9) and the lowest (299.6) was in control (Table 2).

Seedling biomass production: Shoot dry weight and root dry weight were highest (37.86 g and 23.38 g respectively) in T_4. However the total biomass per seedling was highest (61.23 g) in T_4 that was significantly different from control (Table 3).

Table 3: Leaf dry weight, shoot dry weight, root dry weight and total dry weight of *M. dubia* seedlings three months after germination.

Variables	Treatments						
	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Shoot dry weight (g)	22.95a* ±1.18	24.40a ±1.77	33.16a ±1.76	37.86b ±3.38	29.82ac ±2.39	30.03b ±2.99	34.36b ±3.09
Root dry weight (g)	9.20a ±0.26	10.44a ±0.42	19.94b ±0.44	23.38c ±1.04	16.49bd ±0.61	17.72d ±0.81	21.79c ±0.89
Total dry weight (g)	32.15a ±0.12	34.84a ±0.20	53.11b ±0.21	61.23c ±0.64	46.31b ±0.32	47.75d ±0.44	56.15c ±0.50

*Note: * the same letter (s) are not significantly different at p<0.05. ± indicates the standard error of mean.*

Discussion

Generally the pre-sowing treatments were reported to enhance seeds germination (Hossain, 2005). The germinability of the *M. dubia* seed is less than 25% and the best seed treatment is treating the seeds with cow dung solution (Parthiban, 2009). However, the findings of the present study also show that *M. dubia* seed soaked in cow dung slurry for seven days increased germination speed, germination percentage and seedling growth and biomass production in comparison to the control treatments. Hossain (2005) had also showed that seeds soaking in water improved germination. Luna described that fermentation of seed for three weeks had also given about 60% germination. The results reported in the present study also supported by the findings of the many other authors. For example Nagaveni and Srimathi 1980, 1985; Mahdi, 1986 and Murugesh, 2011 have shown soaking of seeds in water and gibberellic acid has shown very good results.

Conclusion

Exploration of the potential indigenous plants as alternate sources of industrial raw materials support its conservation by contributing to genetic diversity and safeguarding native species from the threat to become endangered thus promoting their sustainability in that region. This is the initial step for the commercial production of these plants in nurseries. Mass propagation of native plants like *M. dubia*, can be standardized for further commercial use. It is inferred from this study that seed pre- treatments are one of the factor that can significantly influence germination percentage in seeds of *M. dubia.*

The present study of pre-sowing treatments of seeds would prove itself potential in the practical fields. Among the treatments applied in the experiment for *M. dubia*, seeds soaked in cow dung slurry for seven days and 100 ppm gibberlic acid for 24 hours were found more effective in respect to faster germination, higher germination percentage, seedling growth and biomass production in comparison to control and other treatments. Since, seed soaking in cow dung slurry for a particular period of time is easily applicable and cost effective; the treatment may be recommended for large scale seedling production in the nurseries.

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