

LECTURE-16
**“LEARNING OBJECTIVE: ECONOMICS OF CULTIVATION-
NURSERY AND PLANTING OF *Eucalyptus tereticornis* Sm. AND *Tectona grandis* L.”**



Plate 16.1 *Eucalyptus tereticornis* Sm.

Botanical Name: *Eucalyptus tereticornis* Sm.

Common Name: Eucalyptus, Safeda, Nilgiri

Family : Myrtaceae

Description

- It is a tall tree upto 40m high
- Bole is straight and clean with whitish mottled bark
- The crown is open
- Juvenile leaves opposite
- Adult leaves alternate
- Inflorescence axillary usually seven flower umbel

Distribution

- In India Eucalyptus is second most widely planted species after teak
- It is distributed/planted all over India except North-eastern states
- It is planted both in the forest and outside in agricultural lands, wasteland, roadsides etc.

Site factor

Climate

Temperature - Maximum 22°C -32°C, Minimum 2°C-12°C

Rainfall - Upto 1500 mm

Altitude - Upto 1700 m.

Soil

- It can be grown in wide variety of soil such as recent alluvial soil, laterite soils, sand dunes, ravine, murum soil and sandy loam soils etc.
- It can be grown in soils having pH more than 10 but growth is poor when pH exceeds 8.5.

Phenology

- It is evergreen species
- Flowering - Twice a year 1st in May-June 2nd in October-November
- High number of fertile seeds was set in first flowering
- Seed collection - July-August

Silvicultural characters

- String light demander
- Susceptible to frost because of thin bark and essential oil in the plant tissues
- Good coppice
- It is a wind firm in nature
- Damaged by termites

Natural Regeneration

- Very poor due to destruction of seeds by ants
- Young seedlings smothered by leaf collar
- Leaves are toxic and contain germination inhibitor

Artificial Regeneration

Seed collection and storage:

- Seeds should be collected from 10 year old trees. Although fertile seed is available from young tree
- In a year two collection 1st - February-March and 2nd – October-November
- Capsules should be dried in shade for one day
- Gently shaken to clean the shells
- Dry and stored in a tins at cool dry places
- 3,67,400 seeds weigh one Kg

Nursery techniques:

- Seed should be sown in raised nursery bed in the month of October-November or February-March
- Soil should be sterilized with Aldrex or BHC against termites
- Seed should be sown 20gm/m² of bed in lines 10cm apart and 2.5mm deep
- Germination takes place within 5-15 days of sowing
- 60-75 seedlings are obtained from one gram of seeds
- Seedlings are pricked out when they attain a height of 4-8cm
- Pricking of seedling should be done in to polythene bag
- Polythene bags initially should be placed in shade for few days and then shifted in the open in sunken beds
- The seedlings are hand watered for some time and later the beds may be irrigated.

Planting out:

- The area to be planted is clear felled ploughing and properly soil working should be done
- In Terai areas of UP for the first year only cash crops are raised and plantings is done in the 2nd year
- Pit size should be 45cm³ or 30cm³
- For saline and alkaline soils large pit of 60cm³ with soil replacement with good soil are dug out at wider spacing
- Planting is done in July in areas subject to South-West Monsoon
- October-November in areas of North-East Monsoon
- Container/bag should be removed at the time of planting
- Watering and fertilizer application should be done in poor soils
- Casualties are beaten up immediately after planting in the first year
- In arid areas 3-4 watering in the first year produce good stock

Spacing

- Spacing depends upon the objective of plantation
- Spacing varies $1.8\text{m} \times 1.8\text{m} - 3\text{m} \times 3\text{m}$
- For firewood/fuelwood
 $1\text{m} \times 1\text{m}$ or $1.5\text{m} \times 1.5\text{m}$
- For pulpwood/poles
 $2\text{m} \times 2\text{m}$ or $3\text{m} \times 2\text{m}$
- For saw log
 $3\text{m} \times 3\text{m}$
- For Windbreaks and shelterbelts
 $1.5\text{m} \times 1.5\text{m}$ or $2\text{m} \times 1\text{m}$

Vegetative propagation

- Clonal propagation has been attempted by means of Grafting, budding, air layering and soft wood cutting
- Propagules should be treated by IBA 10000ppm
- The selected plus tree are cut at about 12cm height from the ground level
- The coppice shoot are harvested between 45 days and 55 days after the tree has been cut
- The cut shoot are placed in a bucket of water transplanted to the nursery
- The length of cuttings vary from 10-15cm
- The base of the cuttings should be treated with 200ppm solution of Benlate Fungicide for 15-30minutes
- The base up to 2cm is treated with 6000ppm IBA diluted with talc powder
- The cuttings are planted in polythene tubes
- The growing media is vermiculite
- Cutting develop good root system within 5-6 weeks

Tending operations

- Like weeding, fertilization thinning etc. Should be done time to time

Economic importance

- (i) Pulp and fuel
- (ii) Pole for general purposes
- (iii) Leaves for oil



Plate 16.2 *Tectona grandis* L. tree

Botanical Name: *Tectona grandis* L.

Common Name: Teak, Sagwan

Family : Verbanaceae

Description

- Large deciduous tree up to 30 m high and 100 cm or more dbh
- Long straight cylindrical bole up to 2/3 of the height of tree.
- Deep tap root system
- Bark pale brown, grey, striate, fibrous, peeling off in thin strips
- Branch lets are quadrangular and channelled

Distribution

- Indigenous in both peninsulas of India, in North-Eastern drier part of Java and other islands of Indian Archipelago
- The Nilambur in Kerala, manmade teak forest are known to foresters throughout world.
- Natural habitat is between 10°N and 25°N on Indian subcontinent, in South-East Asia especially in India, Burma, Thailand, Laos, Cambodia, Vitenam and Indonesia.
- It does not occur naturally in Malaysia

Site factors

Climate

- Teak naturally occurs only in monsoon climate
- Temperature - Maximum 48°C, Minimum 2°C
- Rainfall - 700mm to 2200 mm
- Altitude - 600m to 1200 msl.

Soil

- It grows on variety of geological formations notably trap, limestone, granite, gneiss, mica schist, sandstone, quartzite and clay
- Well drained, well ventilated soils with high oxygen content are best
- Absent in soil having pH < 6.0pH and >8.5pH

Phenology

- Leaf-fall - Dry area- November to January
- Wet area- March
- Leaf renewal - May
- Flowering - June to September
- Fruiting - November to January
- Seed collection - January/February
- Seed viability - more than 1 year
- Seed weight - 125 to 176 per 100 gm.
- Germination - 60 to 80 per cent.

Silvicultural characters

- Strong light demander
- Frost tender
- Drought and wind sensitive
- Fire resistant
- Not browsed
- Good coppice



Plate 16.3 *Tectona grandis* L. fruits

Regeneration

Natural-

- Seeds abundantly
- Requires warmth and light for germination
- In cool shady places the seeds may lie dormant for years
- Establishment of seedlings largely depends on light
- Frost sensitive nature hence seedlings are killed by frost
- Light burning is beneficial
- Weed growth and ground vegetation is obstacles
- Especially *Lantana camera* discourages its regeneration

Artificial-

- First ever plantation is carried out in Nilambur in 1842 under Conolly.
- Seeds, coppice shoots, stump etc.

Seed collection and storage

- Viable seeds obtained from the age of 5-6years
- Twenty year old plantation regenerates naturally
- Nine year old coppice raised plantation produce healthy seedlings
- Seeds should be collected underneath the trees during January-March
- Seeds cleaned and dried are collected in gunny bags and stored in dry areas
- 35 Kg seeds are required to produce stumps for one hectare area

Pre-sowing treatment

- Necessary to break dormancy of the seed
- Seed germination in the untreated seeds is totally absent or very in-significant
- Following treatments require to break dormancy of the seed

- ✓ **Natural Weathering**

Seeds are spread over raised platform in the middle of August during rains seeds get soaked and then with sun they get dried thus getting natural weathering

- ✓ **Artificial weathering**

Freshly collected seeds are put in gunny bags which are then submerged under flowing water for four days. The gunny bags are taken out and spread over in strong sun for four days. It is again submerged in water for 3-4 days following drying. It is repeated for 3-4 times until endocarp and mesocarp get easily cracked

- ✓ **Pit method**

Seeds are put in alternate layers of seeds and straw and daily watered for seven days then dried and stored till the time of sowing

- ✓ **Soaking in water**

Immersion of seeds in water for number of days hastens germination

- ✓ **Biological method**

Burying the seeds for one year near the ant hill is reported to give better results

- ✓ **Chemical treatment**

Soaking the seed in concentrated H_2SO_4 for 20 minutes and thorough washing in running water hasten germination

- ✓ **Scorching**

Scorching the seeds in light running fire of leaves of grass or alternatively seed picked from plantation after a light ground leaf-fire is useful method

- ✓ **Cowdung**

Soaking the seeds in the mixture of cowdung and water enhance germination

Nursery technique

- Nursery beds are prepared one year in advanced of planting
- Beds of 12 m × 1.2 m size are prepared
- In moist localities raised beds are prepared while in dry localities sunken beds are helpful for germination
- Seeds are sown in the nursery bed from February-June
- 2.5-3 Kg seeds are required per bed
- About 1200-1500 seedlings are expected

Preparation of stumps

- Stumps with 1cm to 2cm diameter at collar level with about 25cm root portion and 2.5cm stem portion are most suitable

Plantation technique

Direct sowing

- It is practiced very limited scale due to heavy causality

Entire transplanting

- Dona plants are preferred in place of tree in place of pre-sprouted or normal teak stumps
- The soil in dona retains moisture for comparatively longer period and keep the plant alive
- Dona plants are 4-6 months old at time of planting or casualty replacement in July-August

Stump planting

- This is the most useful and economical method for teak plantation
- Stumps are planted in crow bar holes and generally buried up to the collar
- In Odisha and drier part of Tamil Nadu stumps are buried up to the tip
- In Madhya Pradesh in hard soil stumps are planted in 15cm diameter hole and about 30cm deep
- While planting the stumps the collar is flushed with ground level

Pre-sprouted teak stumps

- In very dry locality pre-sprouted stump planting give satisfactory results
- The stumps are planted 4-6 month in advance and put in container raised on a platform in shade and watered daily
- These stumps after sprouting are planted at the onset of monsoon
- The planting of sprouts is done with the ball of Earth intact in cylindrical holes

Polythene bag

- Planting of seedling raised in polythene bags have also been tried in such cases treated seeds are sown directly in polythene bags filled with manured soil
- The bags are watered daily and planted out when seedling attains a height of 15cm

Vegetative propagation

- Teak can be propagated by grafting, layering and rooting branch cutting
- Among the grafting method used bud grafting is preferred as it is easy, economical and more suitable for grafting on stumps
- Grafting success depends upon age of mother plant, time of grafting and method used

Economic importance

- (i) Furniture and house construction
- (ii) Ship and railway coach
- (iii) Wood oil for decreasing durability of timbers

A-C Zone : West Coast & Ghat Region Tree-Crop combination: Agrisilviculture
 Situation : Rainfed Tree: *Tectona grandis* (Teak)
 Crop : Sweet Potato

Input / Output Analysis

Amount in Rupees

Year	Expenses Per Ha			Benefits Per Ha			Net Benefit Per Ha	
	Tree	Crop	Total	Tree	Crop	Total		
1	38000	18000	56000	0	30000	30000	-26000	
2	11875	18000	29875	0	30000	30000	125	
3	11875	18000	29875	0	30000	30000	125	
4	11875	18000	29875	0	30000	30000	125	
5	11875	18000	29875	0	30000	30000	125	
6	11875	18000	29875	0	30000	30000	125	
7	11875	18000	29875	0	30000	30000	125	
8	11875	18000	29875	0	30000	30000	125	
9	11875	18000	29875	0	30000	30000	125	
10	11875	18000	29875	0	30000	30000	125	
11	11875	18000	29875	0	30000	30000	125	
12	11875	18000	29875	0	30000	30000	125	
13	11875	18000	29875	0	30000	30000	125	
14	11875	18000	29875	0	30000	30000	125	
15	11875	18000	29875	0	30000	30000	125	
16	11875	18000	29875	0	30000	30000	125	
17	11875	18000	29875	0	30000	30000	125	
18	11875	18000	29875	0	30000	30000	125	
19	11875	18000	29875	0	30000	30000	125	
20	11875	18000	29875	3800000	30000	3830000	3800125	
Net Present Value @15% DF			209,715				419,961	210,246

Assumptions :

1. No of trees per ha. = 475
2. Income per ha. = Rs.3800000 (in the 20th year)
3. Expenses per tree=Yr 1=Rs80, Yr 2 & onwards =Rs 25

Crop : Sweet Potato

1. Yield per ha=10000 kg.
2. Sale price per kg. = Rs 3
3. Expenses per ha =Rs.18000

Analysis :

Tree: *Tectona grandis* : Rotation 20 Years Benefit Cost Ratio @ 15% DF = 2.00
 Net Present Value @ 15% DF = 210,246
 IRR = 30%

Investment:

Year 1 = Rs 56000
 Year 2 to 20 = Rs 225625
 Total = Rs. 281625

Note : Investment proposed includes expenses on trees for 20 years and expenses on crop for the first year.

Source: Report of the task force on greening India for livelihood security and sustainable development. Planning Commission. Government of India. July-2001