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BUREAU OF SUGAR EXPERIMENT STATIONS

QUEENSLAND, AUSTRALIA

Mill Technology Division

FIBRE CHARACTERISTICS OF CANE - RESULTS OF MEASUREMENTS CARRIED OUT AT BUNDABERG DURING 1986 SEASON

by

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Bundaberg

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1. INTRODUCTION

During September, 1986 the decision was made to test for extreme fibre characteristics all cane varieties which are prospective Q canes, in the last season before release. The purpose of these tests was to obtain some indication which varieties were likely to cause handling problems during the milling process.

The tests which have been carried out on each sample of cane supplied are :

(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.

up until the end of November, a total of nine samples of cane from Mackay, Ayr, Nambour, Isis and Bundaberg were examined. Work was also carried out to assess the reproducibility of the impact, shear and pith measurements, and to determine the influence of delay between cutting and testing on the results obtained. This report summarises the results of the above tests.

2. DISCUSSION OF RESULTS

(a) Evaluation of new varieties

The varieties examined in this phase of the program were as follows :

Variety	Source
CP51-21	Isis
Q140	Bundaberg and Nambour
Q141	Isis
70S868	Bundaberg
Q110	Mackay
Q133	Ayr
Q135	Mackay

The standards against which these varieties were judged included CP44-101, Q96 and H56-752. The results obtained in these tests are summarised in Table I and illustrated graphically in Figure 1.

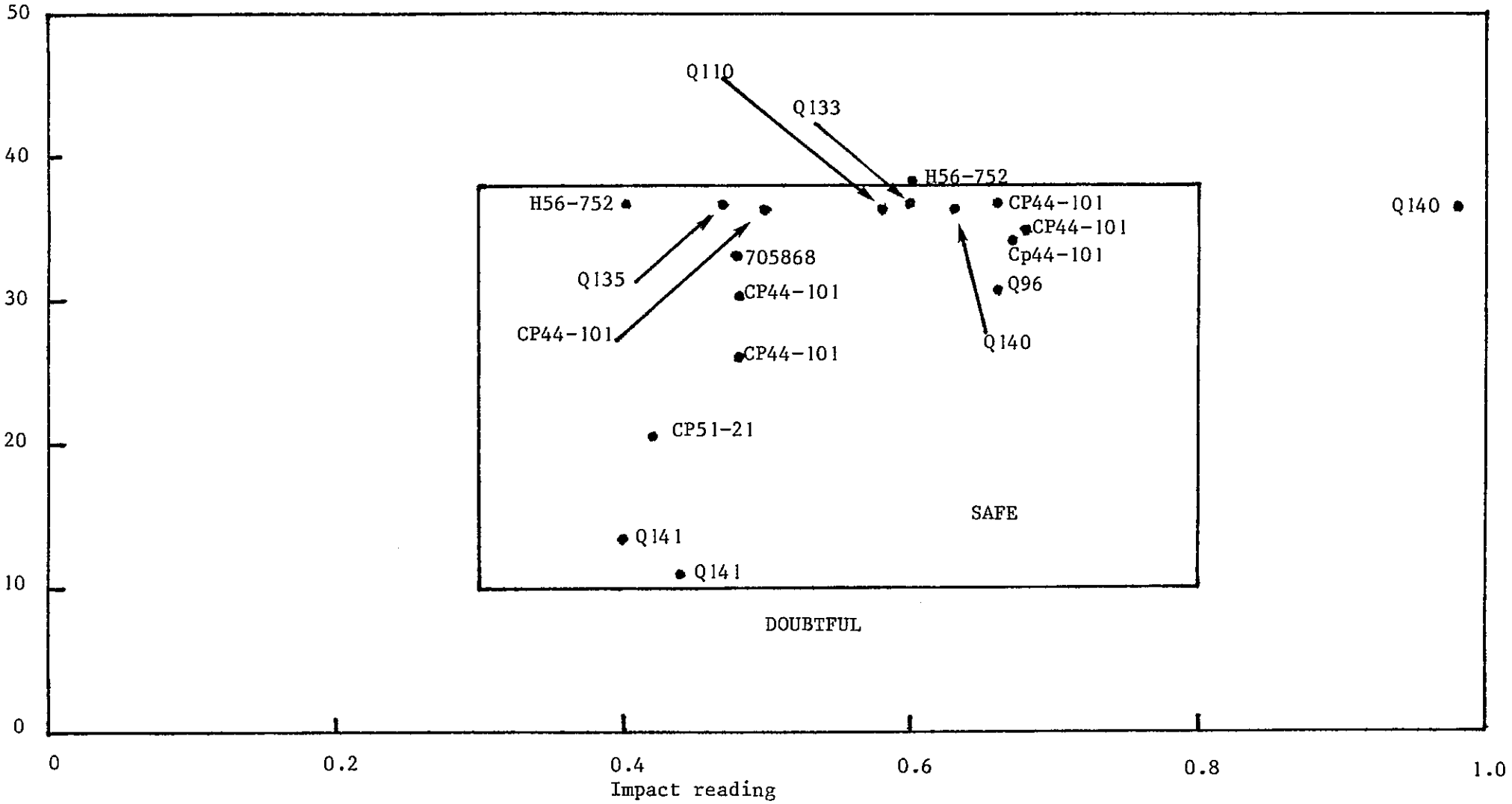
TABLE I

Fibre characteristics of cane - Bundaberg, 1986

Variety	Plant or ratoon	Origin	Impact reading	Shear strength (kg)	% Pith	% Fibre
CP51-21	2nd ratoon	Russo - Isis	0.42	20.4	64.5	16.92
CP44-101*	2nd ratoon	Russo - Isis	0.48	26.0	43.9	16.33
Q141	2nd ratoon	Noakes - Isis	0.44	10.8	78.8	11.21
CP44-101*	2nd ratoon	Noakes - Isis	0.67	34.1	48.4	25.08
Q140	1st ratoon	Block C1, BSES, Bundaberg	>0.98	36.5	57.0	15.81
CP44-101*	1st ratoon	Block C1, BSES, Bundaberg	0.48	30.2	57.1	15.44
70S868	1st ratoon	Block C1, BSES, Bundaberg	0.48	33.1	49.6	13.57
CP44-101*	1st ratoon	Block C1, BSES, Bundaberg	0.48	30.2	57.1	15.44
Q141	2nd ratoon	Noakes - Isis	0.40	13.4	77.6	11.44
CP44-101*	2nd ratoon	Noakes - Isis	0.68	34.8	46.1	15.63
Q133	Plant	Ayr	0.60	36.8	47.9	17.12
Q96*	Plant	Ayr	0.66	30.6	64.8	18.40
Q140	N/A	Nambour	0.63	36.4	61.1	19.44
CP44-101*	N/A	Nambour	0.66	36.7	55.5	24.58
Q110	Plant	Zahmell - Mackay	0.58	36.4	60.7	20.76
H56-752*	Plant	Zahmell - Mackay	0.60	38.3	48.7	18.40
Q135	Plant	McDonald - Mackay	0.47	36.8	52.0	21.27
H56-752*	Plant	McDonald - Mackay	0.40	36.8	56.4	18.65
CP44-101	1st ratoon	Block C1, BSES, Bundaberg	0.50	36.3	49.5	19.72

* Standard

FIGURE 1 - Fibre characteristics of cane - 1986 season



The results of previous work in this area (Brotherton et al, 1986 ASSCT Conf.) has 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 the limited number of tests conducted to date, a number of indications of the likely behaviour of the various samples examined may be seen in Figure 1 :

(i) Q140 had a very high impact reading (>0.98) and a relatively high shear strength (36.5 kg). These results confirm those carried out earlier in the year at Meringa, and indicate that there is a distinct possibility that Q140 has a long hard fibre which will be troublesome in milling.

(ii) Q141 had a very low shear strength (10.8 and 13.4 kg) and may well be another very soft variety like Q103.

(iii) CP51-21 and 70S868 both had impact readings (0.42 and 0.48) and shear strengths (20.4 and 33.1 kg) within the acceptable safety limits and should handle satisfactorily in the mill.

(iv) Many of the varieties tested (Q110, Q133, Q135, CP44-101 and H56-752) had a shear strength close to the safe upper limit of 38 kg. A close watch will therefore need to be kept on these varieties in the future.

(v) All other varieties apart from Q140 had impact readings within the acceptable range of 0.30-0.80. The pith content of the samples examined was generally quite acceptable, the highest level recorded (78.8 per cent) being obtained with Q141.

(b) Reproducibility of tests

Duplicate readings were carried out on four samples of cane to check the reproducibility of the test procedures. The results obtained are shown in Table II.

The reproducibility of each of the three tests is clearly very good. The results of the single determinations carried out in the variety assessment program can therefore be viewed with considerable confidence.

(c) Effect of cut-test delay

With some of the samples of cane examined in this program (those from Mackay and Nambour) there was a delay of almost a week between the time the cane was cut and the tests were actually carried out. To check

a trial was carried out in which a series of impact, shear and pith measurements were carried out on a sample of CP44-101 which was held in storage over an extended period. The results obtained are shown in Table III and Figure 2.

It may be seen that the fibre characteristics of the cane altered only slightly as the period of storage was extended. Both the impact reading and shear strength rose by 10-20 per cent over about eleven days, and this change may be associated with a gradual drying out of the cane. The influence of delay since cutting on the fibre content of cane is currently being studied, and the results obtained will be reported when available. In the meantime, however, it is recommended that these fibre characterisation tests be carried out within about four days from the time of cutting so that changes due to drying out are minimised.

TABLE II

Reproducibility of test procedures

Test No.	Variety	Impact reading	Shear strength	% Pith
1	Q141	0.44	10.8	78.8
		0.40	13.4	77.6
2	CP44-101	0.67	34.1	48.4
		0.68	34.8	46.1
3	CP44-101	0.50	36.3	49.5
		0.50	35.0	50.5
4	CP44-101	0.56	40.7	50.0
		0.52	40.5	52.4

NOTE : The two series of measurements comprising Test 1 were carried out on two samples of Q141 from the same source in Isis. In Tests 2, 3 and 4, three different samples of CP44-101 were used, with two sets of measurements being made on each sample.

TABLE III

Effect of cut-test delay on milling properties of cane

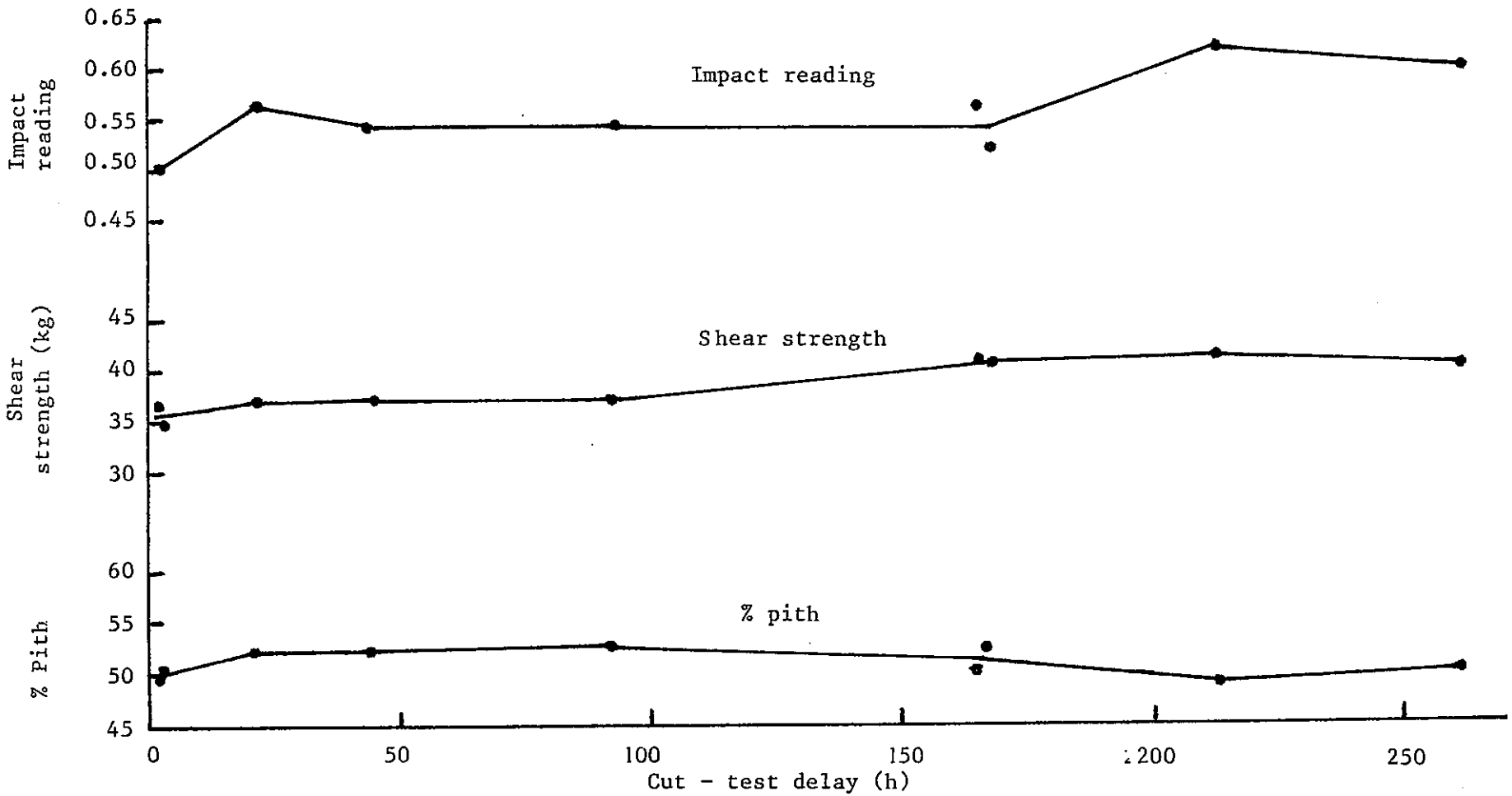
Variety : 1st ratoon CP44-101 (green)

Source : Block C1, Bundaberg

Time of cutting : 1.30 p.m., 17-11-86

Cut-test delay (h)	Impact reading	Pith content (%)	Shear strength (kg)
2	0.50	49.5	36.3
3	0.50	50.5	35.0
21	0.56	52.0	36.8
44	0.54	52.1	36.9
92	0.54	52.5	36.9
165	0.56	50.0	40.7
167	0.52	52.4	40.5
212	0.62	48.9	41.4
261	0.60	53.8	40.5

FIGURE 2 - Effect of cut - test delay on fibre characteristics of cane



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 carried out, 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, 20 g loss is not abnormal.