

# Forest Management for High Pulp Yielding Plantations

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## 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 2010 which may go up to more than 50% by 2015.

Table 1. Demand for wood by 2010

Wood	Million tonnes
Fuel wood and Charcoal	344
Industrial round wood	37
Sawn timber	33
Paper and Paperboards	5.7
Wood based panels	1.3

## 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

Year	Demand	Production (Million tonnes)	Shortfall	Import Cost (Rs. in millions)
2000	4.112	2.560	1.552	19690
2005	5.045	2.762	2.283	29930
2010	6.297	3.154	3.143	42760
2015	7.981	3.325	4.656	64190

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 3. Characteristics of 'Bhadrachalam' Clones

Sl. No.	Clone No	CTA No	Location	Age (Yr)	CAI Vol/ha (UB,CuM)	MAI Vol/ha (UB, CuM)	pH	EC	Disease Resist A-NCE	Tolerance to wind Damage
1	266	23	Bhadrachalam	7	67	54	7.0	0.2	Hardy	Hardy
2	6	22	Bhadrachalam	7	103	44	7.4	0.1	Hardy	Hardy
3	288	21	Bhadrachalam	7	66	40	7.0	0.1	Hardy	Hardy
4	286	21	Bhadrachalam	7	57	39	7.0	0.1	Hardy	Hardy
5	10	1	Ponnekallu	10	40	37	7.4	0.1	Hardy	Tolerant
6	290	50	Bhadrachalam	2	55	37	8.5	0.4	Hardy	Hardy
7	284	21	Bhadrachalam	7	43	35	7.0	0.1	Hardy	Hardy
8	272	22	Bhadrachalam	7	77	35	7.0	0.1	Hardy	Hardy
9	292	22	Bhadrachalam	7	82	34	7.0	0.1	Hardy	Hardy
10	316	32	Bhadrachalam	5	57	33	7.0	0.2	Hardy	Hardy
11	27	2	Bhadrachalam	5	57	33	6.8	0.1	Hardy	Hardy
12	285	21	Bhadrachalam	7	46	33	7.0	0.1	Tolerant	Tolerant
13	3	1	Bhadrachalam	10	33	33	7.4	0.1	Hardy	S.Ptable
14	273	23	Bhadrachalam	7	51	32	7.0	0.2	Hardy	Hardy
15	72	22	Bhadrachalam	7	66	32	7.0	0.1	Tolerant	Tolerant
16	291	22	Bhadrachalam	7	66	32	7.0	0.1	Hardy	Hardy
17	277	21	Bhadrachalam	7	39	30	7.0	0.1	Hardy	Hardy
18	275	21	Bhadrachalam	7	39	30	7.0	0.1	Hardy	Hardy
19	405	38	Santharavuru	4	58	28	7.9	0.4	Hardy	Tolerant
20	115	50	Ponnekallu	2	40	28	8.5	0.4	Hardy	Hardy
21	265	23	Bhadrachalam	7	29	27	7.0	0.2	Hardy	S.Ptable
22	7	1	Bhadrachalam	10	25	27	7.4	0.1	Hardy	Tolerant
23	99	38	Santharavuru	4	52	26	7.9	0.4	Tolerant	Tolerant
24	274	21	Bhadrachalam	7	22	26	7.0	0.1	Tolerant	Tolerant
25	130	28	Gundlapally	6	30	26	8.3	0.4	Tolerant	S.Ptable
26	122	38	Santharavuru	4	36	25	7.9	0.4	Hardy	Hardy
27	223	33	Bhadrachalam	4	33	24	7.2	0.1	Hardy	Hardy
28	438	38	Santharavuru	4	41	24	7.9	0.4	Hardy	Tolerant
29	319	34	Bhadrachalam	5	38	24	7.2	0.1	Hardy	Hardy
30	271	21	Bhadrachalam	7	16	23	7.0	0.1	Tolerant	S.Ptable
31	222	32	Bhadrachalam	5	25	23	7.0	0.2	Hardy	Tolerant
32	439	38	Santharavuru	4	41	23	7.9	0.4	Hardy	Tolerant
33	436	38	Santharavuru	4	40	23	7.9	0.4	Hardy	Tolerant
34	413	35	Bhadrachalam	4	28	22	7.2	0.1	Tolerant	Hardy

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

Village	District	Formation Year	Yield Mai*	Status
Lingamgunta	Prakasam	1994	49.38	Harvested after 7 yeras
Dippakayalapadu	West Godavari	1994	50.00	Harvested after 4 years
Muppavaram	Prakasam	1995	50.72	Standing

\* 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 milliomhos/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

Sl. No.	Operation	Unit	Rate	Qty	Years							Total Rs.
					1	2	3	4	5	6	7	
1	Ploughing	HA	2400	1	2400	2520	2646	2778	2917	3063	3216	19541
2	Alignment/Staking	LS	150		150							150
3	Digging of Pits & Planting	Plant	1.5	1666	2499							2499
4	Wedding/Cleaning/Soil working	HA	833	2	1666	1749						3415
5	Cost of Fertilizers/ Green Manure	HA	2250	1	2250	2363	2481	2605	2735	2872	3015	18320
6	Cost of Antitermite Treatment	HA	800	2	1600							1600
7	Provision for Fencing/ Maintenance	LS	2000		2000	200	200	200	200	200	200	3200
	Subtotal				12565	6832	5327	5583	5852	6135	6431	48725
8	Contingencies			5%	628	342	266	279	293	307	322	2436
	Subtotal				13193	7173	5593	5862	6145	6441	6753	51161
9	Cost of Plants		8	1750	14000							14000
	Subtotal				27193	7173	5593	5862	6145	6441	6753	65161
10	Insurance premium			1.25%	340	430	499	573	650	730	815	4036
	Total Cost (per Ha)				27533	7603	6092	6435	6794	7172	7568	69197
11	Gross Returns	Tonnes	1400	175	(average yield)							245000
<b>Net Returns</b>											<b>175803</b>	

Note: Land lease rent, interest on investment not taken into consideration.

Table 6. Fertilizer Application

Dosage	With inter crop			Without inter crop		
	Urea Kgs/ha	Super Kgs/ha	Potash Kgs/ha	Urea Kg/ha	Super Kg/ha	Potash Kg/ha
First dose (during June)	125	125	125	125	125	125
Second dose (during September)	60	250	---	125	---	---
Third dose (during October)	--	--	--	125	---	---

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

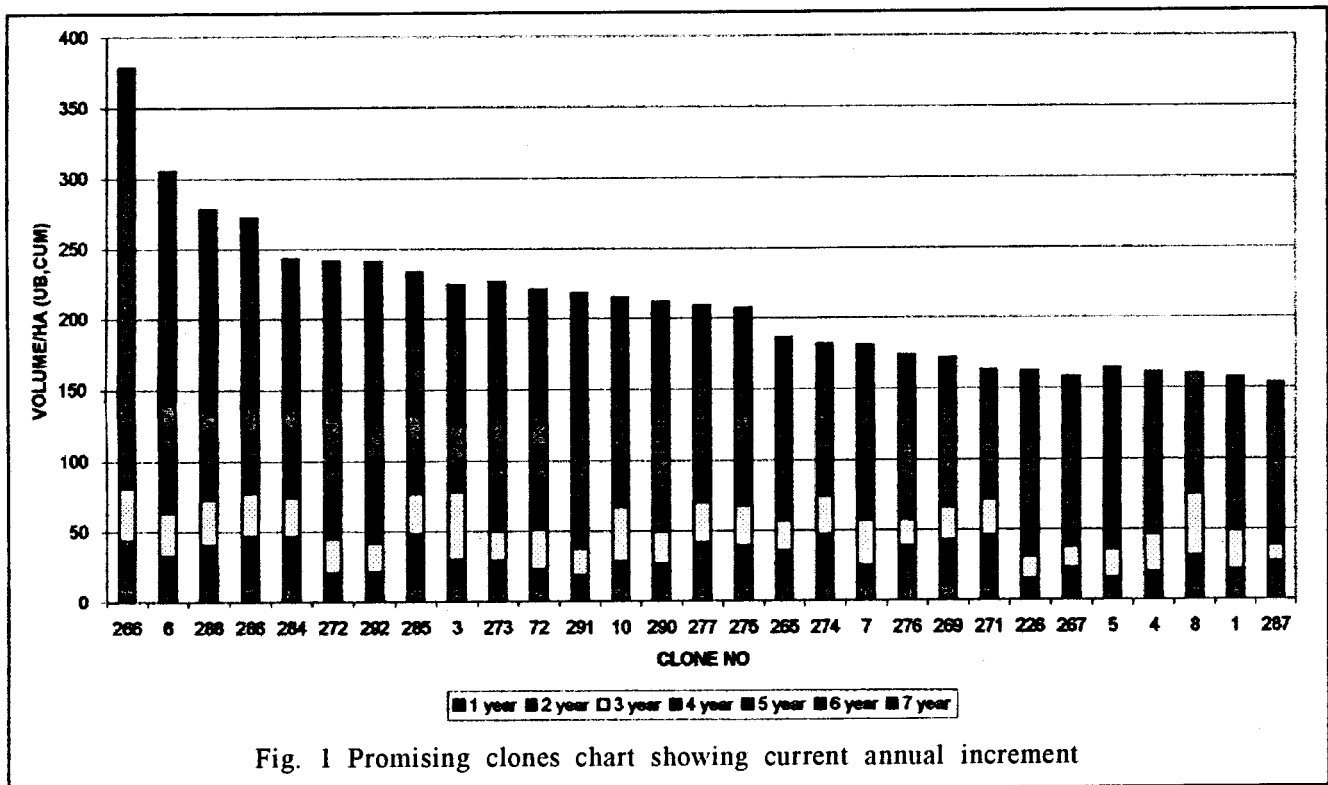


Fig. 1 Promising clones chart showing current annual increment

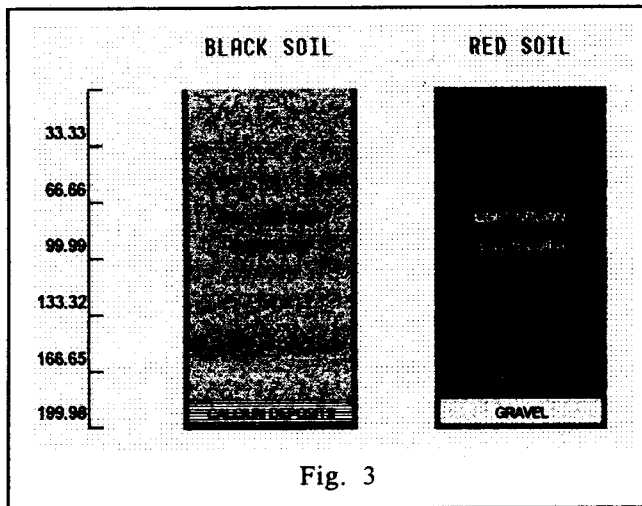


Fig. 3

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 1,66,200 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

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