

Performance of *Melia dubia* under different planting densities: effects on growth and carbon sequestration

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The field experiment to standardise spacing for block plantation of *Melia dubia* was initiated during July 2010 at 'M' Block, Agroforestry unit, Zonal Agricultural Research Station, University of Agriculture Sciences, Gandhi Krishi Vigyana Kendra, Bengaluru. The experiment was conducted in alfisols having moderate water holding capacity (10% to 18% at field capacity), with acidic soil pH (5.5), low organic carbon content (0.30%), low in available nitrogen (235 kg ha⁻¹), medium in available phosphorus (32 kg ha⁻¹) and medium in available potash (299 kg ha⁻¹). The experiment consisted of six spacing, viz. S₁ (24 m × 5 m), S₂ (20 m × 5 m), S₃ (16 m × 5 m), S₄ (12 m × 5 m), S₅ (10 m × 5 m) and S₆ (8 m × 5 m) which accommodated 83, 100, 125, 166, 200 and 250 trees per hectare, respectively. These were laid out in strip plot design and replicated four times. After ten years of planting, the results revealed that there was wide variation in tree height, girth at breast height (GBH) and canopy spread with different spacings. The tree height was significantly higher in S₁ (14.02 m), followed by S₂ (13.99 m) and S₃ (13.04 m). A similar trend was observed for GBH (125.39, 117.03 and 105.36 cm, respectively), canopy spread N-S (8.89, 8.61 and 8.27 m, respectively) and E-W direction (8.35, 8.17 and 7.86 m, respectively). Variation in tree biomass accumulation was also found. The maximum total biomass was recorded with the spacing of S₄ (91.74 tonne ha⁻¹), followed by S₆ (81.44 tonne ha⁻¹) and S₅ (79.85 tonne ha⁻¹). The higher above-ground biomass of *M. dubia* in S₁ is due to wider canopy spread and vigorous growth. Similarly, higher tree carbon was sequestered with the spacing of S₄ (157.81 tonne ha⁻¹), followed by S₆ (140.10 tonne ha⁻¹). The least carbon was sequestered with S₃ (124.94 tonne ha⁻¹). Apart from it also enhanced nutrient content in the soil, viz. soil organic carbon (0.69%), Available nitrogen (295.0 kg ha⁻¹), Phosphorus (29.72 kg ha⁻¹) and potassium (298.0 kg ha⁻¹). There is an improvement in soil pH (6.65) compared to the initial status. Finally, it can be concluded that *M. dubia* planting at a wider spacing of 24 m × 5 m will be effective with respect to tree height, GBH and canopy spread after ten years of planting. But the spacing

of 12 m × 5 m helped in enhancing the soil health and sequestering 157 tonnes of carbon per hectare.

Keywords: Carbon sequestration, *Melia dubia*, soil nutrient status.

THE 21st century is witnessing unprecedented climate change effects, which is estimated as a 1.0°C rise in global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C rise. It is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate¹, which may reduce the productivity of the soil as well as the forest, in turn causing adverse effects on ecological services. Forest trees have the potential to sequester atmospheric carbon by reducing the concentration of greenhouse gases in the atmosphere². Forest trees with higher potential to absorb and store carbon are recognised to play a vital role in the mitigation of climate change in the future³. Soil carbon sequestration can be accomplished by management systems that add high amounts of biomass to the soil, cause minimal soil disturbance, conserve soil and water, improve soil structure, and enhance soil flora and fauna activity. *Melia dubia*, a fast-growing multipurpose tree species from the family Meliaceae, commonly known as Malabar neem, is widely cultivated in southern India for plywood, pulpwood, fodder and timber. Considering its potential for carbon sequestration and ecological services, an experiment was initiated to evaluate the performance of *M. dubia* under varying planting densities.

Material and methods

The field experiment was conducted during July 2010 at 'M' Block, Agroforestry unit, Zonal Agricultural Research Station, University of Agricultural Sciences, Gandhi Krishi Vigyana Kendra, Bengaluru (Figure 1). Coming under the eastern dry zone (Zone-5) of Karnataka, the site is located between 12°51'N lat. and 77°35'E long at an altitude of 930 m above mean sea level (amsl) and receives an average annual rainfall of 920 mm. The experiment was conducted to find out the optimum spacing required for block plantation of *M. dubia*. The treatments consisted of six spacings.

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