Technical Bulletin
CAFRI/2025/05

Standards for Seedling Certification of Agroforestry Tree Species (Volume I)

ICAR-Central Agroforestry Research Institute
Jhansi 284003, Uttar Pradesh

Nodal Agency for Agroforestry
Ministry of Agriculture and Farmers' Welfare, Govt. of India

Technical Bulletin No.: CAFRI/2025/05

Standards for Seedling Certification of Agroforestry Tree Species (Volume I)

1. *Melia dubia*
2. *Pongamia pinnata*
3. *Santalum album*
4. *Tectona grandis*
5. *Dendrocalamus strictus*

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Disclaimer

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Preface

Ensuring the production and access to quality planting material (QPM) is fundamental to the success of plantations and the expansion of agroforestry practices. While the ICAR-Central Agroforestry Research Institute (CAFRI) has previously established guidelines through the "Guidelines for Quality Planting Material of Agroforestry Species," the implementation of these guidelines has seen limited focus. Recognizing the critical need for robust QPM standards, the financial year 2023-24 emphasizes the importance of implementing these standards across States and nurseries. In response, ICAR-CAFRI developed an accreditation protocol for agroforestry nurseries, designed to ensure nurseries adhere to essential criteria, fostering the production of healthy, disease-free seedlings with traceable pedigrees.

Building on this groundwork, we present the "Standards for Seedling Certification of Agroforestry Species." This document serves as a pivotal step in enabling certification, focusing solely on establishing standards rather than detailing the certification process itself. These standards are integral to the seedling certification protocol and are intended to support the effective implementation of the *Rashtriya Krishi Vikas Yojana* (RKVY) scheme's agroforestry component. By setting forth clear and achievable standards, we aim to streamline the production of QPM and reinforce the foundational elements critical for the certification of agroforestry species. As the national nodal agency for agroforestry (technical support), ICAR-CAFRI remains committed to advancing the quality and accessibility of agroforestry planting materials through these rigorous standards.

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Message

The production and accessibility of Quality Planting Material (QPM) are the cornerstones of successful plantation programmes and the promotion of agroforestry across the country. Recognizing this, ICAR-Central Agroforestry Research Institute (CAFRI), Jhansi, has played a pivotal role in formulating guidelines and developing protocols that ensure the availability of quality planting materials to stakeholders.

Building upon the earlier *"Seedling Certification Protocol for Agroforestry Tree Species"*, ICAR-CAFRI has now taken an important step forward by developing the *"Standards for Seedling Certification of Agroforestry Tree Species"*. This document provides seedling quality standards that will form the foundation for certification mechanisms. By ensuring that nurseries adhere to these standards, the initiative will strengthen national efforts toward promoting the production and supply of high-quality, disease-free seedlings.

This publication is timely and aligns with the objectives of the *Rashtriya Krishi Vikas Yojana (RKVY)* agroforestry component, which seeks to scale up agroforestry interventions across States. The implementation of these standards will contribute significantly to enhancing farmers' confidence in quality planting materials, thereby supporting sustainable livelihoods and environmental resilience.

I appreciate the efforts of ICAR-CAFRI in developing this important technical bulletin and trust that it will serve as a valuable reference for nursery operators, policymakers, researchers, and all stakeholders engaged in advancing agroforestry.

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Contents

Abbreviations

AICRP	All India Coordinated Research Project
CAFRI	Central Agroforestry Research Institute
GoI	Government of India
ICAR	Indian Council of Agricultural Research
MoA&FW	Ministry of Agriculture & Farmers' Welfare
SMAF	Sub-Mission on Agroforestry
QPM	Quality Planting Material
RKVY	*Rashtriya Krishi Vikas Yojana*

Scope

The National Agroforestry policy highlighted in 2014 emphasizes that agroforestry has not attained the desired prominence, largely due to the scarcity of quality planting materials. The policy underscores the necessity for an institutional mechanism for the registration and accreditation of nurseries. ICAR-Central Agroforestry Research Institute (CAFRI) has been designated as the national nodal agency (vide F.No.3-1/2021-NRM-SMAF dated 5 April 2023) for the agroforestry component of *Rashtriya Krishi Vikas Yojana* (RKVY) to provide technical support, capacity building, nursery establishment, and the production and certification of QPM.

The need for species-specific standards arises from the diverse array of over 180 multipurpose trees identified for agroforestry purposes, in addition to numerous other species. The previously established accreditation protocol for agroforestry nurseries provides a broad framework for nursery operations but does not delve into the specific criteria and indicators necessary for different species. Given the unique growth characteristics, ecological requirements, and economic potentials of various agroforestry species, it is impractical to apply a single standard across all species. Therefore, this document aims to provide detailed, species-specific standards to ensure the production of high-quality planting materials tailored to the needs of each species. These standards will guide the certification process, ensuring that seedlings meet the necessary quality benchmarks to support successful agroforestry practices and optimize productivity and sustainability

This document focuses on establishing standards for seedling certification of selected agroforestry species, a key step beyond nursery accreditation. These standards are designed to ensure that certified seedlings meet rigorous quality criteria, ultimately enhancing the productivity and economic viability of agroforestry practices. By setting these standards, ICAR-CAFRI aims to facilitate the widespread availability of high-quality planting materials, supporting the national mandate and addressing the challenges identified in the 2014 policy.

Overview of the standards for seedling certification

The Standards for Seedling Certification of Agroforestry Tree Species serve as a pivotal framework for implementing the Seedling Certification Protocol across India's diverse agroforestry systems. These standards ensure that seedlings produced in accredited nurseries are of high physiological quality, genetically sound, and morphologically superior—thereby guaranteeing robust field establishment and long-term productivity. Recognizing the diversity of agroforestry tree species, the standards are species-specific, tailored to address the distinct growth patterns, ecological adaptability, and propagation methods of each species. They provide a clear, uniform, and traceable mechanism to assess and certify seedlings, thus promoting the large-scale use of Quality Planting Material (QPM) in agroforestry-based land-use systems.

These species-specific standards can be developed by any recognized research or development institution, including ICAR institutes, ICFRE, State Agricultural Universities, or other competent agencies. Once developed, the standards must be submitted to the National Nodal Agency for Agroforestry (NNAAC) for review, vetting, and formal notification. Upon approval, each species-specific standard will receive a unique coding format to ensure transparency, traceability, and institutional accountability. The coding format follows a structured system — [Institution Code]-SCS:[Species Code][Version] (Year) — for example, CAFRI-SCS:MD1 (2025), representing a standard for Melia dubia developed by ICAR-CAFRI in its first version, issued in 2025. To further distinguish propagation methods, an alphabet suffix will be used — where 'S' denotes seed-based propagation and 'A' denotes vegetative propagation (such as grafting, cutting, or budding). Thus, CAFRI-SCS:MD1S (2025) would represent the seed-based standard, while CAFRI-SCS:MD1A (2025) would indicate the vegetative propagation standard.

Importantly, these standards are dynamic and evolving. As new research findings, improved propagation techniques, or advanced physiological and genetic assessments become available, the standards can be revised and updated to reflect contemporary scientific understanding and field requirements. Each revision will carry an updated version number, ensuring a transparent record of progress in quality enhancement. By embedding scientific rigor, traceability, and institutional collaboration, the Seedling Certification Standards provide a strong foundation for the effective deployment of the Seedling Certification Protocol for Agroforestry Tree

Species, ultimately fostering trust among stakeholders, ensuring the supply of superior planting material, and contributing to resilient, productive, and sustainable agroforestry landscapes.

A total of 17 criteria have been identified for seedling certification, grouped as quantitative, qualitative, and subjective. The quantitative criteria include measurable traits such as period in nursery, height, collar diameter, number of branches, number of stems, and sturdiness quotient, which provide an objective assessment of seedling growth and vigor. The qualitative criteria includes observable characteristics such as colour of mature leaf, colour of bud leaf, hardening, incidence of pests and diseases, symptoms of nutritional deficiency, grading and culling specification, poly bag size, and potting media, reflecting the physiological quality and overall health of seedlings. Subjective criteria like Dickson's Quality Index, Volume index, and number of leaves or leaflets are based on expert judgment and complement the other two indicator types. Out of the total seventeen criteria, a minimum of eight must be satisfactorily met for a seedling to qualify for certification. These essential criteria include period in nursery, height, collar diameter, number of branches, number of stems, colour of mature leaf, hardening, incidence of pests and diseases, and poly bag size (recommended). For instance, the disease and pest incidence mentioned in the standards indicates the acceptable level of the disease and pest. Meeting these minimum standards ensures that seedlings possess the desired vigor, uniformity, and resilience for successful establishment in the field.

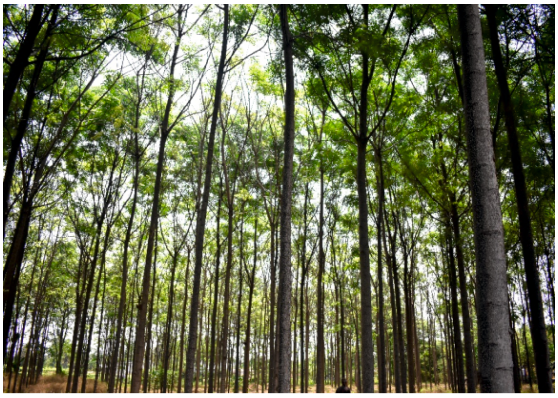
Species Specific Standards

CAFRI-SCS:MD/A1 (2025)

Malabar Neem (*Melia dubia* Cav.)

Melia dubia is a fast-growing, deciduous tree species belonging to the Plantae kingdom, Magnoliophyta (angiosperms), Magnoliopsida (dicotyledons), order Sapindales, family Meliaceae (mahogany family), and *Melia* genus. It is native to the Indian subcontinent and widely distributed across tropical and subtropical regions of India, particularly in Tamil Nadu, Karnataka, Kerala, and Andhra Pradesh. The species has gained immense importance in recent years as a promising agroforestry tree due to its rapid growth, high-quality timber, and suitability for multiple industrial uses.

The wood of *Melia dubia* is light to moderately hard, with a pale pinkish to light brown hue, fine texture, and a straight to interlocked grain pattern. It is widely used in the plywood, furniture, and paper industries due to its excellent workability and uniform quality. The tree grows rapidly, reaching harvestable size within 8–10 years, making it a preferred alternative to traditional species like Eucalyptus and Poplar in industrial agroforestry. The species is also valued for its adaptability to a wide range of soil and climatic conditions and its compatibility in intercropping systems.



Propagation protocol

Propagated via vegetative propagation (mini clonal cutting)

Clonal propagation Techniques

The clonal propagation technique of Melia dubia involves selection of clones from individual trees based on the morphogenic superiority (sometimes tested for genetic superiority). The individual trees were selected based on their growth attributes. The selected trees were given a cut at the base preferably at 15 cm above the ground and were left to coppice. Alternatively, the true-to-true type of the selected tree is established in the mother bank and maintained for coppice shoot production. The coppice shoots are then harvested and treated with rooting hormones (IBA – 1500 ppm) and ramets were multiplied for out planting. Given the constraints in the germination of Melia dubia seeds. It would be prudent to adopt clonal propagation techniques for

the mass production of high-quality seedlings, ensuring uniformity and superior growth performance. Special care should be taken in the selection of mother trees for the collection of ramets or cuttings, choosing only phenotypically superior, disease-free, and high-yielding trees to maintain the desired genetic quality of planting stock.

a) *Melia dubia* cuttings; b) a) *Melia dubia* raised via vegetative propagation (cuttings)

Ideal standards recommended for *Melia dubia* (vegetative propagation : mini clonal cutting)

S.No	Criteria	Indicator
1	Period in nursery	3-4 months
2	Height (in cm)	30 - 45 cm
3	Collar diameter (cm)	0.8 - 1.2 cm
4	Number of branches	<2
5	Number of stems	1(no forking)
6	Sturdiness Quotient	3-4
7	Dickson's Quality Index	>1.5
8	Volume Index	19-65
9	Colour of the mature leaf	Dark lush green
10	Colour of the bud leaf	Light Green
11	Hardening	15-20 days
12	Incidence of pest & diseases	Completely free from pest & diseases
13	Symptoms of nutritional deficiency, if any	Completely free from nutritional deficiency
14	Grading and culling specification	Unhealthy seedlings observed in the nursery has to be culled (stunted and abnormal growth i.e. etiolated seedling)
15	Polybag size (recommended)	10 x 15 – 10 x 20 (cm); Root trainers of $\geq$ 150 cc
16	Number of leaves /leaflets	3 - 5
17	Potting media	Soil+ Sand+ FYM (1:1:1)

CAFRI-SCS: PP1 (2025)

Karanj/ Indian Beech - [*Pongamia pinnata* (L.) Pierre (Syn. *Millettia pinnata*)]

Pongamia pinnata is a medium-sized, nearly evergreen, leguminous tree belonging to the family Fabaceae. Taxonomically, this species has long been a subject of nomenclatural discrepancy — it is often referred to as *Millettia pinnata* (L.) Panigrahi due to historical classification under the genus *Millettia*. However, based on molecular and morphological evidence, *Pongamia* has been as the accepted genus, and *Pongamia pinnata* is now the widely recognized and valid botanical name. The tree is moderate in size, with a spreading canopy, short and often crooked trunk, and smooth greyish bark. It can grow up to 18 meters tall and attain a trunk girth of about 1.5 meters. The bark is approximately 0.8 cm thick, light grey to greyish-brown externally, and yellowish inside. The leaves are compound, bearing five to nine leaflets arranged oppositely along the rachis. Each leaflet is ovate-oblong, pointed at the tip, and bright green on the upper surface. The flowers are white with a tinge of violet or pink, arranged in short clusters that do not exceed the length of the leaves. The calyx is purplish and covered with brownish hairs, while the corolla is white with petals fused at the tips. The stamens are united into a single bundle, and the ovary is nearly stalkless. The fruit is a woody, indehiscent pod, pointed at both ends, yellowish-grey when ripe, and typically containing one or two reddish-brown, wrinkled seeds. When two seeds occur, they are irregularly shaped and flattened where they touch. A notable variation exists among Pongamia pinnata populations found across different regions of India, suggesting the presence of local ecotypes or varieties adapted to specific ecological conditions.

This species occurs widely throughout India, particularly along rivers, streams, canal banks, and coastal areas. It is also found often cultivated along roadsides, field bunds, and water bodies for its multiple ecological and economic benefits. The tree is valued for its nitrogen-fixing ability, oil-rich seeds (used for biofuel), and shade-providing characteristics, making it a key species in agroforestry systems.

Propagation Protocol

Propagated via Seeds

For seed-based propagation, mature *Pongamia pinnata* pods are collected from trees exhibiting good form, vigour, and seed productivity, as the colour change from green to brown. The seeds are extracted from the pods by gently cracking them open using a light hammer or by pressing a knife along the pod seams. The seeds generally do not require any pre-sowing treatment as they have a naturally high germination rate. The extracted seeds are directly sown in nursery polybags of size 18 × 10 cm, filled with a potting mixture comprising sand, farmyard manure, and soil in the ratio of 2:1:1. The medium ensures good aeration and moisture retention necessary for early seedling establishment. Regular watering is done to maintain adequate moisture without waterlogging. Germination begins within 10–15 days after sowing, and the seedlings

exhibit steady growth under partial shade conditions. Once the seedlings attain a height of 60–80 cm, they are considered suitable for out-planting in the main field. Proper hardening under open nursery conditions for 2–3 weeks before transplanting enhances survival and field establishment.

a) *Pongamia pinnata* pods; b) *Pongamia pinnata* seeds/kernels

Ideal standards recommended for *Pongamia pinnata* (Seeds)

S.No	Criteria	Indicator
1	Period in nursery	6-12 months
2	Height (in cm)	60-150 cm
3	Collar diameter (cm)	1.2-1.7 cm
4	Number of branches	<5
5	Number of stems	<2
6	Sturdiness Quotient	≤ 6
7	Dickson's Quality Index	≥ 0.28
8	Volume Index	200-350
9	Colour of the mature leaf	Dark green
10	Colour of the bud leaf	Light green
11	Hardening	30-40 days
12	Incidence of pest & diseases	Occasionally Mealy bug and gall infestation can occur in seedlings
13	Symptoms of nutritional deficiency, if any	Leaf turned yellowish indicating nitrogen deficiency
14	Grading and culling specification	Lanky seedling, severe leaf spot, blight, mildew, or other visible fungal/bacterial infections should be culled out
15	Polybag size (recommended)	18 x 10 cm
16	Number of leaves /leaflets	3-5 leaflet per leaves
17	Potting media	Soil+Sand+FYM+Vermicompost(1:1:1:1)

CAFRI-SCS:SA1 (2025)

Indian Sandalwood/White sandal tree (*Santalum album* L.)

Santalum album is a small to medium-sized, evergreen tree belonging to the family Santalaceae. It is renowned for its fragrant heartwood and essential oil, which are highly valued in perfumery, pharmaceuticals, and religious rituals. The tree is native to peninsular India and widely distributed in Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, and parts of Odisha and Madhya Pradesh. Indian sandalwood is semi-parasitic, depending partially on the roots of suitable host plants for water and nutrients through specialized structures called haustoria. The tree grows up to 12–15 meters tall, with a girth of 60–80 cm under favorable conditions. The bark is dark grey or brown, smooth in young trees, and rough and fissured in older ones. Leaves are opposite, simple, ovate-lanceolate, and smooth, while flowers are small, purplish-brown, and borne in clusters. The fruit is a globose drupe, turning purple-black when ripe, enclosing a single seed. The heartwood and essential oil (sandalwood oil) are the primary economic products. The heartwood develops after 10–15 years, reaching commercial maturity at 25–30 years. The species thrives in well-drained red loamy soils, with a pH range of 6.0–7.5, and performs best in regions with 600–1600 mm annual rainfall and temperature between 12°C and 35°C. Felling and transit restrictions for sandalwood vary between states; therefore verify local regulations and permit requirements carefully before planting this tree as plantations and agroforestry systems.

Propagation Protocol

Propagated via Seeds

For seed-based propagation, mature fruits are collected from superior plus trees (aged 15–25 years) during June–September. The fruits are depulped by soaking in water for 48 hours to soften the outer layer, followed by manual rubbing to extract the seeds. Cleaned seeds are shade-dried for 2–3 days before sowing. Since Santalum album exhibits a hard seed coat and dormancy, pre-sowing treatment is essential. The seeds are

soaked in warm water (40–45°C) for 24–36 hours to soften the coat and improve germination. Alternatively, mechanical scarification (gentle rubbing with sandpaper) can also be used.

a) *Santalum album* fruits; b) *Santalum album* seeds (depulped)

Seeds are sown in raised nursery beds (2 × 1 m) or polybags (15 × 10 cm) filled with a well-drained potting mixture of red soil, sand, and farmyard manure (1:1:1). Light irrigation is provided daily. Germination usually begins within 15–25 days, and the germination rate ranges between 30–60% under optimal nursery conditions.

Since sandalwood is a semi-root parasite, it is critical to establish a primary host plant in the nursery. Suitable hosts include *Cajanus cajan* (pigeon pea), *Alternanthera sessilis*, or *Desmodium* spp., planted 15–20 days before sandalwood sowing. The host roots facilitate haustorial connections, improving seedling vigor and nutrient uptake. Seedlings are maintained under 50% shade for the first 2–3 weeks and gradually exposed to sunlight for hardening. When seedlings reach 25–35 cm height (about 6–8 months old) and show good root–host establishment, they are ready for outplanting.

Ideal standards recommended for *Santalum album* (Seeds)

S.No	Criteria	Indicator
1	Period in nursery	8-10 months
2	Height (in cm)	20-25 cm
3	Collar diameter (cm)	6-8 mm
4	Number of branches	<8
5	Number of stems	1 (no forking)
6	Sturdiness Quotient	2-4
7	Dickson's Quality Index	≥ 0.2
8	Volume Index	>20
9	Colour of the mature leaf	Shining green
10	Colour of the bud leaf	Light green
11	Hardening	40-50 days
12	Incidence of pest & diseases	Completely free from pest & diseases
13	Symptoms of nutritional deficiency, if any	Leaf turned yellowish indicating lack of haustoria formation with host
14	Grading and culling specification	Stunted and small leaves have to be culled out
15	Polybag size (recommended)	18 x 10 cm and 30 x 20 cm
16	Number of leaves /leaflets	18-25
17	Potting media	Soil+Sand+FYM+Vermicompost (1:1:1:1); Mandatory presence of host in the seedling bag

CAFRI-SCS:TG1 (2025)

Teak (*Tectona grandis* L.f.)

Tectona grandis is a large deciduous tree belonging to the family Verbenaceae. It is globally renowned for its durable and high-quality timber, widely used in shipbuilding, fine furniture, and structural applications. Native to India, Myanmar, and Thailand, teak also occurs naturally in parts of Laos and Indonesia and is extensively cultivated across Africa, Central, and South America. In India, it is distributed in the states of Madhya Pradesh, Maharashtra, Tamil Nadu, Kerala, and Odisha, thriving mainly on low hilly terrains up to 900 m above mean sea level.The tree attains a height of 30–40 meters and a girth of 2–3 meters under favorable conditions. The stem is straight, often buttressed at the base, with grey to brownish-grey bark about 1–1.5 cm thick, exfoliating in thin flakes. Leaves are large, opposite, ovate to elliptic, rough above, and densely hairy beneath. Flowers are small, white, and borne in large terminal panicles during the rainy season. The fruit is a globose drupe about 1.5–2 cm in diameter, enclosing one or more seeds covered by a thick, spongy pericarp.

Teak is deciduous, shedding leaves during the dry season (January–March) and flushing new foliage with the onset of monsoon rains. The species grows well in deep, well-drained alluvial or loamy soils with a pH of 6.5–8.0 and an annual rainfall range of 900–2500 mm. It prefers a temperature range between 13°C and 39°C. The wood is golden brown, aromatic when freshly cut, and darkens with age, showing characteristic streaks. The heartwood is durable, resistant to decay, termites, and water, making it one of the most valuable tropical timbers.

Propagation Protocol

Propagated via Seeds

Tectona grandis fruit (drupe)

For seed-based propagation, mature drupes are collected from selected plus trees (aged 30–50 years) during December–May. Collected fruits are dried and subjected to alternate soaking and drying for five days to facilitate the removal of the pericarp and enhance germination. The cleaned seeds are sown in raised nursery beds (10 × 1 × 0.5 m) before the onset of the monsoon, preferably during the last week of May. The beds are filled with a well-drained mixture of soil, sand, and farmyard manure and watered lightly every day.

Germination begins in 15–25 days, with success rates varying between 30–60%, depending on seed source and pre-treatment efficiency. Forty-five to sixty-day-old healthy seedlings are transplanted into polybags (22.5 × 15 cm, 1 mm thickness) containing the same potting mixture. The seedlings are maintained under 50% shade for about 30 days and gradually hardened in full sunlight. Plants attaining 25–35 cm height and showing robust root development (approximately 3–4 months old) are suitable for field planting.

Ideal standards recommended for *Tectona grandis* (Seeds)

S.No	Criteria	Indicator
1	Period in nursery	9-10 months
2	Height (in cm)	40-45 cm
3	Collar diameter (cm)	0.8- 1.0 cm
4	Number of branches	4-6
5	Number of stems	01 (No forking)
6	Sturdiness Quotient	5-7
7	Dickson's Quality Index	$\geq$ 0.2
8	Volume Index	30-50
9	Colour of the mature leaf	Green
10	Colour of the bud leaf	Green to pale green
11	Hardening	30-40 days
12	Incidence of pest & diseases	Termites and rust incidence
13	Symptoms of nutritional deficiency, if any	Yellowing due to nitrogen deficiency
14	Grading and culling specification	On the basis of collar diameter 1) Grade A - Dia. > 0.8 cm 2) Grade B - Dia. 0.5 – 0.8 cm
15	Polybag size (recommended)	18 x 10 cm and 22.5 x 15 cm
16	Number of leaves /leaflets	9-12
17	Potting media	Soil+Sand+FYM (1:1:1)

CAFRI-SCS:DS1 (2025)

Soild Bamboo (*Dendrocalamus strictus* (Roxb.) Nees)

Dendrocalamus strictus is a large, densely tufted, deciduous bamboo species belonging to the family Poaceae (subfamily Bambusoideae). It is one of the most widely distributed and economically important bamboo species in India, valued for its strength, versatility, and adaptability to semi-arid and dry regions. The species occurs naturally throughout the Indian subcontinent and Southeast Asia, extending to Malaysia, Indonesia, and the Philippines. In India, it is common in Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, and parts of the Himalayan foothills up to 1000 m elevation.

The culms grow 8–16 meters tall and 2.5–8 cm in diameter, with thick walls and pale bluish-green color when young, turning dull green or yellowish with age. Culms are slightly curved above the mid-height, and nodes are swollen, often rooting at the base. The internodes are 30–45 cm long, and culm sheaths are 8–30 cm in length, hairy on the back, and striated. Leaves are linear-lanceolate, 10–25 cm long and 2–3 cm wide, rough on the upper surface and softly hairy beneath. The inflorescence is a large panicle with dense globular heads 4–5 cm apart. Spikelets bear 2–3 fertile flowers mixed with sterile ones. Stamens are long-exserted with yellow anthers, while the ovary is turbinate, hairy, and surmounted by a purple feathery stigma. Flowering in D. strictus is mostly gregarious at long intervals of 30–60 years, though sporadic flowering occurs annually in some regions. The species thrives in well-drained sandy loam to red loam soils with pH 6.0–7.5 and performs best in areas receiving 750–1500 mm annual rainfall and temperatures between 15°C and 38°C. D. strictus is among the two most important commercial bamboo species in India. It is widely utilized in paper and pulp industries, house construction, agricultural implements, and as scaffolding material. Due to its strong and solid culm, it is also suitable for furniture and handicrafts. It plays a vital role in ecological restoration and is recommended for soil conservation and ravine land reclamation.

Propagation Protocol

Propagated via Seeds

Dendrocalamus strictus seed

For seed-based propagation, mature seeds are collected from naturally flowered clumps. The husk is removed, and seeds are soaked in cold water for 10–12 hours to enhance germination. The treated seeds are sown in raised nursery beds (10 × 1 × 0.25 m) filled with a well-drained mixture of red soil, sand, and farmyard manure (2:1:1). Light irrigation is provided daily. Germination usually begins within 10–15 days, and the seedlings attain 10–15 cm height in 30–40 days.

Healthy seedlings are transplanted into polybags filled with the same potting mixture, maintaining one seedling per bag. The transplanted seedlings are kept under 50% shade for about 30 days for hardening and then gradually exposed to full sunlight. Seedlings reaching 30–40 cm height in 2–3 months are ready for field planting.

Ideal standards recommended for *Dendrocalamus strictus* (Seeds)

S.No	Criteria	Indicator
1	Period in nursery	7-8 months
2	Height (in cm)	50-60 cm
3	Collar diameter (cm)	0.3-0.6 cm
4	Number of branches	5-8
5	Number of stems	05
6	Sturdiness Quotient	10-15
7	Dickson's Quality Index	$\geq$ 0.05
8	Volume Index	>7.5
9	Colour of the mature leaf	Green
10	Colour of the bud leaf	Light yellow
11	Hardening	75-90 days
12	Incidence of pest & diseases	Completely free from pest & diseases
13	Symptoms of nutritional deficiency, if any	Yellowing due to nitrogen and magnesium deficiency
14	Grading and culling specification	On the basis of the number of tillers/ stems seedlings can be graded as: 1) Grade A - > 5 tillers 2) Grade B - 3-5 tillers
15	Polybag size (recommended)	18 x 10 cm and 22.5 x 15 cm
16	Number of leaves /leaflets	9-12
17	Potting media	Soil+Sand+FYM (1:1:1)

Notes

Swachh Bharat Abhiyan

स्वच्छ भारत

एक कदम स्वच्छता की ओर

Agrisearch with a human touch

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"कृषिवानिकीः एक जीवन दायिनी"

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