



**Recent Techniques of Production and out planting of bare foot and container seedlings.**

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# Scope

## A. Production:

1. Species-Poplar, Eucalyptus, *Melia dubia* and horticulture species.
2. Root trainer technology.
3. Gene bank/ germplasm hedges.
4. Mini cuttings.
5. Planting medium.
6. Green House operations.
7. Shade House and Hardening/Open nursery.

## B. Out Planting:

1. Clonal plants/ Seedlings
2. Pits & soil management
3. Irrigation
4. Plantation management



**Eucalypts based AF**

# BENEFITS OF AGROFORESTRY

- ❖ Higher income per unit land-synergistic effect.
- ❖ Additional income from tree component-
- ❖ Improvement of soil fertility, structure, micro-climate, moisture etc.
- ❖ 5 Fs- fuelwood, fodder, floss, flower, firewood & food.
- ❖ Improved general climate of the locality- more rainfall.
- ❖ Shelterbelts & windbreak.
- ❖ Round the year employment –removal of disguised unemployment.
- ❖ May integrate with-dairy, poultry, fishery, animal husbandry.
- ❖ Upgraded living standard of the people adopting the AF.

# Agro-forestry- Tree+ agriculture crop

## TREE:

- Eucalyptus
- Poplar
- Melia
- Teak
- Shisham
- Kadam

## AGRICULTURE CROP:

- Sugarcane
- Wheat
- Any Vegetable-
- Any other crop-pulses, paddy.



<b>Plant</b>	<b>Water use (Litres/Kg of total biomass)</b>
Cotton/Coffee/ Bananas	3200
Pongomia	2600
Sunflower	2400
Field pea	2000
Paddy Rice	2000
Horse bean	1714
Cow Pea	1667
Conifers(T)	1538

\*T-Tree

<b>Plant</b>	<b>Water use (Litres/Kg of total biomass)</b>
Dalbergia(T)	1483
Soybean	1430
Acacia	1323
Syzygium	1017
Potato	1000
Sorghum	1000
Albizia(T)	967
Eucalyptus (T)	785
Finger Millet	592



# Eucalyptus based Agro-forestry System

Tree: Eucalyptus

Agri crop:

Wheat

Sugarcane

Pulses-Urd, Moong Arhar

Mustard

Chilli

Vegetable crops

Maize



# Root Trainers











# Eucalyptus Production



PAPERBOARDS  
AND  
SPECIALTY  
PAPERS DIVISION

## Eucalypts propagation

by -

Seed origin/ Hybrid seedlings.

## Eucalypts propagation- Clonal tech.

Higher yield

Pest & disease resistant.

Uniform growth

Self pruning

Short rotation

Cylindrical & clear bole

Shallow root system

Thin branches

Narrow branch angle



## CUTTINGS PLACED UNDER MIST CHAMBER







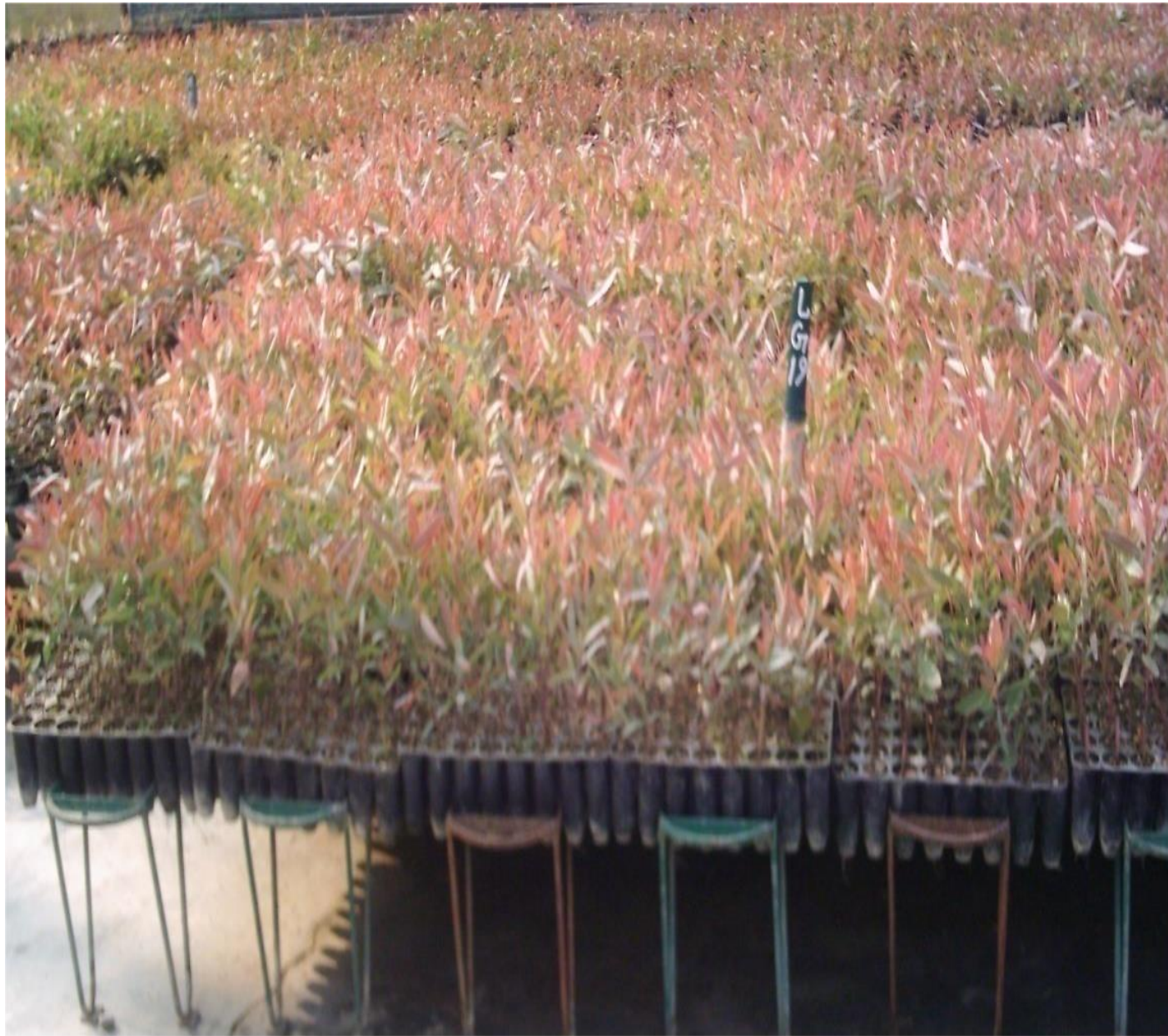








# EUCALYPTS CLONAL PLANTS READY FOR SALE





## Background-Eucalyptus Plantation

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- National Forest Policy 1988 mandated to reduce pressure on forests for fuelwood, fodder and industrial raw material requirement, through plantations under farm forestry and social forestry initiatives
- To meet growing wood requirement, Forest Departments, Forest Development and Plantation Corporations and Pulp and Paper industry joined hands with the farmers, leading to creation of a sustained wood resource base of more than 3 million ha of plantations under farm / agro forestry, 70% of which is eucalyptus plantation
- This could be made possible by massive investment of resources by the industry and the Corporations, to bring in genetic improvement and development of highly productive and disease resistant clones, which increased plantation productivity by more than 400%, making these extremely viable in terms of competitive crops/land use

## Background-Eucalyptus Plantation (continued)

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- Multiplication of clonal plants to raise farm /agro forestry plantation, is done with root trainer technology, which promotes lateral root system (vs tap root system of seed based plants), to enable root system to go only up to 1.5-2 meter soil depth
- With clones, rotation of eucalyptus plantation (1 main + 2 coppice crops) has reduced to 10-12 years vs 20-25 years earlier, which also helps in reduced depth of root system. This is evidenced by easy uprooting of trees/plantation by the farmers, when they decide to shift to alternate crops
- Clonal eucalyptus plantation has its root system far above the ground water level; and is a surface feeder for water and nutrient requirement

# Eucalyptus Plantation – Social, Economic and Environmental Impacts

- Eucalyptus was introduced in India in later part of 18<sup>th</sup> century, and is currently estimated to be grown over 3.0 million ha, ~80% of which is under farm / agro forestry. India has ~10% of world's eucalyptus plantation
- As per Food and Agriculture Organisation (FAO) Report (FP/48/E) 2014, around 93% of industrial wood requirement of the country, is met out of farm/agro forestry plantations (~70 % is eucalyptus). And, it has benefitted the farmers and the industry, and has substantially reduced pressure on forests
- As per Centre for Science and Environment (CSE) Report, 2017 (Titled: The Puzzle of Forest Productivity), Eucalyptus plantation yields more net income/ha/annum to farmers than almost 60-70% of the agriculture crops, and can play a major role in increasing future farm level income, on the back of new productive clones, under development by the industry
- Every year around 1.5 lac ha of eucalyptus plantation is raised in India, creating employment of around 70 million in rural areas



## Eucalyptus Plantation – Social, Economic and Environmental Impacts (continued)

- National Green Tribunal (NGT) in its order dated 20th July, 2015 in Original Application No.9 of 2014, in para31 stated that based on studies (in Annexure) conducted in different countries, growing of eucalyptus, one of the major farm forestry species, has no adverse environmental impact nor is it disastrous for water table, as it consumes less water per Kg of total biomass generated vs many tree and agricultural crops (para-29)

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## Annexure-I

### Water Consumption : Root Structure

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One of the most authoritative study on Eucalyptus is by J. Davidson, published by FAO (1985), titled “Setting aside the idea that Eucalyptus are always bad” stated that:

- Species of Eucalyptus planted in India, '*Eucalyptus tereticornis*'\* has a root depth of 3m
- It therefore uses rainfed soil moisture from the upper soil profile
- Most Eucalyptus (species) root systems are more specifically adapted to using rainfed soil moisture from the upper soil profile, rather than from the groundwater table at considerable depth
- Eucalyptus plantation in study area, supports more luxuriant undergrowth and had a greater species diversity than the same in sal plantation

\* non-clonal/seed based

## Annexure-II

### Water Consumption

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- Mr. Francis, H. Raj, N.C.M. Rajan, K. Rajagopal and H.N. Mathur, belonging to the prestigious Forest Research Institute, Dehradun, in their article titled 'Some Hydrological Investigations on Blue Gum at Osmund (Nilgiris)' (1980):
  - Eucalyptus (Blue Gum) is not a water intensive species and does not drain waterlogged areas, as indicated by plantations raised in such areas in UP
  - Eucalyptus does not play any significant role in depletion of water table and the criticism is not based on scientific facts
  - Study did not reveal any adverse effect of blue gum on the hydrological cycles in the Nilgiris
  - Local ground water and soil moisture regime and water quality in Nilgiris have not been upset adversely due to blue gum planting

## Annexure-III

### Water Consumption

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- Dr. Dinesh Kumar, a well known scientist at the Indian Agricultural Research Institute, New Delhi, in his paper titled 'Place of Eucalyptus in Indian Agro Forestry Systems' in book on 'Eucalypts in India- Past, Present and Future' (1986) states that:
  - Eucalyptus is a xerophytic specie, i.e. plant adapted to life in a dry or physiologically dry habitat by means of mechanism to prevent water loss and as such has low rates of transpiration
  - Further, in the low water availability areas, eucalyptus has ability to close up its leaves in such a way that it's evaporation transpiration process is dramatically reduced
  - It may be noted that when it does not rain and the other trees turn yellow and parched, the eucalyptus stays green not because it has enormous reserves of water which is hoarded, but because it shuts off the stomas, and does not allow the water to escape through them
  - In other words, eucalyptus does not lose as much water by way of transpiration as other trees

## Annexure-IV

### Water Consumption

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In a study done by R.M. Singhal, B.C. Ramola and S.P.Pant (1986) at the Forest Research Institute, Dehradun on Effect of *Eucalyptus* plantation on ground water table, it was concluded that:

- The tap root of *Eucalyptus* (where it exists) is not a major absorber of water from the water table in the low lying area
  - Thus establishing the fact that the roots of eucalyptus do not grow enough to tap the ground water table and therefore,
  - The tree does not absorb more water than is actually available on the surface soil, akin to any other dry deciduous tree
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## Annexure-V

### Environmental Impact

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Report published by Mr.Vinayakrao Patil, an eminent forest scientist, titled 'Local Communities and Eucalyptus - An Experience in India' (1995) mentions:

- Co-operative agro forestry, and specially eucalyptus plantations, can be used as an effective medium to fight the battle against environmental degradation. By meeting the needs of the people for small timber and domestic energy locally, pressure on national forests will be relieved considerably
- The Report further goes on to 'dispel the myths and misconceptions about eucalyptus' and states among other things that-
  - a. Eucalyptus does not compete for ground water and other nutrients with crops in its vicinity
  - b. Eucalyptus does not need plenty of water and does not drain away subsoil water
  - c. Eucalyptus does not cause degradation of land and does not hamper soil fertility