

# Wild Sugarcane : Alternative to Conventional Bagasse for Paper Making

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## ABSTRACT

Most of the sugar mills in Tamil Nadu have switched over to recovery based varieties of sugar cane having low fibre content. Further, in conventional milling, greater extent of useful fibre is getting fragmented reducing useful fibres for paper making. Both of these factors greatly affect fibre procurement for TNPL. To overcome this problem, a wild sugarcane having less sucrose content without milling is selected and pulping study carried out. Wild cane bagasse bleached pulp characteristics are compared with normal cane bagasse pulp.

## INTRODUCTION

TNPL is one of largest manufacturers of paper in India using bagasse as a principle raw material. Plant has been successfully utilising bagasse which has emerged as a most potential nonwood substitute for wood in wood short countries like India. The mill has installed two major pulping lines using bagasse for production of newsprint and printing and writing paper.

In newsprint furnish 40% Mechanical Bagasse Pulp, 30% Chemical Bagasse Pulp, 20% Chemo Thermo Mechanical Pulp from soft wood, 10% Chemical pulp from mixture of Eucalyptus Hybrid and Casuarina are used. In writing and printing paper furnish 75% kraft bagasse pulp and 25% Chemical pulp from mixture of Eucalyptus Hybrid and Casuarina are used. Thus TNPL has been and will continue to be forefront in the development of bagasse based paper making technology. It becomes necessary for developing alternative raw material for partial replacement of conventional milling technology bagasse in the area of raw material research. This paper presents results of our study on pulping and bleaching from wild cane variety in comparison to that of regular bagasse pulp.

## EXPERIMENTAL

Pulping experiments were carried out with wild sugarcane bagasse samples. The following conditions were maintained during the cooking:

Bath ratio                    1:4  
Steaming time                60 min.

Cooking time                20 min.  
Cooking temp.               170°C  
H factor                      450

Screened pulps were used for determining kappa no. and brightness. Refining of pulps to a standard freeness level of 300 ml CSF was performed using PFI mill at 10% consistency.

## Bleaching

Unbleached pulp was bleached with  $CE_pH$  sequence.  $H_2O_2$  was used in the extraction stage.

	C	$E_p$	H
Consistency %	3	8	8
Temperature	ambient	60	40
pH	2	>10.5	8.5-9.5
Minute	30	60	120

## RESULTS AND DISCUSSION

### Conventional varieties of Sugarcane

In the liberalised economy severe competition and for better survival, most of the sugarmills in Tamilnadu have switched over to recovery based variety like CO 86032 to increase the recovery. In the conventional milling technology the fibres of CO 86032 get fragmented which is very important factor for pulp and paper making. This variety was developed by national institutes like Sugarcane Breeding Institute (SBI), Coimbatore, to have high sugar content, early maturity and low fibre content to improve the recovery percentage. Also this variety can be cultivated in various agro climatic zones in India and known to have high resistance to pests attack and tolerance to abiotic

stresses. This leads to increased percentage cultivation of CO 86032 variety year by year. Currently in Tamil Nadu more than 60% cane cultivated by farmers are CO 86032 only. Particularly Sakthi Sugars, Appakudal have switched over to 90% Co 86032 variety. Sucrose content maturity is attained in early stage i.e. less than 12 months by more addition of nutrients like NPK and micro nutrients etc. (1). The increased uptake of by macro/micro nutrients/chemical ripeners by the canes with triggering mechanism and enhancement of growth and increase in yield occurs. (2). Therefore sugar mills are releasing cutting orders based on sucrose content (20-22%) before 12 months. Average fibre content is 12-13% and yield per acre is 60-65 tonnes with 11-11.5% recovery (3).

### Status of Sugar Industry in Tamil Nadu

In view of the present sugar market condition, all the co-operative sugar mills in Tamilnadu are running with severe financial crisis. Recently, Govt. of India have permitted to mix 5-10% ethanol with petroleum products for vehicles use. Sugar mills having own distillery will be benefitted because of Govt. of India notification. In future many mills may switch over to ethanol production by reducing sugar production. For ethanol production, still short duration (8-10 months) varieties may be preferred in future. In short duration varieties, cane will have high juice content and less fibre content (4). To improve their financial position many sugar mills are coming forward to put up co-generation plant, with the high pressure boilers using bagasse as a main fuel. In future bagasse generated during crushing season will be utilised during offseason as a boiler energy fuel. Some mills are interested to go for newer technology like diffusion process, low pressure extraction technology etc. However, conversion of exiting mills into new technology is not feasible. Also investment in modern juice extraction technology is also found to be very high.

### TNPL's experience regarding procurement of conventional sugarcane bagasse

TNPL is procuring bagasse from the five tie-up sugar mills, by supplying steam in exchange for bagasse. Recently, due to introduction of sugar rich varieties fibre content is going down (12-13%). In conventional milling due to severe hydraulic load (160-180 kg/cm<sup>2</sup>), 10-15% fibres get fragmented which reduces the useful fibre content in wet whole bagasse which is undesirable in pulping and subsequent paper making process. Since TNPL has a tie-up with sugar mills which have this conventional technology are consuming more steam supplied by TNPL. Due to fibre content loss in the cane, sugar mill is supplying less wet whole bagasse to TNPL. TNPL gets bagasse equivalent to the heat value of the steam supplied to sugar mills by burning fossil fuels in TNPL boiler. The cost of fossil fuels going up every year, the cost of bagasse is also showing increasing trend. TNPL is utilising almost 6-7

lakhs tonnes of sugarcane bagasse (*Saccharum officinarum*) as major raw material. In the recent years, CO 86032 is wildly cultivated variety which yields bagasse having useful fibre (48-52%) and pith (30-44%).

In view of the above mentioned problems useful fibre content is getting reduced year by year in wet whole bagasse. At the same time TNPL is planning to increase chemical bagasse production capacity upto 450 tpd. Correspondingly wet whole bagasse requirement will increase in future. Quality of chemical bagasse pulp is reducing year by year due to increase of fragmented fibres portion in the useful fibre. Current market demands high brightness paper for all cultural varieties. To achieve high brightness in paper, currently we are maintaining Chemical Bagasse bleached pulp brightness upto 88-90% ISO even with conventional bleaching sequence of CEH. High pulp brightness affects the quality of pulp by reversion of colour/brightness etc. To preserve the required quality of pulp during bleaching, we are adding chemicals like Sulphamic acid, H<sub>2</sub>O<sub>2</sub> etc.

### Wild Sugarcane variety

The six species of *Saccharum* and the related genera comprising of *Erianthus*, *Miscanthus*, *Narenga* and *Selerostachya* constitute the basic genetic resources of sugarcane (5).

Table 1 Analysis of Wild Sugarcane

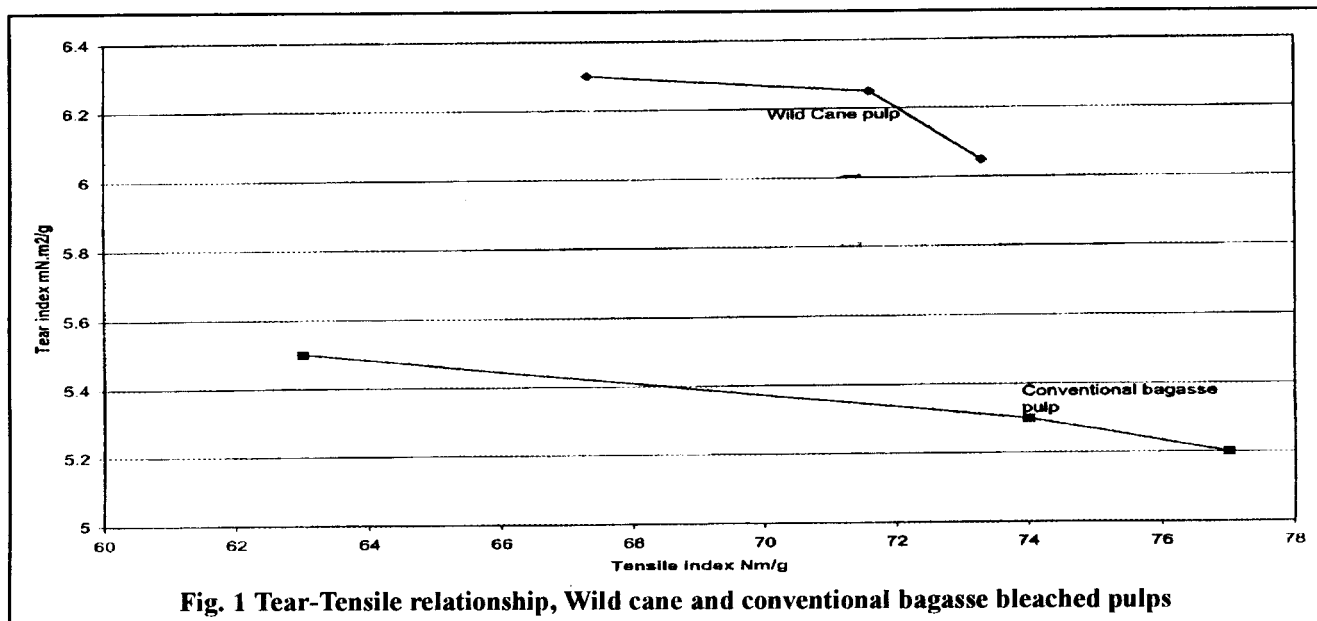
Particulars	Wild Sugarcane	Normal Cane
Brix % (Specific gravity)	7.42	16.0-17.0
Pol % (Sucrose content)	0.86	13.0-14.0
Purity %	11.59	80.0-85.0
Fibre on cane %	48.0	12.0-13.0
Bagasse yield %	85.0-90.0	25.0-30.0

Table 2 Pulp properties

Particulars	Regular bagasse from normal Cane	Bagasse from Wild Sugarcane
Pulp total yield %	55-57	55
Kappa no.	10-12	12.5
Brightness % ISO	85-88	88
Viscosity cps	16-18	22

Table 3 Pulp strength properties at 300 ml CSF

Particulars	Regular bagasse from normal Cane	Bagasse from Wild Sugarcane
Breaking length, m	6000-7000	7400
Tear Factor	55-58	62
Burst Factor	38-40	43



**Fig. 1 Tear-Tensile relationship, Wild cane and conventional bagasse bleached pulps**

India is one of the major centres of diversity for saccharum species and related genera. Erianthus and endinaceous show a wider distribution from North East India to southern peninsula. Saccharum spontaneum is most polymorphic among the saccharum species and has a wider distribution through out the country, from the sub-himalayan region to the peninsular India. Distribution of other species of Erianthus and Miscanthus Narenga and Sclerostachya is confined to the North Eastern region.

Wild sugarcane variety (i.e. Erianthus) sample was collected and tested in sugar mill laboratory for fibre content and juice characteristics. The results shown in Table 1 shows that sucrose content in wild cane is very less i.e. 0.86%. Bagasse yield is four times higher than the normal cane. Since wild variety cane is having less sugar (i.e. <1% sucrose) it need not undergo conventional milling operations. Integrated Pulp and Paper mills those who are using maximum quantity of bagasse pulp in the furnish can substitute wild sugarcane bagasse by directly procuring sugarcane from farmers. By installing fibrizer equipment in paper mill campus itself preparation of fibre can be done. However, we will have to work out ways and means of treating in the excess bio-degradable sugars in the effluent.

Known quantity of wild sugarcane was subjected to depithing and pith separated in TNPL laboratory. The fibre to pith ratio (FPR) is 3.87 :1 as against our normal cane bagasse FPR of 2.5:1.

#### **Pulping and Bleaching**

- Result from Table 2 shows that total yield of wild sugarcane bagasse is comparable to regular bagasse yield.
- Kappa no. brightness of wild sugarcane bagasse is comparable to regular bagasse pulp.

- Cleanliness of wild cane pulp is comparable with conventional bagasse pulp.

- Bleached pulp viscosity of wild sugarcane bagasse is higher than normal cane bagasse pulp.

- Table 3 shows that pulp strength properties of wild sugarcane is better than the normal cane bagasse pulp.

#### **CONCLUSION**

Bagasse yield in the wild cane in the range of 85-90%. It is about 4 times higher than the normal cane bagasse 25-30%. Wild cane pulp total yield is 55%. Wild cane variety procurement cost is expected to be very less. Wild cane can be directly procured from farmers. Wild cane bagasse deterioration during storage will be less.

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