**Effect of growing media and light intensities on seed germination of Mahogany (*Swietenia mahogany* (L.) Jacq.) in South-Eastern region of Rajasthan.**

**ABSTRACT**

A study was conducted from June 2024 to March 2025 at the College of Horticulture and Forestry, Jhalrapatan (Rajasthan) to assess the effect of growing media and light intensities on the germination of Swietenia mahogany (L.) Jacq. The experiment was laid out in a Completely Randomized Design (Factorial CRD) comprising 69 treatment combinations, derived from 23 growing media formulations (combinations of soil, sand, vermicompost, and FYM) and three light intensity levels (100%, 50%, and 25%), to evaluate their individual and interactive effects on germination parameters. The Soil: Sand: VC (1:1:1) (M10) and M16 [Soil: Sand: FYM (1:1:2)] mixtures showed the earliest 50% germination and peak germination. M20 [Soil: Sand: VC: FYM (1:1:2:1)] produced the highest germination percentage, earliest completion of germination. At 50% light intensity (L1), most of the parameters showed better performance except early peak germination. Among interactions, L2M20 showed the earliest germination, highest germination rate and earliest peak of germination.

Keywords: *Swietenia mahogany*; germination; light intensity; growing media.

1. **INTRODUCTION**

In the vast tapestry of India’s diverse landscape, forests stand as sentinel guardians, nurturing life, preserving biodiversity, and safeguarding the delicate equilibrium of our ecosystem (ISFR,2023). Deforestation and forest degradation have led to a decline in both the area and quality of forests, creating a major global issue for the forest industry. Restoration and reforestation of damaged forests and land are essential to halting the loss of forest cover. Therefore, forest rehabilitation is necessary to enhance the functions of forests, including water storage, water balance, carbon sequestration, climate mitigation, and restoring soil fertility to prevent erosion. Planted forests are plantations established by planting seedlings or seeds. The Global Forest Resource Assessment report estimated that planted forests comprise 7% of the total forest area worldwide (FAO,2020). Sustainably maintained forest plantations have the potential to provide ecological and social benefits. However, the significant loss of tree cover is affecting the environmental and socio-economic conditions of people. According to Global Forest Watch, there was a 16% loss of total tree cover globally from 2002 to 2022. The increasing demand for timber and fuelwood can be met by plantations, which help to protect natural forest habitats. Beyond their protective and productive services, trees also reduce soil erosion and mitigate land degradation.

The nursery serves as the foundation for successful planting. In a typical nursery, various activities can occur, such as raising plant seedlings, cultivating rootstocks, propagating improved crop varieties, performing vegetative propagation, conserving delicate seedlings, multiplying rare plant types, and generating income. Nurseries are crucial for the success of plantation programs. The plants grown in nurseries tend to be of superior quality and the desired size, with production possible year-round in controlled environments. To meet the seedlings' needs for different afforestation initiatives, nurseries are essential. Seedlings grown in nurseries shorten the establishment period for plantations and increase the likelihood of success. To ensure high-quality planting material, it is vital to use suitable growing media or substrates, as these significantly influence the rooting system. A healthy medium offers adequate stability or support while acting as a reservoir for water and nutrients. It also facilitates the entry of gases to the roots and supports oxygen exchange between the surrounding environment and the substrate (Abad et al., 2002). Research indicates that vermicompost positively influences the growth and yield of various crops (Joshi *et al*., 2015). Incorporating organic media into the potting mixture raises the organic matter content, resulting in improved soil structure and aggregation. Additionally, using soil mixtures that include farmyard manures and vermicompost boosts the vigour, uniformity, and establishment of seedlings upon transplanting (Choudhary *et al*., 2023).

*Sweitenia mahogany*, commonly referred to as Mahogany or West Indies Mahogany, is a large evergreen tree from the Meliaceae family. This species is indigenous to South Florida, the Bahamas, and the western Caribbean. It can reach heights of up to 75 feet and features a round, symmetrical crown. Thriving in warm climates, it requires rainfall between 1,250 and 2500 mm. The leaves are even-pinnately compound, consisting of 4-6 pairs of opposite leaflets with an ovate-lanceolate shape. The bark starts off gray and smooth, evolving into dark, rough, scaly textures that flake to reveal red patches as it matures. This tree exhibits drought and salt tolerance and is resistant to pests. It grows straight and offers protection against strong winds and storms.

**2.** **MATERIALS AND METHODS**

**2.1** **Study Site and Experimental Design**

The current research took place at the College of Horticulture and Forestry in Jhalrapatan (Jhalawar), located at a latitude of 24°53’ N and a longitude of 76°14’ E in the southeastern part of Rajasthan from June 2024 to March 2025. This location features a subtropical and subhumid climate, characterized by hot summers and moderate winters, akin to the climate of the Indo-Gangetic plain. Seedlings were raised under three distinct growing conditions: open conditions (L0), a green shade net house allowing approximately 50% light intensity (L1), and another with about 25% light intensity (L2). Prior to sowing, the seeds were soaked in water for 6 hours and then placed in polybags filled with various growing media components, including soil, sand, vermicompost (VC) and Farm Yard Manure (FYM) in different ratios, resulting in 23 treatments of growing media. These treatments included: M0 (Soil), M1 [Soil: Sand (1:1)], M2 [Soil: Sand (1:2)], M3 [Soil: Sand (2:1)], M4 [Soil: VC (1:1)], M5 [Soil: VC (1:1)], M6 [Soil: VC (2:1)], M7 [Soil: FYM (1:1)], M8 [Soil: FYM (1:2)], M9 [Soil: FYM (1:1)], M10 [Soil: Sand: VC (1:1:1)], M11 [Soil: Sand: VC (1:2:1)], M12 [Soil: Sand: VC (1:1:2)], M13 [Soil: Sand: VC (2:1:1)], M14 [Soil: Sand: FYM (1:1:1)], M15 [Soil: Sand: FYM (1:2:1)], M16 [Soil: Sand: FYM (1:1:2)], M17 [Soil: Sand: FYM (2:1:1)], M18 [Soil: Sand: VC: FYM (1:1:1:1)], M19 [Soil: Sand: VC: FYM (1:1:2:1)], M20 [Soil: Sand: VC: FYM (1:1:2:1)], M21 [Soil: Sand: VC: FYM (1:1:1:2)], and M22 [Soil: Sand: VC: FYM (2:1:1:1)], Thus, all these 23 treatments of growing media were subjected to three light conditions, resulting in a total of 69 treatment combinations designed statistically under a completely randomized design with a factorial concept. Each combination was replicated three times, with 12 polybags per replication, amounting to 36 polybags for each treatment. Treatment differences were assessed using an 'F' significance test based on the null hypothesis. For each case, the appropriate standard error (S. Em ±) was calculated, and the critical difference (C.D.) at a 5% significance level was determined to compare treatments when significant effects were observed.

**2.2 Observation Parameters**

Light measurements were conducted bi-monthly at two-week intervals using a lux meter throughout the study period from June 2024 to March 2025. Readings were taken at 8:00, 13:00, and 16:00 hours. To assess the actual light intensity, readings were collected for all media treatments under three different light conditions. The lux meter was positioned above the polybags, with growing seedlings placed between the rows. The readings were recorded in kilolux. Various germination parameters, including the days required for 50% germination, days required to complete the germination span, germination percentage, and peak germination period, were noted by counting the daily emergent seeds.

**3 RESULTS AND DISCUSSION**

**3.1 Light intensity (k Lux) levels in different growing conditions**

Microclimate refers to the climatic conditions surrounding the research study location. The study had low light intensity in July, December, and January. This may be due to the rainy season starting at the end of June and the winter season starting after mid-December, so light intensity was not too high in these months. The difference in light intensity received affected the availability of energy in the process of photosynthesis and respiration in plants.

As suggested by Table 1, readings from the Lux meter noticeably decreased from open conditions to the shade net houses with 50% light (L1) and 25% light irradiance (L2). As the Tables indicate, the 50% shade net house restricted 22-38% of light intensity compared to the open condition. A 41-63% reduction in light intensity was observed in the L2 shade net condition compared to full sunlight (L0). A similar trial was conducted by Kumari *et al.* (2025) to analyze the effect of different light intensity levels, namely, 100%, 50%, and 25% light, on the seedling growth of Gamari (*Gmelina arborea*). The study found that, in comparison to open light, the 50% light intensity shade net reduced total radiation by 20-47%, and the 25% light intensity shade net reduced it by 44% to 68%. Following the research conducted by Sankeshwar (2009) on *Pongamia pinnata* and Shukla *et al.* (2009) on *Eucalyptus tereticornis* and *Albizzia procera*, differing light intensities were maintained by growing seedlings in open environments and shade net houses with variable shade factors.

**3.2 Germination attributes**

The findings in Table 2 show that the germination characteristics of mahogany seedlings are greatly influenced by growing substrate, light intensities, and their interactions. The growing media treatment M10 [Soil: Sand: VC (1:1:1)] produced early 50% germination in 16.44 days, according to the study's findings. The growing media treatment M20 [Soil: Sand: VC: FYM (1:1:2:1)] produced the highest germination percentage of 98.44% and the quickest germination completion in just 20.89 days. When compared to other media treatments, M16 [Soil: Sand: FYM (1:1:2)] achieved the peak of germination in a very short period (15.67), which is statistically comparable to M10, M12, and M20. A balanced media mixture that promoted early seed germination was produced by the increased percentage of organic manure, which also improved drainage, aeration, and mineral mobilization. The addition of vermicompost to the growing media mixture results in accelerated germination and a significant increase in germination percentage due to high porosity and availability of nutrients (Lazcano *et al*., 2010). Panwar (2009) reported that a mixture of soil, FYM, and sand (1:2:2) serves as a better medium for germination of *Jatropha curcus*. Kumari *et al.* (2025) observed early 50% and complete germination, early peak germination, and the highest germination percentage in *Gmelina arborea* seedlings when grown in media with a higher proportion of FYM.

Among different light conditions, there were notable variations in the number of days needed for 50% germination, the germination span, the germination peak, and the germination percentage according to the light intensity (Table 2). Of the three light intensities, 50% light intensity (L1) had the highest germination percentage (98.64%), the shortest germination span (22.90 days), and early 50% germination (17.07 days). L2 (25% light condition) had the earliest peak germination at 16.48 days. The higher and earlier germination in L1 might have been caused by the ideal light intensity as well as shelter from unfavorable weather. Conversely, reduced light irradiance may be the cause of a minor delay in germination in L2, which may not be optimal for *Swietenia mahogany's* early germination. The results about the characteristics of germination under various light levels are in line with those of Kumari *et al.* (2025). Similar findings regarding germination percentage were seen in *Moringa oleifera*, where the best conditions for germination were reported to be medium shade (50%) (Ahmed *et al*., 2014).

The treatment combination L2M20 found notable variations in 50% seed germination (13.67 days), early germination complete (18.33 days), and early peak germination (14 days) across interactions between light and growth conditions. When growth media treatment and 50% light intensity were combined, the maximum germination percentage (100%) was observed. According to Kumari *et al.* (2025) in *Gmelina arborea*, Verma *et al*. (2018) in *Prosopis cineraria*, and Ahmed *et al*. (2014) in *Moringa oleifera*, the balanced mixtures of growing media required for germination and the maintenance of a suitable microclimate within the shade net house under 50% light conditions (L1) may be the cause of these treatment combinations' notable influence.

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**Table 1. Light intensity (k Lux) from June 2024- March 2025 in various treatment combinations in *Switenia mahogany* (L.)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Growing media** | **Jun-24** | | | | **Jul-24** | | | | **Aug-24** | | | | **Sep-24** | | | | **Oct-24** | | | |
| **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** |
| **M0** | 40.09 | 31.81 | 23.04 | **31.65** | 19.15 | 13.45 | 9.62 | **14.07** | 35.61 | 25.35 | 16.95 | **25.97** | 38.06 | 28.75 | 16.48 | **27.76** | 32.00 | 20.78 | 11.98 | **21.59** |
| **M1** | 40.19 | 31.79 | 23.34 | **31.78** | 19.10 | 13.37 | 9.95 | **14.14** | 35.70 | 25.31 | 17.41 | **26.14** | 38.20 | 28.80 | 16.67 | **27.89** | 31.96 | 20.80 | 12.27 | **21.68** |
| **M2** | 39.69 | 31.76 | 22.94 | **31.47** | 19.02 | 13.50 | 9.47 | **14.00** | 35.81 | 26.06 | 17.53 | **26.47** | 38.01 | 28.92 | 16.77 | **27.90** | 31.83 | 20.93 | 12.24 | **21.66** |
| **M3** | 39.69 | 31.86 | 23.04 | **31.53** | 19.29 | 13.50 | 9.88 | **14.22** | 35.68 | 26.66 | 17.05 | **26.46** | 38.21 | 28.91 | 16.81 | **27.98** | 31.82 | 20.85 | 12.01 | **21.56** |
| **M4** | 39.79 | 31.94 | 22.94 | **31.56** | 19.22 | 13.45 | 9.82 | **14.16** | 35.48 | 24.95 | 17.28 | **25.90** | 38.03 | 29.00 | 16.84 | **27.96** | 32.00 | 20.93 | 12.09 | **21.67** |
| **M5** | 39.69 | 31.76 | 22.84 | **31.43** | 19.12 | 13.47 | 9.92 | **14.17** | 35.85 | 25.40 | 17.33 | **26.19** | 38.40 | 29.00 | 16.70 | **28.03** | 32.31 | 21.05 | 12.13 | **21.83** |
| **M6** | 39.69 | 31.86 | 23.34 | **31.63** | 19.21 | 13.45 | 9.85 | **14.17** | 35.65 | 24.62 | 17.45 | **25.91** | 38.23 | 29.05 | 16.60 | **27.96** | 32.10 | 20.95 | 12.19 | **21.74** |
| **M7** | 39.69 | 31.86 | 23.34 | **31.63** | 19.07 | 13.53 | 10.03 | **14.21** | 35.70 | 25.36 | 17.25 | **26.10** | 38.28 | 29.00 | 16.70 | **27.99** | 31.82 | 21.01 | 12.14 | **21.66** |
| **M8** | 40.09 | 31.68 | 22.74 | **31.50** | 19.29 | 13.55 | 9.52 | **14.12** | 35.51 | 26.16 | 16.86 | **26.18** | 37.96 | 28.95 | 16.55 | **27.82** | 32.26 | 21.11 | 12.04 | **21.80** |
| **M9** | 39.79 | 31.66 | 22.74 | **31.40** | 19.07 | 13.55 | 9.33 | **13.98** | 35.78 | 25.91 | 16.88 | **26.19** | 38.28 | 28.96 | 16.55 | **27.93** | 31.83 | 21.13 | 12.06 | **21.67** |
| **M10** | 39.79 | 31.76 | 22.74 | **31.43** | 19.18 | 13.55 | 9.67 | **14.13** | 35.80 | 25.83 | 16.86 | **26.16** | 38.36 | 29.00 | 16.55 | **27.97** | 32.13 | 20.93 | 12.05 | **21.70** |
| **M11** | 39.89 | 31.76 | 23.14 | **31.60** | 19.24 | 13.50 | 9.77 | **14.17** | 35.71 | 25.86 | 17.11 | **26.23** | 38.40 | 28.95 | 16.70 | **28.01** | 32.01 | 21.05 | 12.12 | **21.73** |
| **M12** | 39.99 | 31.66 | 23.14 | **31.60** | 19.17 | 13.45 | 9.72 | **14.11** | 35.61 | 25.94 | 17.11 | **26.22** | 38.33 | 28.95 | 16.65 | **27.97** | 31.86 | 21.15 | 12.21 | **21.74** |
| **M13** | 40.09 | 31.69 | 22.84 | **31.54** | 19.07 | 13.45 | 9.67 | **14.06** | 35.73 | 25.55 | 16.98 | **26.09** | 38.30 | 29.00 | 16.70 | **28.00** | 32.28 | 21.05 | 12.24 | **21.86** |
| **M14** | 39.99 | 31.78 | 23.24 | **31.67** | 19.17 | 13.48 | 9.80 | **14.15** | 35.60 | 25.49 | 17.03 | **26.04** | 38.38 | 28.76 | 16.55 | **27.90** | 32.01 | 21.01 | 12.02 | **21.68** |
| **M15** | 39.76 | 31.79 | 23.08 | **31.54** | 19.15 | 13.37 | 9.70 | **14.07** | 35.66 | 25.62 | 17.00 | **26.09** | 38.21 | 28.78 | 16.61 | **27.87** | 31.95 | 21.13 | 12.09 | **21.72** |
| **M16** | 39.99 | 31.74 | 23.09 | **31.61** | 19.08 | 13.45 | 9.80 | **14.11** | 35.56 | 25.47 | 17.13 | **26.06** | 38.26 | 29.06 | 16.58 | **27.97** | 32.36 | 20.95 | 12.16 | **21.82** |
| **M17** | 39.81 | 31.78 | 22.84 | **31.48** | 19.20 | 13.48 | 9.68 | **14.12** | 35.68 | 25.51 | 17.01 | **26.07** | 38.25 | 29.06 | 16.61 | **27.97** | 32.26 | 21.11 | 12.04 | **21.81** |
| **M18** | 39.76 | 31.78 | 22.93 | **31.49** | 19.22 | 13.45 | 9.63 | **14.10** | 35.75 | 25.99 | 16.90 | **26.21** | 38.35 | 28.89 | 16.61 | **27.95** | 31.88 | 21.13 | 12.00 | **21.67** |
| **M19** | 39.83 | 31.71 | 23.04 | **31.53** | 19.29 | 13.48 | 9.73 | **14.17** | 35.80 | 25.99 | 16.96 | **26.25** | 38.36 | 29.05 | 16.61 | **28.01** | 32.20 | 21.06 | 12.11 | **21.79** |
| **M20** | 39.89 | 31.69 | 23.03 | **31.54** | 19.02 | 13.50 | 9.90 | **14.14** | 35.61 | 25.90 | 17.10 | **26.20** | 38.38 | 28.98 | 16.60 | **27.99** | 32.16 | 20.93 | 12.17 | **21.76** |
| **M21** | 39.96 | 31.73 | 23.11 | **31.60** | 19.20 | 13.40 | 9.60 | **14.07** | 35.68 | 25.59 | 17.23 | **26.17** | 38.30 | 28.98 | 16.60 | **27.96** | 32.20 | 21.08 | 12.11 | **21.79** |
| **M22** | 39.82 | 31.70 | 23.04 | **31.52** | 19.26 | 13.38 | 9.64 | **14.09** | 35.70 | 25.38 | 17.17 | **26.09** | 38.28 | 28.45 | 16.62 | **27.78** | 32.01 | 21.09 | 12.05 | **21.72** |
| **Mean** | **39.87** | **31.76** | **23.03** |  | **19.16** | **13.47** | **9.73** |  | **35.68** | **25.65** | **17.11** |  | **38.25** | **28.92** | **16.64** |  | **32.05** | **21.01** | **12.11** |  |
|  | | | | | | | | | | | | | | | | | | | | |
|  |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |
| **P** | **NS** | 0.22 | 2.10 | **P** | **NS** | 0.11 | 2.38 | **P** | **NS** | 0.21 | 2.39 | **P** | **NS** | 0.27 | 2.90 | **P** | **NS** | 0.16 | 2.15 |
| **L** | O.22 | 0.07 |  | **L** | 0.12 | 0.04 |  | **L** | 0.21 | 0.07 |  | **L** | 0.27 | 0.9 |  | **L** | 0.16 | 0.05 |  |
| **P\*L** | **NS** | 0.38 |  | **P\*L** | **NS** | 0.19 |  | **P\*L** | **NS** | 0.36 |  | **P\*L** | **NS** | 0.47 |  | **P\*L** | **NS** | 0.27 |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Growing media** | **Nov-24** | | | | **Dec-24** | | | | **Jan-25** | | | | **Feb-25** | | | | **Mar-25** | | | |
| **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** |
| **M0** | 24.82 | 15.44 | 11.14 | **17.13** | 20.07 | 12.97 | 8.51 | **13.85** | 13.38 | 9.81 | 6.95 | **10.05** | 21.88 | 16.23 | 11.89 | **16.67** | 37.50 | 29.21 | 20.45 | **29.05** |
| **M1** | 24.91 | 15.55 | 11.26 | **17.24** | 20.16 | 12.99 | 8.76 | **13.97** | 13.68 | 10.15 | 7.03 | **10.29** | 22.21 | 16.41 | 12.39 | **17.00** | 37.60 | 29.20 | 20.75 | **29.18** |
| **M2** | 25.17 | 15.37 | 11.14 | **17.23** | 20.03 | 13.21 | 8.84 | **14.03** | 13.60 | 9.98 | 7.11 | **10.23** | 22.43 | 16.23 | 11.91 | **16.86** | 37.10 | 29.16 | 20.35 | **28.87** |
| **M3** | 25.24 | 15.37 | 11.19 | **17.27** | 19.99 | 13.21 | 8.82 | **14.01** | 13.60 | 10.05 | 7.18 | **10.27** | 22.51 | 16.28 | 12.08 | **16.95** | 37.10 | 29.26 | 20.45 | **28.94** |
| **M4** | 24.81 | 15.32 | 11.12 | **17.08** | 20.06 | 13.16 | 8.72 | **13.98** | 13.65 | 9.65 | 6.78 | **10.03** | 22.19 | 16.29 | 12.01 | **16.83** | 37.20 | 29.35 | 20.35 | **28.96** |
| **M5** | 25.22 | 15.34 | 11.22 | **17.26** | 20.14 | 13.17 | 8.84 | **14.05** | 13.61 | 9.98 | 7.11 | **10.24** | 22.48 | 16.41 | 12.06 | **16.98** | 37.10 | 29.16 | 20.25 | **28.84** |
| **M6** | 24.96 | 15.32 | 11.16 | **17.15** | 20.21 | 13.16 | 8.62 | **14.00** | 13.40 | 9.88 | 7.01 | **10.10** | 22.33 | 16.54 | 12.33 | **17.06** | 37.10 | 29.26 | 20.75 | **29.04** |
| **M7** | 25.29 | 15.41 | 11.19 | **17.30** | 20.19 | 13.24 | 8.81 | **14.08** | 13.61 | 10.08 | 7.21 | **10.30** | 22.38 | 16.51 | 12.33 | **17.07** | 37.10 | 29.26 | 20.75 | **29.04** |
| **M8** | 24.79 | 15.42 | 10.82 | **17.01** | 20.04 | 13.26 | 8.47 | **13.92** | 13.45 | 9.88 | 7.01 | **10.11** | 22.18 | 15.95 | 11.61 | **16.58** | 37.50 | 29.08 | 20.15 | **28.91** |
| **M9** | 25.22 | 15.42 | 10.64 | **17.10** | 20.14 | 13.26 | 8.27 | **13.89** | 13.60 | 9.98 | 7.11 | **10.23** | 22.43 | 16.27 | 11.61 | **16.77** | 37.20 | 29.06 | 20.15 | **28.80** |
| **M10** | 25.12 | 15.42 | 10.97 | **17.17** | 20.04 | 13.26 | 8.59 | **13.96** | 13.61 | 9.98 | 7.11 | **10.24** | 22.56 | 16.05 | 11.61 | **16.74** | 37.20 | 29.16 | 20.15 | **28.84** |
| **M11** | 25.06 | 15.37 | 11.07 | **17.17** | 20.31 | 13.21 | 8.69 | **14.07** | 13.61 | 10.05 | 7.18 | **10.28** | 22.31 | 16.37 | 11.86 | **16.85** | 37.30 | 29.16 | 20.55 | **29.00** |
| **M12** | 24.96 | 15.32 | 11.02 | **17.10** | 20.21 | 13.16 | 8.62 | **14.00** | 13.68 | 10.11 | 7.25 | **10.35** | 22.29 | 16.30 | 11.86 | **16.82** | 37.40 | 29.06 | 20.55 | **29.00** |
| **M13** | 25.06 | 15.37 | 10.97 | **17.13** | 20.31 | 13.07 | 8.59 | **13.99** | 13.66 | 10.11 | 7.25 | **10.34** | 22.24 | 16.22 | 11.93 | **16.80** | 37.50 | 29.10 | 20.25 | **28.95** |
| **M14** | 25.04 | 15.36 | 11.11 | **17.17** | 20.29 | 13.19 | 8.56 | **14.01** | 13.70 | 10.08 | 7.21 | **10.33** | 22.36 | 16.31 | 11.94 | **16.87** | 37.40 | 29.18 | 20.65 | **29.07** |
| **M15** | 25.01 | 15.42 | 11.19 | **17.21** | 20.42 | 13.12 | 8.59 | **14.05** | 13.58 | 9.98 | 7.11 | **10.22** | 22.39 | 16.54 | 12.13 | **17.02** | 37.16 | 29.20 | 20.48 | **28.95** |
| **M16** | 25.22 | 15.42 | 11.01 | **17.22** | 20.11 | 13.14 | 8.66 | **13.97** | 13.45 | 9.88 | 7.01 | **10.11** | 22.29 | 16.27 | 11.89 | **16.82** | 37.40 | 29.15 | 20.50 | **29.01** |
| **M17** | 25.02 | 15.36 | 10.89 | **17.09** | 20.26 | 13.22 | 8.84 | **14.11** | 13.45 | 9.91 | 7.05 | **10.14** | 22.48 | 16.05 | 11.79 | **16.77** | 37.21 | 29.18 | 20.25 | **28.88** |
| **M18** | 25.12 | 15.37 | 11.01 | **17.17** | 20.01 | 13.22 | 8.59 | **13.94** | 13.71 | 10.18 | 7.31 | **10.40** | 22.33 | 16.17 | 11.91 | **16.80** | 37.16 | 29.18 | 20.33 | **28.89** |
| **M19** | 25.11 | 15.34 | 11.11 | **17.18** | 20.17 | 13.26 | 8.52 | **13.98** | 13.63 | 10.01 | 7.15 | **10.26** | 22.28 | 16.35 | 11.94 | **16.86** | 37.23 | 29.11 | 20.45 | **28.93** |
| **M20** | 25.06 | 15.32 | 10.87 | **17.08** | 20.07 | 13.19 | 8.52 | **13.93** | 13.70 | 10.15 | 6.82 | **10.22** | 22.19 | 16.30 | 11.73 | **16.74** | 37.30 | 29.10 | 20.43 | **28.94** |
| **M21** | 25.12 | 15.34 | 10.86 | **17.11** | 20.09 | 13.19 | 8.59 | **13.96** | 13.56 | 10.11 | 7.25 | **10.31** | 22.43 | 16.41 | 11.99 | **16.94** | 37.36 | 29.13 | 20.51 | **29.00** |
| **M22** | 24.76 | 15.43 | 11.10 | **17.10** | 20.33 | 13.20 | 8.48 | **14.01** | 13.64 | 10.13 | 7.16 | **10.31** | 22.14 | 16.28 | 12.32 | **16.91** | 37.28 | 29.07 | 20.56 | **28.97** |
| **Mean** | **25.05** | **15.38** | **11.05** |  | **20.16** | **13.18** | **8.63** |  | **13.59** | **10.01** | **7.10** |  | **22.32** | **16.29** | **11.96** |  | **37.28** | **29.17** | **20.44** |  |
|  | | | | | | | | | | | | | | | | | | | | |
|  |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |
| **P** | **NS** | 0.21 | 3.72 | **P** | **NS** | 0.09 | 1.98 | **P** | **NS** | 0.09 | 2.50 | **P** | **NS** | 0.19 | 3.35 | **P** | **NS** | 0.21 | 2.21 |
| **L** | 0.21 | 0.07 |  | **L** | 0.09 | 0.03 |  | **L** | 0.08 | 0.03 |  | **L** | 0.19 | 0.06 |  | **L** | 0.21 | 0.07 |  |
| **P\*L** | **NS** | 0.37 |  | **P\*L** | **NS** | 0.16 |  | **P\*L** | **NS** | 0.15 |  | **P\*L** | **NS** | 0.33 |  | **P\*L** | **NS** | 0.37 |  |

**Figure 1. Light intensity in k lux for *Switenia mahogany* (L.)under various growing conditions between June 2024 and March 2025.**

**Table 2 Effect of growing media, light intensities and their interactions on various germination parameters in *Swietenia mahogany* (L.).**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Light intensity (L)** | | **Days required for 50% germination** | | | | **Days required for complete germination** | | | | **Peak period of germination (days)** | | | | **Germination percentage( %)** | | | | |
| **Growing media (M)** | | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** | **L0** | **L1** | **L2** | **Mean** |
| **M0** | Soil (control) | 1 | 19.33 | 18.67 | 19.67 | **19.22** | 29.00 | 24.67 | 24.67 | **26.11** | 22.67 | 18.33 | 20.33 | **19.11** | 93.33 | 93.00 | 90.00 | **92.11** |
| **M1** | Soil: Sand | 1:1 | 21.67 | 17.67 | 17.33 | **18.89** | 27.33 | 22.67 | 22.33 | **24.11** | 20.33 | 16.33 | 15.67 | **17.44** | 92.00 | 99.33 | 100.00 | **97.11** |
| **M2** | Soil: Sand | 1:2 | 24.33 | 18.33 | 17.33 | **20.00** | 29.00 | 22.33 | 23.33 | **24.89** | 20.00 | 16.67 | 16.00 | **17.56** | 66.67 | 100.00 | 97.67 | **88.11** |
| **M3** | Soil: Sand | 2:1 | 23.33 | 18.67 | 18.00 | **20.00** | 31.33 | 22.67 | 26.33 | **26.78** | 19.33 | 16.67 | 15.67 | **17.22** | 75.67 | 93.33 | 90.00 | **86.33** |
| **M4** | Soil: VC | 1:1 | 21.33 | 17.67 | 17.33 | **18.78** | 31.67 | 23.33 | 25.33 | **26.78** | 22.33 | 16.00 | 15.67 | **18.00** | 85.00 | 98.00 | 100.00 | **94.33** |
| **M5** | Soil: VC | 1:2 | 21.00 | 18.67 | 19.33 | **19.67** | 27.00 | 24.67 | 25.67 | **25.78** | 21.00 | 17.67 | 16.00 | **18.22** | 93.33 | 99.33 | 92.67 | **95.11** |
| **M6** | Soil: VC | 2:1 | 19.33 | 16.67 | 18.67 | **18.22** | 27.33 | 25.67 | 26.67 | **26.56** | 17.67 | 17.67 | 18.00 | **17.78** | 76.33 | 99.00 | 100.00 | **91.78** |
| **M7** | Soil: FYM | 1:1 | 18.67 | 18.33 | 19.00 | **18.67** | 26.33 | 24.00 | 27.67 | **26.00** | 16.67 | 18.67 | 17.67 | **17.67** | 85.33 | 100.00 | 76.33 | **87.22** |
| **M8** | Soil: FYM | 1:2 | 22.67 | 17.00 | 19.33 | **19.67** | 28.67 | 23.67 | 23.67 | **25.33** | 18.00 | 18.00 | 18.00 | **18.00** | 83.33 | 100.00 | 100.00 | **94.44** |
| **M9** | Soil: FYM | 2:1 | 23.67 | 16.67 | 18.67 | **19.67** | 26.67 | 24.33 | 25.00 | **25.33** | 18.33 | 17.00 | 20.00 | **18.44** | 80.67 | 97.67 | 100.00 | **92.78** |
| **M10** | Soil: Sand: VC | 1:1:1 | 17.33 | 15.67 | 16.33 | **16.44** | 25.33 | 19.33 | 22.33 | **22.33** | 17.00 | 15.33 | 15.00 | **15.78** | 85.33 | 100.00 | 99.00 | **94.78** |
| **M11** | Soil: Sand: VC | 1:2:1 | 22.33 | 18.33 | 17.33 | **19.33** | 28.67 | 22.00 | 23.33 | **24.67** | 17.67 | 16.67 | 17.00 | **17.11** | 76.33 | 100.00 | 100.00 | **92.11** |
| **M12** | Soil: Sand: VC | 1:1:2 | 19.33 | 14.67 | 18.33 | **17.44** | 26.33 | 21.33 | 25.67 | **24.44** | 17.00 | 16.33 | 14.67 | **16.00** | 94.00 | 100.00 | 97.67 | **97.22** |
| **M13** | Soil: Sand: VC | 2:1:1 | 18.33 | 16.67 | 18.00 | **17.67** | 26.33 | 21.67 | 24.33 | **24.11** | 19.00 | 17.00 | 16.00 | **17.33** | 94.00 | 100.00 | 98.33 | **97.44** |
| **M14** | Soil: Sand: FYM | 1:1:1 | 19.00 | 17.00 | 19.33 | **18.44** | 27.33 | 24.33 | 25.67 | **25.78** | 18.67 | 18.67 | 18.33 | **18.56** | 90.00 | 100.00 | 100.00 | **96.67** |
| **M15** | Soil: Sand: FYM | 1:2:1 | 19.33 | 17.33 | 18.00 | **18.22** | 26.67 | 22.00 | 26.67 | **25.11** | 18.67 | 16.00 | 14.00 | **16.22** | 86.67 | 97.00 | 98.67 | **94.11** |
| **M16** | Soil: Sand: FYM | 1:1:2 | 20.33 | 15.33 | 17.67 | **17.78** | 24.33 | 23.67 | 19.33 | **22.44** | 17.00 | 15.33 | 14.67 | **15.67** | 87.00 | 92.00 | 100.00 | **93.00** |
| **M17** | Soil: Sand: FYM | 2:1:1 | 19.33 | 15.67 | 15.67 | **16.89** | 26.67 | 23.00 | 23.33 | **24.33** | 17.67 | 15.67 | 16.33 | **16.56** | 94.33 | 100.00 | 97.00 | **97.11** |
| **M18** | Soil: Sand: VC: FYM | 1:1:1:1 | 18.67 | 17.00 | 16.33 | **17.33** | 28.33 | 24.33 | 23.67 | **25.44** | 17.67 | 16.33 | 16.33 | **16.78** | 87.00 | 100.00 | 100.00 | **95.67** |
| **M19** | Soil: Sand: VC: FYM | 1:2:1:1 | 18.67 | 16.00 | 16.00 | **16.89** | 26.33 | 21.67 | 21.33 | **23.11** | 18.00 | 17.00 | 14.67 | **16.56** | 89.33 | 100.00 | 98.67 | **96.00** |
| **M20** | Soil: Sand: VC: FYM | 1:1:2:1 | 19.67 | 16.33 | 13.67 | **16.56** | 23.33 | 21.00 | 18.33 | **20.89** | 18.00 | 16.33 | 14.00 | **16.11** | 95.33 | 100.00 | 100.00 | **98.44** |
| **M21** | Soil: Sand: VC: FYM | 1:1:1:2 | 19.33 | 16.00 | 18.00 | **17.78** | 25.67 | 22.33 | 22.67 | **23.56** | 18.67 | 18.00 | 17.67 | **18.11** | 93.67 | 100.00 | 98.00 | **97.22** |
| **M22** | Soil: Sand: VC: FYM | 2:1:1:1 | 21.67 | 18.33 | 18.67 | **19.56** | 30.33 | 22.00 | 26.00 | **26.11** | 18.67 | 18.00 | 17.33 | **18.00** | 95.33 | 100.00 | 99.33 | **98.22** |
| **Mean** | | | **20.38** | **17.07** | **17.74** |  | **27.39** | **22.90** | **24.06** |  | **18.70** | **16.94** | **16.48** |  | **86.96** | **98.64** | **97.10** |  |
|  | | |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |  | **CD0.05** | **SEm (±)** | **CV** |
| **M** | 1.00 | 0.36 | 5.80 | **M** | 1.16 | 0.42 | 5.03 | **M** | 0.88 | 0.32 | 5.46 | **M** | 3.20 | 1.14 | 5.61 |
| **L** | 0.36 | 0.13 |  | **L** | 0.42 | 0.15 |  | **L** | 0.32 | 0.11 |  | **L** | 1.16 | 0.41 |  |
| **M\*L** | 1.72 | 0.62 |  | **M\*L** | 2.01 | 0.72 |  | **M\*L** | 1.53 | 0.55 |  | **M\*L** | 5.54 | 1.98 |  |