

FORTY-THIRD ANNUAL SUMMARY OF LABORATORY REPORTS OF SUGAR FACTORIES IN SOUTHERN AFRICA COVERING THE 1967—1968 SEASON

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N.B. All data in this summary are (except where otherwise stated) as declared by the Mills in their final laboratory reports.

A. THE SOUTH AFRICAN CANE CROP OF THE 1967-68 SEASON

A—(i) THE WEATHER

Good rains were recorded during the growing period of the 1967/68 sugar cane crop. However, a severe winter drought occurred from May to September, 1967. Good rains fell again in October and November, 1967, but the rain falling in December was less than half the average for the month, retarding the growth of next season's crop. This reviews the weather conditions prevailing during the growing, maturing and harvesting times of the 1967/68 crop. In the following paragraphs and tables particulars of this crop will be discussed in comparison with those of previous seasons.

A—(ii) SUCROSE % CANE BY MONTHLY PERIODS

In the first column of the first table the sucrose content of the cane refers to the period between 1927 and 1944 when, for the first half of the period, UBA CANE was the main variety. The second column covers the average sucrose content for the period 1945 to 1966 inclusive, a period when Co.—and N:Co.—varieties were crushed.

TABLE 1

Month	Averages 1927/44	Averages 1945/66	1967/68 Season
May	12.30	12.57	11.78
June	12.70	13.13	12.37
July	13.37	13.70	12.87
August	13.80	14.23	13.31
September	14.18	14.45	13.72
October	14.05	14.19	14.26
November	13.55	13.64	13.52
December	12.75	13.08	12.81
January	12.30	12.65	12.47

The table gives the impression that the ripening process as recorded for the past season was lagging a month behind the usual pattern. In other words had the season started a month later the average sucrose content of the cane would have been higher during the first seven months of the 1967/68 season.

The table shows also that the average sucrose content of the cane in the UBA-period was slightly lower than in the following era. However, we will see in the next table that the UBA-cane juices had a higher purity quotient than the Co.'s and the N:Co.'s.

A—(iii) MIXED JUICE PURITIES BY MONTHLY PERIODS

In the second table a similar comparison is shown

as in the previous one, but this time the average mixed juice purities are compared.

TABLE 2

Month	Averages 1927/44	Averages 1945/66	1967/68 Season
May	84.10	84.00	83.36
June	84.70	85.16	83.49
July	85.40	85.72	83.67
August	85.95	85.68	83.64
September	86.32	85.92	83.51
October	86.40	85.88	83.75
November	86.00	85.57	84.12
December	85.00	84.73	83.78
January	84.00	83.88	82.47

Comparison of the mixed juice purities of the 1967/68 season with the averages of previous periods shows how extremely low the purities were during the past season. The table also shows that the peak value for purity lagged a month behind the usual month for highest purity, i.e. October.

Of even greater interest are the results of the cane harvested in the optimum periods. To compare again the results of the past season with those obtained during the Uba period and the Co. and the N:Co. period would make the table too long; therefore in the third table only the results of the post-Uba period are compared with past seasons' data.

A—(iv) COMPARISON OF THE CANE HARVESTED DURING THE OPTIMUM PERIODS FOR THE LAST 23 YEARS

The table confirms the previous findings that the sucrose content of the cane harvested during the past season was low and that the juice purity was extremely low.

Only once was a lower sucrose content recorded, i.e. in 1951 when the crop was harvested after a severe drought; and only once was a lower juice purity recorded, i.e. in 1962, the period of restrictions on cutting. Twice only was a more unfavourable cane/sugar ratio obtained, viz. in 1951 and 1965; the former year was a season when drought stricken cane was crushed.

The years after 1960 show in general lower sucrose contents, lower juice purities and higher cane to sugar ratios than the previous years. What is the reason for this drop in cane quality?

Starting with the 1960/61 season, restrictions on sugar production were imposed, which lasted three

TABLE 3

Year	Sucrose % Cane	Fibre % Cane	Mixed Juice Purity	Tons Cane/Tons Sugar
1945	14.66	16.03	86.33	8.06
1946	14.33	16.20	85.88	8.27
1947	13.58	15.78	86.48	8.65
1948	14.26	15.82	86.02	8.30
1949	13.86	16.20	86.49	8.50
1950	14.79	15.99	86.69	7.92
1951	13.47	16.36	84.94	8.88
1952	14.39	15.98	86.71	8.16
1953	14.32	16.31	86.07	8.26
1954	13.97	15.96	86.42	8.53
MEAN	14.14	16.06	86.20	8.35

Year	Sucrose % Cane	Fibre % Cane	Mixed Juice Purity	Tons Cane/Tons Sugar
1955	14.45	15.60	86.39	8.13
1956	13.84	15.70	86.19	8.51
1957	13.73	15.24	85.86	8.44
1958	13.77	15.73	85.10	8.57
1959	13.99	15.76	86.06	8.47
1960	14.11	15.16	86.10	8.38
1961	14.11	14.46	86.69	8.23
1962	13.77	15.32	83.51	8.58
1963	13.91	15.38	86.09	8.36
1964	14.41	15.20	86.01	8.06
Mean	14.01	15.36	85.80	8.37
1965	13.10	15.44	84.53	9.06
1966	14.14	14.76	86.65	8.33
1967	13.51	14.78	83.74	8.75

seasons. As a result of these restrictions it has been estimated that more than five million tons of cane were not harvested in the correct season, but were left over. When restrictions were finally lifted this old cane was harvested. Calamitous droughts also struck the sugar belt in 1962, 1964 and 1965. All these facts should be taken into account when considering what has been wrong with the cane harvested since 1960.

A—(v) CANE AND SUGAR PRODUCTIONS IN RECENT YEARS

TABLE 4
In short tons (of 2000 lbs)

Season	Tons Sugar	Tons Cane	Cane/Sugar Ratio
1963/64	1,264,704	10,970,338	8.66
1964/65	1,395,446	11,752,031	8.42
1965/66	1,001,784	9,266,324	9.21
1966/67	1,794,423	15,545,625	8.65
1967/68	2,008,683	18,643,889	9.28

Actually less sugar has been made in the past season than indicated by tables 4 and 5. The fact is that Mount Edgecombe Mill produced High Test Molasses instead of sugar during the 1967/68 season. However, to make the results of the past season comparable with those of the previous seasons, the tons

TABLE 5
In metric tons (of 1000 kg)

Season	Tons Sugar	Tons Cane	Cane/Sugar Ratio
1963/64	1,147,321	9,939,529	8.66
1964/65	1,265,921	10,661,207	8.42
1965/66	908,803	8,406,269	9.21
1966/67	1,627,869	14,102,756	8.66
1967/68	1,822,249	16,913,471	9.38

of sugar which Mount Edgecombe Mill would have produced if it had not made High Test Molasses have been estimated and added to the tonnages of the other nineteen mills.

The increase in sugar production in the last two years has, for the greater part, been due to the addition of three new sugar factories with their newly opened cane areas. Dalton and Jaagbaan areas started their first season in 1966 and Malelane Mill in 1967.

The factories-cum-refineries Pongola, Gledhow and Sezela report only the results of the rawhouse sections of their Mills, while Malelane, Entumeni, Marromeu, Mhlume and Ubombo Ranches, which also produce white sugars by remelting, publish the results of their complete factory processes.

In order not to show different tonnages of sugar in one table from the other, in table B (at the end of the summary) the official tonnages of sugar are shown and not (as in previous years) the tonnages of rawsugar going from the rawhouse section to the refinery department of Pongola, Gledhow and Sezela. The boiling house and overall results, however, only reflect the results of the rawhouse sections of these mills.

A—(vi) VARIETAL CHANGES

There are two trends noticeable in the changes in cane varieties crushed in recent years. The first has been brought about by the planting of considerable quantities of N:Co.293, N:Co.382 and Co.331 by the new Mills in the Natal Midlands. The second trend is a more general one, i.e. the supersession of N:Co.310 by N:Co.376.

TABLE 6

Season	1963/64	1964/65	1965/66	1966/67	1967/68
<i>Varieties</i>					
Co. 331	6.32	4.41	2.70	1.83	1.41
N: Co. 310	50.75	46.91	40.15	33.63	24.77
N: Co. 293	4.93	3.72	4.51	5.98	6.21
N: Co. 376	21.45	23.36	32.19	36.45	41.46
N: Co. 382	1.81	2.87	3.35	4.89	6.42
N: 20/211	1.23	2.84	3.52	3.56	3.80

Co.331, which was rapidly on its way out, is now lingering on due to the fact that Jaagbaan and Dalton mills both crushed approximately 9% of this variety.

Owing to the crushing of 40 and 50% respectively of the variety N:Co.293 by the same two factories, the percentage of this variety is increasing.

The same can be said about the increase of N:Co. 382, of which variety Jaagbaan crushed 25% and Dalton 28% during the past season.

The stronghold of N:Co.310 is in Zululand, where in particular the three most northerly factories (Pongola, Umfolozi and Empangeni) are still crushing high percentages of this variety.

With regard to N:Co.376, Renishaw, Sezela and Umzimkulu crushed more than 70%, while Malelane, Entumeni, Doornkop, Darnall and Gledhow crushed more than 50%. Glendale, Melville, Tongaat, Mount Edgecombe and Illovo crushed more than 40% of this variety.

We draw attention to the fact that a number of Mills recorded high percentages of 'mixed' or 'not further identified' canes. We are sure that part of these percentages consisted of N:Co.310.

A—(vii) TIME ACCOUNT AND CRUSHING RATE

TABLE 7

Season:	1965/66	1966/67	1967/68
Tons cane crushed	9,266,324	15,545,625	18,643,889
Total hours Mills open	76,751	109,216	120,963
Total hours actual crushing	67,090	95,229	105,436
No. of mills crushing	17	19	20
Average crushing rate	138	163	177
Average length of season	32 weeks	39 weeks	40 weeks
Average days of crushing	164 days	209 days	220 days
Overall Time Efficiency	87½%	87%	87¼%
Hours of Stoppages of which due to cane in short supply	12½%	13%	12¼%
	6%	5%	4¼%

Compared with the 1965/66 season the number of factories crushing increased by 18% and the mean crushing rate by 13%. Notwithstanding these increases, the past season was an exceptionally long one, which pleased neither the farmer nor the factory staff.

A long season does not leave the engineering staff time for a proper overhaul between seasons. For thorough maintenance of the boilers, and overhaul and repair of the plant a period of three months between seasons is necessary. If the inter-season is shorter, special measures are required. For example, a number of mills started to overhaul their milling tandems during the week-end stops. However, this practice cannot be extended to boilers and other plant if spare units are not available, for example spare centrifugals, spare pumps, etc., and last but not least a spare boiler. This would necessitate a heavy increase in expenditure.

A long season means an early start and a late ending and necessitates processing first the juice of unripe cane and later the juice of overripe cane. Both kinds of juice produce their inherent difficulties in processing, with which the process manager has to cope using available equipment.

Regarding length of season, in the following table a

review is given, from 1950/51 onwards, of the increase in the yearly tonnage of cane crushed, the increase in combined crushing rate and the average duration of the season.

TABLE 8

Season	Total Tons Cane Crushed %	Combined Crushing Rate %	Average Duration of Season
1950/51	100.0	100.0	31 weeks
1951/52	84.2	99.6	27 "
1952/53	100.1	102.9	29 "
1953/54	108.8	104.9	30 "
1954/55	128.8	117.6	36½ "
1955/56	139.6	128.1	35 "
1956/57	131.8	130.2	32 "
1957/58	150.0	135.8	37 "
1958/59	179.6	143.7	39 "
1959/60	159.8	144.8	36 "
1960/61	151.5	150.9	32 "
1961/62	164.4	156.4	33 "
1962/63	187.9	149.6	40 "
1963/64	192.1	165.1	37½ "
1964/65	205.8	171.4	38 "
1965/66	162.3	185.7	31 "
1966/67	272.3	227.2	39 "
1967/68	325.7	263.6	40 "

To facilitate the comparison, the tons of cane crushed and the combined crushing rates are indicated as percentages of the results obtained in the 1950/51 season. In that season 5.71 million tons of cane were crushed which has been fixed as 100.0%. The crushing rate of all mills added together was 1300 t.c.h. for that season; this is also said to be 100.0%. The average duration of the seasons is expressed in weeks, as this is the common practice.

The general trend revealed by the table is an extension of the duration of the seasons. Capable of improvement are the overall time efficiency and the combined crushing rate.

With regard to the overall time efficiency an investigation into how far the decrease in efficiency is a result of the prolonged seasons should be worthwhile. Hours of stoppages for shortage in cane supply showed an increase in percentage and the same can be said for the percentage of hours of stoppage for other reasons. This was a general trend. In addition there are a number of factories with extremely low overall time efficiencies for example Malelane, Empangeni, Jaagbaan and Sezela. In the case of the last mentioned mill the low overall time efficiency was mainly due to the high number of hours of stoppages for cane in short supply; in the case of the other three factories the reason for the high hours of stoppages lay within the mill concerned.

With regard to the combined crushing rate, an increase for the following season is expected when Malelane and Jaagbaan really get into their stride.

A—(viii) GENERAL IMPRESSION OF THE S.A. SEASON 1967/68

It has been a difficult season owing to the low purities of the juices causing overloading of the back-ends of the factories. It will be seen later that the amount of final molasses produced was more than commensurate with the juice purities.

In general it was an unsatisfactory season, not only because of the high cane to sugar ratio, but also from the point of view of operation and operational results.

A—(ix) NEWLY INTRODUCED FEATURES

(a) Starch Removal

During the past season a large number of factories introduced the Rabe Flotation Process to reduce the starch content of the raw sugar.

There was also an increase in the number of mills which used the natural enzyme of the juice to reduce the starch content. Some of the latter factories introduced this process pending further development of the current processes. One of these processes adds a bacterial enzyme to the juice to augment the action of the natural enzyme present in the juice. This process was tried out at a number of factories and it appears to be very promising qua results as well as qua expenses.

With regard to the removal of starch in a diffuser, the future does not look too bright. If the temperature in the diffuser is lowered to 60° to prevent starch from being dissolved, the sucrose extraction could be affected. Perhaps the correct answer will be to maintain in the diffuser the optimum temperature for maximum extraction and afterwards apply bacterial enzyme to the diffusion juice.

N.B.—Of course if temperature and pH could be well controlled during the diffusion process, the bacterial enzyme could also be introduced in the diffuser, as it is resistant to higher temperatures than the natural enzyme of the juice.

It should also be mentioned that there are a number of factories, such as Doornkop and Jaagbaan where the juices contain a higher natural enzyme concentration than normal and which therefore can remove more than 50% starch by maintaining the juice at a temperature of 70°C for 10 minutes, without the addition of artificial enzymes.

(b) Milling-cum-Diffusion

During the past season two more diffusion plants were commissioned, bringing the total number of diffusers operating in Southern Africa to four.

Both factories where the milling-cum-diffusion process was running for the second year in succession had a smooth run. However, this is not to say that all problems surrounding diffusion have been solved, or that we know all the answers to questions concerning diffusion.

With regard to the two new milling-cum-diffusion plants, the one at Malelane has finally settled down. However, the question as to how well mechanical loading of cane and diffusion go together is still in the balance. It is a well-known fact that mechanical loading brings in more extraneous matter with the cane than manual loading. In particular when the soil is wet from rain the quantities of soil sticking to the cane is out of all proportion and only a cane laundry can cure this. A cane laundry discharges cane still dripping wash water. This water dilutes the first expressed juice sample to such an extent that the Java Ratio Method for sucrose distribution purposes cannot be applied. In other words: the introduction of cane laundries will have to be accompanied by a system of direct analysis of cane.

The other new milling-cum-diffusion plant was commissioned in the middle of the past season. It had more than its normal share of teething troubles. It was first thought that a too fine preparation of the cane impeded percolation, however, later it was discovered that the bagacillo returned from the juice screens formed an impervious layer on top of the bagasse bed in the diffuser. Next season this will be amended and the shredder will be re-installed to increase the crushing rate.

It is also possible that the flattening of the bagasse by the action of the first mill has something to do with unsatisfactory percolation, in which case change-over from bagasse- to cane-diffusion would be the answer.

(c) New Sugar Factory-cum-Refinery

The Transvaalse Suikerkorporasie Beperk erected a new factory complex near Malelane to accompany the introduction of sugar cane cultivation in the Lowveld of the Eastern Transvaal.

The designed crushing rate of the mill is 200 t.c.h. but this could not be achieved during the past season. However, as a higher cane yield per acre is expected, it appears that 200 t.c.h. will be too small a capacity. Measures will be taken not only to increase the capacity to the designed rate, but to an even higher one, i.e. 225 t.c.h.

The juice extraction plant consists of a de Smet diffuser preceded by and followed by an 84" Walker mill with a pressure feeder.

The refinery follows the Tate & Lyle (flue gas) carbonation process and is of such capacity that nearly 100% refined sugar can be produced; the remaining sugar is turned out as Golden Brown.

A new feature is the application of continuous centrifugals for curing the B- and C-masseccutes.

Special mention should be made of the LUCKS (patent) silo for storage of 15,000 tons of refined sugar under closely controlled conditions of temperature and relative humidity of the air circulating through the sugar stored in bulk.

B. DISCUSSION OF THE OPERATION OF ALL MILLS

We will now start with the discussion of the results of all factories which regularly contribute to the summaries published by the S.M.R.I.

The first item to be discussed is:

B—(i) OPERATION OF THE EXTRACTION PLANTS

In the following table (Table 9) the factories are arranged according to the percentages of lost undiluted juice they achieved during the past season. The reason why 'undiluted' and not 'absolute' juice has been chosen for the comparison is the fact that the calculations based on absolute juice are affected by the accuracy of the bagasse weight. Tests conducted at Entumeni before 'diffusion' was introduced showed that the bagasse weight calculated by inference was 7% higher than the weight assessed by automatic and continuous weighing of the bagasse. Owing to the higher operational temperatures with diffusion the losses due to evaporation will be higher than in the case of plain milling. Therefore the bagasse weight assessed with the aid of the Fundamental Equation will differ even more from the actual bagasse weight,

leading to a *too high* percentage for sucrose in cane and a *too low* figure for sucrose extraction. Independent of errors in weighing is the yardstick 'Lost Undiluted Juice % Fibre in Final Bagasse' as for this calculation *only* analyses are used.

Actually, according to the 'Undiluted Juice Conception' the Brix of the primary juice should be used. However, this figure is not available at all mills, therefore 'Lost undiluted juice % fibre' was calculated with the aid of the analyses of the first expressed juice, assuming that the slight difference in Brix between these two juices would be the same for all factories.

Other data shown in Table 9 are:

- (a) Unit Load, being the lbs of fibre milled per hour and per cu. ft. of Total Roller Volume.
- (b) Imbibition % fibre to indicate how much water had to be used to achieve the final result, followed by:
- (c) The number of imbibition stages, as the number of times the water is recirculated had a great effect on the final result, and
- (d) Lost absolute juice % fibre, for sake of comparison.

Actually two more items should be added, but this would have made the table too unwieldy. These items are:

- (e) the Brix of the undiluted juice, because it is easier to obtain a low percentage 'lost juice' with a high juice density than with a low one, and
- (f) the purity of the last expressed juice as this affects the calculation of Brix % bagasse.

Items (e) and (f) hold as well for lost absolute as for lost undiluted juice. With regard to (f) it should be added that as the drop from first to last expressed juice determines the purity of the last expressed juice, keeping the mills clean will reduce the figure for loss of juice.

TABLE 9

Mill	Lost Undiluted Juice % fibre	Unit Load	Imbibition % fibre	No. of Imbibition Stage	Lost Absolute Juice % Fibre
RN	28.4	53	220	4	29.7
DL	29.9	53	355	5	30.8
ME	30.9	55	286	6	32.5
FX	31.7	40	237	(5 & 6)	33.2
EN	32.1	diff	310	9	34.4
IL	32.2	47	309	5	33.7
AK	33.0	58	281	6	34.1
UF	33.1	35	285	6 & 6	34.7
TS	33.2	49	218	6 & 6	35.0
UC	33.5	diff	229	9	34.7
UR	35.7	59	190	6	37.3
ML	37.0	diff	250	9	37.6
PG	39.0	36	268	4 & 5	40.9
MV	39.6	46	287	4	41.2
DK	39.6	52	247	5	41.8
JB	40.4	25	251	5	42.0
GD	41.5	58	248	4	43.0
SZ	43.4	52	260	4	45.4
UK	44.0	65	213	5	46.2
LB	45.3	68	195	5	47.2
EM	46.3	diff	265	9	48.2
GH	46.6	61	199	5	48.0
MH	47.6	64	144	5	48.9
TR	51.6	41	237	(5/4/3)	53.8
MR	53.0	69	166	4	55.2

The lowest undiluted juice loss was recorded by Renishaw, a fifteen roller tandem applying less than average imbibition. The highest loss was shown by Marromeu, also with a fifteen roller milling train, but applying one of the lowest imbibitions recorded. Preceding Marromeu in Table 9 is Triangle, which crushed its cane with three tandems: one of 12 rollers, one of 15 rollers and another of 19 rollers. Mhlume had the *lowest* imbibition, but one of the highest juice losses.

The highest figure for imbibition % fibre was again recorded by Darnall, which also recorded one of the lowest losses of undiluted juice % fibre. With regard to the amount of imbibition applied Darnall is followed by Entumeni and Illovo, two factories with low percentages for lost juice.

A comparison of straight milling with milling-cum-diffusion does not *yet* show an advantage for the latter as far as lost juice is concerned. However, we must not overlook the fact that straight milling is more than a hundred years old while diffusion is, at least for Southern Africa, a new system of juice extraction. Although there is an enormous amount of experience and literature available regarding straight milling and experienced mill engineers are available, it still usually takes a couple of years before a new milling tandem reaches its peak performance. With regard to diffusion (with the exception of Egypt) there is no experience at hand and experienced diffusion engineers are not available. It will, therefore, take quite a number of years before the diffusion plants are at their peak performance.

Entumeni completed its second season and obtained, with the aid of 310% imbibition, a lost juice per centage of 32.1%. Dalton completed also its second season and achieved 33.5%, lost undiluted juice using 229% imbibition. Malelane, like Dalton, a completely new factory got into its stride only in the middle of its first season. Average lost juice equalled 37.0%, achieved with the aid of 250% imbibition.

Finally, Empangeni changed during the past season from straight milling to milling-cum-diffusion. The plant was still 'running in' when the season came to an end.

As mentioned above it will still take a number of years before our milling-cum-diffusion plants reach top performance. In the meantime we extend our congratulations to Renishaw for their extraordinary performance: 28.4% lost undiluted juice obtained with only 220% imbibition and only five mills.

B—(ii) BOILING HOUSE RESULTS

The best way to characterise this season and the previous ones is to show the nonsucrose accounts.

Perusing previous annual summaries it is seen that before 1960 the average nonsucrose factor for the S.A. Mills was round 0.80. Since then the factor has increased, implying that more final molasses were produced than commensurate with the mixed juice purities:

$$\text{N.S. factor} = \frac{\text{N.S. in Total Final Molasses}}{\text{N.S. in Mixed Juice}}$$

in which formula N.S. in Total Final Molasses means

the N.S. in weighed final molasses plus the N.S. in bagged sugar.

TABLE 10

Mill	1967	1966	1965	1964	1963
ML . . .	0.78	—	—	—	—
PG . . .	0.88	0.84	0.84	0.79	0.74
UF . . .	0.82	0.81	0.83	0.79	0.66
EM . . .	0.88	0.85	0.89	0.84	0.80
FX . . .	0.84	0.88	0.87	0.79	0.81
EN . . .	0.97	0.91	0.89	0.86	0.87
AK . . .	0.83	0.83	0.80	0.80	0.81
DK . . .	0.89	0.77	0.79	0.81	0.82
GD . . .	1.00	1.02	0.88	0.90	0.81
DL . . .	0.78	0.78	0.81	0.80	0.78
GH . . .	0.84	0.82	0.87	0.82	0.79
MV . . .	0.95	0.89	0.92	0.97	0.83
JB . . .	0.92	0.92	—	—	—
UC . . .	0.87	0.90	—	—	—
TS . . .	0.82	0.83	0.85	0.83	0.77
ME . . .	—	0.82	0.91	0.85	0.84
IL . . .	0.88	0.85	0.82	0.88	0.83
RN . . .	0.82	0.86	0.84	0.82	0.83
SZ . . .	0.93	0.86	0.85	0.93	0.92
UK . . .	?	?	?	?	?
Mean . . .	0.87	0.84	0.85	0.83	0.79
LB . . .	0.85	0.78	0.93	0.92	0.88
MR . . .	0.72	0.73	0.78	0.75	0.76
MH . . .	0.75	0.87	0.89	0.78	0.75
UR . . .	0.89	0.82	0.92	1.00	0.72
TR . . .	1.01	0.91	—	1.08	—
HV . . .					

As we know, almost all the rise in purity from mixed juice to clarified juice is a result of an incorrect Brix determination in mixed juice. Therefore a similar ratio as the above is calculated, but this time based on the N.S. present in clarified juice as divisor.

TABLE 11
FINAL MOLASSES PRODUCED

as a percentage of the estimated quantity based on the purity of the clarified juice.

Mill	%	Mill	%
ML	79	uc	88
PG	95	TS	93
UF	89	ME	—
EM	91	IL	98
FX	95	RN	93
EN	91	SZ	95
AK	98	UK	?
DK	93	Mean	94
GD	108	LB	84
DL	89	MR	86
GH	91	MH	91
MV	104	UR	96
JB	98	TR	108
		HV	

The latter ratio is usually considered to be better than the former as it is not based on the doubtful purity of mixed juice. However, when drawing up Table 11 it was discovered that there were clarified

juice purities which were lower than the syrup purities as well as clarified juice purities which were higher. Another point is that basing a calculation on sucrose in clarified juice implies the tacit acceptance that no losses (except in filter cake) occurred between the juice weighing tanks and the sampling place of the clarified juice.

As no percentage ratios of previous seasons are at hand, we have to limit our observations to the remark that the percentages above 100 could point to a too high molasses weight.

In order to obtain an insight into this question, the fluctuations in undetermined sucrose losses should be perused, as a drop in undetermined sucrose loss accompanied by a rise in N.S. factor could indicate a too high molasses weight.

TABLE 12
UNDETERMINED SUCROSE LOSSES
per 100 sucrose in mixed juice

Mill	1967	1966	1965	1964	1963
ML . . .	10.36	—	—	—	—
PG . . .	2.55	2.06	0.91	1.11	1.57
UF . . .	0.34	0.66	1.63	0.96	3.04
EM . . .	1.17	1.37	1.02	1.12	1.02
FX . . .	1.07	2.14	1.80	1.36	1.63
EN . . .	1.20	2.00	2.64	2.22	2.10
AK . . .	1.59	0.94	1.97	1.64	1.90
DK . . .	1.92	2.44	2.24	1.30	1.56
GD . . .	2.18	1.24	1.47	1.02	0.63
DL . . .	1.57	1.30	1.75	1.04	1.26
GH . . .	0.54	1.86	1.76	1.21	1.95
MV . . .	0.46	1.29	1.84	1.01	0.57
JB . . .	3.08	7.27	—	—	—
UC . . .	1.70	2.19	—	—	—
TS . . .	0.45	0.41	1.26	0.30	0.55
ME . . .	—	1.78	1.23	1.30	0.94
IL . . .	3.00	3.21	2.14	2.04	2.83
RN . . .	1.64	1.59	3.24	2.74	2.53
SZ . . .	0.33	0.45	1.98	0.96	1.62
UK . . .	?	?	?	?	?
Mean . . .	1.95	1.90	1.80	1.33	1.61
LM . . .	2.39	3.11	1.93	1.25	0.19
MR . . .	1.89	2.78	2.02	2.12	0.74
MH . . .	0.91	2.24	1.86	2.24	1.62
UR . . .	1.12	0.77	0.51	0.85	0.82
TR . . .	2.41	1.48	—	0.94	—
HV . . .					

Comparison of the data of Tables 11 and 12 show that of the three factories with a percentage above 100 in Table 11, only one has a big drop in undetermined loss in Table 12.

We may therefore assume that the high figures in Tables 11 and 12 of one of the three factories is caused by a too high final molasses weight, which is also confirmed by the data of this factory in Table 13. With regard to the other two factories, although their undetermined sucrose loss did not drop, this is not definite proof that the final molasses weight was not too high. To investigate this matter further Table 13 was drawn up.

Table 13 shows the undetermined sucrose loss as a percentage of sucrose in clarified juice, the undeter-

mined Brix loss as a percentage of the Brix in clarified juice and in the last column the ratio:

$$100 \frac{\text{Tons undetermined Sucrose Loss}}{\text{Tons undetermined Brix Loss}}$$

TABLE 13
UNDETERMINED LOSSES
(Season 1967/68)

- (a) Sucrose % Sucrose in Clarified Juice
- (b) Brix % Brix in Clarified Juice
- (c) Percent Ratio between these two losses.

Mill	a	b	c
ML	10.49	12.68	66
PG	2.59	2.87	78
UF	0.34	2.07	14
EM	1.18	2.45	40
FX	1.06	1.68	54
EN	1.20	2.46	41
AK	1.60	1.61	85
DK	2.02	2.77	62
GD	2.18	0.84	217
DL	1.59	3.14	42
GH	0.55	0.21	226
MV	0.46	-0.30	irrel.
JB	3.12	2.90	90
UC	1.70	3.65	38
TS	1.46	0.46	26
ME	H.T.M	—	—
IL	3.01	2.82	90
RN	1.65	2.46	58
SZ	0.72	0.34	39
UK	?	?	?
Mean	2.05	2.51	62
LB	2.40	4.49	46
MR	1.90	3.54	46
MH	0.92	1.94	41
UR	1.13	1.64	58
TR	2.43	0.93	223
HV			

This ratio is usually between 70 and 90 and we assume then that the loss has been mainly mechanical or the mixed juice weight has been assessed too high. Two of the three factories show a percentage ratio well above the 200% which confirms the assumption that the molasses weights were too high. The other factory shows a negative ratio, which, with the drop in undetermined sucrose loss, also confirms that the molasses weight was too high.

A low percentage ratio points to inversion or a too low final molasses weight, or a combination of the two.

Perusing Table 14 it is seen that the number of cu. ft. of C-m.c. boiled per ton of Brix in mixed juice ranges from 7.1 cu. ft. for Pongola to 12.3 cu. ft. for Illovo. This widespread difference is caused by the great number of variables which affect the number of cu. ft. of C-m.c.:

- (a) the purity of the mixed juice
- (b) the nonsugars removed and the nonsugars formed during processing
- (c) the purity of the C-m.c.
- (d) the purity of the final molasses and
- (e) the degree of molasses circulation.

Table 15 gives us an insight into the question of the ratio between crystal and molasses in the C-masses cuites. For example Illovo's figure of 38.4% crystal

TABLE 14

Mill	Cu. ft of Masses Cuites per ton of Brix in mixed juice				Purity Rise from Syrup
	A-m.c.	B-m.c.	C-m.c.	Total	
ML	39.3	15.4	11.4	66.1	+2.94
PG	26.8	9.8	7.1	43.7	+0.87
UF	31.2	10.0	9.1	50.3	+2.21
EM	21.1	10.1	9.9	41.1	+0.43
FX	28.6	8.9	9.0	46.5	+1.98
EN	27.2	12.4	8.5	48.1	-1.30
AK	29.7	9.7	8.4	47.8	+1.50
DK	28.8	9.9	9.2	47.9	+4.01
GD	21.1	14.4	9.6	45.1	-2.30
DL	24.0	7.2	9.0	40.2	+0.75
GH	24.3	12.3	9.7	46.2	+2.90
MV	34.8	15.2	10.8	60.8	+3.60
JB	28.5	11.2	10.8	50.5	+1.70
UC	23.8	13.8	10.4	48.0	+2.85
TS	26.5	12.8	10.4	49.7	+2.80
ME		High	Test	Molasses	
IL	49.1	14.5	12.3	75.9	+3.54
RN	21.6	12.1	7.8	41.5	-1.40
SZ	23.6	13.7	10.6	47.9	+0.09
UK	29.4	9.5	8.2	47.1	+0.56
LB	26.9	12.1	11.7	50.6	-1.15
MR	22.9	13.0	8.3	44.2	+1.29
MH	22.7	12.1	9.2	44.0	-0.24
UR	32.5	11.9	10.9	55.3	+3.30
TR	43.6	9.2	10.5	63.3	+4.03
HV					

in C-m.c. indicates that at the time of curing there was (100.0—38.4) or 61.6% final molasses by weight present in the C-m.c. However, it does not imply that by curing 61.6% was separated as final molasses. The actual percentage separated depends on the purity of the (single-) cured C-sugar, or in other words on the amount of molasses recirculated with the C-sugar.

TABLE 15

Mill	Recovered Crystallised Sucrose per 100 parts Sucrose in masses cuites			lb. of Crystals per 100 lb. of C-m.c.
	A-m.c.	B-m.c.	C-m.c.	
ML	59.5	59.2	59.6	35.9
PG	64.0	62.1	60.2	33.3
UF	62.0	54.2	54.7	32.4
EM	60.9	58.2	50.5	28.8
FX	67.6	62.1	59.4	34.2
EN	60.0	53.7	48.6	27.8
AK	68.2	64.6	60.7	34.5
DK	70.7	58.7	61.6	36.5
GD	66.0	66.8	61.5	33.0
DL	64.7	57.1	59.5	34.5
GH	68.4	60.9	59.8	35.0
MV	63.5	67.7	56.5	32.9
JB	65.4	61.0	59.5	35.1
UC	67.2	68.4	55.6	30.6
TS	61.9	61.0	52.3	28.5
ME		High	Test	Molasses
IL	61.7	62.2	65.5	38.4
RN	63.2	62.6	58.2	34.1
SZ	60.8	59.6	57.7	34.6
UK	64.2	62.2	57.1	33.7
LB	63.0	56.2	58.1	34.4
MR	61.3	62.4	64.5	40.0
MH	62.8	58.9	58.3	33.1
UR	62.7	62.9	61.3	36.7
TR	66.8	68.3	70.6	43.3
HV				

The following table, i.e. Table 16 will give an insight into item (e), viz. the degree of molasses circulation between C-m.c. pan and C-m.c. forecurers.

TABLE 16
Final Molasses (Nonsucrose) Circulation

Mill	1967	1966	1965	1964	1963
ML	125	—	—	—	—
PG	106	124	100	126	132
UF	121	139	125	148	159
EM	121	134	119	137	132
FX	128	135	124	152	130
EN	116	106	120	111	121
AK	120	133	143	129	126
DK	127	153	142	163	155
GD	115	110	132	142	144
DL	126	143	131	124	116
GH	113	121	119	121	137
MV	126	136	124	141	135
JB	122	N.R.	—	—	—
UC	123	124½	—	—	—
TS	143	137	138	146	143
ME	H.T.M.	148½	117	132	139
IL	144	146	115	146	172
RN	106	126	115	166	130
SZ	144	187	N.R.	125	133
UK	?	?	?	?	?
Mean	123	135	124	138	138
LB	194	200	165	137	151
MR	149	142	135	156	155
MH	129	106	N.R.	N.R.	121
UR	129	147	128	115	143
TR	124	141½	—	—	—
HV					

As in the previous season only one Mill shows an abnormal (high) figure for circulation, pointing to a too low assessment of the weight of the final molasses. However, any confirmation of a too high final molasses weight cannot be established from the figures of the past season.

With regard to Table 17 showing the percentages of reducing sugars in total final molasses, the ratios above 100% indicate either a too high final molasses weight, inversion, or a combination of the two.

Summarising the foregoing discussions: of one of the three factories (mentioned when discussing the high N.S. factors shown in Table 10) the figures in the other tables confirm the assumption that the final molasses weight has been too high. With regard to the other two, not all the other tables confirm the assumption of a too high final molasses weight. Therefore it may now be assumed that in the past season more molasses was produced than commensurate with the mixed juice purity. This fact should be kept in mind when considering reasons why the Boiling House Performance figures of the last season are so much lower than in previous years. *Note:* Another reason for the low B.H.P. figure is the fact that for its calculation a factor is used which assumes that a lower mixed juice purity is invariably accompanied by a lower molasses purity. In the 42nd Annual Summary of the 1966/67 season a table is published which illustrates the effect on the results when the

TABLE 17
REDUCING SUGARS IN TOTAL FINAL MOLASSES
as a percentage ratio of the original amount of reducing sugars present in Mixed Juice

Mill	1967	1966	1965	1964	1963
ML	85	—	—	—	—
PG	N.A.	N.A.	N.A.	N.A.	N.A.
UF	94	109	105	92	86
EM	97	98	106	100	97
FX	N.A.	N.A.	87	85	88
EN	N.A.	N.A.	85	N.A.	N.A.
AK	113	111	105	89	97
DK	103	101	96	96	103
GD	N.A.	N.A.	N.A.	N.A.	N.A.
DL	80	93	98	88	91
GH	68	66	81	81	84
MV	126	110	114	89	87
JB	87	109	—	—	—
UC	86	N.A.	—	—	—
TS	92	98	105	109	91
ME	H.T.M.	107	97	101	101
IL	106	99	102	115	91
RN	N.A.	N.A.	N.A.	N.A.	N.A.
SZ	120	128	102	119	119
UK	N.A.	N.A.	N.A.	N.A.	N.A.
Mean	98	99	99	97	95
LB	84	94	133	134	100
MR	87	63	43	90	113
MH	92	N.A.	N.A.	N.A.	N.A.
UR	N.A.	—	N.A.	112	N.A.
TR	N.A.	82	—	—	—
HV					

computation of B.H.P. is carried out with a varying factor and when a constant factor of 0.5 is used.

The discussion ends by showing how the original quantity of reducing sugars in mixed juice fared during processing. Generally only a small portion will be destroyed during the clarification process of the juice; the percentage present in clarified juice should be between 95 and 98%. In the evaporator reducing sugars will be formed due to inversion occurring owing to the high temperature in the first vessel, but at the same time this high temperature will also destroy reducing sugars. Therefore whether the percentage in syrup will be higher or lower than in clarified juice depends on:

- the time the juice remains in the first vessel,
- the temperature (vapour pressure) in the first vessel and
- the pH of the clarified juice.

With regard to the pH the fact should not be overlooked that, for example, a pH of 7.4 measured at 20°C will be reduced to 6.2 when the temperature is raised to 110°C. At the same time the OH-ion concentration will increase from pOH = 7.8 at 20°C to pOH = 5.9 at 110°C. These changes in pH and pOH imply that the H-ion concentration increases 16-times and the OH-ion concentration 80-times as a result of the rise in temperature from 20°C to 110°C. Reducing the retention time of the juice at high temperatures is therefore the only remedy to fight inversion of sucrose and destruction of reducing sugars in the first vessel of the evaporator.

The percentage of reducing sugars in total final molasses, i.e. in final molasses and commercial sugars

should not show a big difference from the percentage in syrup. In the following table (Table 18) two Mills show very high percentages of R.S. in Total Final Molasses. One is caused by a too high final molasses

weight, while it is not certain if the high figure of the other one is (only) caused by a too high final molasses weight.

In order not to make the summary too unwieldy, the eighteen tables in the text and the seven tables at the end of this summary are not discussed in extenso. However, a careful study of the tables and a mutual comparison is recommended.

TABLE 18
REDUCING SUGARS ACCOUNT
(R.S. in Mixed Juice = 100%)

Mill	Percentages of R.s. present in:		
	Clear Juice	Syrup	Total Final Molasses
ML	95	95	85
PG	93	82	N.A.
UF	89	90	94
EM	100	84	97
FX	84	81	N.A.
EN	85	72	N.A.
AK	92	85	113
DK	101	114	103
GD	102	85	N.A.
DL	98	84	88
GH	74	71	68
MV	98	103	126
JB	98	83	87
UC	86	81	86
TS	95	91	92
ME	High	Test	Molasses
IL	98	67	106
RN	80	51	N.A.
SZ	97	71	120
UK	107	106	N.A.
LB	96	63	84
MR	79	77	87
MH	82	57	92
UR	120	86	N.A.
TR	91	84	N.A.
HV			

SUMMARY

The past season has been extremely long; the average season length being 40 weeks. In addition the quality of the cane crushed has been disappointing, from the point of view of the supplier as well as of the miller, sucrose content of the cane and juice purity both being low.

The poor juice quality led to the production of an even bigger quantity of final molasses than commensurate with the (low) juice purity. This again had an adverse effect on the boiling house performance.

NOTE:—For the calculation of the averages of the purity and the Brix of the final molasses, the final molasses data of those five Mills which apply the refractometer have been converted to conventional purities and spindle Brix by assuming that:

$$100 \frac{\text{sucrose}}{\text{refractometer Brix}} - 2\frac{1}{2} = 100 \frac{\text{sucrose}}{\text{spindle Brix}}$$

The conversion of refracto Brix to spindle Brix has been used to calculate:

Final Molasses (85°Brix) % Cane

Conversion from refracto Brix to spindle Brix has not been applied for the calculation of other averages such as: Brix of syrup, Brix of masses cuites, purities of masses cuites, etc.

TABLE A
FINAL PRODUCTION—1967-68 SEASON
BASED ON REFINERY AND TERMINAL RECEIVED WEIGHTS
 (according to data kindly supplied by the South African Sugar Association)

	LOCAL MARKET			EXPORT MARKET			Total	
	White	Cargo Refining	Golden Brown	High Pol.	Low Pol.	Umzimkulu Raws		High Test Molasses
			Short Tons					
Darnall		11,903.0000	423.0000	25,625.9050	128,583.4000	—	—	166,535.3050
Amatikulu	—	18,995.7500	258.0000	6,372.1000	181,930.4500	—	—	207,556.3000
Felixton	—	110,634.7500	980.0000	8,510.8500	—	—	—	120,125.6000
Empangeni	—	105,424.8500	265.0000	5,648.8000	—	—	—	111,338.6500
Mount Edgecombe	—	1,013.3750	1,778.8800	—	—	—	125,124.2690	127,916.5240
Tongaat	—	104,895.9825	485.2500	98,563.7385	—	—	—	203,944.9710
Melville	—	18,494.5750	2,245.2500	12,971.5000	10,529.1000	—	—	44,572.8250
			332.4000					
			Treacle					
Umfolozi	—	—	14,746.6806	—	130,725.6500	—	—	145,472.3306
Glendale	—	28,649.0500	72.0000	—	—	—	—	28,721.0500
Sezela	72,765.0000	—	160.0000	61,887.1500	—	—	—	134,812.1500
Renishaw	55.6250	—	34,557.6250	—	—	—	—	34,613.2500
Pongola	40,192.4750	—	48,811.9500	—	—	—	—	89,004.4250
Gledhow	97,311.0000	—	125.0000	63,729.3500	—	—	—	161,165.3500
Umzimkulu	—	—	96.0215	—	—	89,436.6055	—	89,532.6270
Dalton (U.C.)	—	—	49.4000	40.7500	26,075.8500	—	—	26,166.0000
Illovo	—	31,407.3500	7,657.9950	3,919.3000	31,290.9000	—	—	74,280.8050
				Syrup 5.2600				
Jaagbaan	—	16,232.3325	—	84,457.5675	—	—	—	100,689.9000
Doornkop	—	—	134.2500	19,812.6000	23,971.7000	—	—	43,918.5500
Malelane	59,201.5100	—	9,745.8500	—	—	—	—	68,947.3600
Entumeni	10,032.8750	—	1,946.6750	17,410.0000	—	—	—	29,389.5500
	279,558.4850	447,651.0150	124,871.2271	408,954.8710	533,107.0500	89,436.6055	125,124.2690	2,008,703.5226

TABLE B—CANE CRUSHED AND SUGAR MADE, CANE COMPOSITION AND VARIETIES,

SYMBOL INDICATING FACTORY:	ML	PG	UF	EM	FX	EN	AK	DK
Tons Sugar Made	68,947	89,004	145,472	111,340	120,126	29,390	207,566	43,919
Percentage White Sugar made	81%	45%	Nil	Nil	Nil	34%	Nil	Nil
Average Pol of all sugars made	99.68	98.75	97.64	98.50	98.	98.85	97.43	98.01
Tons Cane Crushed	718,716	737,552	1,289,527	1,080,929	1,115,062	267,128	1,803,597	398 150
Season started on	24.4.67	3.5.67	2.6.67	19.5.67	4.5.67	15.6.67	27.4.67	24.4.67
Season ended on	1.4.68	6.1.68	22.1.68	17.3.68	18.3.68	18.1.68	17.3.68	7.2.68
TIME ACCOUNT								
Hours crushed % Hours Mill Open	63.60%	94.92	90.25	80.24	90.07	87.64	90.39	94.68
Hours Cane Shortage % H.M.O.	4.65	1.17	1.57	3.17	2.98	4.51	1.13	2.41
Other Hours of Stoppage % H.M.O.	31.75	3.91	8.19	16.60	6.95	7.85	8.48	2.91
THROUGHPUTS per hour actual crushing								
Tons cane crushed	170.46	156.12	255.16	207.03	177.85	58.19	292.33	72.27
Tons fibre milled	25.20	20.39	35.22	37.14	28.41	7.70	43.25	10.68
Tons Brix processed	26.77	24.55	38.72	29.16	25.63	8.52	43.58	10.30
Tons sugar bagged	16.42	19.04	28.78	21.32	19.16	6.41	33.66	7.99
COMPOSITION OF CANE CRUSHED								
Sucrose % Cane	13.33	14.37	13.21	12.89	12.72	13.10	13.20	12.95
Fibre % Cane	14.78	13.06	13.80	17.94	15.97	13.23	14.80	14.77
Java Ratio	80.70	80.90	79.00	77.41	77.84	78.69	79.66	78.63
Tons Cane per Ton Sugar	10.38	8.20	8.86	9.71	9.28	9.07	8.68	9.04
Tons Cane per Ton 96° Sugar	10.05	7.97	9.51	9.46	9.01	8.81	8.47	8.68
CANE VARIETIES CRUSHED								
Co. 331	Nil	Nil	0.22	0.03	0.39	0.56	0.05	1.53
N: Co. 310	32.75	90.96	80.39	71.64	44.19	1.61	26.19	7.80
N: Co. 293	0.01	0.75	0.09	0.07	Nil	32.28	1.16	16.44
N: Co. 376	55.34	7.47	6.92	20.31	32.28	54.99	15.93	58.81
N: Co. 382	2.42	0.17	10.38	3.17	11.50	3.60	0.83	9.07
N: 50/211	Nil	0.17	0.76	2.84	2.84	6.62	1.25	4.56
Unspecified	9.48	0.48	1.24	1.94	8.80	0.34	54.59	17.90
LOST ABSOLUTE JUICE % FIBRE								
Imbibition % Fibre	37.62	40.93	34.75	48.17	33.20	34.45	34.06	41.78
SPECIFIC FEED RATE*	250.00	268.23	284.78	264.71	236.81	310.00	281.27	247.17
Sucrose Extraction	diff.	35.70	35.29	diff.	39.64	diff.	58.34	52.10
Reduced Extraction	94.37	94.84	95.12	90.29	94.56	95.57	94.69	93.79
Imbibition % Cane	95.36	95.09	96.64	93.26	95.91	95.85	95.63	94.88
	40.85	35.03	39.31	47.49	37.83	41.02	41.61	36.51
Boiling House Performance								
Boiling House Recovery	85.66	95.55	95.88	95.84	97.21	94.33	97.60	96.64
	76.39	88.33	87.64	87.18	88.56	87.00	89.74	89.21
SUCROSE BALANCE (% Sucrose in Cane)								
Lost in Bagasse (A)	5.63	5.16	4.88	9.71	5.44	4.43	5.31	6.21
Lost in Filter Cake (B)	1.09	0.95	1.57	0.52	0.64	0.60	0.47	0.40
Lost in Final Molasses (C)	11.31	7.69	9.87	9.99	9.18	10.68	7.73	7.84
UNDETERMINED LOSSES (D)	10.42	2.42	0.32	1.06	1.00	1.15	1.51	1.89
BOILING HOUSE LOSSES (B) + (C) + (D)	22.82	11.06	11.76	11.57	10.82	12.43	9.41	10.13
SUM OF ALL LOSSES (A) + (B) + (C) + (D)	28.45	16.22	16.64	21.28	16.26	16.86	15.02	16.34
Overall Recovery	71.55	83.78	83.36	78.72	83.74	83.14	84.98	83.66
TOTAL RAINFALL DURING 1967	N.R.	23.79	20.76	48.21	55.48	43.39	37.20	46.14

THROUGHPUTS AND TIME ACCOUNTS, FACTORY PERFORMANCES

GD	DL	GH	MV	JB	UC	TS	ME	IL	RN	SZ	UK	Totals and Means
28,761	166,535	161,165	44,573	100,690	26,166	203,946	(127,896)	74,281	34,613	134,812	89,533	2,008,683
Nil	Nil	61%	Nil	Nil	Nil	Nil	H. T. Mol.	Nil	Nil	54%	Nil	15
98.59	97.69	99.38	98.21	98.60	97.71	98.67	(98.70)	98.07	98.99	99.41	98.66	98.34
269,524	1,481,052	1,538,822	413,823	1,001,948	258,400	1,946,041	1,241,879	708,302	318,711	1,247,444	807,283	18,643,889
4.5.67	27.4.67	18.5.67	10.5.67	19.5.67	22.5.67	25.4.67	15.5.67	5.5.67	25.5.67	17.5.67	1.6.67	24.4.67
9.3.68	23.3.68	4.3.68	24.2.68	6.3.68	23.12.67	14.3.68	1.3.68	22.3.68	9.1.68	26.2.68	17.2.68	1.4.68
84.51	94.21	94.69	87.07	80.54	91.26	90.18	93.00	87.50	87.71	74.00	85.38	87.23
8.29	2.84	0.88	7.72	5.52	1.89	1.41	3.45	6.91	6.83	21.15	7.70	4.20
7.20	2.95	4.43	5.21	13.95	6.85	8.41	3.54	5.59	5.46	4.85	6.92	8.55
50.20	219.66	251.20	80.94	209.02	62.35	298.79	210.95	118.37	78.20	284.00	175.65	176.78
7.17	32.40	38.72	12.29	28.53	8.46	46.80	32.86	17.38	13.47	42.00	24.68	26.53
7.19	33.30	35.66	11.66	29.64	8.64	41.96	30.00	16.99	11.32	41.79	25.14	25.78
5.34	24.73	26.31	8.72	21.00	6.33	31.41	—	12.42	8.49	31.17	19.48	17.88
12.70	13.09	12.84	12.96	12.45	11.92	12.45	12.21	12.48	12.90	13.34	13.18	12.92
14.28	14.75	15.42	15.30	13.65	13.57	15.66	15.58	14.68	17.22	14.79	14.05	15.01
80.18	80.20	79.39	79.23	80.36	80.31	78.08	77.58	78.44	76.65	78.70	79.79	79.02
9.40	8.88	9.39	9.28	9.95	9.84	9.51	—	9.53	9.21	9.11	9.02	9.28
9.16	8.73	9.22	9.07	9.69	9.67	9.25	—	9.33	8.93	8.74	8.77	9.06
9.59	2.08	0.23	2.19	8.94	9.24	0.48	2.32	1.59	0.34	0.56	0.52	1.41
5.32	22.26	4.81	5.44	2.70	0.57	7.31	4.48	10.56	5.40	4.56	8.98	24.77
2.43	0.61	1.27	0.17	39.58	50.16	1.42	9.68	30.38	0.04	0.38	5.59	6.21
41.82	53.58	63.25	44.27	22.39	9.49	42.47	42.68	42.50	71.57	81.88	82.09	41.46
0.89	1.25	3.41	1.72	24.62	28.44	8.58	5.48	11.75	11.88	4.80	0.72	6.42
2.65	6.48	3.31	12.08	0.62	2.10	10.84	7.38	1.72	6.84	1.34	1.02	3.80
37.30	13.94	23.72	34.13	1.15	Nil	29.00	27.98	1.50	3.93	6.48	1.08	15.93
43.04	30.81	58.62	41.25	42.05	34.86	35.02	32.46	33.73	29.68	45.37	46.27	38.32
247.82	354.61	198.71	287.05	250.65	228.63	218.17	286.16	308.61	220.11	260.04	212.56	260.88
58.17	53.46	60.93	46.02	37.57	diffus.	49.11	54.61	47.49	L53.12	51.56	64.69	N.R.
93.93	95.50	92.73	93.42	94.46	95.23	94.05	95.20	94.38	94.78	93.32	93.31	94.15
94.79	96.28	94.30	94.80	95.00	95.66	94.50	96.28	95.33	96.42	94.50	94.15	95.27
35.40	52.29	30.63	43.93	34.22	31.02	34.17	44.57	45.32	37.91	38.46	29.87	39.15
96.68	96.32	97.15	95.32	92.61	96.33	97.18	—	94.66	96.04	93.86	96.23	95.82
87.97	88.00	88.49	87.45	84.21	87.45	88.56	—	86.39	87.93	87.34	89.01	87.52
6.07	4.50	7.27	6.58	5.54	4.77	5.92	4.80	4.56	5.22	6.68	6.69	5.92
0.27	0.72	0.82	0.52	1.16	0.33	0.71	0.25	0.41	1.18	1.22	0.60	0.80
8.98	9.24	9.35	10.78	10.80	10.00	9.63	—	9.72	8.71	10.28	N.A.	9.38
2.05	1.51	0.50	0.42	2.91	1.62	0.43	—	2.86	1.55	0.31	?	1.57
11.37	11.47	10.67	11.72	14.87	11.95	10.77	—	12.99	11.44	11.81	10.26	11.75
17.37	15.97	17.94	18.30	20.41	16.72	16.69	—	17.55	16.66	18.49	16.95	17.67
82.63	84.03	82.06	81.70	79.58	83.28	83.31	—	82.45	83.34	81.51	83.05	82.33
36.28	40.41	33.69	38.81	26.09	36.11	36.11	40.64	41.66	37.47	34.68	42.14	38.72

TABLE C—ANALYSIS OF BAGASSE, JUICES, FILTER

SYMBOL INDICATING FACTORY:	ML	PG	UF	EM	FX	EN	AK	DK
FINAL BAGASSE								
Sucrose % Bagasse	2.29	2.48	2.01	2.84	1.94	1.80	2.10	2.38
Moisture % Bagasse	51.45	52.78	54.25	55.52	52.49	56.39	52.88	52.94
Fibre % Bagasse	45.19	43.74	42.97	40.76	44.79	41.08	44.31	43.76
Milling Loss*	5.07	5.67	4.66	6.97	4.33	4.38	4.74	5.44
Bagasse % Cane	32.71	29.86	32.12	44.03	35.66	32.21	33.39	33.75
Lower Calorific Value (btu/lb.)**	3,164	3,045	2,945	2,802	3,080	2,746	3,043	3,033
Brixfree Water % Fibre	9	32	30	13	23	45	18	30
Imbibition Efficiency	76	45	43	79	48	41	50	59
DILUTION RATIO	72	73	81	72	80	86	79	73
FIRST EXPRESSED JUICE								
Degrees Brix	20.02	20.41	19.57	19.74	19.15	19.12	19.20	19.02
Degrees Purity	83.12	87.06	84.43	84.35	85.32	87.10	86.50	86.60
LAST EXPRESSED JUICE								
Degrees Brix	4.65	2.80	2.10	4.99	2.35	1.76	2.53	3.45
Degrees Purity	68.33	71.43	72.16	76.34	71.28	70.70	74.80	72.33
Purity Drop	14.77	15.63	12.27	8.01	14.04	16.40	11.70	14.27
MIXED JUICE								
Degrees Brix	15.07	15.08	14.16	13.61	14.11	13.46	13.78	13.87
Degrees Apparent Purity	—	85.94	82.84	—	—	—	—	85.08
Degrees Gravity Purity	79.96	85.94	—	82.62	83.43	85.50	83.80	85.20
Purity Drop	3.16	1.12	1.59	1.73	1.89	1.60	2.70	1.40
Reducing Sugars/Sucrose Ratio	7.29	3.20	3.88	4.88	5.04	3.33	3.91	3.30
CLARIFIED JUICE								
Degrees Brix	14.53	15.53	14.48	13.30	12.95	13.87	12.81	14.03
Degrees Purity	79.84	86.80	83.72	82.17	84.98	84.60	85.90	85.64
Reducing Sugars/Sucrose Ratio	7.00	3.02	3.53	4.92	4.28	2.85	3.62	3.36
Average pH	7.18	6.82	7.27	7.30	7.20	7.27	7.53	7.20
FILTER CAKE								
Sucrose % Cake	4.87	2.82	4.16	1.94	1.35	2.62	1.23	1.03
Cake % Cane	3.00	4.84	5.00	3.48	6.00	3.00	5.09	5.00
SYRUP								
Degrees Brix	61.65	63.23	61.43	64.26	63.11	59.28	60.40	60.07
Degrees Purity	80.88	86.11	84.12	83.13	85.62	84.60	86.60	85.43
Reducing Sugars/Sucrose Ratio	7.04	2.64	3.51	4.11	4.11	2.40	3.33	3.78
Average pH	6.48	6.66	6.54	6.60	6.30	7.05	6.68	6.70
FINAL MOLASSES								
Spindle Brix (undiluted)	—	93.79	94.80	—	94.09	90.25	95.14	92.31
Refracto Brix (undiluted)	86.28	—	—	88.15	88.84	—	89.00	—
Apparent Purity (Spindle)	—	37.55	40.48	—	—	—	—	37.18
Gravity Purity (Spindle)	—	—	40.17	—	37.91	41.71	36.35	39.05
Pol/Refr. Brix Purity	—	—	—	42.91	37.41	—	36.57	—
Sucrose Refr. Brix Purity	40.89	—	—	41.47	40.15	—	38.85	—
Percentage sulphated ash	12.03	—	15.13	15.10	15.15	—	15.29	—
Percentage reducing sugars	17.05	—	11.86	15.40	16.50	—	17.00	12.23
Molasses (85° Spindle Brix) % Cane	4.65	3.46	3.82	3.89	3.62	3.96	3.30	3.21

*Milling Loss = 100 x Sucrose % Bagasse/Fibre % Bagasse

**L.C.V. of bagasse = 7650 - 18-times pol % bagasse - 86.4-times moisture % bagasse

CAKE, SYRUP AND FINAL MOLASSES

GD	DL	GH	MV	JB	UC	TS	ME	IL	RN	SZ	UK	Averages
2.44	1.80	2.63	2.40	2.17	1.78	2.07	1.67	1.63	1.69	2.52	2.70	2.19
51.34	52.33	52.77	53.34	53.91	54.88	53.23	53.07	55.48	54.16	54.53	53.48	53.47
45.16	45.07	43.40	43.38	42.92	42.61	44.03	44.53	41.99	43.15	41.90	42.94	43.46
5.40	3.99	6.06	5.53	5.06	4.18	4.70	3.76	3.88	3.92	6.01	6.29	5.04
31.63	32.72	35.52	35.28	31.80	31.85	35.57	35.12	34.97	40.29	35.29	32.72	34.53
3,170	3,096	3,043	2,988	3,953	2,876	3,014	3,035	2,827	2,916	2,893	2,981	2,991
21	14	15	24	25	25	28	25	27	25	25	30	22
48	32	42	35	41	90	55	43	47	61	45	70	52
67	81	65	74	74	82	86	94	84	90	73	81	76
18.66	19.25	18.90	19.11	18.32	17.66	18.80	18.80	18.73	19.67	19.59	18.93	19.16
84.90	84.79	85.00	85.60	84.60	84.03	84.79	83.74	84.94	85.60	86.52	87.22	85.26
3.03	1.53	2.83	2.00	2.27	3.97	2.69	1.99	2.04	2.54	2.75	4.36	2.83
69.62	69.38	68.40	73.10	68.40	70.82	75.46	64.70	64.22	71.20	70.91	75.46	71.43
15.28	15.41	16.60	12.50	16.20	13.21	9.33	19.04	20.72	14.40	15.61	11.76	13.83
13.81	12.68	14.93	13.26	13.85	13.97	14.21	12.99	13.01	14.78	14.26	14.73	13.94
83.24	N.R.	N.R.	N.R.	N.R.	81.90	83.40	N.R.	82.47	84.42	84.57	85.74	83.41
—	82.44	83.84	84.01	82.91	81.99	—	81.76	82.96	—	—	86.92	—
1.66	2.35	1.16	1.60	1.69	2.13	1.39	1.98	2.47	1.18	2.01	1.48	1.85
5.36	5.49	5.06	4.43	6.29	5.92	5.95	5.67	5.08	3.31	4.18	3.81	3.81
13.84	11.83	13.85	12.28	13.82	14.36	14.40	12.06	12.78	16.14	14.42	13.97	13.76
84.00	84.12	84.70	85.20	83.70	81.86	84.90	85.18	84.35	85.80	84.60	86.75	84.44
5.46	5.41	3.77	4.28	6.21	5.11	5.67	5.49	5.00	2.68	4.11	4.11	4.46
7.30	7.50	7.12	N.R.	7.10	7.40	7.25	7.48	7.46	N.R.	7.23	7.50	7.28
1.16	1.77	2.00	1.34	2.94	2.33	4.31	0.60	1.41	2.83	2.75	1.97	2.10
3.00	5.33	5.24	5.00	4.90	1.71	2.04	5.14	3.62	5.39	5.33	4.00	4.71
62.12	60.60	53.19	57.56	62.70	58.91	63.30	54.53	61.62	54.39	59.34	57.47	59.96
84.30	85.55	84.90	84.60	83.30	81.71	84.10	85.15	84.01	86.10	84.79	86.22	84.59
4.59	4.63	3.62	2.18	5.27	4.79	5.60	5.71	3.43	1.71	3.00	4.06	4.25
6.80	6.70	7.00	N.R.	6.20	6.70	6.42	6.49	6.67	N.R.	6.72	7.10	6.66
94.90	—	91.00	90.82	91.56	91.79	91.73	—	92.60	93.43	91.68	85.09	92.03
—	85.90	—	—	—	—	—	—	—	—	—	—	—
31.60	—	38.20	40.20	—	37.26	37.40	—	34.86	38.91	39.28	38.89	—
—	—	38.59	40.67	39.09	39.27	39.77	—	37.82	—	39.75	40.65	—
—	38.00	—	—	—	—	—	—	—	—	—	—	38.75
—	40.80	—	—	—	—	—	—	—	—	—	—	—
—	14.16	—	—	12.37	12.00	11.77	—	11.00	N.R.	13.01	13.93	12.85
—	16.37	11.41	15.92	16.28	14.62	18.41	—	16.57	N.R.	16.58	12.64	15.04
4.11	3.62	3.68	4.04	4.07	3.76	3.55	—	3.77	3.40	4.06	N.A.	3.69

TABLE D—DATA REGARDING: MASSES CUITES, CONSUMPTION

SYMBOL INDICATING FACTORY:	ML	PG	UF	EM	FX	EN	AK	DK
Brix in Mixed Juice % Cane	15.70	15.86	15.17	14.08	14.41	14.65	14.92	14.26
A-MASSECUITE:								
Cu. ft. per ton Brix*	39.31	26.77	31.19	21.12	28.64	27.2	29.7	28.78
Brix of A-massecuite	91.71	91.97	93.29	92.36	91.98	91.9	93.2	94.62
Purity of A-massecuite	83.82	86.98	86.33	83.56	87.60	83.3	88.1	89.44
Purity of A-molasses	67.74	70.65	70.61	66.54	69.60	66.6	70.2	71.26
Drop in purity	16.08	16.33	15.72	17.02	18.00	16.7	17.9	18.18
EXHAUSTION**	59.47	63.97	61.96	60.87	67.59	60.0	68.2	70.72
PURITY A-m.c.—PURITY SYRUP	+2.94	+0.87	+2.21	+0.43	+1.98	-1.3	+1.5	+4.01
B-MASSECUITE:								
Cu. ft. per ton Brix*	15.44	9.85	9.97	10.14	8.87	12.4	9.7	9.92
Brix of B-massecuite	93.27	94.59	95.78	93.13	92.72	94.3	94.5	94.46
Purity of B-massecuite	74.13	74.60	70.87	72.88	71.99	68.8	72.3	73.93
Purity of B-molasses	53.93	52.67	52.72	52.89	49.36	50.5	48.0	53.92
Drop in Purity	20.20	21.93	18.15	19.99	22.63	18.3	24.3	20.01
EXHAUSTION**	59.15	62.11	54.17	58.22	62.07	53.7	64.6	58.74
C-MASSECUITE:								
Cu. ft. per ton Brix*	11.35	7.06	9.10	9.88	9.01	8.5	8.4	9.23
Brix of C-massecuite	95.00	98.30	98.96	94.61	95.30	98.1	95.5	97.90
Purity of B-massecuite	63.44	60.17	60.00	60.31	60.44	58.2	59.5	60.62
Purity of C-molasses	41.22	37.55	40.48	42.91	38.28	41.7	36.6	37.18
Drop in Purity	22.22	22.62	19.52	17.40	22.16	16.5	22.9	23.44
CRYSTAL % C-massecuite	35.91	33.31	32.45	28.84	34.22	27.8	34.5	36.53
EXHAUSTION**	59.58	60.20	54.66	50.54	59.40	48.6	60.7	61.55
CLARIFYING AGENTS								
<i>Per 1000 tons of cane</i>								
Tons Limestone	N.R.	4.68	Nil	Nil	Nil	Nil	Nil	Nil
Tons Coke	N.R.	0.47	Nil	Nil	Nil	Nil	Nil	Nil
<i>Per ton of cane</i>								
Lb. of lime	N.R.	N.R.	1.41	1.72	1.19	5.99	1.17	0.95
Lb. of sulphur	N.R.	0.03	Nil	Nil	Nil	1.12	Nil	Nil
<i>p.p.m. Juice</i>								
Phosphoric Paste or Acid	N.R.	Nil	Nil	Nil	Nil	Nil	12.1	Nil
Flocculants	N.R.	4.24	3.26	2.15	Nil	1.72	1.5	1.26
ADDITIONAL FUEL								
<i>Per 1000 tons of cane</i>								
Tons of Coal	N.R.	17.33	3.30	6.01	6.50	2.06	0.64	Nil
Tons of Wood	N.R.	Nil	1.27	4.79	0.64	5.88	Nil	14.11
Tons of Oil	N.R.	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Converted into tons of Bagasse***	N.R.	69.30	14.72	29.79	26.78	15.30	2.55	16.93

*per ton of Brix present in Mixed juice

**Parts of recovered crystallized sucrose per 100 parts of massecuite

***1 ton coal equivalent with 4 tons bagasse of 3000 btu/lb

1 ton wood equivalent with 1.2 tons bagasse of 3000 btu/lb

1 ton oil equivalent with 6 tons bagasse of 3000 btu/lb

1m³ oil equivalent with 6.1 tons bagasse of 3000 btu/lb

OF CHEMICALS AND ADDITIONAL FUELS

GD	DL	GH	MV	JB	UC	TS	ME	IL	RN	SZ	UK	Averages
14.32	15.86	14.20	14.41	14.18	13.86	14.04	14.22	14.35	14.48	14.71	14.31	14.58
21.08	24.0	24.3	34.8	28.5	23.77	26.5	—	49.08	21.6	23.60	29.39	29.44
93.70	93.5	92.9	91.2	92.8	93.07	92.9	—	91.56	92.5	92.12	93.07	92.65
82.00	86.3	87.8	88.2	86.5	85.56	86.9	—	87.55	84.7	84.88	86.78	86.07
60.75	69.0	69.4	73.2	67.1	64.25	68.6	—	72.93	67.1	68.77	64.22	68.34
21.25	17.3	18.4	15.0	18.4	20.31	16.9	—	14.62	17.6	16.11	16.64	17.73
66.02	64.7	68.4	63.5	65.4	67.18	61.9	—	61.68	63.2	60.77	64.22	65.05
-2.30	+0.8	+2.9	+3.6	+1.7	+2.85	+2.8	—	+3.54	-1.4	+0.09	+0.56	+1.48
14.39	7.2	12.3	15.2	11.2	13.84	12.8	—	14.49	12.1	13.69	9.47	11.74
95.78	94.0	94.7	93.6	94.7	94.97	94.7	—	93.15	95.0	95.22	95.89	94.44
71.20	73.1	72.6	75.5	73.4	71.17	72.8	—	74.04	72.4	73.41	73.37	72.76
45.08	53.8	50.9	49.9	51.8	43.81	51.2	—	51.89	49.5	52.72	50.99	50.82
26.12	19.3	21.7	25.6	21.6	27.36	21.6	—	22.15	22.9	20.69	22.38	21.94
66.80	57.1	60.9	67.7	61.0	68.42	61.0	—	62.18	62.6	59.61	62.23	61.31
9.60	9.0	9.7	10.8	10.8	10.42	10.4	—	12.34	7.8	10.64	8.20	9.59
98.50	96.4	96.6	96.0	96.5	96.72	97.0	—	96.19	97.0	99.21	98.90	96.98
54.54	60.2	60.6	60.7	61.1	57.19	58.6	—	60.92	60.4	60.48	59.71	59.84
31.60	38.0	38.2	40.2	38.9	37.25	37.4	—	34.96	38.9	39.28	38.89	38.38
22.94	22.2	22.4	20.5	22.2	19.94	19.2	—	25.96	21.5	21.20	20.82	21.46
33.03	34.5	35.0	32.9	35.1	30.63	28.5	—	38.39	34.1	34.64	33.69	33.77
61.48	59.5	59.8	56.5	59.5	55.56	52.3	—	65.52	58.2	57.73	57.06	58.28
Nil	Nil	5.33	Nil	Nil	Nil	Nil	Nil	Nil	Nil	4.52	Nil	4.91
Nil	Nil	0.64	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.50	Nil	0.55
1.34	1.32	4.96	1.16	2.10	1.37	1.24	1.42	1.12	1.42	4.75	1.07	1.33
Nil	Nil	1.10	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1.17	Nil	—
Nil	198.8	Nil	25.6	178.3	Nil	Nil	Nil	Nil	9	93	226	—
1.86	9.0	Nil	6.5	3.6	0.97	0.6	Nil	7.09	Nil	6	12	—
N.R.	Nil	15.22	7.40	Nil	19.74	N.R.	0.22	5.80	Nil	10.74	Nil	5.00
1.68	0.44	1.45	2.05	5.93	2.40	N.R.	Nil	5.98	Nil	1.32	2.70	2.67
Nil	Nil	Nil	Nil	4.75	Nil	N.R.	Nil	Nil	Nil	11.60	Nil	0.86
2.00	0.52	62.64	32.06	52.23	81.84	N.R.	0.88	30.38	Nil	114.14	2.75	25.96

TABLE E—DATA OF MILLS AFFILIATED TO THE S.M.R.I.

NAME OF FACTORY	Luabo	Marromeu	Mhlume	Ubombo R.	Triangle
Season started on	8th May	15th Nov.	1st May	3rd May	—
Closing date of reporting	2nd Dec.	17th Dec.	1st Jan.	4th Jan.	—
TONS (2,000 lb.) CANE CRUSHED	694,585	669,996	739,326	755,382	—
TONS SUGAR MANUFACTURED	68,690	74,024	82,414	82,426	—
Tons Cane crushed per hour	178	151	164	153	—
Mechanical Time Efficiency	95	98	90	98	89
Overall Time Efficiency	89	95	85	94	89
WHITE SUGAR MADE (%)	49	64	5	8	Nil
SUCROSE % CANE	12.08	13.61	13.23	12.94	14.27
FIBRE % CANE	14.51	14.51	13.59	13.30	13.00
Tons Cane per Ton Sugar	10.11	9.05	8.97	9.16	8.08
JUICES					
Purity of First Expressed Juice	86.04	86.00	86.58	84.86	86.6
Purity of Last Expressed Juice	74.99	76.69	78.51	73.02	78.4
Purity Drop	11.05	9.31	8.07	11.84	8.2
Purity of Mixed Juice	85.49	84.46	84.98	82.46	85.01
Reducing Sugars/Sucrose Ratio	5.34	3.47	5.11	5.14	5.18
Ditto of Clarified Juice	5.18	3.25	3.47	6.20	4.71
Ditto of Syrup	3.40	3.14	2.15	4.45	4.35
MILLING AND BAGASSE					
LOST ABSOLUTE JUICE % FIBRE	47.15	55.20	48.93	37.32	53.85
Lb. Fibre/hour per cu. ft. T.R.V.	67.60	69.34	63.65	59.26	40.99
Imbibition % Fibre	194.79	165.88	144.22	189.80	237.19
SUCROSE EXTRACTION	92.95	91.31	92.85	94.93	92.49
Reduced Extraction	94.07	92.69	93.51	95.28	92.82
Sucrose % Bagasse	2.56	3.59	3.13	2.23	3.63
Moisture % Bagasse	52.93	51.25	51.12	51.77	53.17
Fibre % Bagasse	43.63	44.07	44.90	45.17	42.22
MILLING LOSS	5.87	8.15	6.96	4.94	8.59
Lower Calorific Value (btu/lb.)	3,031	3,157	3,177	3,137	2,991
Available btu per lb. Brix	7,671	7,065	6,651	6,239	5,674
SUCROSE LOSSES % SUCROSE IN CANE					
Lost in Filter Cake	1.01	0.89	0.28	0.67	0.41
Lost in Final Molasses	8.65	8.16	8.86	10.02	7.51
Undetermined Losses	2.22	1.73	0.84	1.06	0.41
LOST IN BOILING HOUSE	11.88	10.78	9.98	11.75	10.28
Lost in Bagasse	7.05	8.69	7.15	5.07	7.51
TOTAL OF ALL LOSSES	18.93	19.47	17.13	16.82	17.79
OVERALL RECOVERY	81.07	80.53	82.87	83.18	82.21
BOILING HOUSE PERFORMANCE					
Boiling House Recovery	94.75	96.37	96.85	96.33	96.94
Boiling House Recovery	87.23	88.21	89.25	87.62	88.88
WASTE PRODUCTS					
Filter Cake % Cane	4.50	4.74	2.32	4.47	2.85
Sucrose % Filter Cake	2.71	2.55	1.59	1.95	2.12
Final Molasses (85°B) % Cane	3.05	3.16	3.13	4.02	4.14
Gravity Purity	39.82	40.63	43.99	37.91	36.06
Apparent Purity	39.27	38.97	39.23	35.85	32.30
°Brix of Final Molasses	92.16	91.25	89.21	88.71	94.37
Reducing Sugars (%)	17.14	13.51	12.97	—	—
Sulphated Ash (%)	12.36	15.41	14.58	—	—
SYRUP DENSITY (°BRIX)					
SYRUP DENSITY (°BRIX)	57.33	63.30	61.09	58.80	61.34
CU. FT. MASSECUITE PER TON BRIX					
A-massecuite	26.91	22.92	22.72	32.49	43.60
B-massecuite	12.08	12.96	12.13	11.87	9.19
C-massecuite	11.70	8.32	9.16	10.92	10.48
TOTAL of all massecuites	50.59	44.20	44.01	55.28	63.27
EXHAUSTION*					
A-massecuite	63.02	61.33	62.76	62.66	66.85
B-massecuite	56.25	62.38	58.87	62.93	68.33
C-massecuite	58.14	64.50	58.26	61.29	70.62
Crystal % C-massecuite	34.37	40.04	33.07	36.68	43.27
Purity of Evaporation Syrup	84.60	86.20	87.31	83.80	86.30
Purity of A-massecuite	83.45	87.49	87.07	87.10	90.33
Difference in Purity	-1.15	+1.29	-0.24	+3.30	+4.03

*Exhaustion = Recovered crystallized sucrose % sucrose in massecuite.

TABLE F — COMPARATIVE MANUFACTURING DATA OF RECENT YEARS (S.A. MILLS)

SEASON	1967/68	1966/67	1965/66	1964/65	1963/64
CANE					
Sucrose % Cane	12.92	13.72	12.99	13.90	13.55
Fibre % Cane	15.01	15.09	15.57	15.38	15.50
JUICES					
Brix° First Expressed Juice	19.16	19.84	19.27	20.27	19.78
Purity of First Expressed Juice	85.26	86.97	86.30	87.54	87.37
Purity of Last Expressed Juice	71.43	72.43	72.30	74.30	72.66
DROP in Purity	13.83	14.54	14.00	13.24	14.71
Purity of Mixed Juice	84.44	85.06	84.22	85.52	85.30
Reducing Sugars/Sucrose Ratio	4.46	3.62	3.73	3.32	3.44
MILLING					
Imbibition % Fibre	260.88	262.00	260.53	256.00	258.26
LOST ABSOLUTE JUICE % FIBRE	38.32	37.91	37.58	36.98	37.47
Imbibition % Cane	39.15	39.60	40.57	39.37	39.84
EXTRACTION	94.15	94.22	93.99	94.16	94.08
Sucrose % Bagasse	2.19	2.29	2.20	2.34	2.29
Moisture % Bagasse	53.47	53.52	52.98	52.64	52.46
Bagasse % Cane	00.00	34.56	35.42	34.36	34.92
Lower Calorific Value (btu/lb.)	2,991	2,985	3,033	3,061	3,066
Available btu per lb. Brix	7,084	6,788	7,414	6,870	7,166
RECOVERIES					
BOILING HOUSE PERFORMANCE					
Boiling House Recovery	95.82	95.96	95.65	97.07	97.19
Overall Recovery	87.52	88.38	87.67	89.65	89.60
Tons Cane per Ton Sugar	82.33	83.27	82.40	84.52	84.30
	9.28	8.63	9.20	8.42	8.63
FILTER CAKE					
Sucrose % Cake	2.10	2.16	1.57	1.30	1.37
Filter Cake % Cane	4.71	5.21	5.62	5.25	5.57
FINAL MOLASSES					
GRAVITY PURITY					
Degree Brix	38.75	40.65	39.91	39.87	39.45
Weight at 85° Brix % Cane	92.03	93.45	91.72	91.58	91.21
	3.69	3.47	3.59	3.33	3.15
AVERAGE SUGAR POLARIZATION					
	98.34	98.58	98.49	98.60	98.51
SUCROSE BALANCE					
Lost in Filter Cake	0.80	0.82	0.68	0.52	0.56
Lost in Final Molasses	9.30	8.75	9.38	8.13	7.79
Undetermined Losses	1.57	1.38	1.53	1.09	1.43
LOST IN BOILING HOUSE	11.75	10.95	11.59	9.73	9.78
Lost in Bagasse	5.92	5.78	6.01	5.84	5.92
TOTAL OF ALL LOSSES	17.67	16.73	17.60	15.58	15.70
CU. FT. OF MASSECUITES PER TON BRIX					
A-massecuite	29.44	29.02	27.89	27.79	26.67
B-massecuite	11.74	10.30	11.78	11.27	11.03
C-massecuite	9.59	8.83	9.14	7.98	7.92
TOTAL	50.77	48.15	48.81	47.03	45.62
EXHAUSTION OF MASSECUITES					
A-massecuite	65.05	62.85	62.78	62.45	62.18
B-massecuite	61.31	58.36	59.53	60.39	60.54
C-massecuite	58.28	55.59	56.37	56.80	56.95
PURITY RISE					
A-massecuite purity	86.07	86.68	85.91	86.68	86.10
Syrup purity	84.59	86.03	85.06	86.70	86.38
RISE	+1.48	+0.65	+0.85	-0.02	-0.28
DENSITY (°BRIX) OF SYRUP					
	59.96	60.35	59.33	58.77	58.06

TABLE G—AVERAGE MANUFACTURING RESULTS by Monthly Periods for S.A. Mills
(Season 1967-1968)

END OF MONTHLY PERIOD:		May 27 1967	July 1 1967	July 29 1967	Sept. 2 1967	Sept. 30 1967	Oct. 29 1967	Dec. 2 1967	Dec. 30 1967	Jan. 27 1968	March 2 1968	April 1 1968
TONS CANE CRUSHED	Month	948,595	2,252,625	1,851,295	2,410,491	1,917,333	1,797,666	2,208,324	1,672,500	1,511,749	1,576,330	504,679
	To-date	948,595	3,201,220	5,052,515	7,465,006	9,380,339	11,178,005	13,386,229	15,058,714	16,570,463	18,146,813	18,643,889
TONS SUGAR M & E	Month	88,512	218,172	188,669	255,913	207,529	201,574	232,137	169,347	145,378	136,588	43,899
	To-date	88,512	306,684	495,353	751,246	958,775	1,160,349	1,392,486	1,561,833	1,707,211	1,843,799	2,008,683
TONS CANE CRUSHED per hour actual crushing	Month	162	171	180	176	171	180	169	179	185	194	—
	To-date	162	168	172	174	173	174	173	174	174	175	176
SUCROSE % CANE	Month	11.75	12.37	12.87	13.31	13.72	14.26	13.52	12.81	12.47	11.70	10.84
	To-date	11.75	12.18	12.50	12.73	12.92	13.14	13.20	13.15	13.09	12.97	12.92
FIBRE % Cane	Month	14.56	14.54	14.24	14.59	14.68	14.80	15.26	15.30	15.67	15.96	16.03
	To-date	14.56	14.55	14.53	14.55	14.58	14.62	14.72	14.81	14.89	14.98	15.01
TONS CANE PER TON SUGAR	Month	10.15	9.59	9.10	8.89	9.07	3.33	8.88	9.88	9.73	11.54	11.50
	To-date	10.15	9.75	9.40	9.26	9.12	8.98	8.97	9.04	9.06	9.84	9.28
LOST ABSOLUTE JUICE %FIBRE	Month	40	41	38	37	36	35	37	36	39	41	42
	To-date	40	41	40	39	39	38	38	38	38	38	38
IMBIBITION % FIBRE	Month	273	259	265	263	268	263	261	269	260	239	236
	To-date	273	263	264	263	264	264	264	264	264	262	261
SUCROSE EXTRACTION	Month	94.08	93.91	94.30	94.41	94.67	94.40	94.32	94.30	93.66	93.21	92.69
	To-date	94.08	93.96	94.09	94.20	94.30	94.32	94.32	94.32	94.26	94.18	94.15
Sucrose % BAGASSE	Month	2.08	2.24	2.02	1.94	2.21	2.36	2.19	2.05	2.15	2.14	2.14
	To-date	2.08	2.19	2.13	1.92	2.20	2.23	2.22	2.20	2.20	2.19	2.19
MOISTURE % BAGASSE	Month	53.64	53.80	53.31	53.10	53.16	53.00	53.34	53.79	53.95	53.96	53.74
	To-date	53.64	53.75	53.59	53.43	53.34	53.29	53.30	53.35	53.41	53.46	53.47
BOILING HOUSE PERFORMANCE	Month	—	96.94	96.98	97.22	96.09	95.22	95.15	95.27	94.85	93.82	—
	To-date	—	96.54	96.64	96.94	96.74	96.48	96.26	96.10	96.00	95.76	95.82
BOILING HOUSE RECOVERY	Month	87.71	86.51	88.86	89.47	88.57	86.80	87.00	87.58	88.00	—	—
	To-date	87.71	87.30	88.18	88.62	88.61	88.18	87.98	87.93	87.88	88.03	87.52
OVERALL RECOVERY	Month	82.48	81.24	83.71	84.46	83.82	81.86	81.98	82.54	82.84	79.16	—
	To-date	82.48	82.03	82.90	83.43	83.51	83.12	82.93	82.88	82.88	82.56	82.33
PURITY OF MIXED JUICE	Month	83.36	83.49	83.67	83.64	83.51	83.75	84.12	83.78	82.47	81.89	81.21
	To-date	83.36	83.45	83.53	83.57	83.56	83.59	83.68	83.69	83.58	83.45	83.41
REDUCING SUGAR/SUCROSE RATIO	Month	4.66	4.60	4.74	4.82	4.93	4.70	4.14	4.41	5.06	5.84	—
	To-date	4.66	4.65	4.71	4.71	4.75	4.74	4.64	4.61	4.65	4.72	4.77
GRAVITY PURITY OF FINAL MOLASSES	Month	38.57	37.54	37.80	38.05	38.24	39.26	40.24	40.62	38.60	38.73	40.14
	To-date	38.57	38.55	37.70	37.81	37.91	38.17	38.51	38.75	38.75	38.71	38.75
SUCROSE LOST IN MOLASSES % SUCROSE IN CANE	Month	8.73	8.30	8.38	8.52	9.17	9.68	9.02	9.52	10.60	12.16	—
	To-date	8.73	8.58	8.50	8.51	8.65	8.83	8.86	8.97	9.12	9.35	9.38
UNDETERMINED LOST SUCROSE	Month	2.10	3.68	1.84	—	0.83	2.00	2.39	1.25	—	—	—
	To-date	2.10	2.55	2.05	1.44	1.32	1.54	1.68	1.60	1.40	1.40	1.57
MONTHLY RAINFALL (in.) TOTAL FROM 1st JANUARY	Month	0.48	0.51	1.63	0.36	0.96	3.97	5.29	1.90	5.60	3.72	—
	Year	24.16	25.51	26.16	26.61	27.65	31.86	36.79	38.72	5.60	9.36	—

TABLE H—COMPARATIVE DATA of REPORTING S.A. MILLS from 1925 ONWARDS

PERIOD (Season)	Per cent Cane		Cane/Sugar Ratio		Extraction	Lost Absol. Juice % Fibre	Per cent Bagasse		Imbibition per cent		Mixed Juice		Final Molasses Purity	Boiling House Performance	Boiling House Recovery	Overall Recovery
	Sucrose	Fibre	Tel Quel	96s Sugar			Sucrose	Mois- ture	Cane	Fibre	Purity	Reducing Sugar Ratio				
Average 1925-1934 . .	13.19	15.78	9.86	9.64	89.83	58.4	3.88	50.57	27.6	175	85.09	3.65	45.3	90.6	83.67	75.12
Average 1935-1944 . .	13.53	15.30	8.96	8.73	92.05	48.9	3.11	51.60	32.6	213	86.01	3.22	43.3	95.4	88.36	81.34
1945	14.28	15.99	8.29	8.08	93.28	39.3	2.77	50.19	35.0	219	86.23	3.38	42.0	96.4	89.29	83.30
1946	14.21	16.21	8.36	8.14	93.07	40.5	2.79	50.32	35.2	217	85.86	3.30	41.8	96.7	89.12	82.94
1947	13.32	15.80	8.84	8.60	93.44	39.8	2.54	50.46	34.4	218	86.24	2.95	41.1	96.8	89.61	83.73
1948	13.89	15.90	8.55	8.31	93.32	39.8	2.67	50.53	34.1	214	85.92	3.67	41.5	96.5	89.14	83.19
1949	13.52	16.19	8.76	8.52	92.24	41.0	2.66	50.84	33.7	208	86.22	3.11	41.4	96.9	89.68	83.35
1950	14.19	15.80	8.32	8.09	93.53	39.3	2.72	51.22	32.8	206	86.40	3.12	40.5	96.9	89.63	83.65
1951	13.33	16.29	8.98	8.73	92.98	40.2	2.57	51.71	35.0	215	84.92	3.52	40.3	96.7	88.72	82.30
1952	13.87	16.10	8.50	8.27	93.00	40.8	2.65	52.53	34.9	217	86.25	2.92	39.3	97.2	89.96	83.66
1953	13.93	16.31	8.55	8.24	92.67	41.7	2.75	52.47	32.7	200	85.61	3.66	39.5	96.9	89.36	82.81
1954	13.34	16.03	8.87	8.65	92.40	44.1	2.75	62.92	30.7	191	85.86	3.28	39.3	97.4	90.04	83.20
Average 1945-1954 . .	13.79	16.06	8.60	8.36	93.04	40.6	2.69	51.32	33.8	210	85.95	3.29	40.7	96.8	89.46	83.23
1955	13.87	15.74	8.51	8.28	92.32	45.5	2.91	53.18	32.1	204	85.96	3.40	39.6	97.9	90.51	83.56
1956	13.35	15.81	8.87	8.62	92.93	42.1	2.60	53.12	35.2	222	84.49	3.32	39.9	97.4	89.79	83.44
1957	13.11	15.38	8.93	8.67	93.36	40.9	2.47	53.06	34.5	224	85.10	3.69	38.5	98.5	90.43	84.42
1958	13.12	15.92	9.09	8.82	92.87	42.3	2.55	52.38	32.9	207	84.46	4.30	39.1	97.8	89.49	83.11
1959	13.66	15.92	8.74	8.44	92.86	43.0	2.66	53.26	34.6	218	85.52	3.51	40.3	97.1	89.42	83.04
1960	13.69	15.22	8.70	8.41	93.35	42.0	2.60	53.01	36.2	238	85.63	3.31	40.3	96.8	89.40	83.45
1961	13.75	14.52	8.54	8.26	94.21	39.0	2.43	52.54	36.7	253	86.04	3.31	39.5	97.1	89.72	84.53
1962	13.29	15.50	9.01	8.91	94.15	37.4	2.24	52.17	41.2	266	83.36	5.11	39.6	96.6	87.81	82.67
1963	13.55	15.50	8.66	8.42	94.08	37.5	2.29	52.46	39.8	258	85.30	3.44	39.4	97.2	89.60	84.30
1964	13.90	15.38	8.42	8.20	94.16	37.0	2.34	52.64	39.4	256	85.52	3.32	39.9	97.1	89.65	84.42
Average 1955-1964 . .	13.53	15.49	8.75	8.46	93.43	40.7	2.51	52.78	36.3	235	85.24	3.67	39.6	97.4	89.58	83.69
1965	12.99	15.57	9.20	8.97	93.99	37.6	2.20	52.98	40.6	261	84.22	3.73	39.9	95.6	87.67	82.40
1966	13.72	15.09	8.63	8.40	94.22	37.9	2.29	53.52	39.6	262	85.06	3.62	40.6	96.0	88.38	83.27
1967	12.92	15.01	9.28	9.06	94.15	38.3	2.19	53.47	34.5	261	83.41	4.46	39.4	95.8	87.52	82.33

Discussion

Mr. Gunn (in the chair): I do not agree that low sucrose necessarily results from drought conditions.

Last season Tongaat, although juice purities were low, had no clarification problems at all despite a higher crushing rate and the use of one less clarifier. There was no trouble either at the centrifugal stage.

I agree with Mr. Perk that the way to report mill stoppages is on the basis of a 168-hour week.

Mr. du Toit: A moderate drought will cause an increase in sucrose as a result of desiccation, with virtually no change in purity. As conditions worsen, sucrose and purity fall because of cane deterioration. This was demonstrated at Malelane last year when some irrigation farmers dried off their cane excessively with a resultant drop in purity and sucrose.

The drought in 1964/65 caused an early "peak" sucrose with a marked fall thereafter. Last year's low sucrose was due to the excellent rainfall from January to April.

On referring to Table H in the paper it is somewhat disconcerting to note that maximum sucrose was achieved as long ago as 1945, and that in fact overall efficiency seems to be on the downgrade.

I have recently returned from Australia and was once again struck by the low cane to sugar ratio. One reason is their shorter season but another is undoubtedly because of a cane payment system that takes cane quality into account.

It is sometimes said that the Australians grow high sucrose varieties but their best variety is our own N.Co.310.

In this country N.Co.310 is still the top variety in the North but N.Co.376 is the main variety for the rest of the cane belt.

N.Co.293 is being planted in the Noodsberg and Dalton areas because it is a very good high altitude

cane and its proportion will increase as the inland areas expand.

N.50/211 is grown on sandy soils in the North Coast and Southern Zululand area. In the sandy areas further North the variety N.Co.382 predominates. Both these varieties are unfortunately low in sucrose.

Mr. Alexander: I have just returned from overseas where I saw diffusers operating and it appears that taking into account bacterial and enzymatic action and also the dissolution of starch a temperature of just under 70°C is regarded as best for the diffusion process.

Mr. Robinson: On the last page of the summary it is said that the difference between sucrose/refracto Brix purity and sucrose/spindle Brix purity of final molasses is 2½ units; according to me this should be 5 to 6 units.

Mr. de St. Antoine: Although the average difference may three units, say, deviations from the average may be quite marked, as found under Mauritian conditions.

Also, the larger the ash content the larger the difference.

Mr. Perk: According to information received the average difference for the final molasses of the Hulett Mills is 2½ units, which corresponds with a difference between refracto and spindle Brix of approximately 5 to 6 units.

With regard to the different purities recorded by the Mills, it is a pity that not all Mills record the sulphated ash and reducing sugars content of their final molasses in order that the true purities can be approximated and the target purity calculated.