

# Cultivation potentiality of certain fastgrowing plants and their suitability in Indian paper industry

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## ABSTRACT

Quite a few number of perennial fastgrowing plants have significant potentiality for commercial cultivation to use as raw material for pulp and paper industry in regards to the yield of biomass, pulp and paper making quality. Studies were made on some of the fastgrowing plants like *Populus deltoides*, *Eucalyptus species*, *Gmelina arborea*, *Acacia auriculiformis*, *Leucaena leucocephala*, *Azadirachta indica* and *Indigofera teysmanii* cultivated under the agroclimatic conditions of Jorhat. The results revealed that these plants produce comparatively higher optimum biomass alongwith acceptable Pulp characteristics. Papers made from such pulp showed standard quality and these plants have good potentiality to be used as alternate raw material for pulp and paper industry.

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## INTRODUCTION :

A forestation plays a vital role not only in maintaining ecological balance of the globe but also provides raw materials to forest based industries. Pulp and Paper industry is the highest consumer of forest and agricultural resources.

Amongst the common cellulosic raw materials used in pulp and paper industry, bamboo alone constitutes 60% of the total consumption. Hence, the demand of bamboo has gone up quite considerably during last three decades and the demand is presently met from natural bamboo forests. The bamboo forests of the country, therefore are shrinking day by day and it is predicted that the coming decades will face a serious raw material crisis, unless a planned and scientific cultivation of fast growing plants is maintained. A number of workers have studied with fastgrowing plants under different climatic conditions for production of higher biomass<sup>1-4</sup>. The potentiality of some fastgrowing plants to use as raw material for paper industry has also been studied<sup>5-7</sup>.

A detailed study was made at Regional Research Laboratory, Jorhat, Assam on cultivation potentiality of certain fastgrowing plants for development of new fibre resources for pulp and paper industry. The following plants were taken up for the study.

1. *Populus deltoides* (Poplar)
2. *Eucalyptus* (E.hybrid)
3. *Gmelina arborea* (Gomari)
4. *Acacia auriculiformis*
5. *Leucaena leucocephala*
6. *Azadirachta iudica* (Neem)
7. *Indigofera teysmanii* (Neel)

## EXPERIMENTAL :

All the above plants were introduced at the experimental farm of RRL, Jorhat and studies were made on biomass production and pulp and paper making chara-

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cteristics under the agroclimatic condition of Jorhat, Assam.

Plants were spaced at 100 × 100 cm and an uniform dose of N, P and K @ 200, 50 and 50 kg/ha were applied. Plantation was done on 15th April, 1986 and maintained for 5 years. Data were recorded on completion of 5 years on plant height, diameter, green arial yield of biomass per plant and calculated yield of pulpable biomass per hectare (Table-1).

Among the seven plant species, maximum biomass yield was recorded in Poplar (251.186 t/ha) followed by *A. auriculiformis* (226.860 t/ha) *A. indica* (179.900 t/ha), *G. arborea* (155.040 t/ha), *I. teysmanii* (152.750

t/ha), *E. hybrid* (116.800 t/ha) and *L. leucocephala* (95.080 t/ha). Though the yield of pulpable biomass was different for different species, harvesting can be made to use these plant biomass for production of pulp.

#### Studies on Pulp and Paper Making Characteristics :

Wood samples of five years old plants were collected from the experimental farm and subjected to proximate chemical analysis, pulp and paper making characteristics and fibre dimension, recorded in Table—2, 3 and 4 respectively, adopting standard procedures.

Table—1  
Growth and yield of certain fast growing plants at the age of 5 years.

Sl. No.	Species	Plant Height (m)	Diameter at Breast Height (cm)	Pulpable green biomass kg/plant	Moisture %	Pulpable dry biomass (t/ha)
1.	<i>Populus deltoides</i>	11.805	16.4	46.516	46.2	251.186
2.	<i>Eucalyptus hybrid</i>	7.260	9.3	22.250	47.5	116.800
3.	<i>Gmelina arborea</i>	6.150	13.8	28.710	46.0	155.040
4.	<i>Acacia auriculiformis</i>	9.850	12.0	41.550	45.4	226.860
5.	<i>Leucaena leucocephala</i>	6.800	10.1	15.900	40.2	95.080
6.	<i>Azadirachta indica</i>	7.500	7.9	34.600	48.0	179.900
7.	<i>Indigofera teysmanii</i>	5.950	8.8	29.950	48.0	152.750

Table—2  
Proximate analysis of certain fastgrowing plants (5 years old)

Sl. No.	Species	Ash %	Cold water solubility %	Hot water solubility %	1% NaOH solubility %	Alcohol Benzene solubility %	Lignin %	Pentosan %	Cellulose %
1.	<i>Populus deltoides</i>	1.00	3.82	6.10	21.55	2.77	25.00	18.02	58.43
2.	<i>Eucalyptus hybrid</i>	0.80	2.92	10.88	19.00	2.00	24.95	14.22	54.00
3.	<i>Gmelina arborea</i>	0.95	3.98	6.40	18.93	3.88	25.35	15.12	57.00
4.	<i>Acacia auriculiformis</i>	1.28	4.38	8.00	17.25	5.25	22.00	17.12	55.00
5.	<i>Leucaena leucocephala</i>	0.81	1.27	3.20	16.35	1.95	24.00	16.02	55.03
6.	<i>Azadirachta indica</i>	0.93	2.82	6.45	18.98	3.20	21.12	17.10	54.42
7.	<i>Indigofera teysmanii</i>	0.90	3.70	9.25	34.68	5.85	21.55	16.41	52.50

**Table — 3**  
**Pulp yield and physical Strength Properties**

Sl. No.	Species	Unbleached					Bleached					
		Pulp yield %	Burst factor	Tear factor	Breaking length (m)	Folding Endu- rance DF	Pulp yield %	Burst factor	Tear factor	Breaking length (m)	Folding Endu- rance DF	Bright- ness %
1.	<i>Populus deltoides</i>	48.2	55	85	6310	500+	42.5	37	50	4215	70	72
2.	<i>Eucalyptus hybrid</i>	45.8	42	80	5952	77	39.0	34	61	3820	37	76
3.	<i>Gmelina arborea</i>	50.9	55	85	6310	500+	46.0	37	50	4215	70	73
4.	<i>Acacia auriculiformis</i>	50.5	37	90	5590	68	42.7	26	57	4022	31	65
5.	<i>Leucaena leucocephala</i>	50.2	50	85	5330	277	43.0	32	60	4055	76	76
6.	<i>Azadirachta indica</i>	46.8	36	85	5520	82	41.7	29	52	3800	39	70
7.	<i>Indigofera teysmanii</i>	46.9	34	85	5582	68	41.2	27	52	3970	35	71

Active alkali, %	19	Bleaching sequence	H/EH	E. Stage (i) Consistency %	10
Sulphidity, %	25	H-Stage (i) Consistency, %	10		
Cooking Temp, °C	165 ± 2	(ii) Temp. °C	30	(ii) Temp °C	60
Cooking time at Maximum temp.	3 hr. + 1 hr to raise the temp.	(iii) Time Minutes	120	(iii) Time minutes	60

**Table — 4**  
**FIBRE DIMENSIONS**

Sl. No.	Species	Length (mm)			Diameter (micron)		
		Maximum	Minimum	Average	Maximum	Minimum	Average
1.	<i>Populus deltoides</i>	1.55	0.44	1.02	25.0	15.0	21.5
2.	<i>Eucalyptus hybrid</i>	1.21	0.45	0.87	21.5	9.5	18.0
3.	<i>Gmelina arborea</i>	1.20	0.45	0.95	25.0	10.0	22.0
4.	<i>Acacia auriculiformis</i>	1.35	0.45	0.99	19.2	9.0	17.8
5.	<i>Leucaena leucocephala</i>	1.97	0.45	1.20	22.2	10.0	21.7
6.	<i>Azadirachta indica</i>	1.29	0.45	0.97	21.0	12.7	17.5
7.	<i>Indigofera teysmanii</i>	1.58	0.44	0.85	17.5	13.0	15.5

**RESULTS AND DISCUSSION :**

The plants like *Populus deltoides*, *Eucalyptus*, *Gmelina arborea*, *Acacia auriculiformis*, *Leucaena leucocephala*, *Azadirachta indica* and *Indigofera teysmani* have got high potentiality for utilization in Pulp and paper industry as alternative source of raw materials. They yield comparatively higher biomass within a short span of 4-5 years which is an important factor for com-

mercial plantation of fibre crops to use as a raw material for pulp and paper industry. Their wood properties like density, cellulose content, colour etc. were found suitable for making high quality of pulp for manufacture of writing, printing and some other grades of speciality papers.

Organised cultivation of these plant species in large scale, may become a potential source of alternate

fibre to help meet the future demand of cellulosic raw materials in Indian pulp and paper industry particularly for the paper mills in North East India.

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