BUREAU OF SUGAR EXPERIMENT STATIONS

QUEENSLAND, AUSTRALIA

Mill Technology Division

FIBRE CHARACTERISTICS OF CANE - RESULTS OF MEASUREMENTS CARRIED OUT AT BUNDABERG DURING 1987 SEASON

by

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1. INTRODUCTION

During September, 1987 a total of twenty-three samples of cane were tested for extreme fibre characteristics at BSES in Bundaberg. The main purpose of this testing program, which was introduced during 1986 season, is to screen all prospective Q canes prior to their release to obtain some indication which varieties are likely to cause handling problems during the milling process.

The tests which were carried out on each sample of cane supplied were as follows :

(i) Impact test on 10 mm core
(ii) Shear strength of a 5 kg sample
(iii) Pith content of a 1 kg sample
(iv) Fibre content

Details of the experimental procedures involved in these tests are given in the appendix. This report summarises the results of the above tests.

2. DISCUSSION OF RESULTS

(a) Evaluation of new varieties

The varieties examined during 1987 were as follows :

Variety	Source
66C760	Bundaberg and Isis
76S1299	Bundaberg
Q141	Bundaberg
Q145	Bundaberg
CP51-21	Bundaberg and Isis
75C326	Mackay
74C256	Mackay
73C22	Mackay
Q136	Mackay

The standards against which these varieties were judged included CP44-101, Q87 and H56-752. The results obtained are summarised in Table I and illustrated graphically in Figure 1.

The results of previous work on the fibre characteristics of cane (Brotherton et al, 1986 ASSCT Conference) have indicated that handling problems may be experienced in the mill if the shear or impact readings fall outside the following limits :

- shear strength of 10-38 kg
- impact reading of 0.30-0.80

While it is difficult to draw any firm conclusions from such a limited number of tests, a number of indications of likely behaviour of the various samples may be seen from Figure 1 and Table I.

(i) Q141 had a very low impact reading (0.22-0.23) and shear strength (9.0-10.0 kg). The pith content was also relatively high at 76-82 per cent. These results are similar to those obtained during the previous season, and confirm that Q141 is a very soft variety like Q103. The problems experienced by Millaquin in handling Q141 during 1987 are discussed in the next section of this report.

(ii) CP51-21 and 73C22 both had a much higher pith content than desirable (average of 82.3 and 83.3 per cent respectively) and should be watched carefully if introduced as commercial varieties.

(iii) The shear strength of the two samples of 74C256 (36.4 and 41.6 kg) was quite high and may cause problems in the milling process.

(iv) The fibre characteristics of all other varieties tested appear to be quite acceptable.

(b) Milling behaviour of Q141

On August 13th some fifty trucks of Q141 were harvested from Trebbin's farm in the Millaquin area.

Fortuitously Mill Technology staff were made aware that this cane was to be crushed and were present when it came into Millaquin on the morning of Friday 14th.

The consignment was broken into two rakes, as required by the cane payment system. Recordings of turbine pressure, engine revolutions, hopper heights and preparation (by visual assessment) were taken before the Q141 was received, in the hope of being able to compare these with the values obtained during the crushing of Q141. The variety being crushed in front of the Q141 was mainly CP44-101.

The Q141 was a thick stalk cane, with billet lengths of about 200 mm. Truck weights were high, with more than 3.0 tonnes in 2.5 tonne bins.

TABLE I

Fibre characteristics of cane - 1987 season

Variety	Source	Impact reading	Shear strength (kg)	% short fibre	% fibre
66C760	Lines - Bingera	0.39	12.6	71.6	12.34
76S1299	Lines - Bingera	0.39	16.0	61.5	12.11
CP44-101	Lines - Bingera	0.45	31.6	48.8	13.63
Q141	Bingera Plantation	0.22	10.0	82.3	11.24
Q141	Dalton - Bundaberg	0.23	9.0	75.8	10.22
Q145	BSES - Bundaberg	0.35	32.6	53.6	13.89
CP51-21	BSES - Bundaberg	0.40	16.2	79.7	15.27
CP44-101	BSES - Bundaberg	0.46	26.8	60.0	14.24
75C326	Jensen - Mackay	0.46	27.4	61.1	12.65
74C256	Jensen - Mackay	0.66	41.6	53.8	14.92
Q87	Jensen - Mackay	0.37	18.9	74.6	12.38
73C22	Jensen - Mackay	0.37	17.8	82.9	13.90
H56-752	Jensen - Mackay	0.49	32.9	55.4	13.33
CP44-101	Russo Bros - Isis	0.52	31.0	56.8	15.26
CP51-21	Russo Bros - Isis	0.44	15.2	84.9	10.24
CP44-101	Bonanno - Isis	0.56	32.0	50.0	11.91
66C760	Bonanno - Isis	0.41	23.9	62.7	16.59
74C256	Gordon - Mackay	0.68	36.4	59.4	15.60
73C22	Gordon - Mackay	0.45	21.5	83.7	15.20
H56-752	Gordon - Mackay	0.47	33.4	49.4	13.72
Q136	BSES - Mackay	0.73	31.5	57.2	13.82
Q136	Walker - Mackay	0.69	33.5	60.7	14.20
Q136	Barfield - Mackay	0.73	31.6	63.7	14.38

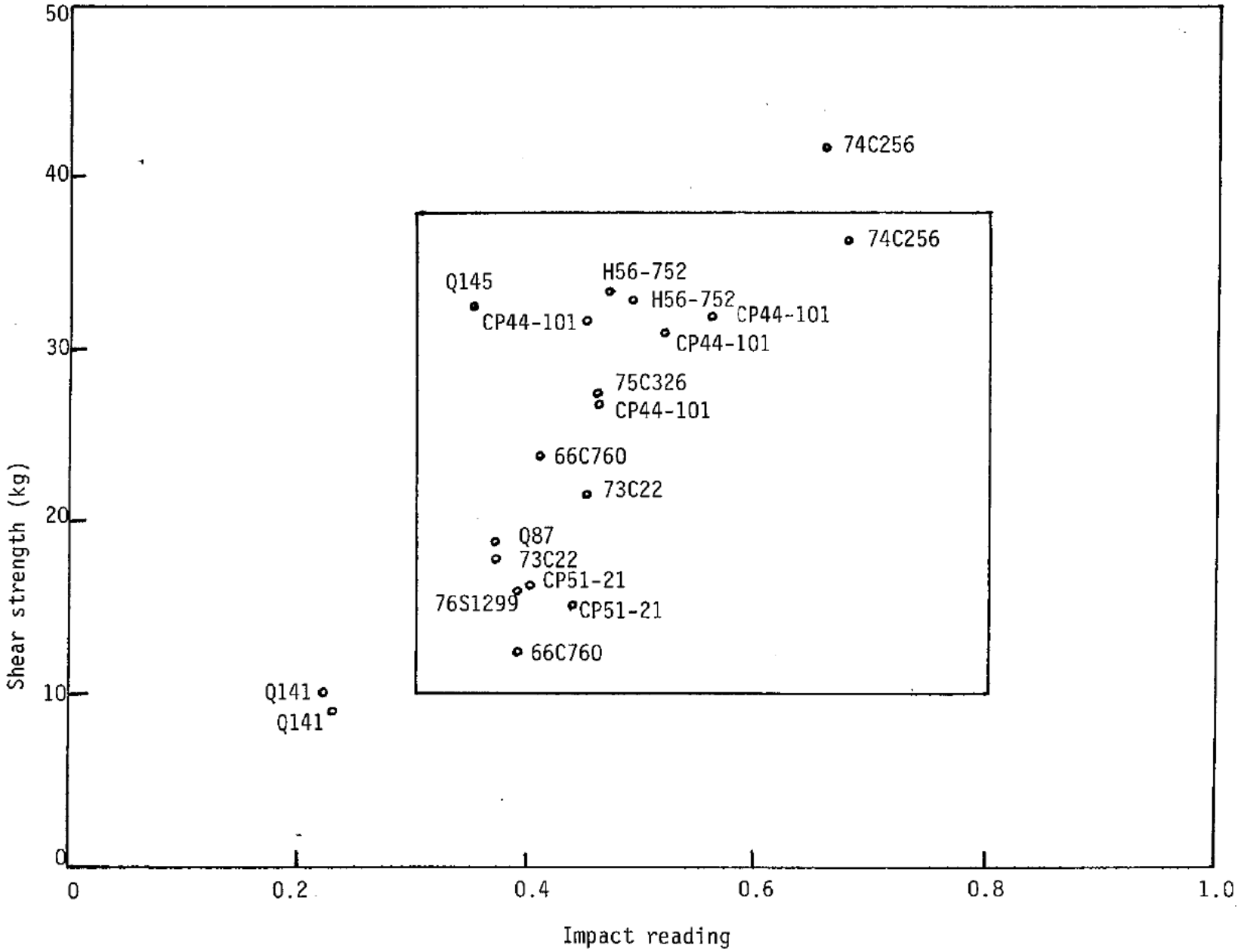

FIGURE 1 - Fibre characteristics of cane - 1987 Season

When the variety reached the shredder and No. 1 mill there was an immediate significant drop in nozzle bowl pressure in both turbines.

Very shortly after this the cane ceased to feed up the elevator between the shredder and No. 1 mill. It caused the chain holding the tines to lift, and the cane ran back down the elevator into the boot, with the result that the elevator came out on overload.

The elevator could not be restarted until virtually all the cane was manually forked out of the system, including that jammed under the chains. This took some three hours (a stop of 2.95 hours was logged).

The remainder of the cane in the carriers was handled by running the elevator fast with a light feed, a procedure not conducive to the attainment of good extraction. The rest of the rake was crushed by interspersing lorry cane between every six truck group of Q141.

This cane gave the following analysis :

Fibre	11.8%	(Mill average 15.2)
C.C.S.	14.0%	(Average for Friday 13.2)
Pol in open cells	89.7%	
Short fibre content at mill preparation	70.3%	(A high value considering the preparation)

Physical examination of the cane showed it to be easily split, with a very soft interior.

The behaviour of this cane vindicates the use of the small scale physical tests developed by the Mill Technology Division and SRI. The cane showed a very high short fibre content and a low shear strength in tests carried out by BSES staff. It is a low fibre, short fibre cane with similar characteristics to Q103.

Like Q103 it is obviously variable in its behaviour, as Bingera has crushed some 1 300 tonnes of it with no apparent problems even though the small scale tests indicated the cane had a low impact reading, low shear strength and high pith content. Millaquin has since carried out minor modifications to the drive chain on the elevator between the shredder and No. 1 mill, and has experienced no problems in crushing a further 1 500 tonnes of this cane variety.

APPENDIX I

TEST PROCEDURES

Maximum shear strength of shredded cane

EQUIPMENT

Makita cutoff saw
Mettler P11 balance
Hammer mill
Mixing tray
Shredded cane container
Shear apparatus

SAMPLING

The shear test requires a minimum of 6 kg, of cane billets. This ensures that, after shredding, 5 kg of shredded cane is available for the actual test. If the pith content test is to be carried out also, then 7 kg of billets are required.

If the impact test is to be carried out also then generally about 10 kg of cane stalks are cut from the plot to be sampled. One each of a one third of a stalk chosen at random representing the top, the middle and the bottom respectively is cut out for the impact test. The remainder is cut into billets using the cutoff saw. This is done by cutting through the nodes to produce billets 150 to 250 mm long where possible. This is to ensure the long fibres in the internode are not artificially reduced in length.

The billets are weighed on the Mettler (in buckets) in the following batch weights :

Shear plus pith content	3.5 kg
Shear only	3.0 kg

SHREDDING

The hammer mill door is swung up, opened and one batch of billets poured in. The door is securely locked and the pin which prevents rotation inserted. The hammer mill is then operated for 15 seconds from the time it reaches full speed. Occasionally, billets of cane jam the hammers at start-up. Starting is discontinued and the hammers freed by rotating the shaft backwards by hand.

The two batches (to total 7 or 6 kg) are dropped into the shredded cane container from the hammer mill and then mixed in the mixing tray. The aim is to preserve the three dimensional configuration of the shredded cane during this process. If pith content is to be measured, 1 kg is weighed out at this stage for this test. Then 5 kg is weighed out in the shredded cane container for the shear test.

SHEAR TEST

On the shear apparatus the top shear plate is run away to one side and the stainless steel mould raised as high as possible around the lower shear plate which then forms the bottom of the mould.

The shredded cane is then placed in the mould by the large handful. Again the aim is to preserve the three dimensional configuration while placing the cane in as evenly as possible.

The top shear plate is then placed on the mould. The compressor lever is then used to force this top plate and the mould walls down until the top plate bearings contact the tracks. The compressor is removed and replaced by the heavy weights which should hold the bearings on to the tracks. The lifting mechanism is then detached.

The mould walls are forced down until the top is below the level of the lower shear plate.

The slave indicator on the spring balance is set to zero, the motor direction switch moved to pull and the motor turned on. This causes the spring balance to begin registering.

When it is obvious that a maximum tension has been reached, the motor is turned off and the reading of the slave indicator recorded.

Impact test

EQUIPMENT

Impact tester
10 mm corer
Cutoff saw

SAMPLE PREPARATION

Each of the one-third stalks, top, middle and bottom, are cut in the cutoff saw to provide three lengths of internode approximately 50 mm long. Thus nine subsamples are available per variety. From each of these a 10 mm core is taken using the corer. The number chosen, nine, is not critical but has

METHOD

The impact unit is set up on a solid base with the pivot shaft level. The release point of the pendulum is adjustable and this adjustment is used to ensure that,without a sample in the anvil, the pendulum on release swings up to the horizontal thus providing a reading of zero. The sample can then be placed in the anvil tube and the slave pointer placed in the vertical position, that is, a reading of one, the pendulum is raised and held by the release catch, the catch is released and after the impact the reading shown by the slave indicator noted.

The nine readings are actually the cosines of the angle that the pendulum reaches from vertical. These are averaged to provide the final result for the variety sampled.

Pith content test

EQUIPMENT

Rotary screening device
Timer

METHOD

The 1 kg of shredded cane is tipped into the cage of the screen and the door clipped closed. The unit is turned on and allowed to run for 90 seconds. During this period the smaller particles of cane fall on to a collecting plate and after the 90 seconds are collected and weighed. This weight is recorded as the pith content. To check that losses have not been too high, the retained long fibre is usually also weighed. Losses up to 20 g are considered normal.