Tropical Hard-Woods of Rampa Tract in Andhra Pradesh as Pulp-Woods for Paper Industry

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The paper and the allied products have become one of the important and necessary items in the modern living. In fact quantity of consumption of paper by a country is often taken as the direct index of the advancement of the civilization of that country. The rapid increase of education in India and industrialization of the country has increased the demand for paper and pulp. At present per capita consumption of paper is estimated to be 1.5 to 1.7 Kg and it is expected to increase to 2.5 Kg by 1975. Accordingly India's current rate of consumption of eight lakh tonnes is likely to increase 15 to 16 lakh tonnes, i.e., the demand is likely to double within a period of 5 to 6 years. These inferences are made in V. Podder's report on Paper and Pulp Industry in India.

At present bamboo and grasses are the chief conventional material for the manufacture of paper. But their availability in the country is limited and not sufficient for stepping up production of paper to meet the anticipated increase of future demand. Therefore, every paper manufacturing unit in India is looking for the alternate raw material for manufacturing paper pulp. Tropical hard-woods appear to be next best substitute in spite of the disadvantages they are associated with for using them as raw material in paper manufacture.

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In Andhra Pradesh, the Andhra Pradesh Paper Mills has a capacity of 100 tonnes of paper production per day and it is dependent on the bamboo available in the forests of Coastal and Rayalaseema districts of the State. The mill has got an expansion programme to double the capacity. Therefore, the mill is installing a plant to utilize locally available tropical hard-woods for pulping under cold-soda process which is reputed to be one of the high yielding process. The mill expects its entire requirement of raw material estimated to be 90,000 m^3 from the Rampa agency forests which are located within 100 Km. radius.

Rampa tract in Eastern ghats of Andhra Pradesh is rich in Forest resources and the forests are well stocked. This tract is situated between 17° to 18° north latitude and 81° 30' to 82° 30' east longitude and extends over Yellavaram and Rampachodavaram taluks of East Godavari District. The forest of this region form industrial catchment with its focal point at Rajahmundry. Until very recently Rampa tract was land locked because of hilly and undulating terrain with inhospitable environment. Therefore, these forests were unexploited and are well preserved.

The total area of the Rampa tract is 1,500 Sq. Miles consisting of more than 2,00,000 hectares of well stocked high forests. In the past the forests were ridden with ownership rights of local tribals and administered under very obsolete and anochronistic, Muthadary system which was in vogue till last year. The forests were acquired by the Government long back by paying compensation to the tribals and they were brought under the control of forest department only during last decade. Under last two Five Year Plans communications were improved by laying of roads and hence large forest areas are opened up for exploitation. Still large areas are in-accessible for want of proper communications and require development for exploitation of forest produce.

The Rampa forests are expected to meet the local needs of the population for fuel, timber for agriculture and house-building. The population of the district is estimated to be 30 lakhs by 1970 and the forest produce from nearly 1.5 lakh hectares of Rampa is needed for meeting the requirements of the local people. Still 50,000 hectares of forest will be available as surplus and ways and means of utilizing this produce is to be found out.

The forests of Rampa consist of tropical miscellaneous forests with inferior quality timber content. Transportation of this produce over long distances to meet the demands of far-of metropolitan places is costly and un-economic. Therefore utilization of standing produce of forest area of 50,000 hectares is somewhat problematic. This can be solved by undertaking supply of tropical pulp woods for the paper mills at Rajahmundry.

The following 34 tree species comprise the bulk of standing

forest. (1) their order of abundance of each species and its approximate contents as evaluated from random sample enumeration in a patch of 1600 hect., and statistical analysis at Forest Research Institute is found out is given in the following table. The following table gives clear quantitative picture of the composition and content of the Rampa forests.

Examination of the table reveals that 16 species comprises of nearly 80 per cent of the standing forest.

The average standing volume of wood in the form of timber, pulp wood and fuel in estimated by the central zone of Pro-investment Survey (in their preliminary estimates) to be 80 to 100 Cu. m. per hectare. But well stocked forest patches are found to contain as much as 180 to 200 Cu.m. per hectare. This volume on average comprises of 17 Cu. ms. of timber, 75 Cu.m. of pulp woods and 30 to 50 cu.m. of fuel. The availability of tropical pulp woods from Kota area is estimated to be 15,00,000 cu. m. The total available pulp woods, is 37,50,000 Cu.ms. in surplus forest of 50,000 hectares.

The local paper mill proposes to use tropical pulp woods for manufacture of paper at the rate of 90,000 C.m. per annum. Therefore the available resources can sustain the supplies for 17 years and at any cost not more than 20 years.

Sl. No.	Name of the Species.	Over 120 Cm.G.H. Percentage of occurrance.	Over 120 Cm.G.H. Mean No. of tree per Hec.	Below 120 Cm.G.H. Mean No. of tree per Hec.	Below 120 Cm.G.H. Standard error.
1	2	3	4	5	6
1.	Xylia xylocarpa.	21.6	1.83	42.89	12.77
2.	Terminalia tomentosa.	16.25	3.68	29.82	9.86
3.	Miscellaneous.	10.39	0.53	20.66	9.88
4.	Anogeissus latifolia.	9.75	1.17	18.14	14.78
5.	Dillenia pentagyna.	5.97	0.72	12.22	9.36
6.	Protium serratum.	4.87	0.28	7.66	18.71
7.	Garuga pinneta.	4.45	1.30	7.60	22.44
8.	Pterocarpus marsupium.	3.85	1.30	6.40	20.66
9.	Adina cardifolia.	2.90	1.77	4.05	18.29
10.	Lagerstroemia parviflora.	2.77	0.74	4.80	17.78
11.	Grewia telifolia.	2.56	0.10	5.01	12.50
12.	Ougeinia dalbugioides.	1.88	0.31	3.44	26.26
13.	Schleichera trijuga.	1.81	1.11	2.51	18.23
14.	Sygygum cuminii.	1.91	0.66	1.71	23.91
15.	Diospyros melanoxyian.	1.23	0.06	3.39	27.40
16.	Mangifera indica.	1.13	0.93	1.33	—
17.	Kydia calycina.	1.04	0.19	1.89	24.84
18.	Shrebera swieteniodes.	0.9	0.10	1 .71	24.64
19.	Hymenodictyon excelsum.	0.86	0.25	1.41	—
20.	Dalbergia latifolia.	0.64	0.16	1.11	—
21.	Terminalia belerica.	0.55	0.10	0.99	—
22.	Bombax malabarium.	0.53	0.41	0.66	—
23.	Lennia grandis.	0.45	..	0.90	—
24.	Madhuca latifolia.	0.4	0.06	0.74	—
25.	Terminalia chebula.	0.33	—	0.66	—
26.	Gamelinia arborea.	0.31	0.04	0.59	—
27.	Bridelia retusa.	0.24	0.04	0.43	—
28.	Vitex altissima.	0.18	0.25	0.10	—
29.	Mitragyma parviflora.	0.16	0.16	0.16	—
30.	Albizzia stipulata	0.05	0.10	..	—
31.	Zanthoxylam rhetsa.	0.02	..	0.04	—
32.	Soymidxa fabrifuga.	0.02	—	0.04	—
33.	Ghloroxylon swietenia.	—	—	—	—

The remaining 30,000 hectares of surplus forests needs large investment for opening up and development of the area to exploit the standing produce. The cost of exploitation of the produce may also be higher and un-economic under present circumstances because of longer leads to the present consuming centre.

It may not be economically feasible unless the consumption centres are brought nearer to the areas of availability.

The cost of exploitation of pulp wood from the exploitable zones works out to Rs. 30 per tonne and it includes cost of felling, debarking, conversion and transport to the mill site. Even when suitable royalties are paid to the Government the cost of raw material at mill site will not be more than Rs. 50 per tonne. This is much cheaper than the average cost of procuring bamboo for paper manufacture.

The available 20,000 hectares of forest will not sustain supplies of raw material for more than 2 decades. The future supplies are to be ensured by raising pulp wood plantations in the same areas from where hard-woods are exploited.

Raising of large scale plantations for Industrial purpose requires thorough knowledge and study of climotological, pedological, and ecological factors of the sites where the plantations are proposed to be raised. Further the species selected for pulp wood plantations must be able to supply the required raw material within 10 years time as it will take nearly 5 years to systematically plan and raise this plantations. Out of the 20,000 hectares of forest area from where the pulp woods are proposed for extraction nearly 10,000 hecatres of area which is suitable for raising pulp wood plantations may be available The exact estimate of the plantable area can be determined after carrying out a detailed soil and productivity survey of the available areas

The hard-wood forest were not subjected to scientific forest management and plantations of any type were not raised in this area. Therefore, it is difficult to predict what type of pulp wood plantations can be raised and how much quantity can be produced for unit area, and at what cost

Study of locality factors of the available Rampa forests from scientific angle throws some light on this problem. The tract is hilly and undulating terrain, the soils are fairly well developed latsols, which are formed out of local geological formations of Khandalites, granitic gnisses, and other aercheon rocks. The steep slopes and hill tops have shallow and skeletol soils. The tract comes under the catchment of Yeleru river. The drainage is good. The climate is tropical monsoon type with annual average rainfall of 155 cms. which is received from July to October with few pre-monsoon showers and scanty winter rainfall. The temperatures are equitable and never go to extremes either in summer or in winter. The moisture is available for major portion of the year (10 months) as inferred from the perenniality of local streams and hence the vegetative growth period is more than 9 months.

Physiologically plant growth occurs by absorption of solar energy, utilisation of soil moisture, plant nutrients and carbon dioxide.(2) In tropical zone: places in the latitude of 18°N. receive 99 K.cal/cms^2. of Solar energy per every growing season. Out of this not more than 5 per cent Cms. is photo-chemically active. Therefore the energy getting fixed up annually resulting in plant growth is 5 x 100 x 100 x 10,000 K. cal per hect. (3) On an average 5,000 K. cal are required for formation of 1 Kg. of vegetative matter. This is just enough to produce vegetative matter of 1,00,000 Kg. (100 tonnes). But in tropical forest 75 per cent of this is respired away. Therefore net production is 25,000 Kg. (4) This comprises of 10,500 Kg. of green parts nearly 40 per cent which are to be replaced every year 5,000 Kg. of roots etc. 20 per cent, which are not recoverable. The remaining recoverable portion is 10,000 Kg. or 15 cu.m. This is a very reasonable estimate of annual growth of wood in this forest. These figures will be applicable if the forest is grown on short rotation keeping up the juvanility of forest when the rate of growth is highest. If the crop is allowed to grow for more than 10 years the growth rate falls due to aging effect or oldness setting in the plants. Thus the productive capacity of this area in term of wood is 10 tonnes per Hec. If plants like Eucalyptus and conifers which do not waste much productive capacity of the site on formation of leaf and other irrecoverable deciduous parts are grown, the productive capacity may go up by at least 50 per cent i.e., upto 15 tonnes per hectare.

The above productivity -can be achieved if the soil plant nutrients and water are not limiting factors. In Rampa forests the average annual rain fall is 155 Cms, out of which 55 Cms. is estimated to go away as annual run off (surface and underground) (3). The remaining moisture for plant growth is 100 cms. and it works out to 10,000 tonnes per hectare. The average moisture requirement for vegetative growth is 400 Kg. per 1 kg. of net vegetative growth. This gives posibility of forming 25,000 Kg. of vegetative matter in the plants. Therefore, water also will not be limiting factor of the productive capacity of the site.

Similarly the soils and the plant nutrients in the zone can not be limiting because soils are well developed and total consumption of plant nutrients (minerals) is estimated to be not more than 700 Kg./Hec. (at 7 per cent) and in a rotation it works out to 7 tonnes for 100 tonnes of wood produced and removed. The remaining nutrients which are cycling in vegetative growth return to soil by decay.

Therefore the scientific consideration of the locality factors of Rampa forests indicate productive capacity of 10 tonnes of pulp wood per hectare per annum. This is achievable limit of wood production by artificial planting of fairly fast growing species and utilizing the existing environmental factors like rainfall, solar energy and plant nutrients in the soil. Only thing is selection of suitable species which are inherently fast growers and which respond well to the existing environment and grow with certainty, are to be judiciously decided. The species like Eucalyptus teresti-cornis and E. grandis are reported to be fast growers, and they come up well in the environment similar to Rampa forests and known to produce estimated quantity of 10 tonnes

pulp wood per hectare per annum. Other species which are expected to grow are carayapappaya and tropical pines. The former species grow well in moist forest, and it attains maturity within 4 or 5 years and hence can be worked in shortest possible rotation of 4 or 5 years. It is an accepted and conventional raw material for paper pulp. It does not coppice but can be easily regenerated by natural or artificial regeneration as it comes up profusely even by sowing of seed.

Cost of production: In the sites with productive capacity of 10 tonnes of pulp wood/hec. the cost of production by raising any suitable species like Eucalyptus is calculated as follows:

1.	Cost of raising plantation including nursery and subsequent maintenance at the prevailing cost of labour and material	Rs. 1,000 Hec.
2.	Cost of establishment for raising maintenance and supervising harvesting.	Rs. 100
3.	Rental value of the land devoted for pulp wood plantation at Rs. 25/Hec/annum for 30 years capitalised to present Value at 7 per cent interest.	Rs. 500
	Total	Rs. 1,600

If the plantation is worked on ten years rotation of coppicing and expected to produce 3 coppicing and expected to produce 3 copice rotation, the total quantity of produce obtained works out to 10 x 30 = 300 tonnes/hec. If the investment is capitalised lised at 7 per cent interest after first 10 years rotation 1/3 investment is to be recovered back) the total value grows nearly to Rs. 6,200 (approximate figure).

Therefore, the cost of production is Rs. 21/tonne. The cost of production will be much higher if the investment is done at current bank rate of interest (12 per cent).

The cost of production can be reduced further by taking higher productive sites, development of still fast growing hybrid species, application of fertilizers and irrigation etc. Thus the cost of production could be reduced to Rs. 15/tonne by systematic research but capital investment will be higher.

The cost of production in poor sites with low rainful of below 80 Cms. and degraded soils is quite high. One of the existing 10 year old plantations of 16 hectares on such poor sites is estimated to produce 500 tonnes. The cost of production works out to Rs. 45/tonne. But the high cost of production is off set by the shortest lead resulting in low cost of exploitation and transport which is not more than Rs. 10 per tonne. Therefore, the cost of material at mill site will be Rs. 50 for the produce from such poor but nearer sites also. The cost can also be brought down by adopting agro-silvicultural method of raising pulp wood plantation but productivity of pulp wood has to be sacrificed to some extent.

The Indian Paper Mill Industry which is reputed for its high cost of production of paper can not afford to pay higher cost for its raw material. Therefore production of raw material is to be subsidized, and ways and means of doing is to be found out. The cost structure of paper production shows that the cost of raw material for producing one tonne of paper is Rs. 13 to 15 and Rs. 150/- to 200/- is realised as other taxes like excise, sales tax etc. And more than equal amount or even more is appropriated as profit by producers and distributors. To ensure such future income to the State and Industry a portion of this income has to be diverted to subsidise the cost of production of raw material for the manufacture of paper. This course of action will enable production of paper without any increase in the cost of production which is already high in the international market.

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