POSTER SUMMARY

ASSESSING THE PROCESSABILITY OF SUGARCANE VARIETIES

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Abstract

The Sugar Milling Research Institute (SMRI) is developing methods to characterise the processability of sugarcane, particularly pre-release varieties from the South African Sugarcane Research Institute's (SASRI) breeding programme. The pith/fibre ratio and colour are presently used to characterise the processability of sugarcane; however, further parameters are required to obtain a better understanding of how a particular variety would behave during processing, particularly in the front end of the factory. A number of methods have been investigated; these include the use of a stereomicroscope to identify pith and fibre, an impact test method and a percolation test method. Each method is described and test results obtained on selected varieties are given. The suitability and feasibility of each of the different methods is discussed.

Keywords: pith/fibre, sugarcane, varieties, impact, percolation

Introduction

The processability of sugarcane is a measure of how easily that cane can be processed in the factory. In the past some varieties of cane have been linked with processing problems such as flooding in diffusers, slippage in dewatering mills, high bagasse moistures and unsuitable mud preparation for filtration. It is believed that softer, high pith or very brittle cane is the cause of the problems (Barker, 2008). However, harder varieties can also pose processing problems such as difficulty in cane preparation, which can lead to high pol in bagasse and reduced extraction (Barker, 2008). The development of methods to evaluate the processing quality of cane is important as this has the potential of highlighting problematic varieties before they are released. The SMRI is developing tools that may be used to characterise cane varieties based on their processing quality, some of which are discussed in this poster.

Experimental

All cane samples used in the experiments were from pre-release variety trials from SASRI. Ten stalks of each of six different varieties were selected randomly from each plot, with each variety having three replicates (plots). Four different methods of predicting the processability of sugarcane have been investigated, as described below.

Pith/fibre ratio

The pith/fibre ratio is the ratio of pith to all fibre. Higher pith/fibre ratios and higher percentages of small fibres will indicate a softer or more brittle cane variety. The method, which is currently used to measure the processability of pre-release sugarcane varieties, is

described in detail by Chinsamy *et al.* (2004). The cane sample is shredded in a Waddell shredder for a period of 30 seconds. Water and air are used to agitate the shredded sample to separate the different sized fibres and pith using three different size screens. All material is collected from each of the three screens, dried and weighed. The amount of small fibres is expressed as % of total fibres.

Stereomicroscope
This method, described by Barker and Wesley-Smith (2008), involves staining a cross sectioned piece of sugarcane so that the stained vascular bundles (fibres) can be counted using image analysis software. This should give an indication of the relative amount of fibre in the stalk, which can be related to the hardness. An accurate method for counting of the individual vascular bundles on the periphery of the cross section area of cane has not yet been developed; hence no results are shown for the stereomicroscope method.

Impact test method
This method is based on an impact test where a hammer, attached to a pendulum arm, is dropped from a known height and allowed to impact on a piece of cane (Hlongwane *et al.,* 2008). The height that the hammer reaches after impact is measured electronically. The energy absorbed by the cane during impact is calculated by measuring the difference between the two heights. The cane can be held in two different ways: the Charpy method holds the cane horizontally (two supports) and the Izod method holds the cane vertically (one support). The amount of energy absorbed by the cane during bending can be related to its behaviour during cane preparation.

The effect of stalk diameter on energy absorbed in bending a piece of cane was investigated by plotting absorbed energy versus diameter and fitting a power law model to the data. This model was used to generate correlations for each replicate. These correlations were used to predict the amount of energy absorbed at the overall mean diameter. The results are expressed as the amount of energy required to bend a piece of cane stalk with an internode length of between 120 mm and 150 mm and a diameter of 22 mm.

Percolation
Percolation is the rate at which juice or water flows through a bed of shredded cane, and is expressed as the percolation rate in m/min. Higher percolation rates are desirable as lower rates cause problems such as flooding in the diffuser, leading to lower throughputs and lower extraction. The cane sample is shredded in a Waddell shredder for a period of 30 seconds and then placed in a glass cylinder of 107 mm diameter and 600 mm length. Hot water (80ºC) is circulated through the cane bed until it reaches equilibrium temperature and Brix. The flow rate of the water to keep a constant head is measured and the percolation rate is calculated.

Results and Discussion

The results from the different methods are shown in Table 1.

The percolation rates measured are higher than those typically found in diffusers and cannot be compared directly. Diffusers have deeper beds, lower open screen areas and other variables that differ from those used for the tests. None of these methods, other than pith/fibre ratio, show N25, which is believed to be a problematic variety, to be significantly different from the other varieties. In particular N19, which is grown in the same areas under similar conditions,

but which has not been reported to present processing problems, gave similar results for all except pith/fibre ratio. However, NCo376, N36 and N40, which have similar pith/fibre ratios to N25, have not been reported to be problematical. Previous work (Barker and Davis, 2005) showed that, although variety appears to have some impact on the pith/fibre ratio of cane, the age of the cane and the geographical regions also appear to have an important effect, masking varietal differences to some extent.

Table 1. Results from the different methods used for measuring processability of sugarcane.

Variety	Pith/fibre		Impact tests: Energy absorption (J)		Percolation rate (m/min)
	Pith/fibre	% small fibres	Charpy	IZOD	
N19	0.35 0.26 0.38	11.1 8.4 16.0	15.9 20.0 20.2	9.8 8.4 11.0	0.78 0.86 0.71
N25	0.42 0.45 0.47	15.6 17.1 13.5	16.7 19.3 17.8	9.3 7.9 11.5	0.68 0.61 0.55
N36	0.47 0.43 0.41	12.2 8.1 13.5	13.3 26.1 24.4	6.2 12.4 14.5	0.90 0.43 0.81
N40	0.50 0.44 0.26	14.3 12.3 6.4	23.3 27.8 27.7	14.3 12.8 11.6	0.70 0.81 0.58
NCo376	0.43 0.42 0.43	13.8 14.2 10.7	20.2 21.1 21.1	10.1 8.4 11.8	0.78 0.57 0.63

Further work is required to either refine these methods or find alternative methods that will be able to characterise problematic varieties more clearly. Two challenges, however, are:

- the difficulty in obtaining reliable information on the processability of particular varieties from the factories, and
- the extreme variability in cane samples within the same variety and under the same growing conditions.

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