

usually produced by coppicing. Seedlings and stumps are planted for a third rotation.

ECONOMICS

The growth of the species is remarkably fast and, on good sites, can reach 20 m height in 5 years. The tree attains more than 30 m height with about 60 cm dbh at maturity. Form of the tree is fair to good, with 6-9 m of clear bole. Some trees can reach 3 m after a year from planting and 20 m after 4.5 years. The yield of *gamhar* is 84 m³/ha at age 12 in poor sandy soils, 210 m³/ha at age of 12 years in clay or lateritic soils, and 252 m³/ha at age of 10 years in favorable alluvial soils all volumes are underbark to 7.5 cm top diameter. The species produces an average volume of about 25 m³/ha/year on clayey loam soils with adequate moisture.

PROTECTION

Browsing : The seedlings and saplings are severely browsed by goat and other cattle. Effective measures should be adopted for protection from grazing.

Pest and insects : The seedlings are highly susceptible to wilting disease caused by *Fusarium solani* at seedling stage. Canker formation and die back are recorded in plantation caused by *Corticium salmonicolor* and *Griphosperia gmelinae*, respectively. Leaf blight and leaf spot disease caused by some pathogens are also recorded.

Mortality : The extent of mortality is reported to be from 30-80%, which may be caused by pathological, environmental, hydrological/ site quality. Following measures should be adopted to increase the survival of plantation :

- Mixed cropping
- Proper site selection
- Removal of diseased trees
- Selection of resistant clones for commercial plantation

USES

The wood of this important species is highly esteemed for different utilitarian aspects such as :

- Plywood, paper and matches
- Agricultural implements
- Construction and furniture
- Fodder

Medicinal properties : Its roots provide a bitter tonic for stomachache and constitutes an important ingredient of "Dashmula" an Ayurvedic formulation. Fruits are used to treat ulcer, anemia, leprosy and constipation. It is also used as a nerve tonic in insanity and epilepsy.

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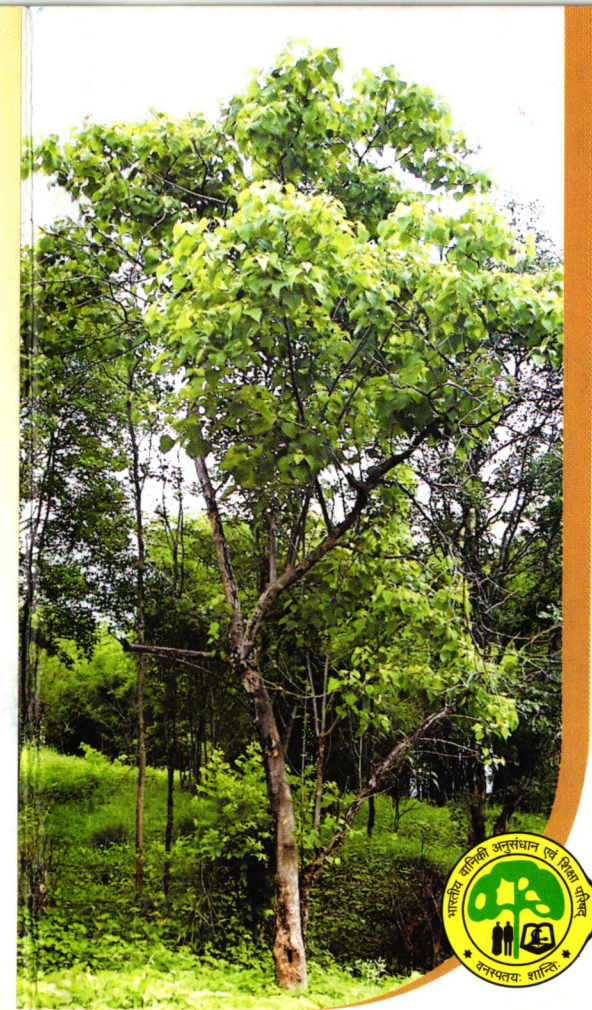
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GAMARI

Gmelina arborea Roxb.

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INTRODUCTION

Gmelina arborea (Family : Verbenaceae), commonly called as gamar, khamer, white teak or yemane, is a moderate to large sized deciduous tree of South East Asia and distributed throughout the greater part of India. It attains height of 30 m or more and girth about 4.5m.

SILVICULTURAL CHARACTERS

- Light: Strong light demander
- Drought: Drought hardy
- Frost: Frost hardy
- Fire: Fire susceptible
- Coppicing power: Very good coppicer

REGENERATION

The species can be regenerated naturally as well as artificially.

Natural Regeneration : It can be done by any of the following methods :

- Seed
- Coppice
- Root sucker

Artificial Regeneration: It is very easy to propagate through artificial regeneration through following methods:

- Direct sowing
- Stump planting
- Entire transplanting
- Vegetative propagation

Seed collection: It starts flowering at the age of 3-4 years. It produces fruits abundantly every year. The flowering appears in the month of February and fruits ripe at the end of April to June. Seeds are collected in May-June. The pulp should be removed from the kernels soon after collection of seeds.

Seed drying and storage : The de-pulped brown colour seeds should be retained and spread out in the sun to dry. The dried seeds can be stored in dry condition in a well ventilated shed and finally stored in sealed gunny bags. Fresh seeds are commended for raising of planting stock as it is reported to germinate about 90%.

Nursery techniques : Seeds are dibbed at spacing of 7.5 cm x 7.5 cm, 1 cm-2.5 cm deep in sunlight exposed raised beds with good drainage. Seeds germinate in 10-15 days. Seedlings are planted out when they are about 15cm high.

PLANTATION TECHNIQUES

The plants can be propagated by three methods namely, direct sowing, stump planting and entire transplanting.

Direct sowing : This is the easiest method to raise its commercial plantation. For sowing in patches at the rate of 4 seeds per patch, about 14 kg seeds are required per ha. Patches of about 0.3 m square are hoed to a depth of 0.3 m at an espacement of 1.8 m x 1.8 m in the cold weather. These patches are allowed to weather for about a month and then filled with good soil, raising the level to 7.5cm above the ground. At the break of monsoon rains, 3-4 seeds are sown, 1.0cm to 2.5cm deep in the each patch. In line sowing, the plants are evenly spaced about 0.9m apart.

Stump planting: The seedlings raised in the month of May become ready for stump planting in June following year at the break of rains. The stumps prepared from one year old seedlings are used for planting.

Entire transplanting: This method is widely used to raise this species artificially. The seedlings are planted out with balls of earth round the root system, without trimming the roots. The entire transplanting is generally done at on set of rains when the young plants are of one month age

or of 2.4 to 2.7m height. This gives more than 95% survival.

Vegetative propagation: Vegetative propagation methods developed at Tropical Forest Research Institute, Jabalpur can be effectively employed for mass propagation of the species. This can be done either through micropropagation or cuttings/macropropagation. The micropropagation method standardized as MS basal medium + 1 μ M BA+ 4mg/l AgNO₃ for shoot multiplication and WPM basal medium + 10 μ M IBA for rhizogenesis. Among different types of cuttings and treatments employed, sprout cuttings treated with 5mM IBA emerged as an efficient procedure for cloning of the species.



Micropropagation of *Gmelina arborea*



Macropropagation of *Gmelina arborea*

ROTATION

Rotations for pulpwood and sawnwood are usually 6 and 10 years, respectively. Rotations of 5-10 years are common for fuelwood. Stands on 10-year rotations are thinned to 50% at five years and another 50% at seven years. The second rotation is