

THE TOPPING OF SUGARCANE IN MAURITIUS

By S. STAUB

During the 1954 crop a study was made on the composition of the different parts of the sugarcane with a view to determining the point at which it would be most economical to top the cane. The study was made at Reunion Sugar Estate as this estate covers regions having varying rainfalls and soils.

Nine experiments were made on the variety M134/32. Individual experiments consisted in harvesting a number of complete stools of cane in order to have about sixty canes. A smaller number of

separately. On the various juices obtained the degree Brix, sucrose per cent. and purity were determined. These results together with the percentage weights of each part are given in Table I.

The available sucrose in each part was then calculated on the assumption that the percentage of fibre in all the parts was constant and equal to 12.5 per cent. This is of course not strictly correct but is sufficiently accurate for the purpose in view. The method of calculation is given hereunder by way of illustration.

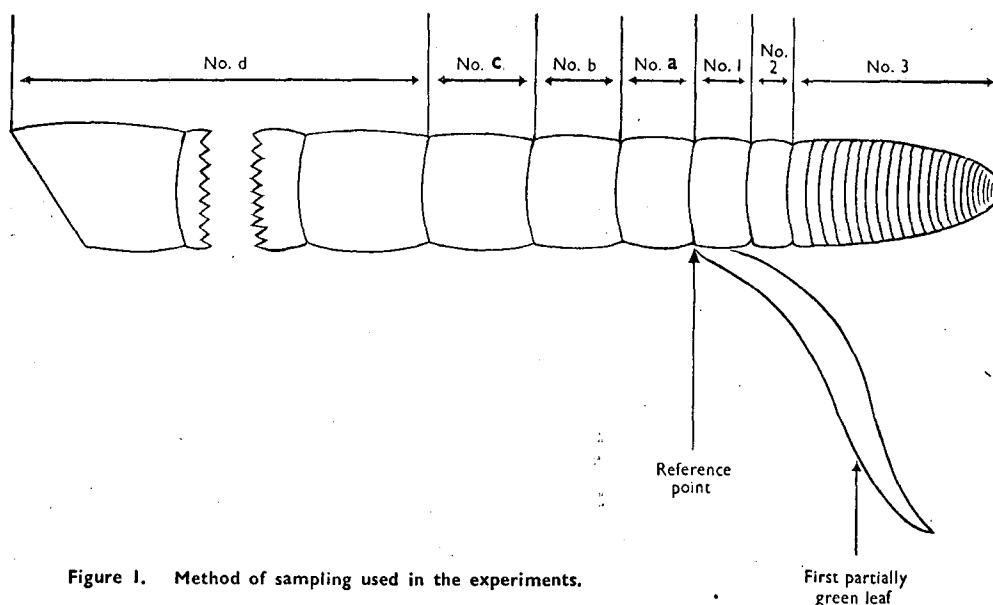


Figure 1. Method of sampling used in the experiments.

canes does not produce an adequate weight of some samples. The number of complete stools so harvested varied from six to nine. It was preferred to harvest every cane in a stool rather than to sample canes at random in a field because it was believed that this method would be more representative of practical conditions. Indeed under the conditions prevailing in Mauritius there is a great variation in sucrose content and juice purity between individual canes in the same stool; this variation is much greater than that between individual complete stools. Each cane was cut into seven parts as indicated in Fig. 1.

The reference point was the point of attachment of the first partially green leaf to the cane stalk. The two nodes above that point were numbered 1 and 2 and the three nodes below *a*, *b* and *c*. Part No. 3 is the white top above node No. 2 and part *d* is the remainder of the cane below node *c*, these parts were composited for all the canes in one experiment, the weights of the composite samples were determined and the samples were then crushed

Available sucrose in part per cent. total cane

$$= \frac{w}{100} \times \frac{100-12.5}{100} \times 0.9 \times S \times .95 \times \frac{99(p-40)}{p(99-40)} \times 0.99$$

where:

- Percentage weight of part ... = W
- Fibre per cent. ... = 12.5
- Factor for converting sucrose per cent. juice extracted into sucrose per cent. absolute juice ... = 0.9
- Sucrose per cent. juice extracted = S
- Mill extraction... = 0.95
- Purity of sugar manufactured. = 99°
- Purity of juice extracted. ... = p
- Purity of final molasses... = 40°
- Boiling house efficiency... = 0.99


The results obtained are given in Table II.

TABLE I—SHOWING THE COMPOSITION OF VARIOUS PARTS OF THE SUGAR CANE

	B R I X								SUCROSE PER CENT. GRAM								P U R I T Y							
	3	2	1	a	b	c	d	3	2	1	a	b	c	d	3	2	1	a	b	c	d			
Expt. I	7.90	11.00	13.65	15.29	16.94	17.99	20.51	3.31	6.96	9.87	12.37	14.41	15.67	19.35	41.9	63.3	72.3	80.9	85.1	87.1	94.3			
Expt. II	7.24	10.29	11.46	13.32	15.71	18.02	20.73	1.82	4.61	6.57	9.29	12.48	15.28	19.44	25.1	44.8	57.3	69.8	79.4	84.8	93.8			
Expt. III	7.54	9.67	11.63	15.08	17.76	19.31	20.87	1.98	4.39	7.50	11.84	15.28	17.46	19.86	26.3	45.4	64.5	78.5	86.0	90.4	95.2			
Expt. IV	7.46	9.12	10.69	13.34	16.36	18.16	20.37	2.31	3.98	5.93	9.47	13.17	16.25	18.80	31.0	43.7	55.5	71.0	80.5	89.5	92.3			
Expt. V	7.64	10.93	14.12	15.08	17.51	18.95	21.26	2.66	6.59	9.06	12.03	14.84	16.82	20.00	34.8	60.3	64.2	79.8	84.8	88.8	94.1			
Expt. VI	7.78	10.64	12.47	14.42	16.29	18.13	21.31	2.32	6.15	8.08	10.80	13.48	15.92	20.22	29.8	57.8	64.8	74.9	82.8	87.8	94.9			
Expt. VII	7.68	10.67	11.75	13.65	15.24	17.24	20.93	2.36	5.62	7.47	9.93	12.82	15.36	19.55	30.7	52.7	63.6	72.8	84.1	89.1	93.4			
Expt. VIII	7.19	9.00	10.21	12.37	14.94	17.65	20.39	1.65	3.97	5.45	8.50	12.08	15.54	19.12	23.0	44.1	53.4	68.7	80.9	88.1	93.8			
Expt. IX	7.41	8.64	9.24	10.19	12.11	14.45	20.37	1.72	2.92	3.81	5.24	7.82	11.18	19.16	23.2	33.8	41.2	51.4	64.6	77.4	94.1			
Arithmetic Mean	7.54	10.00	11.69	13.64	15.87	17.77	20.75	2.24	5.02	7.08	9.94	12.93	15.50	19.50	29.53	49.54	59.64	71.98	80.91	87.00	93.99			
True Mean	7.54	10.00	11.69	13.64	15.87	17.77	20.75	2.24	5.02	7.08	9.94	12.93	15.50	19.50	29.7	50.2	60.6	72.9	81.5	87.2	94.0			

	W E I G H T — K g s								WEIGHT OF PART PER CENT. TOTAL CANE							
	3	2	1	a	b	Total c	d	Weight	3	2	1	a	b	c	d	
Expt. I ...	7,540	813	899	1,001	1,133	1,397	82,800	95,583	7.9	0.9	0.9	1.0	1.2	1.4	86.7	
Expt. II ...	6,031	507	641	811	934	1,052	48,300	58,276	10.4	0.9	1.1	1.4	1.6	1.8	82.8	
Expt. III ...	7,187	998	1,154	1,415	1,576	1,646	40,100	54,076	13.3	1.8	2.17	2.6	2.9	3.0	74.3	
Expt. IV ...	8,741	991	1,229	1,496	1,733	1,888	39,100	55,178	15.8	1.8	2.2	2.7	3.1	3.5	70.9	
Expt. V ...	9,275	826	960	1,062	1,202	1,349	54,800	69,474	13.4	1.2	1.4	1.5	1.7	1.9	78.9	
Expt. VI ...	9,669	831	987	1,156	1,291	1,422	55,600	70,956	13.6	1.2	1.4	1.6	1.8	2.0	78.4	
Expt. VII ...	6,424	531	585	686	774	879	34,600	44,479	14.4	1.2	1.3	1.5	1.8	2.0	77.8	
Expt. VIII ...	11,367	1,248	1,473	1,645	1,987	2,277	50,900	70,897	16.0	1.7	2.1	2.3	2.9	3.2	71.8	
Expt. IX ...	11,834	1,088	1,188	1,410	1,580	1,950	77,000	96,050	12.3	1.1	1.2	1.5	1.7	2.0	80.2	
Arithmetic Mean	8,674	870	1,013	1,187	1,357	1,540	53,689	68,330	13.00	1.31	1.52	1.79	2.08	2.31	77.98	
True Mean ...	8,674	870	1,013	1,187	1,357	1,540	53,689	68,330	12.69	1.27	1.48	1.74	1.99	2.25	78.58	

TABLE II
Available Sucrose in various parts of the Sugarcane

No. of Part	Per Cent. of total Part	Available sucrose in Part per cent. total cane	Cane
3	12.7	—	
2	1.3	0.02	
1	1.5	0.05	
a	1.7	0.10	
b	2.0	0.16	
c	2.2	0.24	
d	78.6	10.90	

Total: 11.47

Table III gives the effect of various points of topping for 100 tons of total cane.

TABLE III
Sucrose Extraction in relation to the Point of Topping

Point of Topping	Weight of Cane Harvested (tons)	Sucrose Extraction Per cent. Cane Harvested	Weight of Sugar Extracted
between 3 & 2	87.3	13.14	11.470
between 2 & 1	86.0	13.31	11.450
between 1 & a	84.5	13.50	11.400

We must now calculate how much it costs to cut, load, transport and manufacture in relation with the point of topping. The cost of cutting, loading and transport will be proportional to weight of cane and we can reckon that the cost of manufacture will be proportional to the weight of impurities. If we assume that the value of the sucrose in the factory bins is Rs 440/ton and that cutting, loading and transport costs Rs 8 per ton of cane and that the cost of manufacture (bagging and transport excluded) is Rs 6.50 per ton of cane topped between 1 and a, i.e. just above the point of attachment of the first partially green leaf, we have, then, for 100 tons of total cane, to the nearest rupee as shewn in Table IV.

TABLE IV
Value of Sucrose Lost and Savings in Costs in Relation to the Point of Topping

Point of Topping	Value of Sucrose Lost	Saving in Cost of Cutting, Loading and Transport	Saving in Cost of Manufacture
between 2 & 1	20kgs × .440 = Rs 9.00	Rs 10.00	Rs 22
between 1 & a	50kgs × .440 = Rs 22.00	Rs 12.00	Rs 17
between a & b	100kgs × .440 = Rs 44.00	Rs 14.00	Rs 13

This is a simplification of the problem as the value of the residues is not taken into consideration nor is it reckoned that the cost of manufacture decreases whilst the tonnage of canes manipulated increases. Also, cane will vary in composition and finally, in special cases where factories are frequently idle due to shortage of canes, the cost of manufacture of an extra two or three per cent. of canes can only be a matter of conjecture. On the other hand factories with a regular supply of canes and no capacity to spare will find it very expensive to crush an additional two to three per cent. of inferior cane.

However, if we consider the problem of topping isolated from related considerations, we see that in principle the cutting blow should be aimed just above the point of attachment of the first partially green leaf. In special circumstances it might be advantageous to cut slightly higher, one or two nodes above the point of attachment of the first partially green leaf; but it is quite certain that in no case should the topping be higher. The top 12½ per cent. of the total cane (leaves excluded) has a purity of less than 30°, and thus its introduction in the mill can only be a very grave disadvantage. I should like to thank Messrs. R. Leclezio and R. Thelemaque for their valuable help in carrying out these experiments, and Mr. E. Julienne, Manager of Reunion Sugar Estates for the interest he has shown in the work.

The President, Mr. Dymond said that this was the second paper we had had from our friends in Mauritius. This particular paper would prove of much interest to sugar people all over the world.

The paper was ready by Mr. Bax of Mauritius, as Mr. Staub was not able to attend the Congress.

Dr. Douwes Dekker said he agreed the subject was of great importance. Work had been done on similar lines in this country, some work at the S.M.R.I. and also some at the Experiment Station. Mr. du Toit had shown that the maturity of the cane was an important consideration.

Mr. du Toit asked whether there was any penalisation for planters sending in dirty canes.

Mr. Bax stated that there was no direct penalisation, but the estate authorities could refuse to take cane which they did not consider suitable for milling.

Mr. Bouvet pointed out that in Mauritius, cane was paid for on a purity basis, as well as on sucrose percentage and the presence of tops did affect the purity of the juice and planters were penalised if they sent in an abnormal quantity of tops. In

reply to Mr. du Toit, he said there was no direct penalisation if planters sent in excessive tops.

Mr. Bax added that he agreed with Mr. Bouvet up to a point, but in general, planters were more interested in their weight of cane, than in the analysis, all the more so in the case of small planters, whose canes were mixed together for analysis.

Mr. du Toit asked what was the basis of payment for cane in Mauritius. Was it the C.C.S., or some other system?

Mr. Bax said that planters were paid a maximum of two-thirds of their extraction as analysed by chemists from the Central Board.

During the whole crop period, chemists from the Central Board visited all the factories and carried out regular analyses of all planters' canes, which were paid for on an extraction basis. The minimum weight of cane from which the cane samples were taken was about fifteen tons, which represented ten to twenty minutes' grinding, according to the tonnage crushed per hour. During that period the first expressed juice of the same cane was sampled at the mills. The sample of cane was sub-sampled and sent to the Central Board laboratory for fibre determination, from which the absolute juice per cent. cane was calculated. The sample of first expressed juice was analysed in the factory laboratory for brix and purity, from which those of the absolute juice were obtained and the "richness" thus calculated.

For the extraction, the average figures for the whole island were taken for mill extraction and molasses purity, while the recovery was calculated from the purity of the first expressed juice of the planter's cane, minus the purity drop between the average first expressed and the mixed juice, as found for both weekly in the laboratory figures.

Mr. du Toit inquired how the absolute juice purity was obtained.

Mr. Bax replied that the purity of the absolute juice was calculated for each planter's cane by deducting from the purity of the first expressed juice found, the purity drop between first expressed juice and absolute juice, as indicated weekly by the factory laboratory figures. He added that it was sometimes argued that the sampling of the cane could not be representative, but he considered that on the whole crop, errors would be compensating and he thought this system for assessing planters' cane was good, as any method had some drawback.

Dr. McMartin inquired what was meant by the reference point. Was it the first leaf turning green, or what?

Mr. Bax said that he understood that it was the first leaf that was yellowing.

Mr. Park said it was the third partially open leaf which was meant.

Mr. Dymond asked if any use was made of tops for planting purposes in Mauritius. This was particularly the case in Cuba. In this country, growers were used to being paid in the past on the weight basis, and did not realise the losses that occurred in factories through sending in immature tops.

Mr. Bax replied that over a limited period of time and over limited areas, tops were used for planting, although most planting was done with young canes from eighteen months to one year old.

Mr. Park said that in Mauritius, 75 per cent. of the cane was planted after the crop was over. Some 25 per cent. was planted during the season. In high rainfall areas ratoons from the latter were superior to those from the former. Actually the amount of tops utilised was only about 10 per cent. of the total required for planting.

Mr. Steward said that it was obvious from Mr. Staub's paper and from the present discussion that cane generally was topped too high.

It was however difficult for planters to top the cane low and thus see tons of apparently good cane being left on the ground with the tops. If planters got into the habit of talking of their yields in tons of sucrose per acre instead of in tons of cane per acre they would come to realise that the extra cane left attached to the top was not as valuable as the rest of the stick and that the loss to them by correct topping was very small.

Dr. McMartin pointed out that the planting of cane tops was a very old Natal practice. Experiments made by the Experiment Station showed that tops were excellent material for planting, but this had long been realised. The Experiment Station had further recommended that for planting purposes cutting a longer top was useful.

Mr. Elysee pointed to the enormous amount of non-sugars introduced into the factory by poor topping. He therefore welcomed data affecting the £ s.d. aspect being introduced into this paper. He found some difficulty in appreciating the value in rupees rather than in £ s.d.

Mr. Bax pointed out that a rupee was worth about 1s. 6d.

Mr. Christianson said that a bigger loss to planters who sent in immature tops, was the loss of plant

food they would sustain. They gained by sending in any part of cane as far as sucrose was concerned with our present cane-testing system.

Mr. Rault pointed out that with the present system of using an average weekly Java Ratio for sucrose distribution, there was no inducement for a cane supplier to send a clean material, as the other man who sent extremely trashy canes scored materially by being allotted a sucrose content in excess of his true one through using a common juice factor. This free gift was at the expense of the clean cane supplier, as no penalty can be imposed on dirty canes.

Mr. Bouvet said that as long as we did not use a purity factor in South Africa the advantage would always be in favour of the growers who send in poor low sucrose and badly-topped cane.

Mr. Dymond pointed out that much of the cane used for planting should go into the mill and that if tops alone were used the good cane would go into the mill. Another very important point was the amount of trash which was sent in with the cane. By trash in this country was meant only the dry leaves. He had carried out experiments which showed a maximum of 17 per cent. of dried trash in some cane as against less than 2 per cent. on well cleaned cane. If cane was properly cleaned the crushing period at Darnall would be reduced by a matter of about sixty-sixty days. He asked Mr. Bax if there was any penalty in Mauritius for trash.

Mr. Bax said that in the case of any unsatisfactory cane being sent into the factory, officials of the Central Board were called in to adjudicate, and they had the power of completely rejecting cane which did not conform to their accepted standard.

Mr. Dymond referred to pre-trashing practice carried out at Illovo, which he had noted was a common practice in Mauritius. He asked if this was still the case.

Mr. Bax said that owing to labour shortages this practice had rather fallen into disuse, except at the beginning of the season.

Mr. Boule said that using tops alone for planting cost twice as much as using cane for planting. That was another reason why tops were not used for planting in this country, to the same extent as elsewhere.

Mr. Pearson said that although the mills might gain sixty-sixty days through the careful removal of

trash, the growers might lose considerably more, as labour costs where pre-trashing was concerned were high. Something might be said for this practice where there were low yields, but not in the case of heavy yields, where the cane would begin to fall down, for it then was not economical. The only advantage to growers in pre-trashing was the extra cutting and loading he could get out of his labour.

Mr. Dymond pointed out that there were however planters in this country whose cleaning of cane compared with that carried out anywhere in the world, and he did not think those growers showed a loss from their planting activities. He would like to know from Mr. Pearson why the cane crop was allowed to grow for such a long period.

Mr. Pearson said that as far as he was concerned he would prefer to see the crops reaped whilst the cane was still upright and before the yields got to fifty tons per acre, when it fell down and was very difficult to harvest.

Mr. Elysee said that sending in the extraneous matter such as tops lowered the efficiency of factories and if this stuff were removed from the cane, the mills would be in a position to pay them more for their crop.

Mr. Palairt said that the figures given implied that there was one ideal break-point; if he cut below this the grower would lose more than the miller gained; whereas, if he cut above this, he gained little, if anything, and the miller lost much. A bonus-penalty scale would not meet this and would never be accepted by the Growers' Association. The purity seems to be so closely associated with the point of topping that it should be possible to determine a purity figure which, on the average, corresponds to correct topping. If the miller were to make a small *ex-gratia* payment on all cane of purity above this figure (such as 6d. a ton of all cane of purity 88 or above) this would compensate the grower for the extra supervision involved, and the extra throughput and better quality juice would more than pay for this.

Mr. Steward said he would like to explain why some planters could top their cane well and others found it impossible to do so. The planter with a small crop could watch and train his boys, but on a large estate, where there might be upwards of 200 labourers to watch, this could not be done to the same extent.

Mr. Dymond pointed out that in the case of one planter, the cleanliness of whose cane should be visible to anybody travelling in Zululand, this grower cut a big crop of 12,000 tons.