NURSERY TECHNIQUE OF COMMON FOREST TREE SPECIES USED IN PLANTATIONS UNDER OFSDP-II

Odisha Forestry Sector Development Society
Forest and Environment Department
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PREFACE

Odisha Forestry Sector Development Project, Phase-II (OFSDP-II) is under implementation in 14 Forest and Wildlife Divisions of the State, with financial support from Japan International Cooperation Agency (JICA). The project is scheduled to be implemented in 1200 Forest Villages spread over 10 Revenue Districts of the State from 2017-18 to 2026-2027. The Project is being implemented in a participatory mode in accordance with the Joint Forest Management (JFM) Resolution-2011 of Government of Odisha which was subsequently amended in 2015.

Under OFSDP-II, a total area of 57,000 Ha is scheduled to be covered under the Assisted Natural Regeneration (ANR) and Artificial Regeneration (AR). While the ANR activities will be taken up in 51,000 Ha land, the AR plantations will be taken up over 6,000 Ha. In addition, the Project is mandated to cover 10,000 Ha of private lands of farmers covering about 10,000 beneficiaries.

All the plantation activities under OFSDP-II will be implemented by the project communities through Vana Surakshya Samities (VSSs). As different areas will be covered under the Project, the Project Management Unit (PMU) has prescribed raising of site specific suitable species in the nurseries, which will he used in the plantations.

For facilitation of easy guidance for raising of nurseries, this Booklet titled "Nursery Technique of Common Forest Tree Species to be raised under OFSDP-II" has been prepared. This document includes some tips on nursery techniques of 75 common plant species.

It gives me immense pleasure to put on record the significant contribution made by Dr. Meeta Biswal, IFS, Additional Project Director, Mrs. Pusazhule Mekro, IFS, Additional Project Director, Mr. Sudhansu Sekhar Mishra, OFS(I)(SB) and Mr. Trinath Pattnaik, Subject Matter Specialist, OFSDS in preparation of this document. I am sure that the document will be very handy and of great value for use in the field, in raising of different species in forest nurseries.

L.K.Tewari, IFS

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III. Annexures

Introduction

Afforestation and reforestation are main approaches adopted by the Forest Department for increasing the forest cover. The initial ground work, for both of these approaches, is development of quality planting material in nurseries where all aspects of plant husbandry are taken into account. With this background an effort has been made to bring out an informative guide for the field staff, involved in plantation, relating to the technical knowledge on nursery raising of some common important forest species with special emphasis upon the local and indigenous species.

The basic information covered in this compilation includes following aspects of nursery technique along with the salient features of each component.

Distribution

- Knowledge on the common areas including site conditions where the plant species grows(distribution) helps to assess suitability of the species for specific site conditions.

Phenology

- It includes a general idea regarding flowering, fruiting and seed collection time of each such plant species.
- On the basis of such information the suitable time for collection of seeds can be properly planned.

Seed collection time and technique

- Particularly seed collection method like collection of ripen fruits from the mother trees/fallen ripe fruits from the ground/ collection of seeds from the dehiscent fruits/collection of dry fruits before dehiscence, etc. can be decided.

Seed weight, Germination percentage and plant percent

- Information on per kg seed number, its germination percentage and plant percent primarily helps desired quantity of seeds to be collected depending on the physical target of the nursery or plantation.

Germination period

- Depending upon the particular plant species, knowledge on germination period helps in preparing time schedule of the nursery i.e. time of seed sowing and making ready the poly pots, shade, etc.

Pretreatment of seed

- This information helps the particular method of pretreatment required for the plant species to facilitate germination process.

Preparation of Nursery beds

Size of nursery bed

- Usual size of poly pot bed earlier was 40′ X 4′. But it would be appropriate to maintain the poly pot bed size to accommodate 1000 poly pot plants with a bed size of 10 m. X 1m. and depth of the bed can be maintained as 15 cm with inter-bed space of 50 cm.

Raised nursery beds

- Raised nursery beds are more suitable for sowing of seeds in many cases, including preparation of stumps and rhizomes. Sunken beds are prepared for maintaining poly pot seedlings and seed sowing of mangrove species.

Soil mixture

- Soil mixture is generally prepared by mixing fertile porous soil, sand and FYM in the ratio of 1:1:1. Substituting FYM by vermi compost reduces possibility of weed growth & white ant attack. The upper layer of soil mixture to a depth of at least 10 cm can be prepared with soil, sand & FYM / vermi-compost in a proportion of 1:1:1 to facilitate germination. Depending upon the nature of available ingredients, the proportion may slightly be modified to facilitate germination and growth of seedlings.

Raised Nursery Beds

Treatment with fungicide and insecticide

- Treatment of soil mixture with insecticide like chloropyrophos is made to reduce chances of insect attack. Further, the seeds need to be treated with fungicide (Bavistin or Blitox) for prevention of the seedlings from fungal disease like Damping Off. The particulars regarding diseases and insect attack, symptoms and control measures have been furnished in Annexure-2. Use of organic manure like neem oil / karanj oil / mahua seed oil cake as manure will also play the role of organic pesticide which is more desirable. Similarly, use of vermi-compost or organic manure is a better preference and also meets the basic requirements in respect of macro-nutrients and micro- nutrients of the nursery seedlings. Particulars of nutrient deficiency symptoms in plants have been presented in Annexure-1.

Mulching

- Mulching by using straw or suitable vegetative/ organic matter is provided to facilitate germination

Seed sowing

- Depending upon the nature of plant species appropriate method of seed sowing like line sowing / broadcast sowing in mother beds or direct dibbling in poly pots is adopted.
- For species with minute seeds broadcast sowing is advisable, species with bigger size seeds which can endure transplanting, line sowing can be followed and in other cases where the seeds are bigger in size and the species do not respond to transplanting then direct dibbling in poly pots is followed.
- Seed sowing in mother beds should be light to reduce competition among the germinated plants for light, water and nutrients.
- A tabular statement showing species wise information on flowering, fruit ripening, seed weight, germination percentage, germination period and method of pre-treatment is given in Annexure-3.

Filling of Poly pots

Soil mixture

- Generally, soil mixture for filling the poly pots is prepared by mixing fertile and porous soil, sand and FYM in the ratio of 1:1:1. Depending upon the nature of available ingredients, the proportion may be slightly modified to facilitate germination and growth of seedlings.
- For preparation of soil mixture sieving of soil and sand are done using 2X2 mm mesh sieve which are generally used for sieving the sand for building construction.
- Substituting FYM by vermi-compost reduces possibility of weed growth & white ant attack.
- Depending upon nature of soil analysis, Macro /micro nutrients can be added to overcome their deficiency.
- Further, the seeds need to be treated with fungicide (Bavistin or Blitox) to prevent soil borne diseases like Damping Off. Similarly, insecticide like chloropyrophos is used to prevent chances of insect attack.
- Use of neem oil cake as a manure will also play the role of organic pesticide.

Size of Poly pots

- Polythene bags of size 9″X5″ are used for raising seedlings of 6 to 8 months old and 10″X6″ are used for raising seedlings of 12 to 18 month old.

Transplanting

- For better survival of poly pot seedlings, it is always advisable to do transplanting when the seedlings are in four leaf stage and for this the usual height of the seedlings should be around 2 to 4 cm.
- For production of quality planting material, culling (elimination of inferior/ unhealthy plants in the mother beds) is followed at regular interval.
- Transplanted seedlings should be put at the center of each poly pot with root portion inside and shoot portion outside the soil mixture level.
- Seedlings of many species are sensitive to root damage during transplanting and as a precaution use of a spatula to lift the seedlings with the surrounding soil is desirable.
- Another very important aspect is the process of planting the seedling and consolidating the soil around it. Precaution must be taken to see that the tap root remains straight while seedlings are trans-planted.

Provision of Shade in the nursery

Use of Agro shade-net in nursery

- In hot climate or having high intensity of sun light, particularly, light overhead shade is to be provided in nursery beds for their establishment for which agro shade net of required % of shade are to be used and the beds are to be aligned along east west.
- Use of agro/green shade net is more economic and saves lot of planting material.

Watering

- As a thumb rule watering (using sprinkler) is to be done in a regulated manner to poly pot beds and mother beds in such a way that the water is just sufficient to drench the soil.

Wrong method of watering

Direct flooding of water to the seedlings may cause the seeds to be washed out of the beds / poly pot soil. Such method is to be avoided.

Use of sprinkler as a better method

Weeding of poly pots & mother beds

- Weeding is to be followed at regular interval depending upon extent of weed growth and before weeding proper watering will help removal weeds along with its root system & further weed growth will be reduced.

Root cutting, grading & re-setting of seedlings

- At regular interval, depending upon relative extent of root and shoot growth; root cutting, grading & resetting of poly pot seedlings are to be done.
- The process of grading & resetting should start as soon as the seedlings reach a height of 15 cm.
- During resetting, seedlings of equal height can be set in each bed instead of keeping seedlings of different height in a descending order to prevent shoot competition.
- To prevent possibility of root penetration into soil and subsequent damage to the seedlings it is essential to use poly sheet in such poly pot beds over which seedlings can be kept.

Plantable Seedling

- The nursery seedlings must be hardened before planting by regulated watering. Initially the watering is done once every day. Later on it may be reduced to 5 days in a week & further reduced to 4,3,2 or even once in a week gradually during which the root system develops very well, the seedlings become more branchy and base of the stem becomes more strong.
- Usually, the seedlings for planting should have a standard height of 45 cm to 60 cm and in case of avenue or row plantation seedlings with more than 60 cm height, preferably one year old or more, can be planted to exceed the height growth of 2 meter by the end of 1st year post planting operation which will reduce chances of damage due to cattle and help establishment of the plants soon.

Root Trainer Nursery Technique

There is a gradual shift from the conventional poly pot seedlings to root trainer (Hycopot) seedlings which is considered as a better nursery technique.

Advantages of root trainer planting technique

- Air pruning of taproot prevents its coiled growth within the container.
- Root trainer plants produce large number of lateral roots into the well-aerated potting medium.
- The vertical ridges provided in the container wall direct these lateral roots downwards and thus prevent their circular growth within the container.
- On reaching the drainage hole at the bottom of the container these lateral roots are also subjected to natural air pruning leading to further enhancement of stress which triggers more root production like a vicious circle.
- Towards the end of this hardening process, the root system of a hardened root trainer plant consists of a central taproot and large number of lateral roots properly oriented within the container.
- The air-pruned roots resume growth within 24 hours after transplanting in the field and this quick growth is very helpful to attain 100% establishment success of root trainer plants.
- The enhanced production of lateral roots influences growth of the plant positively during the juvenile phase.
- In addition to improving quality of the plant materials, advanced planting materials raised in root trainers are found to be cost effective also.
- Cost of production of a nursery plant is mainly decided by labour charges and the expenditure incurred towards the initial planting material, container, potting medium, fertilizer, pesticides, fungicides etc.

Potting mixture (Coarse Sand& Compost) for Root Trainers

Filling of Root Trainers with potting mixture

- A comparative study made on the cost of production has indicated that the advanced planting materials could be raised in root trainers at 60% of the cost of production of poly-bag plants once the initial investment is realized.
- The savings towards transportation, distribution and field planting are the other attractive aspects of root trainer planting technique.
- Due to the compact size and light weight of root trainer plants, the cost required for transport and distribution could be saved up to 75% compared to poly- bag plants.
- The entire process of field planting is so simple and easy that even an unskilled worker could attain several times the turnover compared to poly-bag planting.

Agro shade net chamber for Root Trainers

Arrangement of raised stands for Root Trainers

- Root trainer planting technique is environment friendly, because poly bags used in planting are replaced by reusable root trainers and the top soil is substituted by coir pith, which is an industrial waste.
- This technique is cost effective.

Infrastructural development work such as Root Trainers, potting medium for seed germination & removable agro shade net with overhead sprinkling systems are earmarked.

Some of the important features of Root Trainer nursery are as detailed below-

Preparation of potting medium for Root Trainer seedlings

- The common potting medium will contain 50% compost and 50% coarse sand only.
- Potting mixture can also be prepared with compost, soil & coco peat or compost, soil and paddy husk or vermiculite.

Germination of seed in Root Trainers

Development of Secondary Root System in Root Trainers

i. Species to be raised.

In the Hi-Tech Nursery, most commonly recommended species to be raised are Sal, Karanja, Neem, Khaira, Bel, Amla, Bija, Harida, Bahada, Kasi,,Dhaura, Mai, Gambhar, Asana, Panasa, Kusum, Ashok, Mahula, Char, Sisoo, Ata, Maha Neem, Kadamba, Acacia, Acacia mangium, Sirisa, Phasi, Babul, Simili, Dhala Sirisa, Kanchana, Sidhha, Rakta Chandan, Ritha, Simaruba, Padhel, Tentuli, Agasti, Moringa, Teak etc. Mostly Sal associates local species are to be raised in poly pots and Root trainers.

More precisely, in the Root Trainer of 150 cc size is suitable for raising species like Bija, Neem, Amla, Haldu, Acacia and other tree species whose seeds are small.

In 300cc Root Trainer, species like Sal, Mahula, Bahada, Karanja, Ashok, Kusum, Char, Arjun, Ritha, Gambhar, Asana, Teak, etc. with relatively larger seeds can be raised.

ii. Culling:

In order to raise even and uniform vigorous plants and to get Quality Planting Material (QPM), the culling operations of seedling are required in raising Root Trainer nursery also. Culling of the seedling is to be taken up as follows:

1. Culling in germination bed- it is to be taken after 21-25 days of the germination itself. Late germinators, diseased and drying seedling should be culled out every week.
2. The 1st culling of the seedlings (Fast Growing), in root trainer, is to be taken up at the time of transfer of plants from the protected removable shed area to the hardening area. At this stage diseased and inferior seedling are culled out. However, Sal seedlings and slow growing species will be culled 6 weeks after germination of seed.
3. The 2nd culling out of the slow growing species like Sal is to be carried out again after 5 months.
4. Final Culling: The final culling out of the seedlings is to be taken up just before the seedlings are ready for plantation. A random sample of 50 seedlings per lot is measured in height and root collar at base. Calculate the average of height and collar diameter. The seedlings having height 20% above or below the average height/collar girth of the seedling should be culled out.

iii. Grading

Grading of seedlings shall be done species wise on the basis of height and collar in each bed before transportation to the field for planting.

iv. Hardening of Seedlings:

It refers to progressive withdrawal of the favourable conditions in which the Root Trainer seedling has been developed in the nursery with the objective of conditioning of the plants for survival in the harsher environment in the field.

v. Transportation of seedlings:

Utmost care is taken while transporting seedlings to the planting site. The main problems that arise during transportation are damage of the root collar, due to bad lifting, vibration on the way, wind damage, drying out and sun scorch. Efforts shall be made to avoid such problems.

Clonal Propagation of Bamboo by using culm cuttings

- Nursery technique for different species of bamboo basically includes two common methods:

  (1) By using pre-sprouted rhizomes in case of species like Dendrocalamus strictus and Bambusa bamboo (B. arundinacea) where seeds are available. This has been dealt separately species wise.

  (2) Where seeds are not readily available nursery stock is raised by a common vegetative / clonal propagation method using nodes known as 'Layering'.

- In Odisha layering method is commonly followed for Bambusa nutans & B. vulgaris.

- The usual practice for above two species of bamboo was bi-nodal cuttings or layering. But vegetative propagation by taking single nodes of bamboo is less cumbersome and production per bed is also more. Usually, each nursery bed of size 40'X4' will accommodate 360 nodes with bi-nodal layering whereas the same size bed can accommodate about 640 nodes by adopting single node cuttings.

Setting of single node cutting in mother beds

Method of uni-nodal clonal propagation of Bamboo includes:

- Collection of bamboo culms of one year-old is made during month of March.
- Culm Cuttings, each having one node with 5 cm inter-node on either side are made without doing any damage to the buds.
- Such cuttings shall be used as soon as possible within 10 to 12 hours of culm cutting for successful sprouting of the buds.
- The cuttings before putting in beds are treated with fungicide (like bavistin) and rooting hormone (like Buteric Acid 1BA/Indol 3-Butyric Acid / rootex).
- The treated uni-nodal bamboo cuttings are put vertically in raised mother beds along lines usually 10 cm apart and with a line spacing of 10 cm. The cuttings are put in the bed in such a way that nodes with bud and inter-node parts are just covered with soil mixture.

Preparation of Single node Cuttings

1st Year growth of Single node Sprouting during July

- Mulching is provided by using straw or any such organic matter.
- Watering is done in a regulated manner.
- Sprouting of buds is noticed within 7 to 10 days and may complete within 20 days.
- By end of June the sproutings can attain height of about 75 cm when they are fit to be collected from the beds and planted.

Sprouted single node bamboo layering

Species

Acacia auriculiformis

Sub-Family : *Mimosoideae*
Family : *Leguminosae*
Common name : *Australian Wattlle*
Odia name : *Acacia / Sunajhari*


Tree morphology


Branch with inflorescence


Seeds from ripe fruit

Distribution	It is a native of Australia and has been successfully introduced in all parts of Odisha state. It grows on a variety of soils such as red, laterite and alluvial soils.
Flowering	Yellow flowers in catkin inflorescence appear in Dec-January.
Fruit ripening	January to March
Seed collection & storage	Brown ripen fruits are twisted with coils and are collected during February to March with branches, dried for two to three days following which the fruits split along the edges and seeds are collected and cleaned. Seeds can be stored in tins up to one year.
Seed weight	30,000 to 40,000 per kg.
Germination percentage	50 %
Plant percent	40 %
Germination period	15 to 30 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours

Seed dibbling

- 2 to 3 pre- treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept in the nursery beds on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using green shade net in areas with hot climate.

Plantable seedling **Poly pot seedlings are suitable for planting during July after the seedling height reaches about 60 cm.**

Acacia catechu

Sub-Family : *Mimosoideae*
Family : *Leguminosae*
Common name : *Catechu / Kher*
Odia name : *Khaira*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Normally found in dry regions all over India; grows on a variety of soil; however thrives best on porous alluvial well drained soil on riverine areas.		
Flowering	June to August.		
Fruit ripening	Pods ripe during December-January.		
Seed collection & storage	Ripe pods are collected from the tree during December-January when they are reddish black just before dehiscence. Pods are dried in the sun to open and seeds are collected, cleaned, dried and stored. Viability may retain up to six months.		
Seed weight	30,00 to 35,000 per kg.	***Plant percent***	30 %
Germination percentage	60 to 70 %	***Germination period***	15 to 25 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours.		

Seed dibbling / sowing

- 2 to 3 pre- treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is to be provided using agro green shade net in areas with hot climate.

Plantable seedling	**Poly pot seedlings are suitable for planting during July when the seedling height reaches about 60 cm**

Acacia mangium

Sub-Family : *Mimosoideae*
Family : *Leguminosae*
Common name : *Black wattle*
Odia name : *Mangium*


Tree morphology


Branch with fruits & inflorescence


Seeds from ripe fruit

Distribution	It is a native of North East Queensland, Australia. Successfully introduced in maximum parts of Odisha state. It grows on a variety of soils such as red, lateritic and sandy soils.		
Flowering	White flowers in catkin inflorescence appear during December-January.		
Fruit ripening	January-March		
Seed collection & storage	Brown ripe fruits are twisted and are collected during February to March with branches, dried for two to three days following which the fruits split along the edges and seeds are collected and cleaned. Seeds can be stored in cool and dry place inside tins up to one year.		
Seed weight	30,000 to 40,000 per kg.	***Plant percent***	50 %
Germination percentage	60 to 70 %	***Germination period***	15 to 30 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours		

Seed dibbling / sowing

- 2 to 3 pre- treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is required.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept in the nursery beds on polythene sheet to prevent root penetration into the soil. Shade is provided using green agro shade net in areas with hot climate.

Plantable seedling	**Poly pot seedlings are suitable for planting during July after the seedling height reaches about 60 cm.**

Acacia nilotica Syn. *Vachellia nilotica*

Sub-Family	:	*Mimosoideae*
Family	:	*Leguminosae*
Common name	:	*Gum Arabic tree / Babul*
Odia name	:	*Babool*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Normally found along cultivated fields; village waste lands, grows on alluvial soil and black cotton soil in many parts of India.
Flowering	July to September.
Fruit ripening	Pods ripe in the following year during April-May.
Seed collection & storage	Ripe pods are collected from the tree during April-May. Pods are dried in the sun to open and seeds are collected, dried and stored. Viability may retain up to one year.
Seed weight	5,000 to 7,000 per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	10 to 30 days
Pre-treatment of seed	Pre-soaking in normal water for 48 hours.

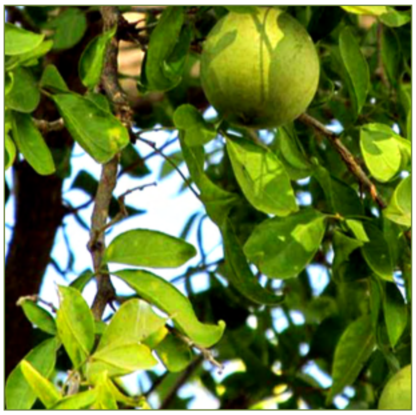
Seed dibbling /sowing

- 2 to 3 pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during April.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is required.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling	**Poly pot seedlings are suitable for planting during July after the seedling height reaches about 45 cm.**

Aegle marmelos

Family : *Rutaceae*
Common name : *Stone Apple, Bel*
Odia name : *Bela*



Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Throughout Odisha; found commonly in stiff, dry clayey and alluvial soils.
Flowering	March to May
Fruit ripening	In the following year during April –May
Seed collection	The ripe fruits are collected and after continuous washing of the pulp, seeds are separated. The seeds are mixed with ash and dried. Viability is short and the seeds should be sown soon after collection.
Seed weight	5,000 per Kg.
Germination percentage	50 to 60 %
Plant percent	50 %
Germination period	10 to 25 days
Pre-treatment of seed	Pre-soaking of seeds in normal water for 24 hours before sowing is suggested.

Seed dibbling

- 2 to 3 healthy seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is required.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Since its growth is slow in the 1st year, seedlings become suitable for planting during July next year after reaching height of at least 60 cm. Hence, Polythene bags of size 10”X6” are to be used.**

Albizia lebbeck

Sub-Family : *Mimosoideae*
Family : *Leguminosae*
Common name : *Siris*
Odia name : *Kala sirisa*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Native to Indo-malaya, New Guinea and Northern Australia. Also occurs wild in the forests and near villages and towns of the state of Odisha. It can grow on a variety of soils including laterite and loamy soils. Successfully planted in many parts of India.
Flowering	Greenish white colored flowers in globose heads appear from May to August.
Fruit ripening	Ripe fruits become straw-coloured and appear for a long time till December to February. Seeds fall from the dehiscent pods.
Seed collection & storage	Ripe pods are collected by lopping the branches, dried in the sun to open and seeds are collected, dried, cleaned and stored. Viability up to one year.
Seed weight	7,000 to 8,000 per kg.
Germination percentage	60 to 70 %
Plant percent	40 to 50 %
Germination period	7 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours.

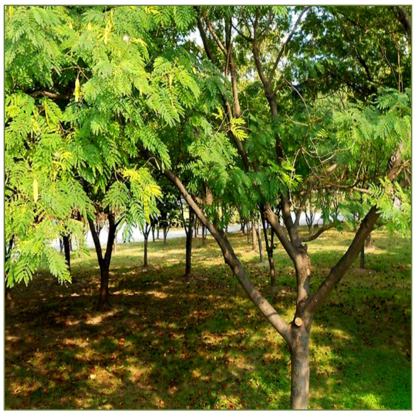
Seed dibbling

- 2 to 3 healthy seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during next year July after attaining a height of about 60 cm.**

Albizia odoratissima

Sub-Family	:	*Mimosoideae*
Family	:	*Leguminosae*
Common name	:	*Ceylon Rose wood*
Odia name	:	*Tentera*



Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is found in forest areas of Odisha on a variety of soils.
Flowering	Pale yellowish white flowers in globose heads appear from April to June.
Fruit ripening	January-February when seeds fall from the dehiscent pods.
Seed collection & storage	Ripe pods are collected by lopping the branches during January-February. Pods are dried in the sun to open and seeds are collected, dried and stored. Viability may retain up to one year.
Seed weight	12,000 to 14,000 per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	10 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours.

Seed dibbling

- 2 to 3 healthy pre- treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during next year July after attaining a height of about 45 cm.**

Albizia procera

Sub-Family : *Mimosoideae*
Family : *Leguminosae*
Common name : *White Siris*
Odia name : *Dhala siris*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Found in Odisha in some moist forests, on river banks and along the streams. It can be planted in sandy loam soil. Its distinguishing feature is smooth yellowish white bark.
Flowering	White colored flowers in globose heads appear from May to August.
Fruit ripening	Ripen fruits become reddish brown and appear during April-May of the following year. Seeds fall from the dehiscent pods.
Seed Collection & storage	Reddish brown ripe pods are collected by lopping the branches, dried in the sun to open and seeds are collected, dried, cleaned and stored in dry containers. Viability may retain up to one year.
Seed weight	15,000 to 20,000 per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	7 to 25 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours.

Seed dibbling

- 2 to 3 pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during next July after attaining a height of about 45 cm.**

Alstonia scholaris

Family : *Apocynaceae*
Common name : *Devil's Tree*
Odia name : *Chatian*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is usually planted on road side.
Flowering	November to March
Fruit ripening	During summer(May-July)
Seed collection	Seeds are collected during first fortnight of May after lopping the branches and fruits (follicles) are dried in the sun to hasten opening.
Seed weight	2,50,000 to 3,00,000 per Kg.
Germination percentage	50 to 60 %
Plant percent	30 %
Germination period	10 to 15 days
Pre-treatment of seed	Not required

Seed sowing

- Broadcast sowing of seeds mixed with ash is done during May on a raised bed with a bottom layer (8 cm to 10 cm) of soil mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand.
- Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done. Since the seedlings are very minute and delicate, watering is to be done carefully in a regulated manner to prevent wash out & damping off.
- Partial shade is provided to the germination bed in areas with hot climate.

Transplanting

- One month old seedlings are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings of height above 45 cm are fit for planting during the month of July.**

Annona squamosa

Family : *Annonaceae*
Common name : *Custard apple*
Odia name : *Atta*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It was an exotic plant but subsequently has become naturalized everywhere. It grows on a variety of soils. Planted usually for afforestation of bare, eroded and denuded areas. It is a drought resistant hardy species.
Flowering	Light green flowers appear in June-July.
Fruit ripening	September to December
Seed collection & storage	Seeds are embedded in a sweet pulp. Ripe fruits are collected from the trees, de-pulped, cleaned and dried in the sun for a day or two and stored in gunny bags in cool and dry place. Seeds do not retain viability for long period.
Seed weight	400 to 500 per kg.
Germination percentage	60 to 70 %
Plant percent	50 %
Germination period	15 to 30 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during February-March.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using green shade net in areas with hot climate.

Plantable seedling	**Poly pot seedlings are suitable for planting during next year July after the seedlings reach height of 60 cm.**

Anogeissus latifolia

Family : *Combretaceae*
Common name : *Axle- wood*
Odia name : *Dhaura*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is found in dry deciduous forest areas of Odisha. Recommended for plantation in sandy loam and alluvial soil.
Flowering	Twice a year, during December-January and June-July.
Fruit ripening	January- February and July-August.
Seed collection & storage	Dry ripe fruits are collected by beating off the branches. Fruits are dried from which two winged seeds are collected. Seeds are minute and after drying should be shown immediately.
Seed weight	About 1,00,000 per Kg
Germination percentage	3 to 4.5 %
Plant percent	2 to 3 %
Germination period	10to 15 days
Pre-treatment of seed	Pre-soaking for 48 Hours in normal water.

Seed sowing

- Broadcast sowing of seeds mixed with ash is done during July-August on raised beds with a bottom layer (8 cm to 10 cm) of mixture containing soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand.
- Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done.
- Since the seedlings are very minute and delicate, watering is to be done carefully in a regulated manner to prevent wash out, damping off & insect attack.

Transplanting

- One month old seedlings of height 4 to 5 cm are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using green shade net in areas with hot climate.

Plantable seedling **Seedlings after attaining 45 to 60 cm height are planted during the following year July.**

Anthocephalus chinensis

Family : *Rubiaceae*
Common name : *Kadam / Burflower tree*
Odia name : *Kadamba*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is commonly seen in swampy ground, along rivers and prefers deep well drained alluvial soil.		
Flowering	Flowers in globose heads appear from May to July		
Fruit ripening	Fruit ripening from September to January.		
Seed Collection & storage	■ Ripe fruits are collected from the ground during August –September and heaped under shade for 3 to 4 days. ■ The fleshy pulpy fruits are washed off by hand in a bucket of water by which seeds sink to the bottom and are separated and dried. ■ The dried seeds can be stored for about 1 year.		
Seed weight	9,00,000 to 10,00,000 per kg.	Germination percentage	50 to 60 %
Plant percent	40 to 50 %	Germination period	10 to 20 days
Pre-treatment of seed	No specific treatment is required but the seeds, since very minute, are mixed with ash and then sown by broad cast method.		

Seed sowing

- Broadcast sowing of seeds mixed with ash is done during January-February on raised bed with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand.
- Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done.
- Since the seedlings are very minute and delicate, watering is to be done carefully in a regulated manner to prevent wash out, damping off & insect attack.
- Partial shade is to be provided to the germination bed in areas with hot climate

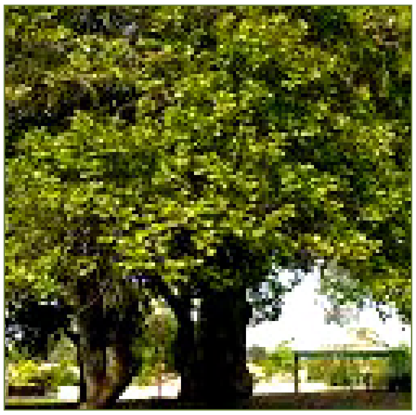
Transplanting

- One month old seedlings are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling **Seedlings of height above 60 cm are ready for planting during the month of July. Hence, Polythene bags of size 10″X6″ are used.**

Artocarpus heterophyllus

Family : *Moraceae*
Common name : *Jack –fruit tree*
Odia name : *Panasa*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	A large semi evergreen tree with spreading crown found in deep moist and well-drained soil. Planted in and around human habitations.
Flowering	Light green flowers appear in November to December.
Fruit ripening	July-August.
Seed collection & storage	Seeds are embedded in a sweet pulp. Ripe fruits are collected from the trees, de-pulped, cleaned and dried in the sun for a day or two and stored in gunny bags in cool and dry place. Seeds do not retain viability for long period.
Seed weight	100 to 150 per kg.
Germination percentage	60 to 70 %
Plant percent	50 %
Germination period	15 to 30 days
Pre-treatment of seed	Not required.

Seed dibbling

- 2 to 3 healthy seeds are dibbled in the center of poly pots filled with soil mixture during July.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling	**Poly pot seedlings are suitable for planting during the following year July after the seedling height reaches at least 60 cm.**

Artocarpus lacucha

Family : *Moraceae*
Common name : *Monkey fruit*
Odia name : *Jeutha*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	A large semi evergreen tree with spreading crown usually found in deep moist and well-drained soil. Usually planted in and around human habitations.
Flowering	January-February.
Fruit ripening	April-May.
Seed Collection & storage	Fruits are smooth yellow and irregularly lobed. There are 40 to 50 flat seeds in each fruit. Yellow fruits are collected by plucking them directly from the trees. Under ripe or over ripe fruits give poor result. Seed viability is very hardly for 4 to 5 days. Seeds are separated from the fleshy portions of the fruits, thoroughly washed and dried.
Seed weight	2,000 to 4,000 per kg.
Germination percentage	60 to 70 %
Plant percent	50 %
Germination period	8 to 20 days
Pre-treatment of seed	Not required.

Seed dibbling

- 2 to 3 healthy seeds are dibbled soon after collection in the center of poly pots filled with soil mixture during April.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during next year July after attaining height of 50 to 60 cm. Hence polythene bags of size 10”X6” are desirable to be used as seedlings are kept in the nursery for more than one year.**

Azadirachta indica

Family : *Meliaceae*
Common name : *Neem*
Odia name : *Neema*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It grows on a variety of soils from sandy to clayey and black cotton soil. Commonly found in dry area with well-drained soil. Grows well where drainage is good and sub soil water level is fairly high.		
Flowering	March -April		
Fruit ripening	June to August		
Seed collection & storage	Ripe fruits are collected from the trees are swept from the floor under the trees. The pulp is washed up and seeds collected are dried in shade & used soon as viability is lost in 2 weeks.		
Seed weight	2,000 to 3,000 per kg	Germination percentage	70 to 90 %
Plant percent	40 to 50 %	Germination period	10 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours		

Seed sowing

- Line sowing of seeds mixed with ash is done during June-July on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5cm.
- Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done.
- Partial shade is provided to the germination bed in areas with hot climate.

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using green shade net in areas with hot climate.

Plantable seedling **Poly pot seedlings of one year old are suitable for planting during the following year July after the seedling height reaches at least 60 cm.**

Barringtonia acutangula

Family : *Lecythidaceae*
Common name : *Fresh water mangrove*
Odia name : *Hinjala*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is generally seen along the banks of streams and rivers.		
Flowering	June-July. Colored flowers are seen in slender, pendulous & racemes		
Fruit ripening	November to January		
Seed collection & storage	Fallen fruits are collected from the banks & the seeds are sown immediately in mother beds.		
Seed weight	1,000 to 1,200 per Kg	***Plant percent***	40 %
Germination percentage	70 to 80 %	***Germination period***	30 to 40 days
Pre-treatment of seed	Pre-soaking for 12 Hours in normal water.		

Seed sowing

- Line sowing of seeds mixed with ash is done during January-February on a raised bed with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done.
- Watering is done in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**The seedlings grow slowly in the nursery and hence are suitable for planting during next year July.**

Bauhinia racemosa

Sub-Family : *Caesalpinioideae*
Family : *Leguminosae*
Common name : *Orchid tree / Camel's foot tree*
Odia name : *Kanchan*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Found in a wide range of forest areas and also in village areas of Odisha as a small tree.
Flowering	April to June
Fruit ripening	Ripen fruits appear during October-December.
Seed Collection & storage	Reddish brown ripen pods are collected by lopping the branches, dried in the sun to open and seeds are collected, cleaned, dried and stored in dry condition. Viability may retain up to one year.
Seed weight	5,000 to 6,000 per kg.
Germination percentage	60 to 70 %
Plant percent	30 to 40 %
Germination period	7 to 25 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours.

Seed dibbling

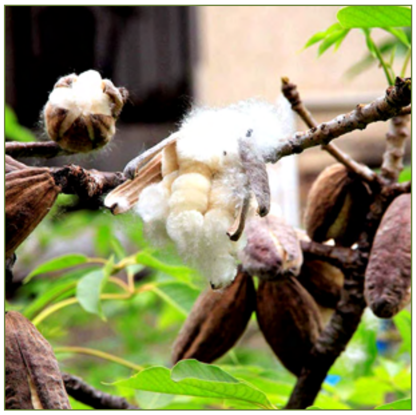
- 2 to 3 healthy pretreated seeds are dibbled in the center of poly pots filled with soil mixture during January.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil.
- Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during next July after attaining height of about 45 cm.**

Bombax ceiba

Family : *Bombacaceae*
Common name : *Semul / Cotton tree*
Odia name : *Simili*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It is usually found throughout Odisha in a scattered manner. Usually found in deciduous forests. It grows on a variety of soils from sandy to clayey soil. Planted in a wide range of soils.		
Flowering	February-March		
Fruit ripening	March to May.		
Seed collection & storage	Ripe fruits (capsules) are collected from the trees by lopping the branches just before dehiscence & dispersal of seeds. These fruits are dried in the sun for 2 to 3 days when seeds come out. Silky floss is removed and seeds are stored in gunny bags in cool and dry place. Seeds remain viable for 1 year.		
Seed weight	20,000 to 30,000 per kg.	***Plant percent***	20 to 30 %
Germination percentage	50 to 70 %	***Germination period***	10 to 30 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours		

Seed sowing

- Line sowing of seeds mixed with ash is done during March-April on raised beds with a bottom layer (8 cm to 10 cm) of mixture containing soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done.
- Partial shade is provided to the germination bed in areas with hot climate.

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade provided using agro green shade net in areas with hot climate.

Plantable seedling **Poly pot seedlings are suitable for planting during July after the seedling height reaches about 60 cm. height.**

Bridelia retusa

Family : *Euphorbiaceae*
Common name : *Spinous Kino tree*
Odia name : *Kasi*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Found in the forest throughout the state as a drought hardy species. It is a good coppicer.		
Flowering	June to August		
Fruit ripening	September to October		
Seed collection & storage	Globose ripe fruits, purple black in color, are collected from the tree and then washed to remove the pulp. The seeds collected are dried and used soon since the viability is short.		
Seed weight	15,000 to 16,000 per Kg.	***Plant percent***	40 to 50 %
Germination percentage	60 to 70 %	***Germination period***	15 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours		

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during October.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during July after the height reaches about 45 cm.**

Buchanania lanzan

Family : *Anacardiaceae*
Common name : *Chironji / Charoli Tree*
Odia name : *Chara*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Throughout Odisha; in dry deciduous forest. Recommended for plantation in sandy loam and alluvial soils.		
Flowering	Pyramidal panicles of greenish white flowers appear in January-March.		
Fruit ripening	Fruits ripe from April to May.		
Seed collection & storage	Dry ripe fruits are collected by beating the branches. Fruits are dried from which two winged seeds are collected. Seeds are very small and after drying should be shown immediately.		
Seed weight	About 4,000 to 5,000 per Kg	***Plant percent***	50 %
Germination percentage	50 to 60 %	***Germination period***	10 to 15 days
Pre-treatment of seed	Pre-soaking for 48 Hours in normal water.		

Seed sowing

- Line sowing of seeds mixed with ash is done during April-May on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm. Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done.
- Since the seedlings are very small and delicate, watering is to be done carefully in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling **Seedlings are planted during July of the following year.**

Careya arborea

Family	:	*Lecythidaceal*
Common name	:	*Wild guava*
Odia name	:	*Kumbhi*

Tree morphology

Branch with fruits & inflorescence

Seeds from ripe fruit

Distribution	Found throughout the state in most of the forest areas. It is a good coppicer.
Flowering	Yellowish or greenish white flowers with foetid smell appear in April-May when trees are leafless.
Fruit ripening	July-August.
Seed collection & storage	Seeds more in number; are embedded in fleshy pulp. After de-pulping, seeds are collected, cleaned and dried for use.
Seed weight	2,500 to 2,800 per kg.
Germination percentage	25 to 30 %
Plant percent	25 %
Germination period	15 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours.

Seed dibbling

- 2 to 3 healthy pretreated seeds are dibbled in the center of poly pots filled with soil mixture during July.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are planted during July of the following year after attaining a height of 50 to 60 cm. Hence polythene bags of size 10"X6" are suitable to be used as seedlings are kept in the nursery for more than one year. Shade is provided to mother beds in areas with hot climate using agro green shade net.**

Cassia fistula

Sub-Family : *Caesalpinioideae*
Family : *Leguminosae*
Common name : *Indian labarnum*
Odia name : *Sunari*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Found in the forest throughout the state in clay soil of dry deciduous forests. It is a good coppicer.
Flowering	April-June
Fruit ripening	January to April of the following year
Seed collection & storage	Fruits (Ripe pods) are collected during February-March. Seeds are separated from the pulp, washed with cold water and dried. Viability is one year.
Seed weight	6,000 to 7,000 per Kg.
Germination percentage	40 to 50 %
Plant percent	30 %
Germination period	30 to 40 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during April.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are planted during July of the following year after attaining height of 50 cm or more. Hence, polythene bags of size 10"X6" size are used.**

Casuarina equisetifolia

Family : *Casuarinaceae*
Common name : *Casuarina*
Odia name : *Jhaun*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Most commonly planted in the coastal districts of the state and in areas close to the sea on loose sand. It is a light demander and sensitive to water logging and fire.		
Flowering	Twice in a year i.e February to April & September to October.		
Fruit ripening	Two corresponding fruiting periods are June & December.		
Seed collection & storage	Ripe fruits (globose) as woody cones containing minute seeds are plucked from the branches before the cones dehisce. The fruits are dried in the sun & thrashed to separate the small winged seeds. The dried seeds retain viability for about one year.		
Seed weight	7.5 to 10.0 lakhs per Kg.	Germination percentage	50 to 60 %
Plant percentage	50 %	Germination period	10 to 20 days
Pre-treatment of seed	Not required		

Seed sowing

- Line sowing of seeds mixed with ash is done during January-February on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Lines are maintained with a spacing of 5 cm.
- Organic pesticide is more desirable to mix with the soil mixture.
- Mulching is done using straw or any such organic matter.
- Watering is to be done carefully in a regulated manner to prevent wash out, damping off & insect attack.
- Partial shade is provided to the germination bed in areas with hot climate using green shade net.

Transplanting

- Seedlings of 3 to 4 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using green shade net in areas with hot climate.

Plantable seedling **Seedlings are fit for planting during July after attaining height of 45 cm to 50 cm.**

Chloroxylon swietenia

Family : *Meliaceae*
Common name : *Satin wood*
Odia name : *Bheru*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Distributed in dry deciduous forest of different districts of the state. Recommended for the plantation in poor soil with good drainage containing sand and gravel.
Flowering	March-April
Fruit ripening	May to August
Seed collection & storage	Mature fruits (capsules), dark brown when ripe, are collected before dehiscence and are dried to get the seeds. Seeds lose viability quickly.
Seed weight	1,400 to 3,000 per Kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	15 to 20 days
Pre-treatment of seed	Not required

Seed sowing

- Line sowing of seeds mixed with ash is done during May-June on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Organic pesticide is more desirable to mix with the soil mixture.
- Mulching is done using straw.
- Watering is done carefully in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet, to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling	**Seedling growth is slow & is fit for planting during July of the following year after attaining height of at least 60 cm.**

Dalbergia latifolia

Sub-Family : *Fabaceae (Papilionioideae)*
Family : *Leguminosae*
Common name : *Indian Rose wood*
Odia name : *Pahadi sissoo*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Found in moist deciduous forests of different districts of the state but nowhere abundant. It is a drought resistant and a good coppicer. Recommended for plantation in good, deep loam or clayey soil.
Flowering	Panicles appear in June-July.
Fruit ripening	December to March.
Seed collection & storage	Ripe dark brown fruits (pods) are collected from the trees by lopping the branches, dried in the sun and broken before dehiscence and are dried to get the seeds. Pods can be stored up to one year but germination percentage decreases significantly.
Seed weight	20,000 per Kg.
Germination percentage	50 to 60 %
Plant percent	40 %
Germination period	10 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours.

Seed sowing

- Line sowing of pre-treated seeds is done during February-March on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Organic pesticide is more desirable to mix with the soil mixture.
- Mulching is done using straw.
- Watering is done carefully in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling	**Seedlings are fit for planting during July of the same year after attaining height of 45 cm to 50 cm.**

Dalbergia sissoo

Sub-Family : *Fabaceae (Papilionioideae)*
Family : *Leguminosae*
Common name : *Shesham / North Indian rosewood*
Odia name : *Bali sissu*


Tree morphology


Branch with inflorescence


Ripe fruit

Distribution	Sissoo grows most typically on alluvial ground in riverine tracts. But the species is planted in variety of soils including road side and hilly areas preferably in sandy and alluvial soils.		
Flowering	Axillary panicles appear in March-April.		
Fruit ripening	November-February.		
Seed collection & storage	Ripe dark brown fruits (pods) are collected from the trees by lopping the branches and dried in the sun for two to three days. Well dried pods can be stored up to one year in cool and dry place.		
Seed weight	12,000 to 14,000 pods per Kg.	***Plant percent***	60
Germination percentage	70 to 80	***Germination period***	10 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for twelve hours		

Seed sowing

- Line sowing of seeds is done during February-March on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm to 4 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Organic pesticide is more desirable to mix with the soil mixture.
- Mulching is done using straw or any such organic matter.
- Regulated watering is done.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed. Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days. The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling **Seedlings are fit for planting during July of the same year after attaining height of 50cm to 60cm. Sissoo is a strong light demander and requires porous well-aerated soil for its proper development. One year old stumps can also be prepared in mother beds.**

Dendrocalamus strictus

Family : *Poaceae*
Common name : *Bamboo*
Odia name : *Salia baunsa*

Tree morphology

Branch with inflorescence and fruits

Seeds from ripe fruit

Distribution	This is the most common bamboo occurring in deciduous forests of almost all the districts of Odisha. It prefers well drained soil. It is a drought hardy species.
Flowering	Sporadic flowering is more common and gregarious flowering occurs once in twenty to thirty years. Flowering takes place during November to March.
Fruit ripening	March-May.
Seed collection & storage	Fruits are collected by cleaning the ground and then lopping the panicles.
Seed weigh	30,000 per Kg.
Germination percentage	50 to 60 %
Plant percent	40 %
Germination period	10 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours.

Seed sowing

- Line sowing of seeds is done during March on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm. Organic pesticide is more desirable to mix with the soil mixture.
- Mulching is done using straw.
- Regulated watering is done. Nursery maintenance is done till the following year for getting one year old rhizomes during March.

Transplanting

- Rhizomes are collected from mother beds, processed and transplanted to polythene bags filled with soil mixture as discussed in the beginning during March. Mulching is done using straw.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during July after attaining height of about 45 cm.**

Dillenia indica

Family : *Dilleniaceae*
Common name : *Elephant apple*
Odia name : *Oau*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It is an evergreen tree which is usually found around human habitations rather than any forest area of the state and grows well in sandy loam soil.		
Flowering	White flowers appear from May to June .		
Fruit ripening	Fruits ripe during October and continues to fall on the ground till February of the following year.		
Seed collection & storage	Seeds of reniform shape and sunk in a gelatinous pulp inside ripen fruits (pseudocarps) are collected from December to January, thoroughly dried in the sun and the separated by winnowing. Viability of the seed is very low.		
Seed weight	30,000 to 40,000 per Kg.	***Plant percent***	5 %
Germination percentage	20 %	***Germination period***	15 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours.		

Seed sowing

- Line sowing of healthy pre-treated seeds is done during January on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Mulching is done using straw or any such organic matter.
- Watering is done in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate.

Transplanting

- Seedlings of 4 to 5 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling **Seedlings are ready for plantation during July after attaining height of about 45cm.**

Dillenia pentagyna

Family	:	*Dilleniaceae*
Common name	:	*Karmal*
Odia name	:	*Rai*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is a large deciduous tree which is usually found in mixed deciduous forest areas of the state.
Flowering	March-April when trees are without leaves.
Fruit ripening	May-June.
Seed collection & storage	Seeds, more in number; are embedded in fleshy pulp. After de-pulping seeds are collected, thoroughly dried in the sun and can be stored in a cool & dry place.
Seed weight	2,500 to 2,800 per kg.
Germination percentage	25 to 30 %
Plant percent	25 %
Germination period	15 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours.

Seed sowing

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during May-June.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are planted during July of the following year after attaining height of at least 50 to 60 cm. Hence polythene bags of size 10"X6" are desirable to be used as seedlings are kept in the nursery for more than one year.**

Diospyros melanoxylon

Family : *Ebenaceae*

Common name : *Malabar Ebony*

Odia name : *Kendu*

Tree morphology

Fruits

Seeds from ripe fruit

Distribution	It is found in dry areas of the state both inside forest and also in open lands.
Flowering	April to June
Fruit ripening	March –April of the following year.
Seed collection & storage	Ripe fruits are collected during April. After de-pulping the seeds are collected and then dried. Viability may continue up to one year.
Seed weight	Around 1,000 per Kg.
Germination percentage	40-50 %
Plant percent	40 %
Germination period	20 to 30 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using green agro shade net in areas with hot climate.

Plantable seedling	**Seedlings are ready for planting during July of the following year as the growth is slow in the first year.**

Emblica officinalis
Syn. Phyllanthus emblica

Family : *Euphorbiaceae*
Common name : *Emblic-myrobalan / Amla*
Odia name : *Anla*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It is a common species of dry deciduous forests. It is a light demander and sensitive to drought.
Flowering	Greenish-yellow flowers in dense panicles develop during March to May
Fruit ripening	December to February
Seed collection & storage	Fruits are globose, yellow when ripe with 3 to 4 compressed oblong seeds. Ripe fruits are collected during November-December and seeds are obtained after de-pulping. Seeds retain viability for a short period.
Seed weight	8,000 to9,000 per Kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	25 to 30 days
Pre-treatment of seed	24 hours pre-soaking in warm water

Seed sowing

- Line sowing of pre-treated seeds is done during December-January on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm. Mulching is done using straw.
- Regulated watering is done twice a day.

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture.
- Treated seeds are also sown in poly pots to raise potted seedlings.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet, to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are ready for planting during July after attaining height of about 45 cm.**

Ficus bengalensis

Family : *Moraceae*
Common name : *Banyan tree*
Odia name : *Bara*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It an indigenous tree and planted throughout the state along road side, near temple & villages. This species is a light demander and grows on a variety of soils.		
Flowering	April to June		
Fruit ripening	May-June		
Seed collection & storage	Fruits become red when ripe containing minute seeds with low viability. Ripe fruits are collected during May - June, preferably from excreta of birds. The ripe fruits are collected, rubbed and dried in the sun for 2 to 3 days. These dried fruit parts are mixed with cow dunk and cakes are prepared which are again dried in the sun for 5 to 7 days as a method of pretreatment. The dried cakes are made into powder and used for broadcast sowing.		
Seed weight	Seeds are very minute and weigh about 10, 00,000 per kg.		
Germination percentage	30 to 40 %	***Germination period***	20 to 30 days
Plant percent	20 to 30 %	***Pre-treatment of seed***	As described above.

Seed sowing

- Cakes of ripe fruits with cow dung, as stated above, are sown in mother bed with mixture of soil sand and FYM (1:1:1).
- Vermi compost / neem oil cake can be used as an organic manure-cum-pesticide. Seeds may be treated with fungicide (Bavistin) and soil mixture may be treated with insecticide like chloropyrophos. Mulching is done using straw or any such organic material.
- Watering is done carefully in a regulated manner to prevent wash out, damping off & insect attack.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 2 to 4 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re- setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using green shade net in areas with hot climate

Plantable seedling **Seedlings are fit for planting during July of the following year.**

Gmelina arborea

Family : *Verbenaceae*
Common name : *Gamhar*
Odia name : *Gambhari*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is an indigenous fast growing deciduous tree found throughout the state mainly in deciduous forests. It grows well in fertile, deep, well drained, sandy loam soils in moist valleys.		
Flowering	Yellow tubular flowers in dense panicles develop during March-April when tree is leafless.		
Fruit ripening	Fruits ripen from end of April to June.		
Seed collection & storage	Ripen fruits are collected from the ground below the mother trees. Fruits, after being eaten by goats and released through excreta, show profuse germination. Seeds are obtained after the fruits are washed and de-pulped . Seeds can be stored for one year for which there is slight decrease in viability.		
Seed weight	2, 000 to 2,500 per kg.	***Plant percent***	60 to 70 %
Germination percentage	70 to 80 %	***Germination period***	10 to 15 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours shows better result.		

Seed sowing

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during April-May. Mulching is provided to facilitate germination. Seeds can also be sown in lines in mother beds and after germination are tans-planted to poly pots.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are fit for planting during July after they attain 45 to 60 cm height.**

Haldina cordifolia Syn. Adina cordifolia

Family : *Rubiaceae*
Common name : *Yellow Teak / Haldu*
Odia name : *Haladu*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Throughout Odisha; more common in deciduous forest; grows well in sandy loam & clayey loam soil.		
Flowering	Yellow pedunculated in globose heads appear from June to August.		
Fruit ripening	Fruit ripens In the following year during March to May.		
Seed collection & storage	Seeds are extremely minute. The heads are plucked during March-April and dried in the sun to break and then immersed in water to separate the fertile seeds which settle down. These seeds are dried in sun and then cleaned by winnowing which can be stored in sealed tins up to the next season. Seeds germinate better after storage because they require post ripening.		
Seed weight	10, 00,000 to 18, 00,000 per kg.		
Germination %	30 to 40 %	***Germination period***	10 to 15 days
Plant %	30 to 35 %	***Pre-treatment of seed***	Not required

Seed sowing

- Broadcast sowing of seeds mixed with ash is done during March-May on a raised bed with a bottom layer (8 cm to 10 cm) of soil mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand.
- Organic pesticide is more desirable to mix with the soil mixture.
- Regulated watering is done.
- Since the seedlings are very minute and delicate, watering is to be done carefully in a regulated manner to prevent wash out, damping off & insect attack.
- Partial shade provided to the germination bed in areas with hot climate.

Transplanting

- Two month old seedlings are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are fit for planting during 2nd year July since its growth is slow in the 1st year. Hence, Polythene bags of size 10"X6" are used.**

Lagerstroemia parviflora

Family : *Lythraceae*
Common name : *Benteak*
Odia name : *Sidha*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Commonly found in different moist & dry deciduous forests of the state. It is a light demander, drought resistant and good coppicer. Recommended for Plantation in good, deep loam or clayey soil.
Flowering	White flowers in auxiliary & terminal panicles appear during April to June.
Fruit ripening	December to February
Seed collection & storage	Ripe fruits (capsules) are collected during February before they open, dried in the sun and the seeds are extracted by beating and then cleaned. Seed availability is very low.
Seed weight	28,000 to 50,000 per kg.
Germination percentage	Very low. 2 %
Plant percent	2 %
Germination period	15 to 20 days
Pre-treatment of seed	24 hours pre-soaking in normal water

Seed sowing

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during February.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using green shade net in areas with hot climate.

Plantable seedling	**One-year-old seedlings after attaining at least 60 cm height are planted during July of the following year.**

Lannea coromandelica

Family : ***Anacardiaceae***
Common name : ***Indian ash tree / Wodier***
Odia name : ***Moi***


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Found in moist & dry deciduous forests of the state. It is a light demander, drought resistant and a good coppicer. Recommended for Plantation in deep alluvial soil.
Flowering	Flowers, in spikes, appear during February - April.
Fruit ripening	May to July
Seed collection & storage	Ripe fruits (Drupes) are collected during May-June. Seeds lose viability soon.
Seed weight	6,000 to 8,000 per kg.
Germination percentage	40 to 60 %
Plant percent	15 %
Germination period	15 to 25 days
Pre-treatment of seed	24 hours pre-soaking in normal water

Seed sowing

- Line sowing of seeds mixed with ash is done during May-June on raised beds with a bottom layer (8 cm to 10 cm) of soil mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Mulching is done using straw or any such organic matter.
- Watering is done in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate.

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days. The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**One-year-old seedlings after attaining 60 cm height are planted during July of the following year.**

Madhuca longifolia

Family : *Sapotaceae*
Common name : *Mahuwa*
Odia name : *Mohula*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Found in moist & dry mixed deciduous forests of the state. Recommended for Plantation in sandy soil but also grows in shallow & boulder soil.
Flowering	Green colored scented flowers appear in February to April.
Fruit ripening	June to July
Seed collection & storage	Ripe fruits (Drupes) are collected by shaking the branches and the seeds are separated from the fruits by pressing and then dried. Oily seeds lose viability early on storage.
Seed weight	500 to 600 per kg.
Germination percentage	20 to 30 %
Plant percent	15 %
Germination period	10 to 20 days
Pre-treatment of seed	Not necessary

Seed sowing

- One or two healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during June-July.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil.

Transplanting

- Seeds can also be sown during June-July in raised mother beds having mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil.
- Mulching with hay & overhead shade is provided to facilitate germination.
- One month old seedlings are transplanted from mother beds to Poly pot when 2 to 4 cm in height. Subsequently, seedlings in poly pots can be developed as stated above.

Plantable seedling	**Growth of seedlings is slow at nursery stage for which seedlings are planted during July of the following year after attaining height of 50 to 60 cm.**

Melia azedarach

Family : *Meliaceae*
Common name : *Mahaneem*
Odia name : *Mahaneem*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is usually not found in natural forest. It grows on a variety of soil like sandy to clayey as well as black cotton soil. Planted in wide range of soils more commonly as an avenue plant.		
Flowering	April to June		
Fruit ripening	November - December		
Seed collection & storage	Ripe fruits are collected from the trees. De-pulping is not required. Initially fruits are yellow and subsequently become brown and wrinkled. Ripen fruits are dried in the sun for 2 to 3 days and stored in gunny bags in cool and dry place. Seeds remain viable for 1 year.		
Seed weight	800 to 900 per kg.	***Plant percent***	40 %
Germination percentage	70 to 75 %	***Germination period***	15 to 30 days
Pre-treatment of seed	Pre-soaking in normal water for 48 hours		

Seed sowing

- Line sowing of seeds mixed with ash is done during February on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Mulching is done using straw.
- Watering is done in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning. Direct seed sowing can also be done followed by mulching in poly pots during February. Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling **Poly pot seedlings are suitable for planting during July after attaining height of 50 cm.**

Mesua ferrea

Family : *Guttiferae*
Common name : *Nageswar*
Odia name : *Nageswar*

Tree morphology

Branch with inflorescence

Seeds from ripe fruit

Distribution	It is found in some of the moist evergreen and semi evergreen forests.
Flowering	February-April. Flowers are white, large and scented with yellow stamens. Fruits are ovoid, pointed and somewhat woody containing 1 to 4 seeds.
Fruit ripening	May-June
Seed collection & storage	Seeds are oily and soon lose their vitality. Trees produce fertile seeds at the age of fifteen to twenty years. Isolated trees produce flowers and seeds abundantly
Seed weight	400 to 500 per kg..
Germination percentage	40 to 50 %
Plant percent	30 to 40 %
Germination period	15 to 30 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours.

Seed sowing

- Line sowing of seeds mixed with ash is done during May-June on raised beds with a bottom layer (8 cm to 10 cm) of soil mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Mulching is done using straw.
- Watering is done in a regulated manner.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning. Direct seed sowing can also be done followed by mulching in poly pots during May-June.
- Regular watering, twice a day, is followed. Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate

Plantable seedling	**Seedlings become suitable for planting during July of the following year after attaining height of at least 60 cm.**

Michelia champaca
Syn. Magnolia champaca

Family : *Magnoliaceae*
Common name : *Champ*
Odia name : *Swarna champa*



Tree morphology *Branch with fruits* *Seeds from ripe fruit*

Distribution	It is not commonly found in wild rather it is planted in avenue / institutions / temple /garden, etc. It grows well in loamy soil.		
Flowering	Usually April to June & in certain conditions it may continue up to December.		
Fruit ripening	August-September		
Seed collection & storage	Ripe fruits are collected during August-September, heaped in shade for 2-3 days till they open completely and then the seeds are removed manually. Seeds lose viability soon & hence are sown within 3 to 4 days.		
Seed weight	About 14,000 to 15,000 per Kg.	***Plant percent***	40 %
Germination percentage	60 to 70 %	***Germination period***	15 to 25 days
Pre-treatment of seed	Not essential.		

Seed sowing

- Line sowing of seeds mixed with ash is done during August to September on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Mulching is done using straw.
- Watering is done in a regulated manner.

Transplanting

- Seedlings of 4 to 5 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings may be ready for planting during July of the following year after attaining height of about 60 cm.**

Mimusops elengi

Family : *Sapotaceae*
Common name : *Indian medlar (Bullet wood)*
Odia name : *Boula*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Usually it is not found wild in forest but grown in avenue plantation, near temple, in institutional premises because of its semi evergreen nature, scented flowers and edible fruits.		
Flowering	Flowers appear February to April.		
Fruit ripening	In the following year during March to July		
Seed collection & storage	Ripen fruits (Drupes) are collected during March-April. Seeds loose viability early. Seeds are collected after removing the pulp then washed and dried.		
Seed weight	1,000 to 1,500 per kg.	***Plant percent***	25 %
Germination percentage	30 to 40 %	***Germination period***	60 to 70 days
Pre-treatment of seed	24 hours pre-soaking in warm water		

Seed sowing

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Mulching is provided to facilitate germination.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil.
- Shade is provided preferably using agro green shade net in areas with hot climate.

Transplanting

- Seeds can also be sown in raised mother beds having mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil during March-April.
- Mulching with hay & overhead shade is provided to facilitate germination. Regular watering twice a day is to be followed.
- Seedlings are transplanted from mother beds to Poly pots when 2 to 4 cm in height and grown as above.

Plantable seedling **Since growth of seedling is slow in the nursery, it is planted during July of the following year after attaining height of around 60 cm.**

Mitragyna parvifolia

Family : *Rubiaceae*
Common name : *Keli Kadam*
Odia name : *Mundi*


Tree morphology


Branch with inflorescence


Seeds from ripe fruit

Distribution	It is found growing in well drained forest land with deep soil. It is also recommended for plantation in black cotton soil & alluvial ground near rivers.		
Flowering	Capitate flowers are white or pale yellow & appear in June - July		
Fruit ripening	November to January		
Seed collection & storage	Ripe fruits are collected, dried in the sun and then immersed in water to separate the fertile seeds which settled down. The fertile seeds are dried in the sun and then cleaned by winnowing. Seeds have got low viability and should be sown immediately.		
Seed weight	Around 1, 00,000 per kg.	***Plant percent***	40 %
Germination percentage	40 to 50 %	***Germination period***	30 to 50 days
Pre-treatment of seed	Not required		

Seed sowing

- Broadcast sowing of seeds mixed with ash is done during December-January on a raised bed with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand.
- Regulated watering is done.
- Since the seedlings are very minute and delicate, watering is to be done carefully in a regulated manner to prevent wash out, damping off & insect attack.
- Partial shade is provided to the germination bed in areas with hot climate.

Transplanting

- Two month old seedlings are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are fit for planting during July of the following year after attaining at least 60 cm height.**

Oroxylum indicum

Family : *Bignoniaceae*
Common name : *Oroxylum*
Odia name : *Phanphana*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Various segments of the tree including bark are used in traditional medicine. Usually found in different types of forests and also in peripheral areas.		
Flowering	July-August.		
Fruit ripening	In the following year during December to March. Ripen fruits are black colored and sword like in appearance.		
Seed collection & storage	Ripe fruits are plucked before dehiscence. Initially fruits are green and subsequently become black. Ripen fruits are dried in the sun for 2 to 3 days and after dehiscence the light winged seeds are collected carefully without being blown away by wind. The seeds are stored in gunny bags in cool and dry place. Seeds remain viable for one year.		
Seed weight	15,000 to 20000.	***Plant %***	60 %
Germination %	60 to 70 %	***Germination period***	15 to 30 days
Pre-treatment of seed	Not required.		

Seed sowing

- Line sowing of seeds mixed with ash is done during December-January on raised beds with a bottom layer (8 cm to 10 cm) of soil mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand.
- Mulching is done using straw.
- Watering is to be done carefully in a regulated manner to prevent wash out, damping off & insect attack.
- Partial shade is provided to the germination bed in areas with hot climate

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Direct seed sowing can also be done followed by mulching in poly pots during March. Regular watering, twice a day, is followed. Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Poly pot seedlings are suitable for planting during July after the seedling height reaches at least 45 cm.**

Ougeinia oojeinensis
Syn. Ougeinia dalbergioides

Sub-Family : *Fabaceae (Papilionioideae)*
Family : *Leguminosae*
Common name : *Bandan*
Odia name : *Bandhan*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Found sparsely in dry deciduous forests of the state. Recommended for Plantation in land-slips & river banks. It is a good coppicer & produces abundant root suckers.
Flowering	Pink flowers appear from February to May
Fruit ripening	May to June
Seed collection & storage	Ripe fruits are collected during May to June and dried. Fresh seeds should be utilized for nursery.
Seed weight	25,000 to 30,000 per kg.
Germination percentage	40 to 50 %
Plant percent	5 to 15 %
Germination period	10 to 20 days
Pre-treatment of seed	24 hours pre-soaking in normal water

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during May-June.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are ready for planting during July of the following year after attaining height of 50 to 60 cm.**

Peltophorum ferugineum

Sub-Family : *Caesalpinioideae*
Family : *Leguminosae*
Common name : *Yellow goldmohur*
Odia name : *Radhachuda*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Found in Plantations along avenue, in institutions and parks
Flowering	Yellow color flowers in large panicles are seen commonly during January to March and almost continues in rest part of the year.
Fruit ripening	During March –April
Seed collection & storage	Ripe pods are plucked from the branches, lopped and dried in the sun for 10 to 15 days and then are used for raising nursery
Seed weight	10,000 to 15,000 per kg.
Germination percentage	10 to 20 %
Plant percent	5 to 10 %
Germination period	10 to 20 days
Pre-treatment of seed	24 hours pre-soaking in warm water

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using green shade net in areas with hot climate.

Plantable seedling **Seedlings are ready for planting during July after attaining height of around 45 cm.**

Pithecellobium dulce

Sub-Family : ***Mimosoideae***
Family : ***Leguminosae***
Common name : ***Manila tamarind***
Odia name : ***Bilati kayan***

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	Commonly found in hot regions outside the forests on a variety of soils.
Flowering	Globose flowers appear in January to March
Fruit ripening	March to May
Seed collection & storage	Ripe pods are collected during March to May and de-pulped to get the seeds. Fresh seeds are sown since viability is low
Seed weight	5,000 to 6,000 per kg.
Germination percentage	60 to 70 %.
Plant percent	50 %.
Germination period	10 to 15 days
Pre-treatment of seed	24 hours pre-soaking in normal water

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is to be provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are ready for planting during July after attaining height of about 45 cm.**

Pongamia pinnata

Sub-Family : *Fabaceae (Papilionioideae)*
Family : *Leguminosae*
Common name : *Pongam tree / Karanj*
Odia name : *Karanja*

Tree morphology

Branch with inflorescence

Seeds from ripe fruit

Distribution	A moderately sized nearly evergreen tree with a spreading shady crown and short bole. Commonly found wild in the sandy beds of streams or along the sea shore. It is grown successfully as a road-side tree.
Flowering	April to June
Fruit ripening	Pods ripen from April to June of the following year.
Seed collection & storage	Fresh ripe and fallen pods are collected from the ground below the mother plants. Pods can be stored in a cool and dry place for one year, but fresh seeds germinate better.
Seed weight	400 to 500 per kg.
Germination percentage	60 to 70 %
Plant percent	40 to 50 %
Germination period	10 to 25 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours.

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during April-May.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are fit for planting during July of the following year after the height reaches at least 60 cm.**

Prosopis juliflora

Sub-Family : ***Mimosoideae***
Family : ***Leguminosae***
Common name : ***Nesquite***
Odia name : ***Prosopis***

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is a western India species & planted mainly for green fencing and also in dry localities. It doesn't tolerate water logged condition.
Flowering	Yellow terminal panicles appear once in Sept- Oct & next in Feb- March
Fruit ripening	Pods ripen twice. Once in Nov- Dec & next in April –June.
Seed collection & storage	Ripe pods are collected and soaked in water for 10 days, dried and seeds are separated.
Seed weight	20,000 to 30,000 per kg.
Germination percentage	70 to 80 %
Plant percent	60 %
Germination period	20 to 30 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings after attaining height of about 45 cm are planted during July.**

Pterocarpus marsupium

Sub-Family	:	*Fabaceae / Papilionioideae*
Family	:	*Leguminosae*
Common name	:	*Indian kino tree / Bijasal*
Odia name	:	*Piasal*

Tree morphology

Branch with inflorescence

Seeds from ripe fruit

Distribution	It is a common tree of moist & dry deciduous forests of the State. It grows better on well drained alluvial and a sandy loam soil.
Flowering	Golden yellow flowers in panicles appear from June to Oct.
Fruit ripening	December to March
Seed collection & storage	Ripe pods are collected from the trees or from the ground and dried in sun for two to three days for use in nursery.
Seed weight	Around 2,000 per kg.
Germination percentage	40 to 50 %
Plant percent	20 to 30 %
Germination period	30 to 40 days
Pre-treatment of seed	Pre-soaking in normal water for 72 hours or in cow dung slurry for 48 hours.

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during February-March.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil.
- Shade is provided using agro green shade net in areas with hot climate

Transplanting

- Seeds can also be sown in raised mother beds having mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil during February-March.
- Mulching with hay & overhead shade are provided to facilitate germination. Regular watering, twice a day, is followed.
- Seedlings can be transplanted from mother beds to Poly pot when 2 to 4 cm in height and maintained as stated above.

Plantable seedling	**Preferably, one-year-old seedlings after attaining a height of at least 60cm are planted during July of the following year.**

Pterocarpus santalinus

Sub-Family : *Fabaceae / Papilionioideae*
Family : *Leguminosae*
Common name : *Red Sander*
Odia name : *Rakta chandan*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It is endemic to south Andhra Pradesh but plantations of red sanders are found in a 3 to 4 places of Odisha. Recommended for plantation in lateritic loamy soil.
Flowering	Yellow flowers appear in April-May
Fruit ripening	Fruit ripen in the following year February-March
Seed collection & storage	Ripe pods are collected from the trees or from the ground below the mother plants and dried in sun for 3 days.
Seed weight	1,000 to 1,200 per kg.
Germination percentage	40 to 50 %
Plant percent	30 to 40 %
Germination period	30 to 40 days
Pre-treatment of seed	Pre-soaking in normal water for 72 hours or in cow dung slurry for 48 hours.

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during February-March.
- Mulching is provided to facilitate germination. Regular watering, twice a day, is followed. Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil.
- Shade is provided using agro green shade net in areas with hot climate

Transplanting

- Seeds can also be sown in raised mother beds having mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil during February-March.
- Mulching with hay & overhead shade are provided to facilitate germination. Regular watering, twice a day, is followed.
- Seedlings can be transplanted from mother beds to Poly pot when 2 to 4 cm in height and maintained as stated above.

Plantable seedling	**Preferably, one-year-old seedlings can be planted after attaining height of at least 60 cm. during July of the following year.**

Pterospermum acerifolium

Family : *Sterculiaceae*
Common name : *Bayur tree / Karnikara tree*
Odia name : *Muchakunda*


Tree morphology


Branch with inflorescence


Seeds from ripe fruit

Distribution	It is a large evergreen tree found in the mixed semi evergreen and evergreen forests and also planted as an ornamental species.
Flowering	March to July
Fruit ripening	August to December
Seed collection & storage	Ripe fruits are plucked, during August to December before dehiscence, dried in the sun for 2 to 3 days and after dehiscence the seeds are collected. Seeds remain viable for one year.
Seed weight	About 4,000 per kg.
Germination percentage	60 to 70 %
Plant percent	50 %
Germination period	15 to 60 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours.

Seed sowing

- Line sowing of pre-treated seeds mixed with ash is done during November- December on raised beds with a bottom layer (8 cm to 10 cm) of mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand. Seeds are sown 5 cm apart in each line and lines are also maintained with a spacing of 5 cm.
- Mulching is done using straw or any such organic material.
- Regular watering is done twice a day.

Transplanting

- Seedlings of 4 to 5cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings after attaining at least 45cm height are planted during July. For avenue plantation, tall second year seedlings are used during July by using polythene bags of 10"X6" size. .**

Samanea saman

Sub-Family : *Mimosoideae*
Family : *Leguminosae*
Common name : *Rain tree*
Odia name : *Bada chakunda / Kakapoi*


Tree morphology


Branch with inflorescence


Seeds from ripe fruit

Distribution	It is an exotic species but planted commonly along avenues and also in pastures. It can grow both in saline and alkaline soils.
Flowering	Pinkish white flowers appear in May-June.
Fruit ripening	Fruits ripen during March to April of the following year.
Seed collection & storage	Ripe pods are collected during March-April from the trees or from the ground, dried in sun for 2 to 3 days and beaten to harvest the seeds. Seed viability may remain up to 12 months.
Seed weight	4,000 to 5,000 per kg.
Germination percentage	40 to 60%
Plant percent	50 to 60 %
Germination period	30 to 40 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours.

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted after attaining height of around 50 cm during July.**

Santalum album

Family : *Santalaceae*
Common name : *Sandal / Chandan*
Odia name : *Chandan*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is found naturally in forest areas of Koraput, Gajapati and Kandhamal districts. It grows in different kinds of soil including shallow rocky ground but cannot withstand water logging.		
Flowering	May-June		
Fruit ripening	December to March.		
Seed collection & storage	Ripe fruits are collected during December-January, soaked in water and rubbed to remove the soft pulp. Then the seeds are dried and sown in the nursery.		
Seed weight	About 4,000 to 5,000 per kg.		
Germination percentage	20 to 30 % (Seeds after being eaten by animals & birds and coming out through their excreta germinate better)		
Plant percent	10 to 15 %	***Germination period***	40 to 60 days
Pre-treatment of seed	Due to hard seed coat seeds are treated with concentrated sulphuric acid for 30 minutes and then kept in 0.05% gibberellic acid overnight.		

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during January-February along with seed of primary host plant Cajanas cajan. Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into soil. Shade is provided using green shade net in areas with hot climate

Transplanting

- Seeds may also be sown during February in raised mother beds having mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil.
- Mulching with hay & overhead shade are provided to facilitate germination. Seedlings are transplanted from mother beds to Poly pots when 4 cm in height and maintained as stated above.

Plantable seedling **One year old seedlings are planted during July of the following year after attaining height of around 60 cm.**

Sapindus emarginatus

Family : *Sapindaceae*
Common name : *Soap- nut tree*
Odia name : *Ritha phala*


Tree morphology


Branch with inflorescence


Seeds from ripe fruit

Distribution	It doesn't occur wild in forest but is planted in the villages and other such areas.
Flowering	Very small white flowers appear in cluster during October to December.
Fruit ripening	February to April
Seed collection & storage	Fruits are collected from the floor of the ground under the tree during March and dried for 3 to 4 days. Each fruit contains one seed and following drying seeds are removed from the fruits.
Seed weight	1,500 to 2,000 per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	15 to 25 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March. .
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using green shade net in areas with hot climate.

Plantable seedling **Seedlings after attaining height of around 60 cm. are planted in the following year July.**

Saraca indica
Syn. Saraca asoca

Sub-Family : *Caesalpinioideae*
Family : *Leguminosae*
Common name : *Ashoka tree*
Odia name : *Asoka*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It doesn't occur wild in forest but is planted in the villages institutions and other such areas. Originally it was distributed in Central and Deccan plateau.
Flowering	Red flowers appear in cluster during February-April.
Fruit ripening	July to September
Seed collection & storage	Fruits are collected from the floor of the ground under the tree during July-August and dried for 1 to 2 days. Seeds retain viability for around two months.
Seed weight	100 per kg.
Germination %	60 to 70 %
Plant %	60%
Germination period	25 to 30 days.
Pre-treatment of seed	Pre-soaking in normal water for 12 hours

Seed dibbling

- 1 to 2 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during July-August.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Transplanting

- Seeds may also be sown during July-August in raised mother beds having soil mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil.
- Mulching with hay & overhead shade are to be provided to facilitate germination. Regular watering, twice a day, is followed.
- Seedlings can be transplanted from mother beds to poly pot when 2 to 4 cm in height and are maintained as stated above.

Plantable seedling **One year old seedlings are planted in the following year July after attaining a height of around 60 cm.**

Schleichera oleosa

Family : *Sapindaceae*
Common name : *Kusum / Lac tree*
Odia name : *Kusuma*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It is commonly found in different forest areas of the state preferably in sandy loam soil. The species is a shade bearer.
Flowering	Greenish yellow flowers appear during March-April.
Fruit ripening	June-July.
Seed collection & storage	Fruits are collected from the floor of the tree during June-July, dried and thrashed to separate the seeds which retain viability for around 6 months.
Seed weight	1,400 to 2,000 per kg.
Germination percentage	50 to 60 %
Plant percent	50 %
Germination period	15 to 45 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during June-July.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**One year old seedlings are planted in the following year July after attaining height of around 60 cm.**

Semecarpus anacardium

Family : *Anacardiaceae*
Common name : *Marking Nut*
Odia name : *Bana bhalia*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is a common tree of dry deciduous forests and found in different soil types. It is a moderately shade bearer.
Flowering	Greenish yellow flowers appear during May-June.
Fruit ripening	December to March.
Seed collection & storage	Fruits are collected from the floor of the ground under the tree during December to March. The seeds retain viability for a short period and should be sown soon after collection.
Seed weight	400 to 500 nuts per kg.
Germination percentage	40 to 50 %
Plant percent	50 %
Germination period	25 to 35 days
Pre-treatment of seed	Pre-soaking in normal water for 48 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during January-March.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings can be planted after attaining a height of about 45 cm during July.**

Sesbania grandiflora

Sub-Family	:	*Fabaceae (Papilionoideae)*
Family	:	*Leguminosae*
Common name	:	*Swamp-pea*
Odia name	:	*Agasthi*


Tree morphology


Branch with inflorescence


Seeds from ripe fruit

Distribution	It is a native species of Malaysia. It is planted in different site conditions including backyards in the state of Odisha. It is also grown as a support for betel-vine by the farmers.
Flowering	Large white or pinkish white flowers are produced during November-January.
Fruit ripening	April-May.
Seed collection & storage	Ripen fruits (pods) are collected by lopping the braches, dried in the sun for a day or two and stored in cool and dry condition. Viability may retain up to one year. 20 to 30 seeds are obtained from each fruit.
Seed weight	10,000 to 12,000 per kg.
Germination percentage	80 to 90 %
Plant percent	80 %
Germination period	10 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours.

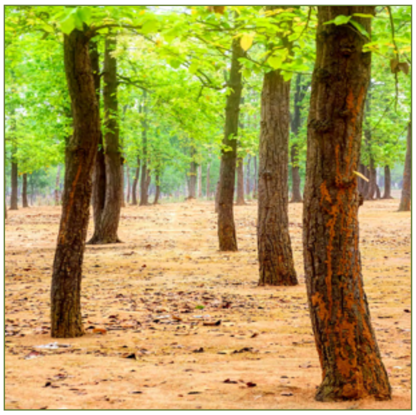
Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during April-May.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during July after attaining height of around 45 cm.**

Shorea robusta

Family : *Dipterocarpaceae*
Common name : *Sal*
Odia name : *Sal*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Found in a wide range of climate as regards both temp & rainfall. Distributed in temperature range from 34 to 47 degree centigrade and rainfall range from 1000 mm to1800 mm. Similarly, as regards topography, it is found stunted on the ridges, grows best on the lower slopes / valleys where the soil is deep, moist and fertile. The most favorable soil for this is well- drained, moist deep sandy loam with good sub soil drainage.		
Flowering	February-April		
Fruit ripening	May-July		
Seed collection & storage	The fruits fall as soon as they are ripe. Sound fresh seeds have a high percentage of fertility, but the seeds rapidly lose vitality and under ordinary conditions remain viable for a very short period. Trees of girth size around 120 cm and 12m. in height have been found to produce abundant seedlings. Coppice crop also is found to produce fertile seeds. Since seeds remain viable for a very short period, it is not stored.		
Seed weight	500 to 1,000 per Kg.	***Plant percent***	40
Germination percentage	50 to 60	***Germination period***	5 to 10 days
Pre-treatment of seed	No pre-treatment required.		

Seed sowing

- Due to very short viability, freshly collected seeds are dibbled in polythene bags during June. Mulching is provided to facilitate germination. Soil from the seeding area is most ideal as required mycorrhiza would be available. Or else artificial inoculation can be made.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of 30 days. The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are fit for planting in the following year during July.**

Simarouba glauca

Family : *Simaroubaceae*
Common name : *Simarouba / Paradise tree*
Odia name : *Simarouba*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	Simarouba tree is well suited for plantation in various types of site conditions including coastal area as well as degraded hills. The tree forms a well-developed root system and dense evergreen canopy that efficiently checks soil erosion, supports soil microbial life, improves ground water position, checks overheating of the soil surface particularly during summer and facilitates wasteland reclamation.		
Flowering	Yellow flowers appear during March-April.		
Fruit ripening	April-May.		
Seed collection & storage	Ripe and fallen fruits, black in color, are collected from the ground below the tree, de-pulped, cleaned, dried in the sun for 2 to 3 days and stored in gunny bags in a cool and dry place. Seeds remain viable for a few months but being oily should be used in the same season.		
Seed weight	300 to 400.per kg.	***Plant percent***	60 %
Germination percentage	60 to 70.%	***Germination period***	15 to 25 days
Pre-treatment of seed	Pre-soaking in warm water for 48 hours		

Seed sowing

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during April-May.
- Mulching is provided to facilitate germination.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Transplanting

- Seeds may also be sown during April-May in raised mother beds having mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil.
- Mulching with hay & overhead shade are to be provided to facilitate germination. Seedlings can be transplanted from mother beds to Poly pots when 2 to 4 cm in height and maintained as stated above.

Plantable seedling **Poly pot seedlings are suitable for planting during July.**

Soymida febrifuga

Family : *Meliaceae*
Common name : *Indian Red Wood*
Odia name : *Rohini*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is found in the dry deciduous forest areas having lime rich soil as well as black cotton soil.
Flowering	Large panicles of small greenish white flowers appear during February to April.
Fruit ripening	Capsules ripen in May-July
Seed collection & storage	Fruits are collected from the trees during May-June before they dehisce and seeds are dispersed by wind. The fruits are dried in the sun to separate the seeds. Seeds lose viability quickly.
Seed weight	9,000 to 10,000 per kg.
Germination percentage	20 to 40 %
Plant percent	25 %
Germination period	15 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 24 hours
Pre-treatment of seed	Pre-soaking in normal water for 24 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during May-June.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Since growth of the seedlings is very slow in the nursery stage, seedlings are planted during July of the following year.**

Spondias mangifera

Syn. Spondias pinnata

Family : *Anacardiaceae*

Common name : *Wild Mango*

Odia name : *Ambada*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is found in some moist semi-evergreen forest areas of Khurda Division, Baripada Division, Paralakhemndi Division, etc.
Flowering	August-September
Fruit ripening	December to February.
Seed collection & storage	Ripe fruits are collected from the ground under the tree during January-February. After de-pulping partly woody and fibrous stones are obtained. Seeds can be stored but loose germination power by 50% after one year.
Seed weight	200 to 250 per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	15 to 25 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during January-February.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during July after attaining a height of around 45 cm.**

Sterculia urens

Family : *Sterculiaceae*

Common name : *Kateera / Gum Tree / Gum karaya*

Odia name : *Genduli*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is a drought resistant species found in rocky soil.
Flowering	Flowers in panicles appear in December to March.
Fruit ripening	April-May
Seed collection & storage	The ground under the tree is made clean before April. During April – May, seeds are collected from the floor of the ground after the follicles burst.
Seed weight	5,000 to 6,000 per kg.
Germination percentage	30 to 50 %
Plant percent	20 to 40 %
Germination period	15 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during April-May.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are planted during July of the following year after attaining height of around 60 cm. Polythene bags of size 10"X6" size are used as it is kept for more than one year in the nursery.**

Stereospermum suaveolens

Syn. Stereospermum chelonoides

Family : *Bignoniaceae*

Common name : *Fragrant padre tree*

Odia name : *Patuli / padhel*

Tree morphology

Branch with inflorescence

Seeds from ripe fruit

Distribution	It is found in different forest areas of the state having clayey soils.
Flowering	Flowers appear in panicle during April to June
Fruit ripening	Capsules ripen during March to May of the following year.
Seed collection & storage	Ripe fruits are plucked from the trees during March-April before dehiscence and dried in the sun on a cloth to separate the membranous seeds. Seeds retain viability for about one year.
Seed weight	25,000 to 27,000 per kg.
Germination percentage	40 to 50 %
Plant percent	20 %
Germination period	15 to 20 days
Pre-treatment of seed	Not required.

Seed sowing

- Line sowing of seeds mixed with ash is done during March-April on raised beds with a bottom layer (8 cm to 10 cm) of soil mixture of soil, sand and FYM in a proportion of 1:1:1 covered with a fine layer (2 cm) of sand.
- Mulching is done using straw.
- Watering is done carefully in a regulated manner to prevent wash out and damping off.
- Partial shade is provided to the germination bed in areas with hot climate.

Transplanting

- Seedlings of 4 to 5 cm height are transplanted to polythene bags filled with soil mixture as discussed in the beginning.
- Regular watering twice a day is to be followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted in the following year during July.**

Strychnos nux-vomica

Family	:	*Loganiaceae*
Common name	:	*Nux- vomica tree*
Odia name	:	*Kochila*

Tree morphology

Branch with inflorescence

Seeds from ripe fruit

Distribution	It is found in different forests having lateritic soil.
Flowering	Small greenish white flowers appear from March to May.
Fruit ripening	Globose fruits ripen during January to June of the following year.
Seed collection & storage	Seeds are collected from January to March. After pulp of the fruit is washed out, the seeds are collected and dried in the sun. Seeds retain viability for about 1 year.
Seed weight	500 to 600 per kg.
Germination percentage	20 to 30 %
Plant percent	25 %
Germination period	60 to 70 days.
Pre-treatment of seed	Pre-soaking in warm water for 48 hours

Seed dibbling

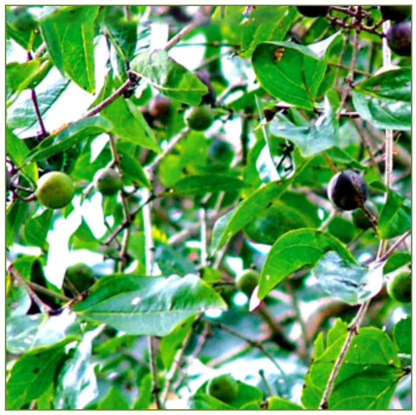
- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during February-March.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet, to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Since growth of the seedlings is very slow in the nursery stage, seedlings are planted during July of the following year. Polythene bags of size 10”X6” size are used as the seedlings are kept for more than one year in the nursery.**

Strychnos potatorum

Family : ***Loganiaceae***
Common name : ***Cleaning nut tree***
Odia name : ***Kataka***


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It is found in different forests as a shade bearer and drought resistant in nature.
Flowering	Small whitish fragrant flowers appear in axillary cymes from February to May.
Fruit ripening	Globose fruits ripe from October to March.
Seed collection & storage	Seeds are collected from January to March. Pulp of the fruit is washed and the seeds are dried in the sun. Seeds retain viability for about 1 year.
Seed weight	1,000 to 1,500 per kg.
Germination percentage	10 to 15 %
Plant percent	10 %
Germination period	45 to 60 days.
Pre-treatment of seed	Pre-soaking in warm water for 48 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during January-February.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Since growth of the seedlings is very slow in the nursery stage, seedlings are planted in the following year during July. Polythene bags of size 10”X6” size are used as the seedlings are kept in the nursery for more than one year.**

Syzygium cumini

Family : *Myrtaceae*
Common name : *Jaamun*
Odia name : *Jamakoli*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is a large semi evergreen tree found commonly along streams and in damp & marshy localities. Recommended for plantation in alluvial clayey soil or loamy sand.
Flowering	White fragrant flowers in trichotomous panicles appear in March-May.
Fruit ripening	Fruits (Drupes) ripen in June to August.
Seed collection & storage	Fresh ripe fruits are collected from the ground under the mother tree during June-August. The fruits are then washed in water and de-pulped to get the seeds. The seeds are dried in shade and used early within a month since viability is for a short period.
Seed weight	1,000 to 1,100 per kg.
Germination %	70 to 90 %
Plant %	60 %
Germination period	15 to 20 days
Pre-treatment of seed	Overnight pre-soaking in warm water for 12 hours

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during June-July.
- Mulching is provided to facilitate germination & regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet, to prevent root penetration into the soil. Shade is provided preferably using agro net shade in areas with hot climate.

Transplanting

- Seeds may also be sown during June-July in raised mother beds having mixture of soil sand and FYM (1:1:1) preferably using sandy loam soil.
- Mulching with hay & overhead shade are provided to facilitate germination. Seedlings can be transplanted from mother beds to Poly pots when 2 to 4 cm in height and are maintained as stated above.

Plantable seedling	**Seedlings are planted in the following year during July. Hence polythene bags of size 10"x6" size are used.**

Tamarindus indica

Sub-Family : *Caaesalpinioideae*
Family : *Leguminosae*
Common name : *Tamarind*
Odia name : *Tentuli*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is commonly found near village out skirts and road side areas. Recommended for enrichment / NTFP plantation in dry deciduous forest.		
Flowering	April to June		
Fruit ripening	Fruits (pods) ripe in March-April of the following year.		
Seed collection & storage	Fresh ripe pods are collected during March-April from the ground under the mother tree after beating the branches if necessary. The pods are then dried in the sun & shells are removed. Seeds are separated from the dry pulp. Then the seeds are dried in shade and used for raising nursery. Viability of the seeds is retained up to one year.		
Seed weight	1,400 to 2,000 per kg.	***Plant percent***	40 %
Germination percentage	50 to 60 %	***Germination period***	15 to 20 days
Pre-treatment of seed	Overnight pre-soaking in warm water for 12 hours		

Seed dibbling

- 2 to 3 healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Growth of the seedlings is slow in the nursery stage and therefore one-year-old seedlings are planted in the following year during July. Accordingly, polythene bags of size 10"X6" are suitable for use..**

Tectona grandis

Family : *Verbenaceae*
Common name : *Teak*
Odia name : *Saguaon*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is indigenous to many parts of India including Maharastra, Kerala, Tamil Nadu, Madhya Pradesh and some parts of Odisha (Like Khariar & Kantabanji). It grows in slightly alkaline soil unlike sal and prefers well drained loamy soil.		
Flowering	White flowers, in panicles, appear during September-October.		
Fruit ripening	Fruits ripe during December-February.		
Seed collection & storage	Ripe fruits are collected from the ground below the tree, cleaned, and dried in the sun for 2 to 3 days and stored in gunny bags in a cool and dry place. Seeds remain viable for one or two years. But freshly collected seeds gives better germination percentage. Each fruit contains two to three seeds enclosed in a flattened bladder like calyx.		
Seed weight	1,500 to 2,500 per kg.	***Plant percent***	10 to 20 %
Germination percentage	20 to 30 %	***Germination period***	20 to 30 days
Pre-treatment of seed	Different methods of pre-treatment are followed. Common method is alternate drying and soaking for 21 days or acid treatment. Seeds are also pre-treated by mixing with a paste of cow dung in a pit followed by regulated watering for a few days.		

Seed sowing

- Pre-treated seeds are sown in lines (10 cm apart) during March-April in raised beds.

Transplanting

- After maintaining the seedlings in the mother beds for one year, stumps (5 to 6″ root & 1″ shoot cutting) are prepared and dressed. These stumps are treated with rooting hormone (like Rootex / Ceradix / IAA) and fungicide like Bavistin or Blitox) and then transplanted to polythene bags. Root trainer seedlings can also be prepared by using treated seeds as well as stumps in proper rooting medium. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Pre-sprouted stumps, raised in poly pots, are suitable for planting during July.**

Terminalia alata

Family : *Combretaceae*
Common name : *Indian Laurel*
Odia name : *Asana / Sahaja*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It is most widely distributed in forests of different parts of the state with alluvial soil & clay soil but normally avoids sandy soil.
Flowering	Small whitish flowers in spikes appear during May- June.
Fruit ripening	Winged fruits ripe in February-April of the following year.
Seed collection & storage	Ripe fruits are collected by lopping the branches when the tree is leafless. The fruits are then dried in the sun for 2 to 3 days and stored in gunny bags. Viability remains up to one year.
Seed weight	400 to 500 fruits per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	15 to 20 days
Pre-treatment of seed	Pre-soaking in warm water for 48 hours. Then the seeds are heaped and watered twice a day. When the seeds begin to sprout, they are removed and sown in poly pots.

Seed dibbling

- One or two healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided preferably using agro green shade net in areas with hot climate.

Plantable seedling	**Growth of the seedlings is slow in the nursery stage and therefore seedlings are planted in the following year during July. Hence, polythene bags of size 10”X6” are suggested.**

Terminalia arjuna

Family : *Combretaceae*
Common name : *Arjun*
Odia name : *Arjuna*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is distributed in forests of almost all the districts of the state mainly on the banks of water courses. It grows well in fertile alluvial loamy soil.
Flowering	Small whitish flowers in spikes appear in April to July.
Fruit ripening	Winged fruits ripe in February-May of the following year.
Seed collection & storage	Ripen fruits are collected during March-April by lopping the branches or from the previously cleaned ground. The fruits are then dried in the sun for 2 to 3 days and stored in gunny bags. Viability remains up to one year.
Seed weight	400 to 500 per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	15 to 20 days
Pre-treatment of seed	Pre-soaking in warm water for 48 hours. Then the seeds are heaped and watered twice a day. When the seeds begin to sprout they are removed and sown / dibbled in poly pots.

Seed dibbling

- One or two healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Regular watering twice a day is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Growth of the seedlings is slow in the nursery stage and therefore seedlings are planted in the month of July of the following year. Hence, polythene bags of size 10”X6” size are used to raise such seedlings.**

Terminalia bellirica

Family : *Combretaceae*
Common name : *Beleric-myrabolan*
Odia name : *Bahada*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is distributed in dry deciduous forests of almost all parts of the state. It grows well in fertile alluvial soil.
Flowering	Small greenish white flowers in spikes appear during March to May.
Fruit ripening	Fruits ripe in November to February
Seed collection & storage	Ripen fruits are collected during January-February by lopping the branches or from the previously cleaned ground. The fruits are then dried in the sun for 2 to 3 days and stored in gunny bags. Viability remains up to one year.
Seed weight	100 to 150 per kg.
Germination percentage	50 to 60 %
Plant percent	50 %
Germination period	15 to 20 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours. Then the seeds are heaped and watered twice a day. When the seeds begin to sprout they are removed and sown in poly pots.

Seed dibbling

- One or two healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are planted during July of the following year after attaining height of at least 60 cm.**

Terminalia catappa

Family : *Combretaceae*
Common name : *Indian almond*
Odia name : *Pesta badam*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It grows well in loose, well drained and fertile soil such as sandy loam & clayey loam. It is commonly planted in avenue, institutions and parks.
Flowering	White flowers in spikes appear in February to May.
Fruit ripening	Fruits ripen in June-July and then fall.
Seed collection & storage	Fresh and ripe fruits are collected from the previously cleaned ground during June-July. The fruits are then dried under shade for 2 to 3 days and stored in gunny bags. Fresh seeds germinate better. After removal of the fibrous pericarp, seeds are used for germination.
Seed weight	140 to 160 fruits per kg.
Germination percentage	25 to 30 %
Plant percent	20 to 25 %
Germination period	20 to 30 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours. The seeds are mixed with cow dung, heaped and watered twice a day. When the seeds begin to sprout they are removed and sown / dibbled in poly pots.

Seed dibbling

- One or two healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling	**Seedlings are planted during July of the following year. Hence, polythene bags of size 10"X6" size are recommended.**

Terminalia chebula

Family : *Combretaceae*
Common name : *Chebulic-myrobalan*
Odia name : *Harida*

Tree morphology

Branch with fruits

Seeds from ripe fruit

Distribution	It is commonly found in mixed, dry and deciduous forest. It grows well in loose, well drained and fertile soil such as sandy loam & clayey loam.
Flowering	Greenish white flowers in spikes appear from April to June.
Fruit ripening	Fruits ripe in the following year from January to March and fall after ripening.
Seed collection & storage	After removal of the fibrous pericarp, seeds are used for germination. Fresh and ripe fruits are collected from the previously cleaned ground. The fruits are then de-pulped, dried under shade for 2 to 3 days and stored in gunny bags. Viability remains up to one year. But fresh seeds germinate better.
Seed weight	150 to 180 per kg.
Germination percentage	40 to 50 %
Plant percent	40 %
Germination period	20 to 30 days
Pre-treatment of seed	Pre-soaking in warm water for 24 hours. The seeds are mixed with cow dung heaped and watered twice a day. When the seeds begin to sprout they are removed and sown in poly pots.

Seed dibbling

- One or two healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during July of the following year.**

Xylia xylocarpa

Sub-Family : *Mimosoideae*
Family : *Leguminosae*
Common name : *Iron wood*
Odia name : *Kangada / Tangini*


Tree morphology


Branch with fruits


Seeds from ripe fruit

Distribution	It grows well in lateritic soil.
Flowering	Pale yellow colored flowers in globose heads appear in March to April.
Fruit ripening	Pods ripe during the following year winter and seeds fall from the dehiscent pods during March to April.
Seed collection & storage	Ripe pods are collected from the tree as soon as they dehisce during March-April. Pods are dried in the sun to open and seeds are collected, dried and stored. Viability may retain up to one year.
Seed weight	2,000 to 2,500 per kg.
Germination percentage	70 to 80 %
Plant percent	70 %
Germination period	10 to 20 days
Pre-treatment of seed	Pre-soaking in normal water for 12 hours.

Seed dibbling

- One or two healthy pre-treated seeds are dibbled in the center of poly pots filled with soil mixture during March-April.
- Mulching is provided to facilitate germination.
- Regular watering, twice a day, is followed.
- Root cutting, grading and re-setting of poly pot seedlings are done in the nursery at regular interval of about 30 days.
- The poly pots are kept, in the nursery beds, on polythene sheet to prevent root penetration into the soil. Shade is provided using agro green shade net in areas with hot climate.

Plantable seedling **Seedlings are planted during July after attaining height of about 30 to 45 cm.**

Annexure-I

Macro Nutrient Defficiency Symptoms In Forest Tree Species:

Nutrient	*Deficiency Symptoms*	*Remark*
Calcium (Ca)	Tender leaves are distorted	Excessive calcium can limit the availability of other nutrients
Nitrogen (N)	Yellowing of older leaves and rest parts may remain light green	Plants absorb nitrogen in the form of ammonium or nitrate.
Magnesium (Mg)	Margin of the older leaves turn yellow leaving a green arrowhead shape in the center.	Mg may be readily leached from soil if calcium is not present.
Phosphorus (P)	Leaf tips look burnt followed by older leaves turning into dark green or reddish purple.	Phosphorus uptake is affected by pH.
Potassium (K)	Older leaves may wilt and look scorched.	Potassium ion can be readily leached from soil.
Sulfur (S)	Tender leaves turn yellow first followed by older leaves.	

Micro Nutrient Defficiency Symptoms In Forest Tree Species:

Nutrient	*Deficiency Symptoms*	*Remark*
Boron (B)	Death of terminal buds.	Problems are seen in closely spaced plants.
Copper (Cu)	Leaves become dark green. Plant shows stunted growth.	Arizona soils have plenty of copper.
Iron (Fe)	Inter vein parts of tender leaves turn yellow.	Uptake is strongly affected by pH. Chelated iron (iron chelate like sea weed) is readily available for use by the plants.
Manganese (Mn)	Inter vein parts of tender leaves turn yellow but may not be as distinct as that of iron. Plant parts (leaf, shoot, and fruit) generally stunted and deformed.	Absorbed as Mn ion.
Molybdenum (Mo)	Older leaves may turn yellow. Rest of the plant is soften light green.	Problems are rare in Arizona soils but occasionally seen in legumes where it mimics nitrogen deficiency.
Zinc (Zn)	Terminal leaves may become rosette and Inter vein parts of tender leaves turn yellow	High pH may limit availability.

Mineral Defficiency Symptoms

Potasium Defficiency

Magnesium Defficiency

Nitrogen Defficiency

Sulphur Defficiency

Potasium Defficiency

Calcium Defficiency

Annexure-II

Common insect /pest attack symptoms and control measures

Insect / Pest	*Symptoms*	*Insecticide*	*Dose*
Sucking insects: Aphids, Jassids, Thrips, white flies, Mealy bug (white wolly patches)	Discoloration of young leaves due to sucking of sap, curling, drying and shedding of leaves	Acetamiprid 20% SP Clothanidin 50% WDP Imidacloprid 17.8% SL Thiamethoxam 25%WP Thiacloprid 21.7%SC Monocrotophos 36%SL	0.4gm/lit. water 1.0 gm/ lit 0.3ml/lit 0.3gm/lit 0.5ml/lit 2ml/lit
Red spider mites	Discoloration of leaves often with white spots.	Dicofol 18.5% EC Propargite 57% EC Spiromesifen 22.9% SC Fenazaquin 10% EC	2 ml/ lit 3ml/lit 1ml/lit 2ml/lit
Leaf eating caterpillars & Beetles	Holes on leaves & cutting of leaves	Emamectin Benzoate 5% SC Indoxacarb15.% SC Chlorpyriphos 20% EC Profenphos 50 EC Spinosad 45% SC Chlorantraniliprole 18.5% SC	0.4 gm/lit 1ml/lit 2 ml/lit 2ml/lit 0.3 ml/lit 0.3 ml/lit
Termites & other root eating insects	Wilting and gradual death of seedling	Chlorpyriphos 20% EC	2ml/lit
Damping off (Fungal disease)	Decaying of seedlings at collar region and death.	Ridomil MZ 68WG% or Thiophanate Methyl 70 wp	2.5gm/lit
Fungal Leaf spot / seedling blight (fungal disease)	Discoloration of leaves & formation of discolored spots. At times show symptoms of blights.	Carbendizim 50 wp / Saaf / Copper Oxychloride 50%	2 gm/lit
Bacterial leaf spot / wilting	Development of minute to circular dark to dark brown spots showing water soak lesions on the leaf/ immediate die of the seedlings	Plantomycin streptocycline	1 gm/lit 0.1gm/10 lit
Seed treatment of seeds	Seedling root / seedling blight during nursery	Vitavax powder	2gm /kg of seed

SP- Soluble Powder, **WP**- Wettable Powder, **WDP**- Water Dispersible Powder, **SL**- Soluble Liquid , **EC**- Emulsifiable Concentrate, **SC**- Soluble Concentrate, **WG**- Water Dispersible Granule

Precautions to be followed in dealing with pesticides

During storage

Do's	Don'ts
i. Store the pesticides away from house premises. ii. Keep pesticides in original containers. iii. Pesticides/weedicides must be stored separately. iv. The area where pesticides have been stored, should be marked with warning signs. v. Pesticides be stored away from the reach of the children and livestock. vi. Storage place should be well protected from direct sunlight and rain.	i. Never store pesticide in house premises. ii. Never transfer pesticides from original to other containers. iii. Do not store insecticides with weedicides. iv. Do not allow children to enter the storage place. v. Pesticides should not be exposed to sunlight or rain water.

While handling

Do's	Don'ts
i. Keep pesticides separate during transportation. ii. Bulk pesticides should be carried carefully to the site of application.	i. Never carry/transport pesticides along with food/fodder/other eatable articles. ii. Never carry bulk pesticides on head, shoulder or on the back

While preparing spray solution

Do's	Don'ts
i. Always use clean water. ii. Use protective clothing viz., hand gloves, face masks, cap, apron, full trouser, etc. to cover whole body. iii. Always protect your nose, eyes, ears, hands, etc. from spill of spray solution. iv. Read instructions on pesticide container label carefully before use. v. Prepare the solution as per requirement. Granular pesticides should be used as such.	i. Avoid spilling of pesticides solutions while filling the spray tank. ii. Always use recommended dosage iii. Do not use muddy or stagnant water. iv. Never prepare spray solution without wearing protective clothing. v. Do not allow the pesticide/its solution to fall on any body parts. vi. Never avoid reading instructions on container's label for use. vii. Never use left out spray solution after 24 hours of its preparation. viii.Do not mix granules with water. ix. Do not smell the spray tank. x. Do not use overdose which may affect plant health and environment. xi. Do not eat, drink, smoke or chew during whole operation of pesticides.

Common Insects and Symptoms due to Insect Attack

Insect Name	Damage Symptom
	
Thrips *(Thysanoptera)*	*Foliage feeder*
	
Whitefly *(Aleyrodidae)*	*Sap feeder*
	
Mite *(Acarina)*	*Sap feeder*

Insect Name

Damage Symptom

Jassid *(Cicadellidae)*

Sap feeder

Termite *(Isoptera)*

Bark feeder

Aphid *(Aphididae)*

Sap feeder

Insect Name	Damage Symptom
	
Mealy Bug *(Pseudococcidae)*	*Sap feeder*
	
Beetle *(Coleoptera)*	*Holes on leaves*
	
Caterpillar *(Lepidoptera)*	*Defoliator*

Common Disease Symptoms In Plants

Leaf Spot *(Cercospora Capsici)*

Wilting *(Fusarium Oxysporum)*

Blight *(Pseudomonas Spp.)*

Annexure-III

Abstract Nursery Raising Information of Common Forest Tree Species

Sl No	Scientific Name	Common local name	Flowering Time	Fruiting Time	No of seeds per Kg.	Germination Period in days	Germination percentage	Pre-treatment of Seed
1	*Acacia auriculiformis*	Sunajhari	December-January	January to March	30,000 to 40,000	15 to 30	50	Pre- soaking in normal water for 24 hours
2	*Acacia catechu*	Khaira	June to August	December to January	30,000 to 35,000	15 to 25	60 to 70	Pre- soaking in normal water for 12 hours
3	*Acacia mangium*	Mangium	December-January	January to March	30,000 to 40,000	15 to 30	60 to 70	Pre-soaking in warm water for 24 hours
4	*Acacia nilotica*	Babool	July to September	April to May	5,000 to 7,000	10 to 30	40 to 50	Pre- soaking in normal water for 12 hours
5	*Aegle marmelos*	Bela	March to May	April to May	5,000	10 to 25	55	Pre-soaking of seeds in normal water
6	*Albzia lebbeck*	Kala siris	March-May	December to February	7,000 to 8,000	7 to 20	60 to 70	Pre-soaking of seeds in normal water for 24 hours
7	*Albizia odoratissima*	Tentera	April to June	January to February	12,000 to 14,000	10 to 20	40 to 50	Pre-soaking of seeds in normal water for 24 hours
8	*Albizia procera*	Dhala siris	May to August	April to May	15,000 to 20,000	7 to 25	40 to 50	Pre-soaking of seeds in normal water for 24 hours
9	*Alstonia scholaris*	Chatian	Nov to February	May to July	2,50,000 to 3,00,000	10 to 15	50 to 60	Not required
10	*Annona squamosa*	Atta	June to July	September to December	400 to 500	15 to 30	60 to 70	Pre- soaking in normal water for 24 hours

Sl No	Scientific Name	Common local name	Flowering Time	Fruiting Time	No of seeds per Kg.	Germination Period in days	Germination percentage	Pre-treatment of Seed
11	*Anogeissus latifolia*	Dhaura	June-July/ December-January	July-August/ January-February	1,00,000	10 to 15	3 to 4.5 %	Pre-soaking for 48 Hours in normal water.
12	*Anthocephalus chinensis*	Kadamba	May to July	September to January	9,00,000 to 10,00,000	10 to 20 days	50 to 60	Not required
13	*Artocarpus heterophyllus*	Panasa	November to December	July to August	100 to 150	15 to 30	60 to 70	Pre- soaking in normal water for 12 hours
14	*Artocarpus lakoocha*	Jeutha	January-February.	April-May	2,000 to 4,000	8 to 20	60 to 70	Pre-soaking in normal water for 12 hours
15	*Azadirachta indica*	Neema	March to April	June to August	2,000 to 3,000	10 to 20	70 to 90	Pre- soaking in normal water for 24 hours
16	*Barningtonia acutangula*	Hinjala	June-July	November to January	1,000 to 1,200	30 to 40	70 to 80	Pre-soaking for 12 Hours in normal water.
17	*Bauhinia racemosa*	Kanchan	April to June	October to December	5,000 to 6,000	7 to 25	60 to 70	Pre-soaking in warm water for 24 hours.
18	*Bombax ceiba*	Simili	February-March	March to May.	20,000 to 30,000	10 to 30	50 to 70	Pre-soaking in normal water for 24 hours
19	*Bridelia retusa*	Kasi	June to August	September to October	15,000 to 16,000	15	60 to 70	Pre-soaking in normal water for 24 hours
20	*Buchanania lanzan*	Chara	January-March.	April to May	4,000 to 5,000	10 to 15	2 to 4.5	Pre-soaking for 48 Hours in normal water.
21	*Careya arborea*	Kumbhi	April-May	July-August	2,500 to 2,800	15 to 20	25 to 30	Pre-soaking for 12 Hours in normal water

Sl No	Scientific Name	Common local name	Flowering Time	Fruiting Time	No of seeds per Kg.	Germination Period in days	Germination percentage	Pre-treatment of Seed
22	*Cassia fistula*	Sunari	April-June	January-April	6,000 to 7,000	40 to 50	40	Pre-soaking in warm water for 24 hours
23	*Casuarina equisetifolia*	Jhaun	February to April & September to October	June & December	7.5 to 10.0 lakhs	10 to 20	50 to 60	Not required
24	*Chloroxylon swietenia*	Bheru	March-April	May to August	1,400 to 3,000	15 to 20	40 to 50	Not required
25	*Dalbergia latifolia*	Pahadi sissoo	June-July	December to March	20,000	10 to 20	50 to 60	Pre-soaking for 12 Hours in normal water
26	*Dalbergia sissoo*	Bali sisoo	March-April	November-February.	12,000 to 14,000 pods	10 to 20	70 to 80	Not required
27	*Dendrocalamus strictus*	Salia baunsa	At the age of twenty to thirty years. During November to March	March-May	30,000	10 to 20	50 to 60	Pre-soaking in normal water for 12 hours.
28	*Desmodium oojeinensis*	Bandhan	February to May	May to June	12,000 to 15,000 pods	10 to 20	40 to 50	24 hours pre-soaking in normal water
29	*Dillenia indica*	Oau	May-June	October and continues till February of the following year.	30,000 to 40,00	15 to 20	20	Pre-soaking in normal water for 24 hours.
30	*Dillenia pentagyna*	Rai	March-April	May-June	2,500 to 2,800	15 to 20	25 to 30	Pre-soaking in normal water for 12 hours.
31	*Diospyros melanoxylon*	Kendu	April to June	April to June	1,000	20 to 30	40-50	Pre-soaking in normal water for 24 hours

Sl No	Scientific Name	Common local name	Flowering Time	Fruiting Time	No of seeds per Kg.	Germination Period in days	Germination percentage	Pre-treatment of Seed
32	*Emblica officinalis*	Anla	March to May	December-February	8,000 to 9,000	25 to 30	40 to 50	24 hours pre-soaking in warm water
33	*Ficus bengalensis*	Bara	April to June	May-June	10, 00,000	20 to 30	30 to 40	Mixing with cow dung & drying
34	*Gmelina arborea*	Gambhar	March-April	May to June.	2,000 to 2,500	10 to 15	70 to 80	Pre-soaking in normal water for 12 hours shows better result.
35	*Haldina cordifolia*	Haldu	June to August	March to May	1,10,000 to 1,18,000	10 to 15	30 to 35	Not required
36	*Lagerstroemia parviflora*	Sidha	April to June.	December to February	28,000 to 50,000	15 to 20	2%	24 hours pre-soaking in normal water
37	*Lannea coromandelica*	Moil	February - April.	May to July	6,000 to 8,000	15 to 20	40 to 60	24 hours pre-soaking in normal water
38	*Madhuca longifolia*	Mohula	February to April.	June to July	500 to 600	20 to30	20 to 50	Pre-soaking in normal water for twelve hours.
39	*Magnolia champaca*	Swarna champa	April to June	August-September	14,000 to 15,000	15 to 25	60 to 70	Not essential.
40	*Melia azedarach*	Mahaneem	April to June	November - December	800 to 900	15 to 30	70 to 75	Pre-soaking in normal water for 48 hours
41	Mesua ferrea	Nageswar	February-April	July-August	300 to 500	15 to 30	40 to 50	Pre-soaking in warm water for 24 hours.
42	*Mimusops elengi*	Boula	February to April.	March to July in the following year	1,000 to 1,500	60 to 70	30 to 40	24 hours pre-soaking in warm water
43	*Mitragyna parvifolia*	Mundi	June & July	November to January	1, 00,000	30 to 50	50	Not required

Sl No	Scientific Name	Common local name	Flowering Time	Fruiting Time	No of seeds per Kg.	Germination Period in days	Germination percentage	Pre-treatment of Seed
44	*Oroxylum indicum*	Phanaphana	July-August.	December-March	15,000 to 20,000.	15 to 30	60 to 70	Not required
45	*Peltophorum ferrugineum*	Radhachuda	Throughout the year	March – April	10,000 to 15,000	10 to 20	10 to 20	24 hours pre-soaking in warm water
46	*Pithecellobium dulce*	Bilati kayan	January to March	March to May	5,000 to 6,000	10 to 15	60 to 70	24 hours pre-soaking in normal water
47	*Pongamia pinnata*	Karanja	April to June	April to June in the following year	400 to 500	10 to 25	60 to 70	Pre-soaking in warm water for 24 hours.
48	*Prosopis juliflora*	Prosopis	Sept- Oct/ Feb- March	Nov- Dec/ April –June	25,000 to 30,000	20 to 30	70 to 80	Pre-soaking in normal water for 24 hours
49	*Pterocarpus marsupium*	Piasal	June to October	December to March	2000	30 to 40	40 to 50	Pre-soaking in normal water for 72 hours and in cow dung slurry for 48 hours.
50	*Pterocarpus santalinus*	Rakta chandan	April-May	Following year Feb-March	1,000 to 1,200	30 to 40	40 to 50	Pre-soaking in normal water for 72 hours and in cow dung slurry for 48 hours.
51	*Pterospermum acerifolium*	Muchakunda	March to July	August to December	4,000	15 to 60	60 to 70	Pre-soaking in normal water for 24 hours.
52	*Samanea saman*	Bada chakunda	May-June	March-April of the following year	4,000 to 5,000	30 to 40	60	Pre-soaking in normal water for 24 hours
53	*Santalum album*	Chandan	May-June	December-March	4,000 to 5,000	40 to 60	20 to 30	Due to hard seed coat seeds are treated with concentrated sulphuric acid for 30 minutes and then kept in gibberellic acid overnight.

Sl No	Scientific Name	Common local name	Flowering Time	Fruiting Time	No of seeds per Kg.	Germination Period in days	Germination percentage	Pre-treatment of Seed
54	*Sapindus emarginatus*	Ritha phala	October to December	February to April	1,500 to 2,000	15 to 25	40 to 50	Pre-soaking in normal water for 24 hours
55	*Saraca asoka*	Asoka	February-April	July-September	80 to 100	25 to 30	60 to 70	Pre-soaking in normal water for 12 hours
56	*Schleichera oleosa*	Kusuma	March-April	June-July	1,400 to 2,000	15 to 45	50 to 60	Pre-soaking in normal water for 12 hours
57	*Semecarpus anacardium*	Bana bhalia	May-June	December-March	400 to 500	25 to 35	40 to 50	Pre-soaking in normal water for 48 hours
58	*Sesbania grandoflora*	Agasthi	November-January	April-May	10,000 to 12,000	10 to 20	80 to 90	Pre-soaking in normal water for 24 hours.
59	*Shorea robusta*	Sal	February-April	May-July	500 to1,000	5 to 10	50 to 60	No pre-treatment required.
60	*Simarouba glauca*	Simarouba	March-April.	April-May	300 to 400	15 to 25	60 to 70	Pre-soaking in warm water for 48 hours
61	*Soymida febrifuga*	Rohini	February-April	April-May	9000 to 10,000	15 to 20	20 to 40	Pre-soaking in normal water for 24 hours
62	*Spondias pinnata*	Ambada	August-September	December to February.	200 to 250	15 to 25	40 to 50	Pre-soaking in normal water for 12 hours
63	*Sterculia urens*	Genduli	December to March.	April-May	5,000 to 6,000	15 to 20	30 to 50	Pre-soaking in normal water for 12 hours
64	*Stereospermum chelonoides*	Patuli / padhel	April to June	March to May	25,000 to 27,000	15 to 20	40 to 50	Not required.
65	*Strychnos nux-vomica*	Kochila	March to May	January to June.	500 to 600	60 to 70	20 to 30	Pre-soaking in warm water for 48 hours

Sl No	Scientific Name	Common local name	Flowering Time	Fruiting Time	No of seeds per Kg.	Germination Period in days	Germination percentage	Pre-treatment of Seed
66	*Strychnos potatorum*	Kataka	February to May.	October to March.	1,000 to 1,500	45 to 60	10 to 15	Pre-soaking in warm water for 48 hours
67	*Syzygium cumini*	Jamakoli	March-May.	June to August	1,000 to 1,100	15 to 20	70 to 90	Overnight pre-soaking in warm water for 12 hours
68	*Tamarindus indica*	Tentuli	April to June	March-April of the following year	1,400 to 2,000	15 to 30	60 to 70	Overnight pre-soaking in warm water for 12 hours
69	*Tectona grandis*	Saguaon	September-October.	December-February.	1,500 to 2,500	20 to 30	20 to 30	Alternate drying and soaking/mixing seeds in paste of cow dung and watering for a few days.
70	*Terminalia alata*	Asana / Sahaja	May- June	February-April of the following year	400 to 500	15 to 20	40 to 50	Pre-soaking in warm water for 48 hours
71	*Terminalia arjuna*	Arjun	April to July.	February-May of the following year	400 to 500	15 to 20	40 to 50 %	Pre-soaking in warm water for 48 hours.
72	*Terminalia bellirica*	Bahada	March to May	November to February	100 to 150	15 to 20	50 to 60 %	Pre-soaking in warm water for 24 hours
73	*Terminalia catappa*	Pestabadam	February to May	June-July	140 to 160	20 to 30	25 to 30	Pre-soaking in warm water for 24 hours.
74	*Terminalia chebula*	Harida	April to June	January to March of the following year	150 to 180	20 to 30	40 to 50	Pre-soaking in warm water for 24 hours.
75	*Xylia xylocarpa*	Kangada / Tangini	March to April.	March-April of the following year	2,000 to 2,500	10 to 20	70 to 80	Pre-soaking in normal water for 12 hours.

NOTE

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NOTE

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