ABSTRACT

Scientifically managed Eucalyptus 'Bhadrachalam' clonal plantations can raise the productivity levels to 25 CuM/ha/yr (MAI) under rainfed and around 50 CuM/ha/yr (MAI) under irrigated conditions. A few success stories are given in this paper. Better management practices in plantations are directly responsible for increasing the productivity levels to ten times to that of natural forests. This paper deals with better management practices of forest plantations in a greater detail, which will help the Indian farming community immensely.

INTRODUCTION

India has 329 million ha geographical area- 2.5% of the world's land area. It is supporting over 15% of the world's human population and around 16% of the world's cattle population. The per capita availability of land is decreasing owing to overexploitation of natural resources for tremendous increase in the demands for food, fuel, fodder, fibre, shelter, communication and industry. The solution could be switching over to clonal technology based plantations on fairly good sites having at least 1 meter deep soils with better management practices.

Depletion of forest cover is very fast and the productivity of forests is very low. India average is 1.37 CuM/ha/yr and World average is 2.1 CuM/ha/yr (1). Restoration of green cover and substantial improvement in land productivity on sustainable basis is the need of the hour. Always there is a great demand for wood and its products. As per FAO (1.2) the demand for wood by 2010 AD will be as shown in Table 1.

The gap between demand and supply is on the increasing trend varying from 30 to 50% by 2015 which may go up to more then 50% by 2015.

<table>
<thead>
<tr>
<th>Wood</th>
<th>Million tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel wood and Charcoal</td>
<td>344</td>
</tr>
<tr>
<td>Industrial round wood</td>
<td>37</td>
</tr>
<tr>
<td>Sawn timber</td>
<td>33</td>
</tr>
<tr>
<td>Paper and Paperboards</td>
<td>5.7</td>
</tr>
<tr>
<td>Wood based panels</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Biomass demand and Supply situation

The productivity of natural forests in world is 2.1 CuM/ha/yr (2). At this rate of production, we will never be able to meet the gap between demand and supply. The best possible answer is adopting 'Clonal' eucalyptus technology based plantations on suitable sites. The productivity of such plantations ranges from 22 to 54 CuM/ha/yr.

Table 2. Biomass demand and supply situation

<table>
<thead>
<tr>
<th>Year</th>
<th>Demand</th>
<th>Production (Million tonnes)</th>
<th>Shortfall</th>
<th>Import Cost (Rs. in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4.112</td>
<td>2.560</td>
<td>1.552</td>
<td>19690</td>
</tr>
<tr>
<td>2005</td>
<td>5.045</td>
<td>2.762</td>
<td>2.283</td>
<td>29930</td>
</tr>
<tr>
<td>2010</td>
<td>6.297</td>
<td>3.154</td>
<td>3.143</td>
<td>42760</td>
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<tr>
<td>2015</td>
<td>7.981</td>
<td>3.325</td>
<td>4.656</td>
<td>64190</td>
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</table>

As per Mr Singhania Report, 1990

Plantations will provide the following benefits

- Sustaining the momentum of green revolution and life support systems.
- Meeting future demand of fuel wood/timber and wood-based products.
- Minimizing biotic pressures on natural forest and conservation of their rich biodiversity.
- Generation of large scale employment opportunities for rural poor- 450 person days per hectare of plantation.
- Conservation of precious soil and water resources and prevention of floods and desertification.
<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Clone No</th>
<th>CTA No</th>
<th>Location</th>
<th>Age (Yr)</th>
<th>CAI Vol/ha (UB,CuM)</th>
<th>MAI Vol/ha (UB,CuM)</th>
<th>pH</th>
<th>EC</th>
<th>Disease Resist A-NCE</th>
<th>Tolerance to wind Damage</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>266</td>
<td>23</td>
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<td>67</td>
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<td>Hardy</td>
<td>Hardy</td>
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<td>6</td>
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<td>Hardy</td>
<td>Hardy</td>
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<td>Hardy</td>
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<tr>
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<td>1</td>
<td>Ponnekallu</td>
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<td>Hardy</td>
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<td>0.4</td>
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<td>0.1</td>
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</tbody>
</table>

Environmental amelioration and restoration of ecological balance.

**RESULTS AND DISCUSSION**

Such technology based plantations of Eucalyptus 'Bhadrachalam' clones taken-up on around 11,64,400 ha planted @ 1,66,200 ha/yr from 2002-03 at a cutting cycle of 7 years will be able to meet the demand of woods required to produce the total country requirement of paper and paperboards by 2010 and further (Table 2). To achieve the above, it is imperative to switch over to forestry and organise for better management of plantations (Table 3). Farmers from West Godavari district in Andhra Pradesh (Table 4) are in the forefront harvesting yields per hectare upto 50 CuM/ha/yr. Some of the success stories are as follows (3,4):

**Better management of the plantations**

A number of criteria need to be made exigent for better management practice, which are mentioned below.

**Selection of Entrepreneur:** Big farmers, absentee landlords/ businessmen. The participant should be resourceful, economically sound to cope up with the
Table 4. Harvesting Yield per hectare

<table>
<thead>
<tr>
<th>Village</th>
<th>District</th>
<th>Formation Year</th>
<th>Yield Mal*</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lingamguntla</td>
<td>Prakasam</td>
<td>1994</td>
<td>49.38</td>
<td>Harvested after 7 yrs</td>
</tr>
<tr>
<td>Dippakayalapadu</td>
<td>West Godavari</td>
<td>1994</td>
<td>50.00</td>
<td>Harvested after 4 yrs</td>
</tr>
<tr>
<td>Muppavaram</td>
<td>Prakasam</td>
<td>1995</td>
<td>50.72</td>
<td>Standing</td>
</tr>
</tbody>
</table>

* Mean Annual Increment.
Source: Annual assessment data of 'Bhadrachalam' clonal plantations.

High expenses and long gestation of the crop. Estimated cost benefits are as follows:

Site: It is mandatory to study Soil Profile. pH should be less than 8.5, and Electrical conductivity should be less than 2 millimhos/cm. Water logging and highly eroded sites are to be avoided, 6 ft. deep neutral soils are preferred. Ideal soil profile could be as follows.

Site preparation: Very good site preparation by mechanical means is required to facilitate good aeration in the soil, which allows maximum percolation of rain water.

Planting stock: Genetically superior, fairly disease resistant and well hardened quality clonal planting stock ensures optimum survival and growth rate which results in better productivity. Minimum age of the planting stock should be 6 months from the date of setting.

Planting: Espacement should be 3x2 meters and pit size - 30x30x30 cms. The appropriate planting time

Table 5. Cost benefits per hectare of Bhadrachalam clonal plantation - Espacement-3x2M

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Operation</th>
<th>Unit</th>
<th>Rate</th>
<th>Qty</th>
<th>Years</th>
<th>Total Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ploughing</td>
<td>HA</td>
<td>2400</td>
<td>1</td>
<td>1</td>
<td>2400</td>
</tr>
<tr>
<td>2</td>
<td>Alignment/Staking</td>
<td>LS</td>
<td>150</td>
<td>150</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>Digging of Pits &amp; Planting</td>
<td>Plant</td>
<td>1.5</td>
<td>1666</td>
<td></td>
<td>2499</td>
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<tr>
<td>4</td>
<td>Wedding/Cleaning/Soil working</td>
<td>HA</td>
<td>833</td>
<td>2</td>
<td>1666</td>
<td>1749</td>
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<tr>
<td>5</td>
<td>Cost of Fertilizers/ Green Manure</td>
<td>HA</td>
<td>2250</td>
<td>1</td>
<td>2250</td>
<td>2363</td>
</tr>
<tr>
<td>6</td>
<td>Cost of Antitermite Treatment</td>
<td>HA</td>
<td>800</td>
<td>2</td>
<td>1600</td>
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<td>7</td>
<td>Provision for Fencing/Maintenance</td>
<td>LS</td>
<td>2000</td>
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<tr>
<td>Subtotal</td>
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<td></td>
<td></td>
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<td>8</td>
<td>Contingencies</td>
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<tr>
<td>9</td>
<td>Cost of Plants</td>
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<td>Insurance premium</td>
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<td>Total Cost (per Ha)</td>
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<tr>
<td>11</td>
<td>Gross Returns</td>
<td>Tones</td>
<td>1400</td>
<td>175</td>
<td>(average yield)</td>
<td>245000</td>
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<tr>
<td>Net Returns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>175803</td>
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</table>

Note: Land lease rent, interest on investment not taken into consideration.
Table 6. Fertilizer Application

<table>
<thead>
<tr>
<th>Dosage</th>
<th>With inter crop</th>
<th>Without inter crop</th>
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<tbody>
<tr>
<td></td>
<td>Urea Kgs/ha</td>
<td>Super Potash Kgs/ha</td>
</tr>
<tr>
<td>First dose (during June)</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Second dose (during September)</td>
<td>60</td>
<td>250</td>
</tr>
<tr>
<td>Third dose (during October)</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

is the beginning of the monsoon season. Before planting clonal sapling should be treated with water mixed with 3-4 gms/litre of anti-termite chemical. Pit should be filled with soil, leaving a space of 7.5 cms. in red soils and 5 cms. in black soils. Pot watering should be continued for 7 to 10 days.

Timely Operations

Weed management: Timely and proper weed management avoids competition from weeds and allow the saplings to pickup fast growth. Timely weeding operations would improve soil aeration.

Water conservation measures enhances the growth almost two times. Such measures, taken up in APFDC plantations boosted up the yields to almost double. It is an actual example happening around Hyderabad.

Fertilizer Application: Timely application of fertilizer has been helping the plants to put on more growth. Schedule for application of fertilizer during first year for the Eucalyptus 'Bhadrachalam' clonal plantation is as follows:

Any fertilizer application has to be followed by irrigation and ploughing. Application of FYM (Farm Yard Manure) and Zinc sulphate helps to avoid chlorosis and helpful for site development.

Irrigation: Timely and on need basis provision of irrigation to the growing plants will enhance the growth by two times to normal growth.

Ploughing: Soil working by means of ploughing in between the lines of technology based plantations is very essential which facilitates the saplings with ease at water and nutrient management. Such conditions are essential for the luxuriant growth of the saplings. Deep ploughing is to be done in either direction followed by harrowing. Ploughing twice a year ensures maximum

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Fig. 1 Promising clones chart showing current annual increment
moisture conservation.

Protection of plantations - Protection is the foremost thing. Protection from human beings, wrong ploughing, white ants, cattle, fire, by not allowing shallow planting and other natural calamities is essential, which avoids injury, mortality and unhygienic conditions in the plantation areas.

Monitoring of plantations - Measuring the standing population is carried out by laying sample plots (@100 trees in each sample plot) for assessing the survival and growth rate. This practice ensures proper accountability of the participating individual or agency.

CONCLUSION

'Bhadrachalam' clonal plantations with better management practices, planted at the rate of 1,66,206 hy/yr from 2002-03 at a cutting cycle of 7 years will be able to meet the demand of total country requirement of woods for producing paper and paperboards by 2010 and further.

REFERENCES
