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Sulphate Pulping of Sesbania Grandiflora

Silvicultural Characteristics:

There is a fast growing demand for paper but the available Bamboo supplies have dwindled mainly due to unrestricted exploitation without sufficient attention towards afforestation of this valuable pulping material. But this is a story of the past. Enlightened Managements of large mills and the Forest Departments of some of the States have taken up the problem of afforestation of bamboo forests with all earnestness. Much valuable data is available on bamboo forests and its silviculture.

In raising plantations of bamboo, it has been found necessary to space them 12' to 15' apart and the plants take 4 to 5 years for putting forth clump formation. Both from the use of intensive use of the land and to make the plantations also economical it has been found very convenient to raise these as mixed plantations of the temporary type, using Sesbania species, which has a short life cycle of 3-4 years. The latter species demands light while bamboo can withstand some amount of shade in early stages.

The growth of Sesbania in the soil leaves it richer with nitrates, as this is a small leguminous plant forming symbiotic association with nitrogen soil bacteria on its roots.

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Laboratory experiments conducted on Sesbania Grandiflora grown in the Pilot Plantation area of the Mills by using Sulphate Process are described. The Pulp so produced from the species, blended with long fibred bamboo pulp in suitable proportions shows good strength properties. This species when young can be pulped without debarking. All these investigations reveal that Sesbania grandiflora will be a promising raw material for Paper Industry provided suitable measures are taken immediately to grow this raw material in large tracts.

As the temporary mixture (i.e. Sesbania) will be cropped within about 4 years, the matured bamboo will be free to start clump formation.

This is comparatively light in weight and fast growing having no timber value. The thickness of the bark is said to range between 0.25 to 1.25 cms. Flowering of this species takes place in January-February and the seeds ripen during April-May. Such fast growing species are susceptible to severe insect damage requiring special protection against such insects and diseases. Under suitable soil conditions it grows faster than bamboo; when 2-3 years old it can be pulped without debarking.

Pilot Plantation Trial

A few Plants of Sesbania grandiflora were raised in a small plot inside the Mills premises by direct sowing of seed in worked up patches. The details of Sesbania Grandiflora Plantation undertaken are given below:

1. Locality: Inside the Mills premises of the Mysore Paper Mills—Bhadravati (Southern Rly).
2. Average Rain fall: 33 Inches.
3. Topography: The Plantation area lie between 13°-22' and 14°-7' North latitude

4. Soil:

tude and 75°-25' and 75°-58' East longitudes approximately.

Coarse, mostly the product of decomposition of the Chlorite and other schists consequently shallow and poor. The canopy is more or less completely covered with plenty of grass on the ground.

5. Preparation of Site:

The entire jungle was cleared, grass removed and one foot cube pits were dug up for sowing the seeds.

6. Escapement:

Spacing adopted was 4' x 4'. The Seeds collected from M/s. Andhra Pradesh Paper Mills and M/S. Poocha were sown directly in worked up patches. Weeding and soil working were carried out.

7. Date of

Planting: 31st July 1971.

8. Area under trial:

2-3 acres.

9. Insect Attack:

Attack of green coloured caterpillars

were observed when the plants were 3 months old—later this attack was removed manually.

Soil contains good moisture content and the plants raised under this treatment have in one year attained an average height of 7.3 metres and 5.8 cms. diameter at breast height.

The height and diameter measurements of one year old *Sesbania grandiflora* are given in Table 1.

TABLE 1

Sl. No.	Height in Metres	Average Diameter in cm.	
		At Breast height(135 Cm.above ground level)	Bottom (30 Cm. above gro-und level)
1.	5.4	5.1	6.0
2.	5.8	4.5	10.0
3.	6.7	5.5	6.5
4.	7.4	6.0	6.0
5.	7.4	6.1	6.4
6.	7.7	6.2	7.0
7.	7.5	6.3	7.5
8.	7.9	7.0	9.8
9.	8.4	5.0	9.0
10.	8.9	6.0	9.0

TABLE 2

Chips classification of *Sesbania grandiflora*:

	%
Dust	0.6
1—5 mm	2.8
5—10 mm	5.2
10—15 mm	14.0
15—25 mm	14.0
25—35 mm	29.0
35—50 mm	7.0
above 50 mm	4.0

Production of Pulp

One year old Stalks of *Sesbania grandiflora* collected from the Plantation area and chipped without debarking in the Mills conventional posture feed chippers, screened. The moisture content of chips was found to be about 62.2%. The chips were then air dried to the moisture content of 10-12% (chips density was 147 Kgs/m³). Air by dry chips equivalent to 200 gms OD weight were loaded in an autoclave and the following cooking conditions were followed:

- (i) Active Alkali on O.D chips. 20.0%
- (ii) Sulphidity. 20.0%
- (iii) Chips to liquor ratio 1:4
- (iv) Time to raise to 160°C. 20 Min.
- (v) Cooking Temperature 160°C
- (vi) Period of cooking 2 Hrs.

After digestion, the Pulp was washed over a 44 wire-mesh sieve and the pulp yield was determined. Standard sheets of unbleached pulp were prepared on a British Standard Sheet making machine after beating in the laboratory with better raising the freeness to 45/ SR. The sheets were air dried and tested for strength properties. The strength properties of unbleached pulp sheets are given in Table—4.

Proximate chemical Analysis employing the Tappi Standard methods were carried out. The results of the analysis are recorded in Table—3.

TABLE 3

S. No.	Proximate Chemical Analysis	% on oven dry basis.
1.	Ash.	1.8
2.	Cold water solubility	0.5
3.	Hot water solubility	2.0

4.	1.0% NaOH solubility	12.0
5.	Alcohol—Benzene solubility	3.0
6.	Pentosans.	16.0
7.	Holocellulose	67.0
8.	Lignin.	20.0

The unbleached Pulp was bleached using Calcium Hypochlorite of 11.8% available chlorine in a single stage at 3.0% consistency. The bleaching was carried out for 1 to 2 hours at room temperature to obtain 80% brightness. pH of the bath was maintained at about 10, throughout the bleaching period. The Pulp was washed after the chlorine was exhausted. The results are recorded in Table—4.

TABLE 4

	Unit	
1. Unbleached Pulp Yield.	%	43.0
2. Permanganate Number.	%	16.0
3. Bleached Pulp Yield (on O.D. weight of chips)	%	41.2
4. Bleach liquor consumption (% available chlorine)	%	11.9
5. Loss in Bleaching	%	4.0
6. 1.0% cuprammonium viscosity of unbleached pulp.	CP.	25.4
7. 1.0% Cuprammonium viscosity of bleached Pulp	CP.	15.0

Standard bleached Pulp Sheets similar to unbleached Pulp were prepared after beating the Pulp to 45/SR. The strength after beating the

properties of bleached pulp sheets are given in Table 5.

Strength properties of unbleached and Bleached Pulp:

TABLE 5

Strength Properties	Sesbania grandiflora	
	Unbleached Pulp	Bleached Pulp
Breaking length in Metres	3255	3930
Burst Factor	17.0	28.0
Tear Factor	85.0	71.0
Double Folds	12	23

By mixing Sesbania grandiflora pulp with bamboo pulp in the ratio of 20:80, the strength properties of the blends were determined and compared with 100% Bamboo Pulp. The results are given in Table 6 and 7.

Table showing the properties of blends of Sesbania and Bamboo unbleached Pulp (20:80) in comparison with 100% bamboo unbleached Pulp.

TABLE 6

	Bamboo Pulp + Sesbania Pulp (80% + 20%)	Bamboo Pulp (100% Unbleached)
Beating time (Min.)	45	50
Freeness (°SR)	45	46
Breaking length in Metres	4800	5154
Burst Factor	31	33
Tear Factor	118	101
Double Folds	69	47
1.0% Cuprammonia Viscosity CP	34	29

Table showing the properties of blends of Sesbania and Bamboo bleached Pulp (20:80) in comparison with 100% bamboo bleached pulp.

TABLE 7

	Bamboo Pulp × Sesbania Pulp (80:20).	Bamboo Pulp (100% bleached).
Beating time Minutes.	8	5
Freeness SR	44	46
Breaking length metres.	4027	4348
Burst Factor	23	22
Tear Factor	65	52
Double Folds	15	10
1.0% Cuprammonium Viscosity CP.	8	7
1.0% NaOH solubility.	21	25
Brightness (MgO=100)	21	25
	84	85

A Microscopic Examination of Sesbania grandiflora Pulp reveals the following Datas:

TABLE—8

	Fibre length in mm.	Fibre diameter in mm.
Minimum	0.4	0.006
Maximum	1.8	0.020
Average	0.9	0.010

CONCLUSIONS

1. Laboratory Investigations on Sesbania Grandiflora by Sulphate process show satisfactory results in respect of pulp yield and strength properties. Bleaching and beating of the pulp was normal.
2. The average fibre length was 0.9 mm.
3. Since the Sesbania Grandiflora Pulp is short fibred, it requires to be admixed with suitable quantity of long fibred pulp, such as bamboo pulp for the manufacture of paper on a commercial scale. The test sheets made in the laboratory scale using 20.0% Sesbania pulp with 80% bamboo pulp, show good formation and satisfactory strength properties.
4. If Sesbania grandiflora can be grown economically in large quantities, it will be very prospective pulpable raw material for paper industry.

REFERENCES

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