

**A REVIEW OF THE SUITABILITY OF SOME COMMONLY OCCURRING
GRASSES OF U.P. FOR THE PRODUCTION OF
BLEACHABLE-GRADE PULPS**

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Introduction

Grasses have been used for papermaking since ancient times. However, with the exception of sabai grass, no other grass has been commercially used for papermaking in India. There are several reasons for this. Although the chemical composition and morphological characteristics of several grass species have established their suitability for papermaking, but the commercial use of individual grass species could not be implemented in the paper mills since the grass species generally occur in mixture and extraction of single species is uneconomical. Keeping this in view investigations on mixtures of grasses were carried out and several mixtures were found suitable for papermaking.

This paper deals with the results of investigations carried out at Forest Research Institute, Dehra Dun and provides a comparative data on the chemical composition, fibre dimensions and papermaking characteristics of some commonly occurring grasses of U.P.

Investigations carried out at F.R.I. on grasses grown in U.P.

Considerable work on the utilization of forest grasses for papermaking has been

carried out. The list of common grass species found suitable (Bhat and Roy, 1952; Bhat and Karnik, 1952; Bhat and Virmani, 1952; Bhat and Jaspal, 1959; Anon, 1958; Bhat *et al.*, 1960) for papermaking along with their local names and distribution has been given in Table 1.

The proximate chemical analysis and average fibre dimensions of above grasses have been recorded in Table 2.

The results recorded in Table 2 indicate that the chemical composition of all the grasses is in general comparable with sabai grass. As expected, ash content is higher in all the grasses (4.8% to 7.5%) except in *S. munja* (2.3%) and *P. karka* (3.09%). Cellulose, lignin and pentosan contents vary from 45.8% to 58.2%, 20.5% to 31.4% and 16.9% to 25.4% respectively. In case of sabai grass the values are 54.5%, 22% and 23.9% respectively. This indicates that all the grasses can be considered, as potential raw materials for papermaking.

The fibre length of the grasses at Sl. Nos. 4-7 (Table 2) is shorter than sabai grass and varies from 1.10 mm to 1.26 mm. However, the fibre length of *T. arundinacea* (2.88 mm) and *S. munja* (2.06 mm) is comparable with sabai grass (2.08 mm).

Table 1*List of grass species found suitable for writing/printing papers*

Botanical name of species	Local Name	Distribution
<i>Eulaliopsis binata</i>	Sabai, Bhabar	Dehradun, Jaunsar, Garhwal, Nainital, Kheri, Haldwani, Saharanpur.
<i>Themeda arundinacea</i>	Ulla, Sarkhara	Jaunsar, Mussoorie, Dehradun, Kheri, Lansdown.
<i>Saccharum munja</i>	Munj, Seritha, Patwar, Kana	Dehradun, Kheri, Saharanpur, Gonda, Pilibhit.
<i>Heteropogon contortus</i>	Kusal, Kuneria, Shora, Sarwala	All over U.P.
<i>Vetiveria zizanioides</i>	Pani, Seenk	Dehradun, Gonda, Kheri, Ramnagar, Etawah, Pilibhit, Gorakhpur.
<i>Phragmites karka</i>	Bansi	Dehradun, Pilibhit, Saharanpur.
<i>Imperata cylindrica</i> *	Siru; Sirhu	Jaunsar, Gonda, Dehradun, Kheri, Ramnagar, North Garhwal, Saharanpur.
<i>Saccharum spontaneum</i> *	Kans, Khus, Khagar	Mussoorie, Dehradun, Kheri, Ramnagar, Bahraich, Ranikhet.

* Used in mixture with other grasses

Table 2*Fibre dimensions and proximate chemical analysis of grasses*

Botanical name of species	Average fibre length (mm)	Average fibre diameter (mm)	Ash (%)	Cellulose (%)	Lignin (%)	Pentosans (%)
<i>Eulaliopsis binata</i>	2.08	0.009	6.0	54.5	22.0	23.9
<i>Themeda arundinacea</i>	2.88	0.016	7.4	54.5	31.4	22.0
<i>Saccharum munja</i>	2.06	0.015	2.3	58.2	20.5	23.7
<i>Heteropogon contortus</i>	1.10	0.010	7.5	52.1	27.3	16.9
<i>Vetiveria zizanioides</i>	1.20	0.008	5.7	45.8	25.8	25.5
<i>Phragmites karka</i>	1.20	0.011	3.09	55.2	25.7	22.4
<i>Imperata cylindrica</i>	1.26	0.010	4.8	50.1	24.3	19.5

Laboratory Pulping

Grasses were pulped by the soda process under varying conditions of temperature, time and concentration of chemicals. Bleaching of the pulps was carried out in single stage using calcium hypochlorite. The sheets were conditioned at 65 per cent R.H. and 25°C temperature and tested for their strength properties and brightness. The digestion conditions, bleached pulp yield and physical strength properties of paper are recorded in Table 3. The results recorded

in Table 3 indicate that bleached pulps in satisfactory yield (31.7% to 48.2%) could be obtained from most of the grasses as compared to sabai grass (40.9% yield). The physical strength properties of the grasses are in general reasonably good though lower in some properties than sabai grass. Breaking length, tear factor and burst factor of grasses varies from 6,330 m to 10,670 m; 65.7 to 86.9 and 36.1 to 54.0 respectively. In case of sabai grass, the values are 9,840 m, 123.0 and 63.9 respectively.

Table 3

Digestion conditions, yield and strength properties of grass pulps for writing/printing paper

Botanical name of species	Total alkali as NaOH (%)	Digestion temperature (°C)	Digestion period (hrs)	Bleached pulp yield (%)	Breaking length (m)	Stretch (%)	Burst factor	Tear factor	Brightness MgO=100
<i>Eulaliopsis binata</i>	17.0	1535		40.9	9840	4.4	63.9	123.0	72
<i>Themeda arundinacea</i>	17.0	142	6	35.8	8090	4.6	48.9	86.9	—
<i>Saccharum munja</i>	19.0	153	6	48.2	6330	—	54.0	69.9	—
<i>Heteropogon contortus</i>	20.0	153	6	31.7	7900	4.9	48.6	74.7	71
<i>Vetiveria zizanioides</i>	17.5	162 for first 2 hrs & 153 for remaining period	5	35.3	10670	3.8	50.7	65.7	—
<i>Phragmites karka</i>	22.0	153	6	40.0	6500	3.8	36.1	76.2	—

Pulping of mixture of grasses

Although on the pilot plant of F.R.I. a few individual grass species have been found suitable for papermaking but, for commercial production, these species are not available in sufficient quantities. Hence, pilot plant investigations (Guha *et al.*, 1964 and 1966) on mixtures of grasses were undertaken and encouraging results were obtained. The results of pilot plant trials obtained from mixtures of U.P. grasses are recorded in Table 4.

From Table 4, it is obvious that though properties of paper prepared from mixture of species are some what inferior to those paper made from single grass species (Table 3); bleached pulps in satisfactory yield and strength properties can be made from mixture of grasses containing *Imperata cylindrica*, *Themeda arundinacea* and *Saccharum spontaneum* obtained from Haldwani, U.P. and mixture of grasses consisting of *Saccharum spontaneum*, *Saccharum munja*, *Imperata cylindrica* and *Vetiveria zizanioides* obtained from Bijnor, U.P.

Table 4

Pilot plant digestions and strength properties of writing/printing paper from mixture of grasses

Composition of grasses	Digestion conditions and yield					Strength properties		
	Total alkali as NaOH (%)	Digestion temp (°C)	Digestion period (hrs)	Bleach consumption as available chlorine (%)	Bleached yield* (%)	Breaking length (m)	Burst factor	Tear factor
(a) <i>Imperata cylindrica</i> } (b) <i>Themeda arundinacea</i> } (c) <i>Saccharum spontaneum</i> }	19	153	6	8	35.6	3880	17.5	70.0
(a) <i>Saccharum spontaneum</i> } (b) <i>Saccharum munja</i> } (c) <i>Imperata cylindrica</i> } (d) <i>Vetiveria zizanioides</i> }	17	153	6	5.6	34.6	4520	19.3	58.5

* The percentage is expressed on the basis of o.d. raw material.

SUMMARY

Investigations carried out at F.R.I. on the production of bleachable grade pulps suitable for cultural papers from some commonly occurring grass species of U.P. have been described. The results have been summarized in terms of chemical composition, fibre dimensions and physical strength properties of pulps under optimum conditions. The results of pilot plant investigations carried out on mixture of grasses suitable for papermaking have also been included.

उत्तर प्रदेश में आमतौर से पाई जाने वाली कुछ घासों से विरजनीय ग्रेड की लुगदी बनाने की उपयुक्तता की समीक्षा

रीता धवन, बी०जी० करीरा व जी०एम० माथुर

सारांश

इस अभिपत्र में उत्तर प्रदेश में आमतौर से पाई जाने वाली कुछ जातियों की घासों से कागज बनाने की उपयुक्त विरजनीय ग्रेड की लुगदी बनाने के वन अनुसंधान संस्थान में किए गए अन्वेषणों का वर्णन दिया गया है। परिणामों को रासायनिक गठन, रेशे की लम्बाई और अनुकूलतम दशाओं में लुगदी का भौतिक शक्ति विशिष्टताओं के रूप में दर्शाया गया है। कागज बनाने के लिए उपयुक्त घासों के मिश्रणों पर किए गए दिग्दर्शी सखन्त्र अन्वेषणों के परिणाम भी इसमें सम्मिलित किए गए हैं।

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