TWENTY-SEVENTH ANNUAL SUMMARY OF CHEMICAL LABORATORY REPORTS

SOUTH AFRICAN SUGAR FACTORIES, SEASON 1951-52

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The "Final Manufacturing Results of the Natal Sugar Factories" have this year again been compiled in the form of three tables:

Table I contains the following data:—

(i) The data for the beginning and the end of the crushing season.

(ii) The weights of cane crushed.

(iii) The quality of the cane crushed.

(iv) The percentages of the cane varieties crushed.

(v) The weights and analyses of the sugars made, and

(vi) An account of time lost by stoppage.

Table II comprises data concerning:—

(vii) The sucrose balance.

(viii) Lost absolute juice per cent. fibre, sucrose extraction, boiling house performance and recoveries; and the analyses of—

(ix) Final bagasse,

(x) First expressed juice,

(xi) Last expressed juice,

(xii) Mixed juice,

(xiii) Clarified juice,

(xiv) Filter cake, and

(xv) Syrup.

Table III includes:—

(xvi) Analyses, quantities and crystal content of massecuites.

(xvii) Data on final molasses.

(xviii) Lbs. of chemicals used per ton of cane, per ton of sugar, and per 1,000 lbs. of brix in mixed juice.

In addition to these tables three more tables are shown:—

Table IV giving a comparison of important final data of the last decade.

Table V showing the monthly results of the last crushing season, and

Table VI comparing Natal's data with those of some other countries.

A.—General.

During the 1951-52 season nineteen mills were in operation, of which seventeen contributed to this Annual Summary. The discussions will involve data and results of these seventeen mills which crushed 99.1 per cent. of all cane crushed, and produced 99.5 per cent. of all sugar produced; the total cane crop being **4,805,249 tons,** and the quantity of sugar produced by all nineteen mills being **532,505 tons.**

These results show a considerable deficit in comparison with the figures of the **1950-1951** season, when a record crop of **5,721,390** tons of cane was harvested, which in turn produced **685,798** tons of sugar. The disappointing result of 1951-52 was due to lack of rain in 1950, combined with drought during 1951.

Due to this shortage of cane the crushing season of the seventeen mills involved lasted only 291 days instead of 338 days as in the previous season.

The amount of N:Co.310 crushed was raised from 15 per cent. during the 1950-51 season to 21 per cent. during the 1951-52 season, and the percentage of Co.331 from 8 to 12.5. However, Co.281 diminished from 36 per cent. to 25 per cent. The percentage of Co.301 crushed remained the same, viz. 38 per cent.

If we consider the number of tons of cane needed to produce one ton of 96° pol sugar as a yardstick for the quality of the cane then, according to Table IV we have to go back as far as the 1942 and 1943 seasons to find the same poor quality of cane, of which as much as 8.7 tons were required to produce one ton of 96° pol sugar. The average sucrose content of the cane during 1951-52 was one of the lowest ever recorded, and so was the purity of the mixed juice; the fibre content, however, was the highest ever recorded.

The average throughput per factory remained the same in so far as cane capacity is concerned, viz. 102 tons of cane per hour actual crushing. Due, however, to the high fibre content of the cane the fibre throughput increased from 16.2 to 16.7 tons per hour. The brix throughput diminished from 15.75 to 14.85 tons per hour, and the sugar output from 12.70 to 11.73 tons per hour actual crushing due to the poor quality of the cane.

B.—Milling Control Data.

Since the throughput was raised from 16.2 to 16.7 tons fibre per hour actual crushing a higher percentage of Lost absolute juice per cent. fibre was to be expected; however, the fact that imbibition was raised simultaneously from 206 to 215 per cent. fibre counteracted the effect of the higher throughput almost completely, as is shown by the average figures for lost absolute juice per cent. fibre, which were 39 for 1950-51 compared with 40 for 1951-52.

Sucrose extraction was reduced from 93.3 (1950-51) to 93.0 (1951-52) due to the rise in fibre content of the cane (from 15.80 per cent. to 16.28 per cent.).

For comparison purposes a table is set out hereunder, giving the Lost absolute juice figures of all seventeen mills during the last two seasons, and also the Lost undiluted juice figures, calculated, however, with the aid of brix per cent. First expressed juice instead of with brix per cent. Primary juice. We see that both figures run parallel. However, the computation of "Lost undiluted juice per cent. fibre" is not so intricate as the computations needed for "Lost absolute juice" and, moreover, the weights of cane, mixed juice and imbibition water can be dispensed with in the case of "Lost undiluted juice" (see Communication No. 7 of the S.M.R.I., page 29).

	Lost absolute juice % fibre in final bagasse.		Lost undiluted juice % fibre in final bagasse.	
	1950.	1951.	1950.	1951.
UF	46	49	45	46
ZM	42	42	41	40
FX	43	42	41	39
EN	43	44	41	42
AK	37	35	35	34
DK	37	42	36	41
DL	53	54	50	50
GL	41	41	39	39
MV	45	45	42	43
CK	39	41	37	39
TS	37	40	35	38
NE	30	33	28	31
IL	36	36	35	36
RN	33	31	32	30
ES	35	38	34	37
SZ	34	36	33	35
UK	35	34	34	33
Arithmetical averages	39.3	40.2	37.4	38.4

A control figure not discussed in Communication No. 7 but which in some cases is very useful to be calculated is the figure for Imbibition Efficiency. The meaning of this figure, and the way to calculate it, is given in Appendix I of this Summary.

Experience has shown that the figure for Imbibition Efficiency diminishes when the quantity of imbibition water is raised, and increases with a lower imbibition per cent. fibre. Intensification of the preparation of the cane before the imbibition is applied will also raise the mixing eкect. However, a high figure can also be caused by too low a determination of sucrose per cent. bagasse, and that is the reason why the Imbibition Efficiency criterion is nowadays often used to control the figure of sucrose per cent. bagasse. For example, a high figure for Imbibition Efficiency, together with a high imbibition per cent. fibre, points to a too low result of the sucrose in bagasse determination.

The following figures were found for the Natal mills for the years 1950 and 1951:

	Imbibition Efficiency.	
	1950.	1951.
UF	30	46
ZM	44	39
FX	38	36
EN	35	27
AK	42	43
DK	92	65
DL	65	62
GL	64	57
MV	45	52
CK	55	54
TS	45	48
NE	43	39
IL	41	41
RN	55	43
ES	42	40
SZ	46	64
UK	39	41
Arithmetical Average ...	48.3	46.9

C.—Boiling House Performance Data.

	Purity of mixed juice.		Purity of final molasses.		Undetermined losses per cent. sucrose in cane.		B.H.P.	
	1950.	1951.	1950.	1951.	1950.	1951.	1950.	1951.
UF	83.7	84.4	40.3	41.8	0.88	0.97	96.96	94.85
ZM	85.8	84.9	40.0	40.21	1.15	0.97	96.38	96.16
FX	84.6	83.8	38.6	37.8	—	0.59	97.67	98.23
EN	87.9	87.0	42.2	43.5	2.32	2.56	95.66	93.70
AK	86.7	85.4	41.7	40.1	0.62	0.92	97.48	96.94
DK	85.9	85.0	37.6	38.5	4.48	—	93.86	96.19
DL	86.3	85.6	38.8	39.3	—	—	96.63	97.16
GL	85.8	85.8	41.0	40.1	1.26	1.26	96.76	96.70
MV	86.2	85.0	39.1	40.6	1.98	1.94	96.03	94.70
CK	87.1	85.3	40.4	38.5	—	—	97.92	97.71
TS	87.9	85.2	41.1	40.5	—	—	96.50	97.17
NE	86.2	85.1	47.3	43.7	2.51	2.24	96.92	97.22
IL	85.0	82.9	42.4	42.7	0.92	0.82	96.56	94.94
RN	86.5	83.2	40.1	39.0	—	—	96.61	95.07
ES	88.7	86.5	38.8	37.8	—	—	97.31	97.26
SZ	87.1	85.0	38.2	38.0	1.75	—	97.47	97.51
UK	86.6	85.0	40.1	40.9	—	—	97.50	96.65
Weighed average	86.4	84.9	40.5	40.3	—	—	96.88	96.66

One of the factory's chemists drew our attention to the fact that it could occur that the to-date figure for B.H.P. did not balance with the previous to-date figure and the monthly figure, due to the table rendering the Winter co-efficient "f". as a function of the mixed juice purity giving "f" in only two decimal places. Since three decimal places are necessary in order to prevent the figures of different periods from not balancing, a new table for "f" had to be drawn up. The new table is shown in Appendix II of this Summary, and ought to be used exclusively in future. All data given in this Summary are already recalculated with the new values for "f."

In order to get an insight into the reason for the slight decrease in B.H.P. in 1951-52 as compared with 1950-51, we showed next to the B.H.P. data the figures for (*a*) purity of mixed juice, (*b*) purity of final molasses, and (*c*) undetermined sucrose losses (as far as known).

The table shows that the lower average in 1951-52 (B.H.P. = 96.66) is not caused by a uniform slight decrease of all seventeen factories in Boiling House Performance. No, there are five factories showing higher, seven factories showing lower, and five factories showing figures almost the same as those for the previous season :—

Higher figures.	*Lower figures.*	*Nearly equal figures.*
(FX) 97.67–98.23	(UF) 96.96–94.85	(ZM) 96.38–96.16
(DK) 93.86–96.19	(EN) 95.66–93.70	(GL) 96.76–97.70
(DL) 96.63–97.16	(AK) 97.48–96.94	(CK) 97.92–97.71
(TS) 96.50–97.17	(MV) 96.03–94.70	(ES) 97.31–97.26
(NE) 96.92–97.22	(IL) 96.56–94.94	(SZ) 97.47–97.51
	(RN) 96.61–95.07	
	(UK) 97.50–96.65	

When we start our discussion with the five factories showing almost the same results in the last two seasons, all these factories, to a greater or lesser degree, show a lower purity of final molasses. Since a lower purity of final molasses should result in a higher B.H.P. figure, the (nearly) identical figures can only be explained by increased undetermined loss figures or by greater losses in filter cake. GL, however, does not show an increased undetermined loss.

Of the five factories with a higher B.H.P. figure three show a better exhaustion of the final molasses, and two a decrease in exhaustion. In the latter case a considerable reduction of the undetermined losses must have caused the improvement in B.H.P. figures.

The lower B.H.P. figures of the last group of factories cannot always be explained by a higher purity of final molasses or by increased undetermined sucrose losses.

NOTE.—The Boiling House Performance figure has been extensively discussed in "One Year of Weekly Factory Report Data" by K. Douwes Dekker, and in "The Twenty-Sixth Annual Summary," both papers having been published in the 1951 S.A.S.T.A. Congress Proceedings. Our readers are referred to these two publications for the purpose of introducing them to the calculation and the meaning of the B.H.P. figure.

D.—Recovery Data.

The lower overall recovery figure (82.5 in 1951-52 against 83.7 in 1950-51) is caused by (*a*) a lower sucrose extraction figure (due to the higher fibre content of the cane), and (*b*) a lower Boiling House Recovery figure (due to the lower purity of the mixed juice).

E.—Sucrose Balance.

In order to produce average figures for—

(*a*) Sucrose lost in final molasses, and

(*b*) Undetermined sucrose losses

the quantity of final molasses of those factories which do not weigh this product was indirectly estimated as follows:—

The average figure for "Non-sucrose in final molasses per cent. non-sucrose in mixed juice" for those sulphitation factories which weigh their final molasses is 83 per cent. By applying this figure in the case of the non-weighing factories, the weight of non-sucrose in final molasses was derived from the weight of non-sucrose in mixed juice, and by using the known analytical data the weight of final molasses for the non-weighing factories was found and the annual average for all seventeen mills computed.

With the aid of these figures the following figures could be calculated :—

(*a*) the weighed average for purity of final molasses;

(*b*) the weighed average for sucrose lost in final molasses per cent. sucrose in cane; and

(*c*) the weighed average for undetermined sucrose losses per cent. sucrose in cane.

F.—Final Molasses Data.

The purities of the final molasses ranged from 37.8 to 43.7 against 38.2 to 47.3 during the 1951-52 and the 1950-51 seasons respectively. Ten factories registered a lower purity than the previous year, one factory even registered a drop from 47.3 to 43.7 degrees. However, the average purity was only slightly lower than that for the previous season, viz. 40.3 instead of 40.5.

Table VI, giving comparative results from other countries, points out that the Natal figure for final molasses is the highest, with the exception of Queensland. It is at present, however, not possible to say to what extent the final molasses purity of the Natal factories can be reduced, the data to be considered not being available. In order to decide how much the molasses purity can be lowered more data about the final molasses and about the equipment to handle the final massecuite are needed. Not only are complete analyses (a.o. degree of saturation) of the final molasses lacking, but also data about viscosities at different purities, temperatures and concentrations are required. Concerning the equipment, the collection and consideration of data on the foreworkers for C massecuites are particularly needed.

In this connection we want to draw attention to a test made in Hawaii several years ago (Reports of the Association of Hawaiian Sugar Technologists, 1935 : High-speed Centrifugals, by Ralph B. Johnson), showing that even with high gravity factor centrifugals, after fifteen minutes' spinning a considerable quantity of molasses that could still have been spun off by prolonged spinning was left unpurged. Cycles of more than thirty minutes for ordinary centrifugals are quite common in other countries, and in some countries even high gravity factor centrifugals are spun as long as that.

Cycles of 30 minutes and more are only possible if a sufficient number of centrifugals are available. In this way the capacity of the C foreworkers is linked with the achieved exhaustion of the final molasses. If more machines of this type are installed a more viscous molasses can be handled, and since lower purity molasses is more viscous than a higher purity molasses, the installation of more C foreworkers allows a better exhaustion. If sufficient time for proper purging is not available the purity of the final molasses must be kept high in order to obtain a tolerable quality of precured C sugar. The twofold object (viz. the lowest possible molasses purity combined with the highest possible precured C sugar purity) can only be obtained with generously dimensioned C massecuite centrifugals. A high purity of precured C sugar means a considerable reduction in boiling back, in recirculation of non-sucrose, and in the required number of C massecuite afterworkers as well. In the case of well-purged C massecuite the capacity of the afterworkers has only to be 25 per cent. of that of the foreworkers.

NOTE.—The Hawaiian standard for low-grade centrifugal installations was 5 sq. ft. of screen area per ton-cane-hour for old-fashioned machines. Mention is made in the 1935 report of a factory changing from 25 baskets of 30 ins. (1,150 revs.) to eight 40 ins. machines (1,700 revs.). A calculation shows that after this change the cycle of the machines is still about $\frac{3}{4}$ hour, against approximately $1\frac{1}{4}$ hours before the change.

G.—Massecuite Data.

But not only the throughput capacity of the C massecuite foreworkers affects the achievement of low molasses purity; the quality of the C massecuite, too, is a determining factor.

For optimum conditions regarding purgability and exhaustibility the size of the crystals must be uniform and of certain dimensions, and the total crystal area must be sufficiently large. In general these conditions are realised if the crystals are approximately 0.35 mm in size and the crystal content of the massecuite is approximately 35 per cent. A higher crystal content, more particularly one exceeding 40 per cent., causes a too stiff massecuite, a massecuite with a too small degree of plasticity (Venton: Report on Investigations into the Treatment of Final Massecuite, page 37). A lower crystal content, on the other hand, does not expose sufficient crystal area to the crystallising sucrose and will lead to poorly exhausted molasses, or to the formation of false grain.

Table III shows that most factories boil a C massecuite with about 33 per cent. crystal content.

H.—Chemicals.

The quantities of lime, sulphur and phosphoric used in the 1951-52 season, compared with those consumed in the 1950-51 season, are :—

Per 1000 parts of brix in mixed juice :

	Parts of Lime.		Parts of Sulphur.		Parts of Phosphoric.	
	1950.	**1951.**	**1950.**	**1951.**	**1950.**	**1951.**
Average..	19.8	20.1	7.8	7.9	2.8	2.7
Maximum	26.0	27.6	10.9	10.6	6.2	6.8
Minimum	12.7	15.5	4.0	4.4	0.2	0.2

In 1951-52 the average consumptions of lime and sulphur are slightly higher than in 1950-51. However, since the quantity of phosphoric is slightly reduced, we can say that the cost of chemicals per 1,000 brix remained the same.

This fact is somewhat amazing when the individual mill data are compared, for it appears that the quantities of chemicals required by the various mills vary considerably. The difference between the quantities of phosphoric paste applied in particular is striking, the minimum being less than 10 per cent. of the average consumption, the maximum being $2\frac{1}{2}$ times as high as the average. Notwithstanding these big variations, the annual averages for all mills are about equal, indicating that there is a certain (involuntary) tendency at the mills to use the same quantity "on brix" as was applied last year, notwithstanding variations in juice quality.

For the purpose of comparison the quantities of chemicals have been related to 1,000 parts of brix in mixed juice.

Since brix and not water, is the material to be processed, it seems logical to base the amount of chemicals on brix, but it has also been suggested that the amount of chemicals be based on non-sucrose, because the chemicals are required to act with the non-sucrose part of the solids, and not with the sucrose part. One step further would be to relate the chemicals to solids minus sucrose and reducing sugars, *i.e.* non-sugar.

In the following table the quantities of chemicals consumed in the 1950-51 and the 1951-52 seasons are shown as functions of cane, sugar, brix and non-sucrose. Secondly, using the same basis, the consumptions in the 1951-52 season are indicated as percentages of the consumptions of the 1950-51 season.

It appears that in 1951-52 less chemicals were consumed, if the weights on cane and on non-sucrose are compared; more, however, if the weights on sugar basis are compared; and that on brix basis the amounts, notwithstanding the more refractory nature of the juice, were about the same.

This fact should yield a preference for the brix basis, but it is preferred to collect more data from ensuing years before a decision about the most appropriate basis is made. In the meantime the Annual Report will continue to comprise a table in which the chemicals are compared on cane, sugar, brix and non-sucrose.

	Lime.		Sulphur.		Phosphoric.	
	1950.	1951.	1950.	1951.	1950.	1951.
Lbs. per 1 ton of:						
Cane	6.10	5.86	2.43	2.30	0.86	0.80
Sugar	49.9	52.7	19.9	20.6	7.17	7.19
Brix	39.5	40.2	15.68	15.75	5.61	5.49
Non-sucrose...	286	265	113	104	40.6	36.2
Cane	100	96	100	95	100	93
Sugar	100	106	100	104	100	100
Brix	100	102	100	100	100	98
Non-sucrose...	100	93	100	92	100	89

H.—Fuel Data.

In Table II under "Final Bagasse" the quantities of bagasse indicated as percentages of cane are shown together with the analyses and the lower calorific values of the bagasse. The average amount of bagasse during the 1951-52 season has been 36.37 per cent. cane, and the average L.C.V. 3,136 Btu./lb.; or per 100 lbs. of cane 36.37 lbs. bagasse with $36.37 \times 3{,}136 = 114{,}058$ Btu.'s were available. Assuming a boiler efficiency of 70 per cent., if all this bagasse was burnt $82\frac{1}{4}$ lbs. of steam from and at 212°F. could have been produced. There is, however, a highly significant association between steam consumption and brix processed, which does not exist between steam consumption and cane crushed; the correlation between steam consumption and sugar bagged being not so strong as between the first-mentioned two factors. Consequently it is better not to indicate the ratio of heat, fuel or steam consumption on cane, but rather on brix.

In our case (based on the average 1951-52 data) $82\frac{1}{4}$ lbs. steam per 100 lbs. of cane corresponds with 5.65 lbs. steam per lb. brix in mixed juice. Assuming 3.50 lbs. steam (F/A 212°F.) per lb. brix processed as "bogey" for a cane sugar factory making raws, it seems to be possible to save a significant fraction of the bagasse produced by the mills if necessary. Assuming again 70 per cent. boiler efficiency, these 3.50 lbs. steam per lb. brix corresponds with 22.5 bagasse per cent. cane, or with 10 per cent. fibre in cane.

The last data to be discussed relate to additional fuel consumed by the factory furnaces, exclusive of fuel consumed by locomotives, workshops, for irrigation purposes, etc. The data of the final reports referring to this subject are assembled in a table reproduced below. This table shows the amounts of coal and wood combusted in addition to bagasse during the 1950-51 and 1951-52 seasons. Additional columns show tons of bagasse equivalent to the amount of additional fuel consumed. For this conversion the Low Calorific Value of Natal coal is assumed to be $3\frac{3}{4}$ times, and of air-dry wood 1.2 times the L.C.V. of average Natal bagasse.

	Season 1950-51.			Season 1951-52.		
	Tons of coal.	Tons of wood.	Equivalent tons of bagasse.	Tons of coal.	Tons of wood.	Equivalent tons of bagasse.
UF	30	8,060	9,784	2	10,993	13,197
ZM	—	1,167	1,400	—	1,541	1,849
FX	326	858	2,252	372	747	2,291
EN	—	—	—	—	—	—
AK	—	86	103	20	500	675
DK	189	429	1,224	28	684	926
DL	947	873	4,599	574	614	2,889
GL	—	—	—	—	—	—
MV	229	2,695	4,093	393	1,585	3,376
CK	15	46	101	—	—	—
TS	—	130	156	—	30	36
NE	—	—	—	—	—	—
IL	—	—	—	—	188	226
RN	—	—	—	—	800	960
ES	—	20	24	—	55	66
SZ	—	1,350	1,620	—	520	624
UK	—	52	62	—	148	178

APPENDIX I

"Imbibition efficiency" is calculated with the aid of the following formula:—

$$\frac{(100-\text{Fibre \% Bagasse}) \times (\text{Sucrose \% Last expressed juice})}{(\text{Sucrose \% Bagasse})}$$

The derivation of the formula is based on the following reasoning:—

Assuming for a moment that the imbibition water is thoroughly (100 per cent.) mixed with the juice in bagasse, the analyses of the last expressed juice and of the juice left in the final bagasse will be the same. So if (100—Fibre % Bagasse) should stand for the amount of juice left in 100 parts final bagasse,

$$\frac{(100-\text{Fibre \% Bagasse}) \times (\text{Sucrose \% Last expressed juice})}{100}$$

will represent "Sucrose % Bagasse."

So if we divide the divisor of this fraction by

(Sucrose % Bagasse)

as determined by direct analysis of the bagasse, the result should be

"100",

if our assumptions were right. However, since imbibition water will never mix completely with the juice left in the bagasse, and (100—Fibre % Bagasse) does not represent the percentage of juice left in bagasse, the final result will never be "100," but always less.

APPENDIX II

Table Rendering the Winter Co-efficient "f" as a Function of the Purity of Mixed Juice.

Purity of mixed juice.	Factor "f."	Purity of mixed juice.	Factor "f."	Purity of mixed juice.	Factor "f."
82.0	0.460	85.0	0.489	88.0	0.515
.1	0.461	.1	0.490	.1	0.516
.2	0.462	.2	0.491	.2	0.517
.3	0.463	.3	0.492	.3	0.517
.4	0.464	.4	0.493	.4	0.518
.5	0.465	.5	0.493	.5	0.519
.6	0.466	.6	0.494	.6	0.520
.7	0.467	.7	0.495	.7	0.521
.8	0.468	.8	0.496	.8	0.521
.9	0.469	.9	0.497	.9	0.522
83.0	0.470	86.0	0.498	89.0	0.523
.1	0.471	.1	0.499	.1	0.524
.2	0.472	.2	0.500	.2	0.524
.3	0.473	.3	0.501	.3	0.525
.4	0.474	.4	0.502	.4	0.526
.5	0.475	.5	0.502	.5	0.527
.6	0.476	.6	0.503	.6	0.527
.7	0.477	.7	0.504	.7	0.528
.8	0.478	.8	0.505	.8	0.529
.9	0.479	.9	0.506	.9	0.529
84.0	0.480	87.0	0.507	90.0	0.530
.1	0.481	.1	0.508		
.2	0.482	.2	0.509		
.3	0.483	.3	0.509		
.4	0.484	.4	0.510		
.5	0.484	.5	0.511		
.6	0.485	.6	0.512		
.7	0.486	.7	0.513		
.8	0.487	.8	0.513		
.9	0.488	.9	0.514		

Table I.—CANE CRUSHED, CANE QUALITY, VARIETIES, SUGARS PRODUCED, TIME ACCOUNT AND THROUGHPUT.

FACTORY.	UF.	ZM.	FX.	EN.	AK.	DK.	DL.	GL.	MV.	CK.	TS.	NE.	IL.	RN.	ES.	SZ.	UK.	Totals. Averages.
Crushing period From	**2.7.51**	**1.5.51**	**3.5.51**	**23.5.51**	**11.5.51**	**22.5.51**	**3.5.51**	**16.5.51**	**17.5.51**	**11.5.51**	**10.5.51**	**9.5.51**	**6.6.51**	**31.5.51**	**24.5.51**	**28.5.51**	**1.6.51**	**1.5.51**
Crushing period To	**16.2.52**	**5.12.51**	**29.12.51**	**27.10.51**	**17.12.51**	**28.11.51**	**10.12.51**	**21.11.51**	**10.10.51**	**3.12.51**	**14.11.51**	**4.12.51**	**30.12.51**	**9.11.51**	**31.10.51**	**7.11.51**	**4.11.51**	**16.2.52**
CANE CRUSHED Tons of 2,000 lbs.	524,700	398,095	409,475	44,720	359,567	99,832	487,447	267,008	88,342	155,034	587,691	558,118	170,977	129,636	140,621	258,455	81,932	**4,761,650**
CANE CRUSHED *Metric tons*	*476,000*	*361,146*	*371,470*	*40,569*	*326,194*	*90,566*	*442,205*	*242,226*	*80,143*	*140,645*	*533,145*	*506,316*	*155,108*	*117,604*	*127,569*	*234,467*	*74,327*	*4,319,700*
CANE																		
Sucrose per cent.	13.06	13.05	12.61	14.11	13.37	13.30	13.09	13.48	13.81	13.26	13.62	13.27	13.24	13.84	14.46	13.81	14.30	**13.33**
Fibre per cent.	12.58	17.58	16.66	15.69	17.46	16.57	17.38	16.58	16.38	17.00	15.85	16.64	16.38	17.03	15.65	17.05	15.40	**16.28**
Java Ratio	78.81	75.09	74.43	78.99	76.36	76.06	73.93	75.85	76.21	76.32	77.52	76.41	78.47	76.21	78.84	77.93	79.89	**76.56**
Tons Cane per ton of Sugar	9.21	9.22	9.47	8.72	8.84	9.16	9.44	8.93	9.01	8.98	8.64	8.97	8.94	8.80	8.13	8.64	8.18	**8.98**
Tons Cane per ton of Sugar of 96° pol.	9.00	9.01	9.18	8.42	8.61	8.85	9.16	8.64	8.72	8.71	8.42	8.63	8.94	8.52	7.86	8.34	7.98	**8.73**
VARIETIES CRUSHED																		
Uba per cent.	—	—	0.01	—	0.01	0.04	0.15	0.06	0.49	0.07	0.34	0.27	0.02	0.66	0.32	0.39	0.05	**0.16**
Co.281 per cent.	20.29	68.67	34.74	33.95	29.71	8.49	17.04	7.11	13.91	14.52	11.85	17.69	21.74	30.22	31.15	22.76	85.32	**25.34**
Co.290 and others	0.27	0.07	1.46	—	0.03	—	0.92	10.25	0.34	0.33	0.10	0.17	0.59	0.17	0.12	0.07	0.38	**0.92**
Co.301 per cent.	7.89	12.92	27.20	1.77	22.98	50.76	41.92	56.05	54.81	53.77	52.86	57.58	48.11	50.06	48.07	58.13	3.26	**38.30**
Co.331 per cent.	2.57	3.62	15.51	41.81	32.36	29.89	22.83	6.04	17.83	18.60	10.14	8.49	12.93	1.21	7.83	9.37	1.76	**12.51**
N:Co.310 per cent.	56.39	14.40	19.36	22.47	14.70	10.82	16.97	20.03	12.60	12.71	24.71	15.78	16.38	17.68	11.80	9.28	9.21	**21.12**
P.O.J.'s per cent.	12.59	0.32	1.72	—	0.21	—	0.17	0.46	0.02	—	—	0.02	0.23	—	0.71	—	0.02	**1.65**
TOTAL RAINFALL during 1951	22.83	36.80	40.45	30.91	30.89	32.20	34.49	36.90	33.97	39.71	32.58	34.81	30.00	32.90	32.98	37.57	34.29	**33.78†**
SUGARS																		
Tons of 2,000 lbs. White Sugar	3,737	—	—	3,603	—	7,487	—	18,734	5,540	7,457	—	59,226	—	8,102	11,248	20,190	31	**145,355**
Tons of 2,000 lbs. Government Grade	5,873	35,775	210	1,348	17,920	3,026	347	5,562	2,617	9,800	8,663	2,993	—	6,122	5,457	8,700	2,081	**116,494**
Tons of 2,000 lbs. Raw Sugar	47,380	7,385	43,037	177	22,748	374	51,279	5,599	1,645	—	59,332	—	19,127*	501	584	1,035	7,909	**268,112**
Sugar made and estimated Tons of 2,000 lbs.	56,990	43,160	43,247	5,128	40,670	10,900	51,625	29,896	9,802	17,257	67,995	62,219	19,127	14,725	17,290	29,925	10,021	**529,977**
Sugar made and estimated *Metric tons*	*51,700*	*39,154*	*39,233*	*4,652*	*36,895*	*9,888*	*46,833*	*27,121*	*8,892*	*15,655*	*61,684*	*56,444*	*17,352*	*13,358*	*15,685*	*27,147*	*9,091*	*480,787*
SO_2 p.p.m. in White Sugar	41	—	—	—	—	—	—	—	—	—	—	—	—	—	42	50	—	**46**
SO_2 p.p.m. in Government Grade	84	70	—	—	82	—	58	71	—	—	—	—	—	—	52	70	—	**72**
Polarization of Government Grade	98.10	98.32	98.71	98.49	98.28	98.60	98.98	98.07	98.58	98.39	98.54	—	—	98.26	98.38	98.54	98.32	**98.35**
Polarization of Raw Sugar	98.13	98.04	99.04	98.27	98.74	97.10	98.97	98.07	98.56	—	98.54	—	—	98.35	98.44	97.37	98.32	**98.42**
Safety factor of Raw Sugar	0.37	0.39	0.21	—	0.31	—	0.26	—	0.26	—	0.35	—	—	—	—	—	—	**0.30**
Average Polarization of all Sugars	98.24	98.28	99.04	99.40	98.41	99.33	98.97	99.18	99.27	99.00	98.54	99.82	96.00	99.11	99.37	99.37	98.32	**98.79**
White Sugar per cent. total Sugars made	6.6	—	—	70.3	—	68.8	—	62.7	56.5	43.2	—	95.2	*	55.0	65.1	67.5	—	**27. ***
OVERALL TIME EFFICIENCY (Hours Actual Crushing per cent. Hours Mill Open)	87.55	89.31	91.11	91.27	90.62	88.12	89.88	89.27	90.94	93.05	90.73	96.33	89.55	95.38	97.45	89.73	93.23	**91.4 †**
Total Hours of Stoppage per cent. Hours Mill Open	12.45	10.69	8.89	8.73	9.37	11.88	10.12	10.73	9.07	6.95	9.27	3.67	10.45	4.63	2.55	10.26	6.77	**8.6 †**
Hours of Stoppage due to Shortage of Cane per cent. Hours Mill Open	2.36	7.96	6.51	6.45	5.21	9.09	6.28	8.21	7.54	4.71	4.55	2.83	7.75	1.97	0.54	6.57	5.60	**5.5 †**
THROUGHPUT per hour actual crushing:																		
Tons of Cane crushed	130.58	100.50	90.42	15.08	87.32	29.88	119.12	77.20	32.95	39.83	168.60	134.30	48.84	42.06	43.70	88.19	28.49	**102.38**
Tons of Fibre	16.42	17.67	15.07	2.37	15.24	4.96	20.71	12.80	5.40	6.77	26.72	22.35	8.00	7.16	6.84	15.04	4.39	**16.67**
Tons of Brix processed	18.96	14.26	12.64	2.27	12.76	4.32	16.31	11.22	4.92	5.72	25.19	19.78	7.32	6.60	6.86	13.39	4.54	**14.85**
Tons of Sugar bagged	14.18	10.90	9.55	1.73	9.87	3.26	12.62	8.64	3.66	4.43	19.50	14.97	5.46	4.78	5.37	10.21	3.48	**11.39**

* Illovo refined 7,000 tons of bought raws in addition to its own 19,127 tons of raws.

† Arithmetical average.

Table II.—SUCROSE BALANCE, RECOVERIES, BAGASSE, JUICES, FILTER CAKE AND SYRUP.

FACTORY	UF.	ZM.	FX.	EN.	AK.	DK.	DL.	GL.	MV.	CK.	TS.	NE.	IL.	RN.	ES.	SZ.	UK.	Averages.
SUCROSE BALANCE (Sucrose % Sucrose in Cane) ...																		
Sucrose in Bagasse (A)	6.22	7.68	7.12	7.39	6.71	7.54	10.49	7.49	8.11	7.68	6.48	5.57	6.17	5.83	6.01	6.54	5.37	**7.01**
Sucrose in Filter Cake (B)	0.59	0.33	0.15	1.01	0.86	—	0.94	0.82	0.68	0.26	0.29	0.52	0.19	0.35	0.12	—	1.31	**0.52**
Sucrose in Final Molasses (C)	10.52	9.35	9.17	8.25	8.16	—	{ 8.46	8.04	9.50	{ 8.96	{ 9.54	7.80	11.75	{ 12.50	{ 9.38	—	{ 9.22	**8.61**
Sucrose in Undetermined Losses (D)	0.97	0.97	0.59	2.56	0.92	—		1.26	1.94			2.24	0.82			—		**1.36**
Sucrose lost in Boiling House (B)+(C)+(D)	12.08	10.66	9.90	11.82	9.94	10.91	9.40	10.12	12.11	9.22	9.83	10.55	12.76	12.85	9.50	10.15	10.52	**11.28**
Sucrose in Total Losses (A)+(B)+(C)+(D)	18.30	18.34	17.02	19.20	16.65	18.45	19.90	17.61	20.22	16.90	16.31	16.12	18.93	18.68	15.51	16.69	15.89	**17.50**
LOST ABSOLUTE JUICE % FIBRE IN BAGASSE ...	*49*	*42*	*42*	*44*	*35*	*42*	*54*	*41*	*45*	*41*	*40*	*33*	*36*	*31*	*38*	*36*	*34*	*42*
Imbibition water per cent. Fibre	192	219	225	259	219	187	225	182	192	169	185	237	246	234	308	334	265	**215**
Imbibition water per cent. Cane	25.12	38.42	37.57	40.65	38.23	30.99	39.16	30.19	31.39	28.78	29.36	39.36	40.24	39.88	39.02	38.68	40.94	**35.00**
Extraction (Sucrose in Mixed Juice % Sucrose in Cane) ...	93.78	92.32	92.87	92.61	93.29	92.46	89.51	92.51	91.89	92.32	93.52	94.43	93.83	94.17	93.99	93.46	94.63	**93.00**
BOILING HOUSE PERFORMANCE	*94.8*	*96.2*	*98.2*	*93.7*	*96.9*	*96.2*	*97.2*	*96.7*	*94.7*	*97.7*	*97.2*	*97.2*	*94.9*	*95.1*	*97.3*	*97.5*	*96.6*	*96.7*
Boiling House Recovery (Sucrose in Sugar % Sucrose in Mixed Juice)	87.1	88.5	89.3	87.2	89.3	88.2	89.5	89.1	86.8	90.0	89.5	88.8	86.4	86.4	89.9	89.1	88.9	**88.7**
Overall Recovery (Sucrose in Sugar % Sucrose in Cane) ...	81.7	81.7	83.0	80.8	83.3	81.6	80.1	82.4	79.8	83.1	83.7	83.9	81.1	81.3	84.5	83.3	84.1	**82.5**
FINAL BAGASSE																		
Sucrose per cent.	2.80	2.52	2.34	3.22	2.24	2.85	3.32	2.71	3.19	2.71	2.47	2.06	2.38	2.23	2.60	2.51	2.58	**2.57**
Moisture per cent....	52.84	52.37	53.26	47.43	53.41	49.11	53.77	52.03	49.17	51.27	52.25	50.68	48.78	50.05	49.63	49.24	44.68	**51.71**
Fibre per cent.	43.37	44.13	43.44	48.42	43.66	47.17	42.00	44.49	46.66	45.20	44.36	46.43	47.79	46.98	46.79	47.38	51.75	**44.76**
Weight per cent. Cane	29.02	39.83	38.35	32.40	39.98	35.18	41.39	37.26	35.10	37.61	35.72	35.83	34.28	36.26	33.45	35.98	29.46	**36.37**
Lower Calorific Value (7650−18 S−86.4 W Btu./lb.)...	*3034*	*3080*	*3006*	*3494*	*2995*	*3356*	*2944*	*3106*	*3345*	*3171*	*3092*	*3234*	*3392*	*3286*	*3315*	*3351*	*3744*	*3136*
FIRST EXPRESSED JUICE																		
Brix	19.0	19.7	19.4	20.4	19.8	19.8	20.2	20.1	20.8	20.0	20.2	20.1	19.6	20.9	20.7	20.3	20.3	**20.1***
Purity (apparent)	87.0	88.1	87.2	89.8	88.4	87.7	87.8	88.1	87.1	86.8	87.0	86.5	85.9	87.0	88.8	87.4	88.1	**87.6***
LAST EXPRESSED JUICE																		
Brix	3.05	2.45	2.07	2.19	2.23	4.66	4.49	3.58	4.07	3.50	2.89	2.13	2.61	2.39	2.68	4.12	3.00	**3.06***
Purity (apparent)	73.9	72.0	71.0	77.6	76.7	75.0	78.5	77.8	76.8	76.7	72.9	70.4	71.3	74.8	72.7	74.4	73.7	**74.5***
Purity drop from First Expressed Juice	13.2	16.1	16.2	12.2	11.7	12.7	9.3	10.3	10.3	10.1	14.1	16.1	14.6	12.2	16.1	13.0	14.4	**13.0***
MIXED JUICE																		
Brix	15.3	14.4	14.1	13.9	14.9	15.1	14.0	15.6	15.5	15.7	16.0	14.2	14.2	15.1	14.9	14.8	14.3	**14.8**
Purity (Gravity)	84.4	84.9	83.8	87.0‡	85.4	85.0‡	85.6	85.8	85.0	85.3	85.2	85.1	82.9	83.2‡	86.5	85.0	85.0‡	**84.9**
Reducing Sugar/Sucrose Ratio	2.59	3.36	4.16	3.07	3.73	3.62	3.31	2.90	3.80	2.44	—	3.77	4.02	4.61	3.80	3.94	—	**3.52**
Purity drop from First Expressed Juice	2.7	3.2	3.4	2.8	3.0	2.7	2.2	2.3	2.1	1.5	1.8	1.5	3.0	3.8	2.3	2.4	3.1	**2.6***
CLARIFIED JUICE																		
Brix	15.1	15.6	13.2	14.2	14.5	15.8	13.7	16.0	16.4	16.0	15.5	14.2	13.8	16.0	16.3	14.5	—	**15.1†**
Purity (apparent)	85.5	85.7	85.3	87.9	86.1	86.4	86.6	87.0	86.2	86.5	86.2	92.3	85.3	84.1	87.5	85.5	85.7	**86.1†**
Reducing Sugar/Sucrose Ratio	2.63	2.70	3.89	2.65	3.40	—	3.11	—	3.50	—	—	1.48	3.49	4.41	3.22	3.81	—	**3.25†**
pH	7.3	7.4	7.4	—	7.2	6.9	7.4	6.7	6.9	6.9	7.5	6.9	7.3	—	7.1	7.0	7.4	**7.2†**
FILTER CAKE																		
Per cent. Sucrose	1.73	0.85	0.33	2.56	1.77	1.31	1.66	2.23	1.57	0.62	0.72	0.61	0.63	0.71	0.29	0.39	5.75	**1.28†**
Weight per cent. Cane	4.50	5.10	5.68	5.57	6.53	—	7.44	4.98	6.00	5.59	5.46	11.34	4.00	6.74	6.11	—	3.06	**5.68†**
SYRUP																		
Brix	55.6	51.2	58.1	54.4	52.2	51.0	45.7	51.5	48.8	51.0	47.5	61.9	56.5	59.4	56.8	56.0	56.8	**53.3†**
Purity (apparent)	85.4	85.8	85.3	87.3	86.0	86.9	87.0	87.2	86.5	86.8	86.2	92.0	85.1	84.5	87.5	86.2	86.3	**86.2†**
Reducing Sugar/Sucrose Ratio	2.55	2.69	3.95	2.41	3.34	—	3.23	2.82	3.50	—	—	1.54	3.55	4.52	3.08	3.34	—	**3.25†**
Purity increase from Mixed Juice	1.1	0.9	1.5	0.3	0.6	1.9	1.4	1.4	1.5	1.5	1.0	6.9	2.2	1.3	1.0	1.2	1.4	**1.3†**
pH	7.1	7.1	7.1	—	6.9	6.7	6.9	6.7	6.7	6.7	—	7.1	7.1	—	7.0	6.7	7.1	**6.9†**

* Arithmetical average. † NE not included in arithmetical average. ‡ Apparent purity.

Table III.—MASSECUITES, RUN-OFFS, FINAL MOLASSES AND CHEMICALS.

FACTORY	UF.	ZM.	FX.	EN.	AK.	DK.	DL.	GL.	MV.	CK.	TS.	NE.	IL.	RN.	ES.	SZ.	UK.	Averages.
FIRST MASSECUITE																		
Brix ...	93.0	92.5	94.3	93.2	92.9	91.4	93.1	91.7	91.0	91.6	92.6	91.0	92.7	93.9	91.9	92.0	92.3	92.5†
Purity (apparent) ...	85.1	84.9	94.2	83.3	81.6	86.1	86.0	87.5	86.5	87.7	86.4	93.9	82.4	83.4	84.3	83.6	82.1	84.7†
Cubic feet per ton of brix in Mixed Juice	24.2	15.6	20.4	22.9	21.2	22.3	19.6	22.4	21.2	—	—	39.5	19.8	19.6	—	24.9	—	21.07‡
Purity of Run-off (apparent)	68.8	64.1	63.4	61.1	61.4	67.8	67.4	68.8	69.4	70.1	70.1	83.1	59.8	63.9	66.8	64.5	63.6	65.7†
Purity drop (apparent) ...	16.3	20.8	20.8	22.2	20.2	18.3	18.6	18.7	17.1	17.6	16.3	10.8	22.7	19.5	17.5	19.1	18.5	19.0†
Crystal per cent. Massecuite I ...	48.6	53.6	53.6	53.0	48.6	51.9	53.0	54.9	50.8	53.9	50.5	58.2	52.2	50.7	48.5	49.6	46.9	51.3†
SECOND MASSECUITE																		
Brix ...	95.4	97.1	98.2	95.0	95.1	94.3	96.6	95.2	93.8	94.3	95.9	93.6	94.3	96.8	95.5	95.0	95.1	95.3†
Purity (apparent) ...	73.4	72.6	70.5	69.8	70.3	76.0	71.4	71.3	73.4	69.6	74.9	82.4	74.2	70.0	71.5	68.9	70.3	71.8†
Cubic feet per ton of brix in Mixed Juice	12.2	12.8	10.7	10.3	11.9	16.1	10.5	11.0	15.6	—	—	19.1	17.5	9.2	—	—	—	11.52‡
Purity of Run-off (apparent)	52.6	47.7	44.7	47.3	47.1	52.4	47.0	46.9	49.8	46.5	52.7	59.8	51.2	47.8	48.7	45.5	50.2	48.6†
Purity drop (apparent) ...	20.8	24.9	25.8	22.5	23.2	23.6	24.5	24.4	23.6	23.1	22.2	22.6	23.0	22.2	22.8	23.5	20.1	23.2†
Crystal per cent. Massecuite II ...	41.9	46.2	45.8	40.6	41.7	46.7	44.6	43.7	44.1	40.7	45.0	52.6	44.4	41.2	42.4	40.8	38.4	43.0†
THIRD MASSECUITE																		
Brix ...	99.3	98.3	98.9	95.5	96.4	96.5	99.0	94.8	95.7	96.6	98.4	98.9	92.7	99.0	98.2	96.5	95.6	97.0†
Purity (apparent) ...	62.5	62.1	60.5	60.2	58.9	62.4	59.5	60.6	59.1	59.3	62.6	69.9	63.5	58.3	60.0	62.0	61.2	60.8†
Cubic feet per ton of brix in Mixed Juice	9.2	7.5	7.2	9.4	7.1	8.7	6.5	7.4	8.2	—	—	8.9	11.5	9.3	—	—	12.0	7.47‡
Purity of Run-off (apparent)	41.8	40.6	40.3	43.3	40.5	38.5	39.3	40.1	40.6	38.5	39.6	43.8	43.9	38.6	38.0	41.3	40.9	40.3†
Crystal per cent. Massecuite III...	35.3	35.6	33.5	28.4	29.8	37.4	33.0	32.4	29.8	32.7	37.5	46.0	32.4	31.8	37.8	34.0	32.9	32.6†
WASH																		
Purity (apparent) ...	—	—	76.6	—	67.8	—	70.7	—	—	—	—	—	76.9	—	—	—	—	—
JELLY																		
Brix ...	—	—	96.9	—	93.2	—	94.3	—	—	—	—	—	90.3	—	93.5	94.1	—	—
Purity (apparent) ...	—	—	49.6	—	42.5	—	57.8	—	—	—	—	—	45.7	—	44.2	43.6	—	—
Purity of Run-off (apparent)	—	—	—	—	—	—	—	—	—	—	—	—	42.7	—	—	36.7	—	—
CUBIC FEET OF ALL MASSECUITES																		
Per ton of Sugar ...	60.9	46.9	50.8	55.8	52.2	62.5	47.4	53.0	60.8	48.8	—	89.2	69.2	52.6	—	55.2	—	52.87‡
Per ton of brix in Mixed Juice ...	45.6	35.8	38.4	42.7	40.4	47.1	36.7	40.8	45.1	37.8	—	67.5	51.6	38.1	—	42.1	—	40.24‡
FINAL MOLASSES																		
Brix ...	94.4	92.6	92.7	87.4	88.1	87.7	90.8	82.2	87.4	86.4	93.8	89.8	86.5	92.3	90.9	88.8	89.7	90.3
Purity (gravity) ...	41.8	40.4	37.8	43.5	40.1	38.5	38.6	40.1	40.6	38.5	40.5	43.7	42.7	39.0	37.8	38.0	40.9	40.3
Reducing Sugars per cent.	10.07	10.39	12.42	—	12.21	—	13.00	10.32	12.42	—	—	9.91	14.47	—	—	—	—	—
Sulphated Ash per cent. ...	13.98	14.59	17.05	—	12.64	—	15.66	—	—	—	—	12.20	11.11	—	—	—	—	—
Reducing Sugar Ash Ratio	0.72	0.71	0.73	—	0.97	—	0.83	—	—	—	—	0.81	1.30	—	—	—	—	—
Weight per cent. Cane (at 85° brix) ...	3.86	3.55	3.30	3.15	3.16	—	—	3.29	3.79	3.21	3.45	2.79	4.29*	—	—	—	—	3.35
CHEMICALS																		
Lime—lbs. per ton of Cane	6.03	5.49	5.51	5.59	5.15	5.03	5.68	6.38	8.24	5.42	4.64	—	8.20	7.61	6.85	7.00	6.66	5.86†
lbs. per ton of Sugar	55.52	50.61	52.13	48.75	45.54	46.11	53.66	57.00	74.27	48.68	40.15	—	73.30	66.96	55.74	60.28	54.49	52.66†
lbs. per 1,000 lbs. brix in Mixed Juice ...	20.77	19.33	19.69	18.60	17.63	17.38	20.76	21.96	27.58	18.88	15.54	—	27.34	24.27	21.81	23.03	20.92	20.10†
Sulphur—lbs. per ton of Cane ...	2.32	2.11	2.11	2.28	2.30	1.74	2.38	2.91	3.17	2.35	1.30	—	3.18	3.15	2.62	2.99	2.30	2.30†
lbs. per ton of Sugar ...	21.38	19.43	19.95	19.89	20.36	15.94	22.47	25.99	28.60	21.09	11.24	—	28.44	27.76	21.30	25.80	18.81	20.63†
lbs. per 1,000 lbs. brix in Mixed Juice	8.00	7.42	7.54	7.58	7.88	6.01	8.69	10.01	10.62	8.18	4.35	—	10.61	10.06	8.34	9.83	7.22	7.87†
Phosphoric—lbs. per ton of Cane	0.06	0.79	0.66	0.52	0.99	1.97	0.87	1.10	0.96	1.06	0.92	—	0.99	0.86	0.77	0.85	0.75	0.80†
lbs. per ton of Sugar	0.51	7.26	6.21	4.52	8.75	18.08	8.18	9.87	8.63	9.50	7.91	—	8.89	7.62	6.23	7.35	6.12	7.19†
lbs. per 1,000 lbs. brix in Mixed Juice ...	0.19	2.77	2.35	1.73	3.39	6.81	3.16	3.80	3.20	3.69	3.06	—	3.32	2.76	2.44	2.80	2.35	2.74†

With the exception of Cubic Feet Massecuites, Final Molasses and Chemicals figures, all averages are arithmetical averages.

* Included molasses produced by refining 7,000 tons of bought raws. † NE excluded. ‡ NE and IL excluded.

Table IV.—COMPARATIVE RESULTS FOR RECENT YEARS.

COUNTRY	NATAL										
YEAR	1941.	1942.	1943.	1944.	1945.	1946.	1947.	1948.	1949.	1950.	1951.
CANE											
Per cent. Sucrose	14.00	13.40	13.14	13.67	14.28	14.21	13.32	13.89	13.52	14.19	13.33
Per cent. Fibre	15.66	15.24	15.26	15.83	15.99	16.21	15.80	15.90	16.19	15.80	16.28
JUICES											
Purity of First Expressed Juice	87.9	88.3	88.7	88.4	88.4	88.2	88.5	88.1	88.6	88.7	87.6
Purity of Mixed Juice	85.7	86.0	86.6	86.2	86.2	85.9	86.2	85.9	86.2	86.4	84.9
Purity of Last Expressed Juice	77.5	76.9	76.4	75.8	75.9	75.1	75.0	75.5	76.2	75.8	74.5
Purity of Syrup	87.7	87.9	88.1	87.8	87.8	87.4	88.0	87.5	87.9	87.6	86.2
Drop in purity First Expressed to Mixed Juice...	2.3	2.3	2.1	2.2	2.1	2.4	2.2	2.2	2.4	2.3	2.6
Drop in purity First Expressed to Last Expressed Juice ...	10.5	11.4	12.3	12.6	12.4	13.1	13.4	12.6	12.5	12.9	13.0
Drop in purity First Expressed Juice to Syrup...	0.2	0.4	0.6	0.5	0.5	0.8	0.5	0.6	0.7	1.1	1.4
Increase in purity from Mixed Juice to Syrup	2.0	1.9	1.6	1.6	1.6	1.6	1.8	1.6	1.7	1.3	1.3
Reducing Sugar/Sucrose ratio of Mixed Juice	3.35	3.07	3.18	3.49	3.38	3.30	2.95	3.67	3.11	3.12	3.52
JAVA RATIO	77.74	77.67	77.78	77.38	77.36	77.03	76.99	76.98	76.47	77.42	76.56
BAGASSE											
Per cent. Sucrose	3.03	2.88	2.76	2.73	2.77	2.79	2.54	2.67	2.66	2.72	2.57
Per cent. Moisture	51.50	51.24	50.80	50.23	50.19	50.32	50.46	50.53	50.84	51.22	51.71
EXTRACTION											
Imbibition % Fibre	222	215	207	213	219	217	218	214	208	206	215
Imbibition % Cane...	35	33	32	34	35	35	34	34	34	33	35
Sucrose in Mixed Juice % Sucrose in Cane	92.4	92.7	93.0	93.1	93.3	93.1	93.4	93.3	92.9	93.3	93.0
Tons of Fibre per hour Actual Crushing...	12.5	12.6	13.3	13.7	14.0	13.6	14.6	14.9	15.4	16.2	16.7
Tone of Cane per hour Actual Crushing	80	83	87	87	88	84	93	94	95	102	102
FILTER CAKE											
Per cent. Sucrose (arithmetical average)...	1.7	1.2	1.1	1.2	1.1	1.0	1.1	1.3	1.1	1.2	1.2
Weight % Cane	5.6	5.4	5.1	5.2	5.6	5.9	6.0	5.9	5.9	5.5	6.0
GRAVITY PURITY OF FINAL MOLASSES	43.4	43.2	41.8	42.4	42.0	41.8	41.1	41.5	41.4	40.5	40.3
RECOVERIES											
Sucrose % Cane lost in manufacture	2.57	2.34	2.16	2.30	2.42	2.42	2.16	2.33	2.25	2.32	2.33
Sucrose in Sugar % Sucrose in Cane	81.7	82.5	83.5	83.1	83.3	82.9	83.7	83.2	83.4	83.7	82.5
Reduced Overall Recovery (12.5% Fibre, 85° purity M.J.) ...	82.6	83.0	83.5	83.6	83.7	83.8	84.1	83.9	84.0	—	—
Sucrose in Sugar % Sucrose in Mixed Juice	88.4	89.0	89.8	89.3	89.3	89.1	89.6	89.1	89.7	89.6	88.7
Reduced Boiling House Recovery (85° purity Mixed Juice) ...	87.8	88.1	88.4	88.2	88.2	88.3	88.5	88.3	88.6	96.9*	96.7*
YIELD											
Tons Cane per ton Sugar	8.62	8.93	8.98	8.67	8.29	8.36	8.84	8.55	8.76	8.32	8.98
Tons Cane per ton Sugar of 96° Pol.	8.39	8.69	8.74	8.44	8.08	8.14	8.60	8.31	8.52	8.09	8.73
LOSSES											
Sucrose in Bagasse % Sucrose in Cane (A)	7.63	7.31	7.03	6.87	6.72	6.93	6.56	6.68	7.06	6.67	7.01
Sucrose in Filter Cake % Sucrose in Cane (B)	0.52	0.41	0.36	0.37	0.35	0.28	0.32	0.36	0.34	0.37	0.52
Sucrose in Molasses % Sucrose in Cane (C) ... ... }	10.18	9.80	9.09	9.62	9.63	9.85	9.39	9.77	9.25	9.34	8.61
Undetermined Sucrose % Sucrose in Cane (B) ... ... }											1.36
Sucrose lost in Boiling House % Sucrose in Cane (B)+(C)+(D)	10.70	10.21	9.45	9.99	9.98	10.13	9.71	10.13	9.59	9.68	11.28
Sucrose in Total Losses % Sucrose in Cane (A)+(B)+(C)+(D)	18.34	17.52	16.48	16.86	16.70	17.06	16.27	16.81	16.65	16.35	17.50
AVERAGE POLARISATION OF ALL SUGARS	98.58	98.65	98.59	98.62	98.73	98.70	98.83	98.93	98.84	98.77	98.79

* Boiling House Performance.

Table V.—AVERAGE MANUFACTURING RESULTS BY PERIODS FOR NATAL SUGAR FACTORIES REPORTING TO THE SUGAR MILLING RESEARCH INSTITUTE, SEASON 1951-1952.

Period ended		JUNE 2, 1951.	JUNE 30, 1951.	JULY 1, 1951.	SEPT. 1, 1951.	SEPT. 29, 1951.	OCT. 27, 1951.	DEC. 1, 1951.	DEC. 29, 1951.	SEASON.
Tons of 2,000 lbs. Cane crushed	This period	—	616,547	685,388	839,319	679,931	632,617	593,825	167,009	
	To date ...	429,989	1,046,536	1,731,924	2,571,243	3,251,174	3,883,791	4,477,616	4,644,625	**4,761,650**
Tons of 2,000 lbs. of Sugar bagged and estimated.	This period	—	69,379	79,895	98,129	77,638	67,782	62,883	16,909	
	To date ...	45,055	114,436	194,331	292,460	370,098	437,880	500,763	517,672	**529,977**
Tons of Cane per ton of Sugar	This period	—	8.89	8.58	8.55	8.76	9.34	9.30	9.09	
	To date ...	9.54	9.14	8.91	8.79	8.78	8.87	8.94	8.98	**8.98**
Sucrose per cent. Cane	This period	—	13.42	13.89	14.04	13.61	12.82	12.71	12.26	
	To date ...	12.74	13.14	13.44	13.63	13.62	13.49	13.39	13.55	**13.33**
Fibre per cent. Cane...	This period	—	16.49	16.42	16.40	16.35	16.21	16.42	15.77	
	To date ...	16.57	16.52	16.48	16.46	16.43	16.40	16.40	16.31	**16.28**
Java Ratio	This period	—	77.02	76.90	77.18	76.37	77.58	73.93	75.51	
	To date ...	76.42	76.78	76.83	76.94	76.83	76.94	76.56	76.52	**76.56**
Sucrose per cent. Bagasse	This period	—	2.58	2.80	2.64	2.60	2.44	2.49	2.48	
	To date ...	2.56	2.57	2.60	2.61	2.60	2.58	2.57	2.57	**2.57**
Moisture per cent. Bagasse	This period	—	51.43	51.42	51.42	51.51	51.29	52.35	53.14	
	To date ...	52.23	51.77	51.63	51.56	51.55	51.51	51.62	51.68	**51.71**
Imbibition per cent. Cane	This period	—	34	36	35	35	36	35	33	
	To date ...	34	34	35	35	35	35	35	35	**35**
Extraction	This period	—	93.1	92.9	93.2	93.0	93.0	92.9	92.6	
	To date ...	92.5	92.9	92.9	93.0	93.0	93.0	93.0	93.0	**93.0**
Boiling House Recovery	This period	—	89.0	89.2	88.9	88.7	88.8	88.7	87.6	
	To date ...	87.9	88.6	88.8	88.8	88.8	88.8	88.8	88.8	**88.7**
Overall Recovery	This period	—	82.9	82.9	82.8	82.5	82.6	82.4	81.1	
	To date ...	81.3	82.3	82.5	82.6	82.6	82.6	82.6	82.5	**82.5**
Purity of Mixed Juice	This period	—	85.4	85.5	85.0	85.4	83.7	83.5	82.5	
	To date	85.0	85.2	85.3	85.2	85.3	85.0	85.0	85.0	**84.9**
Reducing Sugar/Sucrose ratio, Mixed Juice ...	This period	—	3.81	3.29	3.30	2.93	3.95	3.98	3.14	
	To date ...	3.72	3.77	3.57	3.47	3.37	3.46	3.53	3.52	**3.52**
Gravity Purity of Final Molasses	This period	—	39.5	40.4	40.2	41.2	40.8	40.0	38.6	
	to date	40.2	39.7	39.9	40.0	40.3	40.4	40.3	40.2	**40.3**

Table VI.—COMPARATIVE RESULTS FOR RECENT YEARS.

COUNTRY	MAURITIUS		BRITISH GUIANA		QUEENSLAND		TRINIDAD		PUERTO RICO	NATAL	
YEAR	1949.	1950.	1949.	1950.	1949.	1950.	1949.	1950.	1949-50.	1950.	1951.
CANE											
Per cent. Sucrose	14.33	14.14	10.55	10.92	15.01	14.53	12.67	11.67	13.36	14.19	13.33
Per cent. Fibre	12.00	11.80	14.73	15.10	12.74	12.87	14.32	14.07	14.12	15.80	16.28
JUICES											
Purity of First Expressed Juice	89.4	89.3	82.2	83.1	87.9	88.6	84.5	84.4	86.4	88.7	87.6
Purity of Last Expressed Juice	76.2	76.4	—	—	—	—	73.7	73.4	—	75.8	74.5
Purity of Mixed Juice	86.9	86.7	80.2	80.9	—	—	82.4	82.3	—	86.4	84.9
Reducing Sugar/Sucrose ratio of Mixed Juice	3.6	3.5	—	—	—	—	8.2	9.2	—	3.1	3.5
Purity of Syrup	87.1	87.1	81.1	82.2	86.9	87.9	84.3	84.2	85.1	87.6	86.3
Purity drop First Expressed to Mixed Juice	2.5	2.6	2.0	2.2	—	—	2.1	2.1	—	2.3	2.6
Purity drop First Expressed to Syrup	2.3	2.2	1.1	0.9	1.0	0.7	0.2	0.2	1.2	1.1	1.4
JAVA RATIO	80.37	80.99	77.35	75.52	82.16	82.45	77.44	77.17	78.50	77.42	76.56
BAGASSE											
Per cent. Sucrose	3.18	3.17	3.08	3.14	2.61	2.46	2.78	2.59	2.57	2.72	2.57
Per cent. Moisture	45.50	46.00	46.20	46.43	48.54	48.60	48.22	48.34	49.01	51.22	51.71
EXTRACTION											
Imbibition % Fibre...	180	178	148	152	—	—	149	141	179	206	215
Sucrose in Mixed Juice % Sucrose in Cane	94.7	94.8	91.4	91.2	95.4	95.6	93.4	93.6	94.3	93.3	93.0
FILTER CAKE											
Per cent. Sucrose	8.2	7.4	2.9	2.2	3.3	3.3	2.9	2.1	2.6	1.2	1.2
Weight % Cane	1.4	1.8	2.9	2.9	3.0	3.2	2.4	2.5	3.7	5.5	6.0
PURITY OF FINAL MOLASSES	38.5	38.2	32.5	32.3	46.2	45.4	32.2	31.9	31.4	40.5	40.3
RECOVERIES											
Sucrose % Cane lost in manufacture	2.14	2.09	2.14	2.18	2.21	2.07	1.99	1.64	1.73	2.32	2.33
Sucrose in Sugar % Sucrose in Cane	85.1	85.2	79.7	80.0	85.3	85.8	84.3	85.9	87.1	83.7	82.5
Sucrose in Sugar % Sucrose in Mixed Juice	89.8	89.8	87.3	87.79	89.4	90.2	90.2	91.8	92.3	89.6	88.7
YIELD											
Tons of Cane per ton of Sugar	8.07	8.15	11.44	10.98	7.71	7.87	9.05	9.57	8.37	8.32	8.98
Tons of Cane per ton of Sugar of 96° Pol.	7.87	7.97	11.41	11.05	7.50	7.65	8.99	9.49	8.25	8.09	8.73
LOSSES											
Sucrose in Bagasse % Sucrose in Cane (A)	5.30	5.20	8.64	8.81	4.57	4.43	6.56	6.37	5.71	6.67	7.01
Sucrose in Filter Cake % Sucrose in Cane (B)	0.81	0.94	0.80	0.59	0.64	0.65	0.56	0.45	0.72	0.37	0.52
Sucrose in Molasses % Sucrose in Cane (C)	{ 8.79	8.66	8.81	8.44	7.18	6.18	7.34	6.50	6.06	} 9.34	8.61
Undetermined Sucrose % Sucrose in Cane (D)			2.02	2.11	2.32	2.97	1.24	0.74	0.44		1.36
Lost in Boiling House % Sucrose in Cane (B)+(C)+(D) ...	9.60	9.60	11.63	11.14	10.14	9.80	9.14	7.69	7.22	9.68	11.28
Total Losses % Sucrose in Cane (A)+(B)+(C)+(D)	14.90	14.80	20.27	19.95	14.71	14.23	15.70	14.06	12.93	16.35	17.50
AVERAGE POLARISATION OF ALL SUGARS	98.40	98.30	96.27	96.57	98.75	98.68	96.67	96.80	97.36	98.77	98.79

Dr. H. H. Dodds said it gave him pleasure to congratulate Mr. Perk and the Milling Research Institute on the very convenient and well-arranged form of the annual summary of performance of the sugar factories.

Several new and interesting data and resulting statistics had been introduced for the first time, and he hoped it would be found that these and other new ones still to come could be maintained in future to provide additional items for this valuable report, so that eventually the annual summaries of sugar production in South Africa would be as complete and informative as those formerly published in the "Archief" of the Java sugar industry.

He also expressed the hope that it would not be long before Mr. du Toit would receive the necessary census office data to enable him to complete the annual agricultural record of the industry, which in present circumstances he considered to be of equal value with the manufacturing information.

Mr. du Toit congratulated Mr. Perk on the general set-up of his paper. He found the tables clearly set out and in a convenient form.

Reference was made to the comparatively high molasses purities in this country and the difficulty of assessing the possible extent of further reduction in purity. This matter should certainly receive a high priority in future research, but molasses purity by itself was a poor criterion for judging boiling house work. It was known that molasses purity was influenced by mixed juice purity of clarified juice purity, and countries such as Queensland and South Africa which started off with a high purity raw material were likely to end up with a rather high molasses purity, because the reducing sugar ash ratio was probably low, but at the same time the quantity of molasses produced would also probably be low. In fact the relationship between molasses purity and mixed juice purity was recognised to some extent where our boiling house performance had a varying "f" factor depending on the purity of mixed juice. Mr. du Toit also questioned the correctness of the statement in the paper "since a lower purity of final molasses should result in a higher B.H.P. figure, etc." He thought that because of the varying "f" factor the conclusion was not necessarily correct.

Mr. Wheeler remarked that Dr. Douwes Dekker had said that greater efficiency would be obtained by the production of a lower purity final molasses, with which statement he agreed. He also said, however, that the purity of Natal final molasses was second highest of the countries listed, and to this he would remark that in Demerara, when he was there 25 years ago, the purity of final molasses was between 30° and 32°, but the purity of mixed juice rarely exceeded 80°, so that to compare efficiencies of the different sugar countries by the purity of the final molasses was not, in his opinion, sound, as the quality of the raw material influenced the exhaustion of the molasses.

Dr. Douwes Dekker, replying to Mr. du Toit and Mr. Wheeler, said that he agreed that the exhaustability of final molasses depended on the composition of the non-sucrose. In Java he developed a formula—now often mentioned in articles as the Douwes-Dekker formula—which allows the calculation of the expected purity when reducing sugars % non-sucrose, and sulphated ash % non-sucrose in final molasses are known. This formula, which had been discussed in his paper read before the 1949 S.A.S.T.A. Congress, was useful in Java, and as judged from recent reports, was useful in Australia too.

The procedure was as follows: in a final molasses, the purity of which had to be judged, dry matter, sucrose, reducing sugars and sulphated ash were determined. With the aid of the formula, from the results of these determinations, the molasses purity was calculated, to which the average Java factory would have exhausted this particular final molasses. The actual purity was then compared with the calculated purity, the difference between these two values being the criterion on which the boiling house work was judged.

A higher percentage of reducing sugars and a lower percentage of sulphated ash (on non-sucrose) would result in a lower calculated purity and since a higher percentage of reducing sugars was often due to working low purity mixed juice, it was comprehensible that countries working low purity mixed juice, for example Demarara, as indicated by Mr. Wheeler, showed low purity final molasses.

The fact that a lower mixed juice purity was often accompanied by a higher reducing sugar percentage and therefore more easily led to a lower molasses purity was allowed for in Natal's Boiling House Performance figure, which was calculated with a factor "f" which increased with increasing mixed juice purity figures, as shown in Appendix II.

Whether the effect of mixed juice purity on molasses purity was quite correctly taken into account, was still an open question. When more experience was available it might be possible to adjust factor "f." So far experience had not indicated that factor "f" as given in Appendix II was seriously incorrect.

As to Mr. du Toit's last question about the correctness of the statement that "a lower purity of final molasses should result in a higher B.H.P. figure," Dr. Douwes Dekker replied that when factories A and B showed the same losses in filter cake and undetermined, the factory having the lower purity of final molasses would generally show the higher B.H.P. figure. If, however, the mixed juice purities of the two factories differed considerably, it might be the case that the factory showing the higher molasses purity also showed the higher B.H.P. figure. This, however, would be an exception to the general rule.