

Melia dubia

An indigenous tree species for industrial agroforestry in India

S.B. Chavan¹, R. Vishnu¹, Naresh Kumar², Dhiraj Kumar¹, Chhavi Sirohi³
and A.K. Handa⁴

ICAR-Central Agroforestry Research Institute, Jhansi 293003 Uttar Pradesh

Melia dubia Cav., being an indigenous, fast-growing, and economically important multipurpose tree species, can achieve the targets sets in National Forest Policy, 1988 and National Agroforestry Policy, 2014. From the past 15-years, the Melia dubia has been characterized scientifically to understand its suitability in pulp and paper, pencil, plywood, matchstick and pole industries as a potential raw material. This money-spinning business of Melia dubia caught attention by farmers and industries to achieve maximum monetary benefits. The suitability of Melia dubia under various forms of agroforestry and industrial acceptability is key to success for its higher adoption among farmers of Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Punjab, Haryana and some extent in Uttar Pradesh.

Keywords: Indigenous tree species, Industrial agroforestry, Mahogany family

Meliaceae family in plant kingdom has been considered as a gift of nature to humankind due to its multifarious benefits such as timber, medicinal, fertilizer, insecticidal and fodder. This family is widely known as Mahogany family, which includes 50 genera with over 700 species though out the world. In India, it is represented by 20 genera and 70 species. The family is renowned for its high-quality timber, traded as mahogany. The important genera of the family are *Azadirachta*, *Tona*, *Melia*, *Soyimida*, *Swietenia*, and *Chloroxylon*, etc. Among all these, *Melia* genera is finding a new space and receiving wide acceptability as an alternate indigenous source of pulp and plywood for eucalyptus and poplar in India. Important species of *Melia* genera are *M. azedarach*, *M. composita*, *M. dubia* and *M. volkensii* and are widely exploited for industrial as well as local purposes in India. However, this popularity also attracted many business-minded nurseries as well as private firms that

sell low-quality planting material with unscientific field techniques that lead to financial cheating to farmers. For example, a seedling of *Melia* can be obtained at ₹ 10-15 from Government/Forest/ university nurseries, but private nurseries are selling at ₹ 80-200/ seedling. To harness the full potential, an attempt has been made to provide a complete package of practices of *Melia dubia* cultivation in India.

Description

Melia dubia grows up to 20-25 m in height with a clear bole of 10-12 m and 120-150 cm girth in 15-18 years. The bark is smooth, greenish when young and turning dark brown when mature.

Distribution

Melia dubia is endemic to certain pockets of the Western Ghats in India. It is found in tropical moist and tropical dry deciduous forest comprising Very Moist Teak forests (3B/C1a), Secondary Moist

deciduous forests (3C/2S1) and Dry Mixed Moist deciduous forests (5B/C2) subtype in India. Naturally, it is distributed in India, Sri Lanka, Malaysia, Bhutan, Myanmar, Australia and Africa. However, in India, it is mostly found in small pockets of Sikkim Himalaya, Upper Assam, Khasi Hills, Odisha, North Bengal, Deccan Plateau, and Southern India at an elevations ranging from 600 to 1,800 m above MSL.

Climate and soil

The species performs well in moist regions with annual rainfall exceeding 1,000 mm, (650-1,000 mm with irrigation facilities); optimum temperature of 30-35 °C (can tolerate a maximum temperature of 45 °C and a minimum of 0 °C); a light demander species but also grows in moderate shade with teak, casuarina, nutmeg and coconut. Seedlings can tolerate frost up to some extent but severe frost kills them. It grows on well-drained red, red-loam, alluvial



Fig. 1. Mini cutting techniques of *Melia dubia* at ICAR-CAFRI

and black-loam types of soil with pH ranging from 5.5 to 7.5 and requires soil depth up to 1.5 m.

Nursery techniques

Melia dubia is mainly propagated through seeds and vegetative propagation.

Seed sowing: Generally fruits should be collected from identified plus trees, which is middle age with clean and straight bole during the January to March depending upon locality. Due to hard endocarp, the germination percentage of *Melia dubia* seeds are only 5-25 %. Among several seed-pretreatments, soaking in cow dung slurry for 24 hours gives highest germination of 50-60 % followed by soaking in GA3 solutions for 12 hours (40-45%). The drupe fruits or extracted seeds are sown in raised beds and irrigated regularly. The germinations start after 30 days and continue up to 70 days from sowing. The seedlings of 6-12 months old preferred for field planting.

Mini-clonal technique: This technology is widely used in eucalyptus and casuarina for mass multiplication of quality planting material and tried up to some extent in *Melia dubia*. In India, research institutions like Forest College and Research Institute (TNAU), Mettupalayam; Institute of Forest Genetics and Tree Breeding, Coimbatore and ICAR-Central Agroforestry Research Institute,

Jhansi has standardized mini-clonal techniques for *Melia dubia* successfully. The superior clonal plants are planted at 10 × 10 cm or 15 × 10 cm in sunken bed or sand bed trough with properly connected to drip lines for irrigation and fertigation under controlled conditions or green shed net. The plants are allowed to grow up to 30-35 days with proper fertigation of Hoagland solution or standard mixture of macro and micronutrients every day or at least every week (Fig. 1). After 30 days of planting in mother garden, hedges should be pruned once in 15 days for juvenile apical cuttings (Fig. 2). The apical cuttings should be treated with 2% of Carbendazim solution. The basal portion of shoot tips (5-7 cm in length with one or two pairs of leaf i.e. mini-cutting) is treated with IBA @ 1000-2000 ppm powder formulation (1g of IBA in 1 kg of ordinary Talcum powder for 1000 ppm). These are planted in 90 cc root trainers filled with growing medium mainly sand or coir pith and maintained under controlled conditions such as 30-35°C temperature and relative humidity of 80 % with misting at every 20-30 min for fast, easy and uniform rooting. The rooting starts after 15-20 days and maintained up to 30 days in a mist-chamber. The well-maintained mother hedge garden allows the next cut every month with a minimum of 5-7 shoots per plant.

After 30-35 days in mist-chamber, rooted shoots shifted to hardening chamber (50-75% shade) for 15-20 days (Parthiban et al, 2019). Later, plants are shifted to open a nursery and maintained up to planting. During this duration, plants irrigated regularly with fertigation (All mix+ 19:19:19 @ 5-7 g per plant).

Mini-clonal technique offers several technical and economic advantages like high productivity, high success rate, high efficiency (especially in terms of labour, nutrient, water and space), uniformity in planting material, minimum space requirement, reduction in nursery duration, and low nutrient requirement. Generally, 5,000 plants can be produced from 1 m² area annually.

Planting technology

Site preparation: The one deep ploughing with two harrowing should be given for removing unwanted debris of weeds and it is also helpful for easy establishment of seedlings in the field. Generally, an ordinary pit of 45×45×45 cm or 60×60×60 cm is recommended to dig-up during summer (April-May) to reduce the chances of soil-borne insect and pathogens. The pit should be filled up just before monsoon season with 3-5 kg FYM+100-150 g neem cake+50 g DAP.

Planting: *Melia dubia* is planted under different spacing geometries with respect to individual land



Fig. 2. *Melia dubia* mother hedge garden in nursery (left) and field conditions (right) at FCRI, Mettupalayam

holding, end product utilization, type of intercropping, availability of water and requirement of the farmer. The following table shows standard planting geometry for *Melia dubia*. Generally, while establishing plantations, 6-month old seedlings are planted in pits. The chlorpyrifos @ 2 ml/ litter drenched to prevent termite infestation. A spacing of 5 × 5 m is optimal while a spacing of 8 × 2 m is ideal under agroforestry (Table 1).

Irrigation and fertilizer application

Tree growth is mainly driven by irrigation and fertilizer availability. Initial growth is fastened with weekly watering and fertilizers application once in 3 months for the first 3 years. The tree responds well to irrigation given every 10-15 days during non-rainy season. Under rainfed situation, drip irrigation (2 hours every day) is advocated to precise use of water. Application of N, P, K mixture of 25-50 g/tree, 2 times a year helps to

augment growth. From 3rd year onwards, rate of fertilizers should be increased up to 100g/tree.

Pruning and thinning

Pruning is an important operation to get straight, clear and knot free high quality bole. Optimum spacing in plantation enhances self pruning ability of tree, but wider spacing under agroforestry requires artificial pruning practice twice in a year. Proper care should be taken while pruning. It is recommended to start the pruning of side branches when the seedlings attain a height of 2-3 m. Also advised to prune side shoots or nip the nodal buddings grown-in between the main bole and side branches.

Under high-density planting (more than 500 to 5000 trees ha⁻¹), mechanical thinning is advocated at 2nd, 4th, 6th and 8th years of plantation by removing alternate tree to enhance lateral tree growth and to minimize competition. The abnormal trees like diseased, dying, malformed and crooked trees should be removed to maintain hygien conditions in plantation.

Tree protection

Several type of pests and diseases are reported in nursery and plantation of *Melia dubia* and mentioned in following Table 2.

Agroforestry systems

Owing to its manifold enduses, it

Table 1. Spacing and tree density

Type of planting	Spacing (m)	Tree density (tree ha ⁻¹)
Agroforestry	5×4	500
	5×5	400
	6×6	277
	8×2	625
Block plantation	3×3	1111
	2.5×2.5	1600
Bund planting	2 m away	200
	4 m away	100
	zig-zag planting	300-400
Short rotation	1.5×1.5	4500



Fig. 3. High-Density *Melia* plantation at Karur, Tamil Nadu



Fig. 4. Straight and clean bole of *Melia dubia* at 4-years of age

is best indigenous trees species under agroforestry to increase livelihood security of the farmers on a sustainable basis. The deciduous nature (Dec-Feb) and ability to withstand pruning are important characteristics of *Melia dubia* which makes its suitability under agroforestry. Wider spacing permits a variety of crops like groundnut, chilli, turmeric, blackgram, papaya, banana, watermelon and sugarcane in southern India, wheare as pulses, wheat, turmeric, berseem and barley in northern India as inter-crops. In Tamil Nadu, cash crops like banana and papaya (during first two years of plantation); turmeric (up to 5th year); curry leaves, mulberry or coconut (through out the rotation age) are grown. Now a days, *Melia* is considered as most popular host tree species in sandal planatations in Andhra Pradesh, Maharashtra, Tamil Nadu, Gujarath and Karnataka and planted either alternate row or alternate tree.

Yield and economics

Melia dubia, a promising tree highly suitable for industrial agroforestry with a minimum rotation of 3 years is gaining economic importance both in domestic and global markets. The rotation of trees depends upon utility and it varies from 3 to 10 years. The high density planted *Melia dubia* (with tree density of 500-4444) produces biomass of 150-250 tonnes ha⁻¹ at the age of 3-5-years.

Melia wood popularly used in match, pulp and plywood industries. Based on age and diameter growth, trees are sold in the market. At present, *Melia* fetches ₹ 7,000 per tonne for logs of girth 50-120 cm and above ₹ 370 per cubic feet for trees which have attained a girth >120 cm. The tree with the minimum size of 14 cm DBH is saleable at the minimum rate of ₹ 4,000-5,000 per tonne for paper, match and veneer industry. Nowadays, for quick return, famers

Table 2. Pests-disease in *Melia dubia* plantation and its management techniques

Pests/Diseases	Nature of damage and symptoms	Management techniques
Pests		
Red spider mite (<i>Tetranychus urticae</i>)	• Presence of chlorotic spots which coalesce in to pale patches indicates the presence of mite infestation • Extensive webbing underneath the leaves • Drying of leaves drying from the edges and slowly wither away. • Occurrence: June to November	• Hand plucking of infested foliage • Apply 10% of Neem kernel oil • Spraying of 2.5 ml of Dicofol/ liter of water • Application of Derrimax 0.3 ml/lit of water
Giant looper (<i>Ascotis selenaria</i>)	• Larvae and adult are dull green or dark brown looper with marking over the body. • loss of leaves and stunted growth of seedlings. • Alternate host: Prosopis and Neem • Occurrence: May to Novemebr	• Sparying of 0.076% Dichlorvos can control the pest. • Installation of light traps with white lights soon after the rains to trap the adult. • Lopping or pruning of alternate host tree
Thrips	• Occurrence: throughout the year • Both adults and nymphs feed on the sap and causes curling and chlorosis of young terminal leaves. • Insect can be recognized by the typical nature of leaf folding. • Damaged leaves are characterized by irregular, yellowish mottled areas with total absence of chlorophyll leading to leaf drying and shedding or stunted growth of seedlings.	• Application of 5 % of neem kernel extract every 10-15 days interval • Sparaying of Dimethoate @ 2 ml/l or 1.5ml/l of imadacloprid
Diseases		
Leaf blight (<i>Colletotrichum</i> spp.)	• Symptoms like decaying of leaf tip • Spots are small, brown and surrpounded by yellow hallow • Infected leaves crinkle and distorted	• Pruning of affected branches • Sparying of Bordeaux mixture @ 1%, Copper Oxychloride 0.125% or carbendezim 0.2% at 10-15 days interval
Stem & twig blight (<i>Corticium salmonicolor</i>)	• Swelling of bark with liquid oozing out • Often branches turns yellow and shed giving barren appearance	• Pruning the affected portion of tree • Use Bordeaux paste and mixture @ 1%
Ganoderma root rot (<i>Ganoderma lucidum</i>)	• Occurrence of fruit bodies i.e. basidocarp near base of tree • Water stress, one-sided mottling of the canopy	• Drenching with Bavistin @ 0.1% • Removal of affected plants • Use of Trichoderma

Source: Jacob, J. P. 2011. Insect pests of *Melia dubia*. Van Vigyan Newsletter. Vol:3 (2). Parthiban, K.T., S.K. Chauhan and R. Jude Sudhakar (2019). Malabar neem *Melia dubia*. Agronios, Jodhpur. 231 pp.

Table 3. Economic utility of *Melia dubia*

Utility	Rotation (years)	Tree density (tree ha ⁻¹)	Desirable DBH (cm)	Biomass (tonne ha ⁻¹)	Price (₹ tonne ⁻¹)
Biomass	2-3	2,500-4,444	5-15	150-250	3,000-3,500
Plywood	6-8	200-500	14 & above	80-150	5,000-7,000
Pulp	3-4	500-2,500	10-15	120-200	4,000-4,500
Timber	10 and above	Less than 200	35 and above	15-18 cft per tree	350-500 per cft

usually sells trees at 3 years of age and achieves on an average yield of 75 tonne ha⁻¹. They are linked with paper industry and getting assured gross income of ₹ 337,500 per ha by selling @ 4,500 per tonne. As per the study carried out by AICRP on Agroforestry at Forest College and Research Institute, Mettupalayam, *Melia dubia* based agroforestry system with tree density of 450 trees ha⁻¹ provides a net benefit of ₹ 1,193,060 ha⁻¹ with benefit:cost ratio of 1:3.94 @ 15% discounting rate, Net Present Value of ₹ 484,083 ha⁻¹ and internal rate of return of 79%.

SUMMARY

Melia based agroforestry systems have greater potential to meet the ever rising demand for food and wood. In addition to it has the potential to reverse land degradation, sequester carbon and recover site productivity through interactions among trees, soil, agricultural crops and livestock and thus restore environment and enhance productivity. The standard and recommended package and practices of *Melia dubia* could help to farmers for achieving higher diversification of traditional cropping systems and

industrial required raw material.

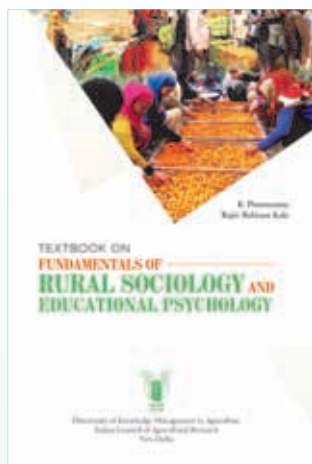
More information

- ICAR-Central Agroforestry Research Institute, Jhansi (UP) Ph: 0510-2730214; Fax: 05102730364.
- Forest College and Research Institute, Mettupalayam, Coimbatore (Dt), Tamil Nadu, Pincode: 638109, Phone: 04254-222010.
- Institute of Forest Genetics and Tree Breeding (Indian Council of Forestry Research and Education) P.B. No. 1061, R.S. Puram P.O., Coimbatore-641002, INDIA Phone: +91 422 2484100, 2484101.

¹Scientist, ²Sr. Scientist, ⁴Principal Scientist at ICAR-Central Agroforestry Research Institute, Jhansi 293003 Uttar Pradesh.

³Assistant Scientist at Department of Forestry, CCS Haryana Agricultural University, Hisar 125004 Haryana.

Textbook on Fundamentals of Rural Sociology and Educational Psychology



India being a land of villages, rural sociology and educational psychology is an essential theme for agricultural students and professionals. Rural sociology deals with rural society and the relations of people who live in villages. Rural sociology presents a scientific picture of rural life.

Extension workers work with farmers very closely in their settings for which their understanding of rural background and farmers' psychology is very essential. Extension professionals should have necessary knowledge of the precise approaches and methods of dealing with farmers. Rural sociology can help professionals in organizing the rural structure in a constructive manner.

This textbook consists of fundamental facts of rural sociology. The book has twenty two chapters covering both rural sociology and educational psychology out of which twelve chapters consist of rural sociology and ten chapters deal with educational psychology. In this text book, emphasis has been given on various aspects of educational psychology also. It provides all the relevant information in the field of rural sociology with special emphasis on Indian culture, merits and demerits of Indian rural societies, the stressful conditions under which farmers live and work. The book will be a good basis of information reference for agriculture students, psychology students besides extension practitioners, research scientists, KVKs and agricultural colleges.

TECHNICAL SPECIFICATIONS

No. of pages : i-viii + 252 • Price : ₹ 450 • ISBN No. : 978-81-7164-181-9

For obtaining copies, please contact:

Business Unit

Directorate of Knowledge Management in Agriculture
Krishi Anusandhan Bhavan-I, Pusa, New Delhi 110 012
Tel : 011-25843657, Fax 91-11-25841282; e-mail : bmicar@gmail.com