Pulping Studies on Fast Growing, Young Trees Part III *Melia azedarach*

J. S. Chawla
G. Shanker
A. N. Sharma
A. K. Dutt

This paper reports the results of investigation on the growth rate, fibre measurements and pulping characteristics of 1½ year old, fast growing, young trees of **Melia azedarach**. *In 1½ year, young trees of* **Mlia azedarach** *attained heights ranging from 5 to 6 metres. The mean girth and diameter of the main stems were 27.5 cm and 8.0 cm respectively. The isolated fibres measured 400–1040 micron long and 4–24 micron broad.*

Chemical pulps with 20% total chemicals yielded 48% unbleached pulp. The alpha cellulose content was 43.7%. Hand sheets of unbleached pulps after 15 minutes beating to 27°SR were found to have a breaking length of 4150 metres. Permanganate number of sulphate pulps was 11.4.

The above data indicated that **Melia hzedarach** *is a very fast growing species and its young trees can yield pulp of suitable quality for paper production.*

Introduction

The shortages of cellulosic raw materials have created problems for the fast expanding pulp and paper industries. Among the various methods adopted to meet the situation, the one of raising industrial plantations of fast growing hard- and soft-wood species is gaining ground. However, the availability of mature wood from these plantations also take quite sometime. Under the present acute shortages of raw materials, the pulp and paper industries are in no position to wait for several years till the wood from the industrial plantations are ready for harvest. As early as 1916, Mathey put forward the idea of pulping the wood of immature eucalypts, as Vidal had already experimented on young trees of *Eucalyptus globulus* with promising results (Penfold, 1961). Scaramuzzi (1961) pointed out that 5 year old *E. viminalis* has a lower wall thickness/lumen diameter ratio than 15 year old wood; he also suggested the use of young trees. Annonymous (1970-71) pointed that the pulp from the young *E. sieberiana* trees has high strength properties. Chawla et al (1973, 1974) working on young trees of *E. citriodora*, *E. sieberiana* and *E. robusta* confirmed that the wood of these young trees produce pulps suitable for paper production. This prompted the authors to undertake the present investigation on the young trees of *Melia azedarach* with a view to find out if they could be exploited for the paper pulp production.

J. S. Chawla, G. Shanker, A. N. Sharma, and A. K. Dutt
Regional Research Laboratory. Jammu-Tawi.

Experimental plantations

Melia azedarach is often cultivated in the plains as an ornamental and avenue tree; it is also grown sometimes as a shade tree in coffee and tea plantations (Annonymous, 1972). *Melia azedarach* stands coppicing well. It also stands dry conditions for pretty long time.

Experimental plantations of *Melia azedarach* has been raised in our experimental fields in Jammu from seeds sown in nursery beds in April. The seeds took a rather longer time to germinate, but once germinated they grew to the heights of 15-20 cm in a month's time. With the onset of the first rains in July, the saplings were transplanted in pits already dug up for the purpose, at a distance of 2×2 metres. The saplings established themselves in about a fortnight and in another fortnight new flushes of leaves started appearing on them. In a year's time, they

grew to the heights of 3.5–4.0 metrers in another six months. the trees attained heights, ranging from 5 to 6 metres, when they were harvested for pulping studies. The mean girth of 1½ year old stems was 18 cm at the ground level, 14 cm at the breast level and 10 cm at the top. Accordingly, the mean diameters were 5.75 cm, 4.25 cm and 3.25 cm respectively. The dry weight of the individual trees ranged from 2.0-2.5 kg.

Physical examination

Physical characteristics of 1½ year old wood of *Melia azedarach* are given in Table 1.

Chemical Examination

The woody material was chemically examined according to Tappi procedures for extractives, alpha cellulose, holo cellulose, pentosans and lignins. The results of the proximate chemical analysis of the wood are given in Table 2.

Preparation of sulphate pulp

Sulphate pulp of the wood was prepared using the experimental conditions given in Table 3. The unbleached sulphate pulp was obtained by cooking the chips in a 1 litre capacity vertical laboratory autoclave by the usual procedure using 20% of the total chemicals (NaoH : Na_2S=3:1) at a temperature of 160°C for 4 hours keeping the material liquor ratio 1:9. The maximum temperature was reached in a period of about 45-55 minutes. After the cooking, the pulp was thoroughly washed with ordinary tap water on a 60 mesh screen and a portion of the pulp was oven dried to calculate the yield. Results of analysis of the unbleached sulphate pulp are given in Table 4. Circular hand sheets of paper from unbleached pulp were prepared on the laboratory sheet forming machine after beating the pulp in the laboratory ball mill and the paper sheets were tested for strength characteristics. Results of evalution of hand sheets from unbleached sulphate pulp are given in Table 5.

Table No. 1—Physical characteristics of *M. azedarach* wood

Total weight of wood (green)	2.55 kg
Total weight of wood (O.D. basis)	2.29 kg
Bulk density of the wood (O. D. basis)	0.20 g/cm³
Moisture content of the wood	10.0 %

Table No. 2—Proximate chemical analysis of *M. azedarach* wood (on oven dry basis)

	%
Ether extractive	0.63
Alcohol Benzene extractive (1:2 Vol.)	1.60
Hot Water extractive	8.70
Pentosans	19.80
Lignin*	18.70
Holocellulose*	82.50
Alphacellulose*	43.70

*Chlculated on extractive free basis.

Table No. 3—Conditions of sulphate pulping of *M. azedarach* wood

Chemicals (NaOH : Na_2S in 3 : 1)	20%
Solid : Liquid ratio	1 : 9
Temperature	160°C
Time of cooking	4 hrs.
Yield of unbleached pulp	48.0%

Fibre dimension measurements

A small representative sample of the sulphate cooked pulp was taken for the measurement of fibre dimensions using Visopan projection microscope. The fibre dimension measurements are given in Table 6.

Discussion

The very fast growing nature of *M. azedarach* trees and the ease with which its trial plantations were raised, coupled with its ability to coppice well makes species suitable for raising industrial plantations for the production of wood.

The proximate chemical analysis of the wood given in Table 2 indicates that the alphacellulose content of 43.7% is as high as in any other mature hardwood and at the same time the percentage of lignin and extractives is fairly low. The yield of unbleached pulp obtained by the sulphate cooking process was 48.0% as given in Table 3. The pulp obtained by sulphate cooking was chemically analysed and the results are given in Table 4. The alphacellulose content was 63.1% whereas the permanganate number was 11.40.

Hand sheets of *Melia azedarach* unbleached pulp after 15 minutes of beating recorded freeness of 27°SR and breaking length of 4150 meters and burst factor 16.0 as given in Table 5.

The data obtained from the young *Melia azedarach* trees indicate that suitable pulp could be obtained from it for paper.

Table No. 4—Analysis of unbleached sulphate pulp of *M. azedarach* wood

Permanganate Number	11.04
Lignin	6.80 %
Pentosans	13.2 %
Holocellulose	91.6 %
Alphacellulose	63.1 %

Table No 5—Strength characteristics of handsheets from unbleached sulphate pulp of *M. azedarach* wood

Freeness (Before beating) SR°	17
Beating time (min).	15
Freeness (after beating) SR°	27
Breaking length (Metres)	1450
Stretch %	2.20
Folding (double folds)	17.0
Burst factor	16.0

Table No. 6—Fibre dimensions of *M. azedarach* pulp

Fibre length (microns)			Fibre width (microns)			B/A ratio
Max.	Min.	Average (B)	Max.	Min.	Average (A)	
1040	400	670	24.0	4.0	15.0	44.7

Fibre length range of 100 fibres			Fibre width range of 100 fibres		
400–500	microns	= 8	4–8	microns	= 17
501–700	,,	= 58	8.1–12	,,	= 26
701–900	,,	= 21	12.1–16	,,	= 32
901–1040	,,	= 13	20.1–24	,,	= 15
			16.1–20	,,	= 10

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