FORTY-SECOND ANNUAL SUMMARY OF LABORATORY REPORTS

OF SUGAR FACTORIES IN SOUTHERN AFRICA FOR THE SEASON 1966/67

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N.B.—All data in this Summary are as declared by the Mills in their laboratory Reports.

A. THE SOUTH AFRICAN CANE CROP OF THE 1966/1967 SEASON

We quote from the Experiment Station's Weather Reports:

"January, 1966, provided optimum growing conditions which followed into mid February. From this stage onwards, however, the soils became increasingly drier and the Industry suffered a short but severe drought. Good rains fell over most of the sugar belt during May. Thus by May 31st 1966, the cane fields (with the exception of those in Northern Zululand) were quite moist, and the crops were green and healthy.

By the end of July, conditions were very dry and good soaking rains would have been extremely welcome throughout the area. Much of the cane in the Natal midlands had been adversely affected by both drought and frost. The eastern part of the midlands was not as badly frosted as the western area. Severe frost damage at Melmoth had been confined mainly to the low-lying valleys. At Pongola frost damage had been negligible.

By the end of October, 1966, the cane belt was still dry. During the month of November 3.61 inches fell compared with a mean of 4.31 inches for this month. The average rainfall for December was 3.66 inches, exactly one inch below the mean for December. Taken over the year 1966, the sugar belt received a mean rainfall of 29.98 inches, compared with an average of 38.23 inches during the past 42 years."

After reading this account of the weather conditions, one would not expect a record sugar output for the 1966/67 season. However, owing to the extension of existing areas and the opening of new cane lands in the Natal midlands and the lower South Coast a record cane crop was harvested resulting in a sugar output of $\pm$1.8 million tons.

Tons of 2,000 lbs Season	Tons Sugar	Tons Cane	Cane/Sugar Ratio
1962/63 . . .	1,193,279	10,731,263	9.01
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	8.66

Tons of 1,000 kg Season	Tons Sugar	Tons Cane	Cane/Sugar Ratio
1962/63 . . .	1,082,525	9,751,707	9.01
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

N.B.—The sugar productions as shown in the above two tables as well as those in Table I (at the end of the text of this Summary) are the official tonnages as supplied by the S.A. Sugar Association. In all other tables in this Summary the sugar productions are as stated in the factories' laboratory reports. There is a material difference between the latter and the official production figures because neither Gledhow nor Sezela record on their laboratory reports the sugar actually made, but only the weights of sugar transferred from one department to another department of their Mills.

The average yearly sugar production for the decade 1941/1950 was 557,000 tons; in the following decade the average production rose to 867,000 tons, while for the period 1961/1966 the average seasonal figure is 1,291,000 tons tel quel. These figures show clearly the expansion of the South African Sugar Industry since 1949.

With regard to the ripening process of the cane, in the following table the trend of the past crop is compared with a ten year average:

COMPARISON OF SUCROSE % CANE BY MONTH

Month	This Season's average	Ten year average
May	12.91	12.35
June	13.45	13.00
July	14.13	13.57
August	14.28	14.20
September	14.45	14.44
October.	14.34	14.21
November	14.06	13.64
December	13.48	13.11
January	13.16	12.59
February	11.84	12.35
March	11.97	N.A.

The comparison reveals that the increase and decrease of the sucrose content of the past season's cane is similar to the general trend as indicated by the 10-year average.

We want, however, to draw attention to the fact that it is better not to compare the first months or the last months of any season with those of other seasons because the same cane areas may not be involved, particularly as it was most unusual that certain of the mills that were still crushing in February should be operating so late.

COMPARISON OF THE RESULTS OF THE OPTIMUM PERIODS

N.B.—Results of seasons before 1961 can be found in the 36th Annual Summary (1960/1961 Season), where a review is given of all results from 1928 to 1960, inclusive.

	% of Crop	Percent Cane		Cane to Sugar Ratio	Purity of Mixed Juice
		Sucrose	Fibre		
Season 1961/62					
Optimum Period .	69	14.11	14.46	8.23	86.69
Balance of Crop .	31	12.98	14.63	9.18	84.52
Total Crop . .	100	13.75	14.52	8.51	86.04
Season 1962/63					
Optimum Period .	56	13.77	15.32	8.58	83.51
Balance of Crop .	44	12.65	15.73	9.63	83.15
Total Crop . .	100	13.30	15.50	8.96	83.36
Season 1963/64					
Optimum Period .	59	13.91	15.38	8.36	86.09
Balance of Crop .	41	13.02	15.66	9.06	84.10
Total Crop . .	100	13.55	15.50	8.63	85.30
Season 1964/65					
Optimum Period .	60	14.41	15.20	8.06	86.01
Balance of Crop .	40	13.17	15.62	9.01	84.74
Total Crop . .	100	13.90	15.38	8.38	85.52
Season 1965/66					
Optimum Period .	67	13.10	15.44	9.06	84.53
Balance of Crop .	33	12.76	15.83	9.50	83.50
Total Crop . .	100	12.99	15.57	9.20	84.22
Season 1966/67					
Optimum Period .	55	14.14	14.76	8.33	85.65
Balance of Crop .	45	13.20	15.50	9.02	84.29
Total Crop . .	100	13.72	15.09	8.63	85.06

N.B.—Please note that all data are based on the tonnages of sugar as declared in the Laboratory Reports. This is the reason why the cane/sugar ratios do not always tally with those based on the Official Sugar Tonnages.

The highest sucrose content for the Optimum Period, i.e. 14.45%, was obtained in the 1955/56 season. In the Optimum Periods of 1960/61 and 1961/62 the sucrose content was 14.11% and in the 1964/65 season it was as high as 14.41%, a near approach to the 1955/56 record. This year's sucrose content is just the average of the six years period shown in the table.

In addition we draw attention to the variations in the percentages of cane crushed in the Optimum Periods. The "highest ever" was recorded in the period 1928-34 when an average 76% of the cane crop was harvested in the Optimum Periods. A percentage as low as 56% was recorded in 1962/63. This season's 55 per cent is just as unsatisfactory for grower and mill engineers as in 1962/63.

VARIETAL CHANGES

The cane varieties planted by the two Midland factories brought new life to the old variety Co.331 and a boost to the percentage of N:Co.293. The South and the North Coast Mills caused the average percentage of N:Co.376 to increase further. The increase in percentages of these three varieties i.e. N:Co.293, N:Co.382 and N:Co.376 decreased the average percentage of N:Co.310 as the following table reveals:

Season	1962/63	1963/64	1964/65	1965/66	1966/67
Co.331 . .	8.89	6.32	4.41	2.70	1.83
N:Co.310 .	54.00	50.75	46.91	40.15	33.63
N:Co.292 .	2.28	2.03	1.32	0.89	0.41
N:Co.293 .	4.62	4.93	3.72	4.51	5.98
N:Co.339 .	3.67	3.23	2.57	1.76	0.97
N:Co.376 .	18.04	21.45	23.36	32.19	36.45
N:Co.382 .	1.92	1.81	2.87	3.35	4.89
N:20/211 .	0.22	1.23	2.84	3.52	3.56

The stronghold of N:Co.310 is in Zululand, especially at Pongola and Amatikulu, where 90% of all cane crushed is still N:Co.310. Felixton crushed more N:Co.376 than N:Co.310 and in addition about 10% N:Co.382, while Entumeni's main varieties were N:Co.293 and N:Co.376.

The highest percentages of N:Co.376 were crushed by Renishaw, Sezela and Umzimkulu, respectively, 78%, 76% and 80%.

Jaagbaan and Union Co-op crushed the highest percentages N:Co.293, respectively 56% and 53%. They crushed also the highest percentages of Co.331, respectively 14% and 16%.

With regard to the Rhodesian Mill Triangle and the two Mocambique factories Luabo and Marromeu, their variety **menu** can best be compared with that of Felixton i.e. approximately the same percentage N:Co.310 as N:Co.376. Triangle has in addition 15% of Co.331.

TIME ACCOUNTS AND CRUSHING RATES OF SOUTH AFRICAN SUGAR MILLS

The starting sequence of the Mills was as follows: 13th April AK; 14th April EM; 27th April TS; 28th April FX and DL; 29th April UF and IL; 4th May GD; 7th May GH and MV; 10th May PG and JB; 11th May ME; 16th May DK; 24th May RN; 25th June UK; 26th June SZ; 21st July EN and finally on the 1st of August UC.

The sequence in which the Mills completed their crushing season was as follows: 10th December PG; 20th January MV; 28th January UC; 1st February UF; 5th February DK; 12th February TS; 18th

February FX; 20th February AK; 21st February EM; 26th February GD, DL and JB; 27th February RN; 1st March GH, ME and UK; 4th March SZ; 15th March EN and 19th March IL.

Season	1964/65	1965/66	1966/67
Total Tons Cane Crushed	11,752,031	9,266,324	15,545,625
Total Crushing Hours	85,266	67,090	95,229
Mean Crushing Rate	138 tch	138 tch	163 tch
No. of Mills Crushing	17	17	19
Average of Days Crushing	209 days	164 days	209 days
Total Hours Mills open	92,457	76,751	109,216
Average Length of Season	37¾ weeks	31⅝ weeks	40 weeks
Mean Time Efficiency	92%	87½%	87%
Hours of Stoppage due to Cane in short supply in % of Hours Mills Open	3½%	6%	5%

Because of the ever increasing total tonnage of cane being crushed, we are of course interested in knowing if the crushing rates of the Mills have kept pace with this increase. In the following table, the total tons of cane crushed in the 1950/51 season has been taken as 100% and the same holds for the sum of the average crushing rates of the Mills in that season:

Cane crushed in 1950/51: 5.71m tons=100%
Sum of Crushing Rates: 1,300 t.c.h.=100%

Season	Total Tons Cane Crushed	Sum of Crushing Rates
1950/51	100.0%	100.0%
1951/52	84.2%	99.6%
1952/53	100.1%	102.9%
1953/54	108.8%	104.9%
1954/55	128.8%	117.6%
1955/56	139.6%	128.1%
1956/57	131.8%	130.2%
1957/58	150.0%	135.8%
1958/59	179.6%	143.7%
1959/60	159.8%	144.8%
1960/61	151.5%	150.9%
1961/62	164.4%	156.4%
1962/63	187.9%	149.6%
1963/64	192.1%	165.1%
1964/65	205.8%	171.4%
1965/66	162.3%	185.7%
1966/67	272.3%	227.2%
1967/68	Estimated at: 240%	

GENERAL IMPRESSION OF THE SOUTH AFRICAN CRUSHING SEASON 1966/1967

In one respect the past season was better than the previous one, i.e. the total sugar output was *not* disappointing.

As in the previous season a number of Mills started too late, because construction or re-construction work was not completed on time. (See the sequence of starting dates.) In addition one of the new Mills had more than its fair share of the teething troubles which are to be expected in a first season.

Three Mills had to cope with the difficulties arising from crushing drought and frost-stricken canes. In some instances the growing points of newly planted cane was killed by frost and this immature and very short cane had also to be crushed. In all three cases the Mills had to slow down for full house as the back-end of the factory could not cope with the increase in volume and stickiness of the final massecuites.

Other factories reported crushing consignments of cane with abnormally low juice purities as a result of the drought.

C-Massecuite Heat Exchangers: The abnormal quantities of C-strikes with their high degree of viscosity brought to the fore in some instances the inadequate heating systems for C-massecuites. In such cases the C-m.c. either had to be dropped at too high a purity and/or the massecuite had to be diluted with water in the crystallisers, both cases resulting in a too high final molasses purity.

Air Conditioning

Even the most efficient heating system cannot prevent the molasses film cooling down and drying out during the spinning process resulting in a highly increased viscosity of the molasses film around the crystals of the C-sugar. The only way to prevent this phenomenon is by blowing into the basket air with a R.H. of 100% and of the same temperature as the massecuite. By preventing the molasses film drying out and cooling down a greater part of the molasses film will be removed and the result will be a single-cured C-sugar as good as and sometimes better than a double-cured C-sugar.

NEWLY INTRODUCED FEATURES

(*a*) **The Rabe Process:**

Though this process, invented and developed by Mr. A. E. Rabe, factory manager of the Umzimkulu Mill, has been running at this Mill for two seasons it can now be mentioned as during the past season the process was made public. The features of the Rabe Process will not be discussed as we may assume that they are known to us all, but we should like to congratulate Mr. Rabe on the success 'his' sugars have had when sent to refiners in different parts of the world. Not only were all refiners satisfied with the quality, but one of them even said that it was the best refining sugar he had handled for a very long time!

(*b*) **Milling-cum-Diffusion:**

Attention this season was focused on the two newly installed diffusion plants and the results they would achieve. Both diffusers started up without a hitch and any difficulties encountered at Entumeni as well as at Dalton were not in the diffusion part of the installations, but with the mills and their carriers.

As a diffuser designed for the combined process of milling and diffusion has about half the number of circulation compartments of a diffuser intended for cane diffusion, the overall result is strongly correlated to the effectiveness of the milling section of the combined process, in particular to the performance of the mill preceding the diffuser proper.

In the coming season, i.e. 1967/68, two more milling-cum-diffusion plants will come into operation, viz. one at EM where it will replace part of the existing milling tandem and the other at Malelane in the Eastern Transvaal as part of the new factory plant.

(*c*) Starch Removal.

In addition to the Rabe process and the enzymatic starch removal, it appears that the diffusion process also removes starch provided the temperature is not raised above 70°C. It was also found during the past season that cane stricken by frost contained less starch; it is assumed that the starch is broken down by the plant into glucose.

(*d*) Further Development of the Rabe Process.

It should be mentioned here that tests carried out by Van Hengel at Darnall revealed that when the underflow of the Rabe vacuum tank was led directly to the evaporator without further clarification, a heavy scaling occurred in the first vessels of the evaporator. The same had been experienced at Umzimkulu, but here the capacity of the first vessel was such that it was *not* necessary to stop for cleaning in the middle of the week.

To reduce the rapid scaling the underflow of Darnall's vacuum tank was heated to 103°C. and settled in an ordinary clarifier. Here the greater part of the calcium triphosphate and proteins present in the underflow was removed and scaling brought down to normal proportions.

A combination of two starch removing procedures will come into operation in the middle of the 1967/68 season at Empangeni Mill, where starch will be removed from the primary juice by the Rabe flotation process, while the starch content of the secondary juice will be reduced during passage through the diffuser.

B. OPERATION OF THE MILLING TANDEMS:

Why does the S.M.R.I. prefer to indicate the milling results in the form of 'lost absolute juice % fibre in final bagasse'? The reason for this was explained as far back as 1951 in the Communication of the S.M.R.I. No. 7 entitled *A Review of Terms Used for Indicating Milling Results*. Here it was explained that the only operation a mill can do is to *squeeze out a certain volume of liquid*, irrespective of whether the liquid contains sucrose, another substance or nothing at all. The term we are to use for indicating what the mill or mills are doing should, therefore, be based on 'squeezing out liquid' and as it means a separation of liquid from fibre, it should be expressed 'per 100 fibre'. However, looking only at how much is gained will give a misplaced feeling of satisfaction, and therefore we should always look at the portion which is still lost.

Lohmann (Java Archief 1904; p. 969) was the first to recognise these facts when he introduced as a yardstick for mill performance 'Lost Normal Juice % Fibre in Final Bagasse'. From this term 'Lost Undiluted Juice' as well as 'Lost Absolute Juice % Fibre in Final Bagasse' have been derived in later years. 'Lost Juice' is therefore a yardstick of sixty years standing.

In the following table the Mills are arranged according to the average percentages of lost juice obtained in the past season. The next columns show:

(*a*) the specific feed rate, being the number of lbs fibre milled per hour divided by the cubic feet of Total Roller Volume of the tandem concerned;
(*b*) the imbibition per 100 fibre;
(*c*) the reduced extraction of Noel Deerr, i.e. the extraction figure converted to cane with a standard fibre content. We chose as "standard" 15½% fibre in cane as this is the average percentage of fibre for S.A. conditions and using the average percentage will reduce the magnitude of the corrections to be applied, which will improve the accuracy of the results;
(*d*) the sucrose content of the first expressed juice as the richness of the cane juice also affects the extraction which can be obtained;
(*e*) the drop in purity from first to last expressed juice as a reduction of 0.1% in pol in bagasse (in the region of 2.0% pol in bagasse) raises the extraction figure by ¼ to ⅓% depending on the fibre content of the cane.

Mill	Lost Absolute Juice % Fibre	Specific Feed Rate (lbs/h/cu ft T.R.V.)	Imbibition % Fibre	Reduced Extraction (15½% fibre)	Purity Drop from First of Last Expressed Juice	Sucrose % First Expressed Juice
ME . . .	27	51	300	98.84	17.39	16.66
DL . . .	29	52	368	95.54	15.84	17.42
TS . . .	31	46	214	94.92	10.68	17.19
IL . . .	33	49	281	95.38	22.17	17.24
AK . . .	33	54	308	94.56	11.62	17.30
FX . . .	34	39	250	94.61	14.72	17.23
EN . . .	36	—	297	94.55	19.60	16.68
UR . . .	36	60	187	94.24	13.18	16.73
UF . . .	37	28	261	93.96	12.68	17.99
UC . . .	37	—	220	94.12	15.16	15.73
MV . . .	40	46	285	93.47	11.20	17.38
RN . . .	43	63	193	93.33	11.90	17.79
SZ . . .	42	48	230	93.51	15.82	17.95
JB . . .	43	28	269	93.48	16.82	16.04
LB . . .	43	56	234	93.35	15.59	17.58
GH . . .	44	58	199	93.32	16.60	16.92
DK . . .	46	52	234	92.51	11.72	17.93
MH . . .	48	53	177	92.23	12.26	16.94
EM . . .	48	60	296	92.20	11.71	17.75
PG . . .	47	38	269	92.60	14.71	18.06
GD . . .	50	53	284	92.04	14.00	16.75
UK . . .	51	54	178	91.66	9.98	17.82
TR . . .	51	54	213	91.43	9.70	17.58
MR . . .	53	63	172	91.01	8.71	16.05

The general trend revealed by the table is as expected, viz. with an increase in 'lost juice' the 'reduced extraction' decreases. There are a number of discrepancies which are caused by the fact that—

(*a*) Noel Deerr's formula is only an approximation; and
(*b*) the correction of Noel Deerr as well as the origi-

nal extraction are both based on pol instead of on "Brix".

The natural drop in purity from first to last expressed juice as well as any loss of sucrose due to inversion, enzymatic or bacteriological action flatter the results. In this respect Brix Extraction and Reduced Brix Extraction are better figures, because there is not a pronounced drop in Brix from first to last expressed juice and the Brix is only affected when enzymatic or bacteriological action leads to gaseous products.

In addition the richness of the juice also has its effect on sucrose extraction, a richer juice leading to a higher extraction figure. For instance, the difference in sucrose % first expressed juice between Pongola and Dalton i.e. 18.06—15.73=2.33% is according to De Haan a disadvantage of 0.4 x 2.33 or 0.93% in sucrose extraction for the Union Co-op Mill.

Milling-cum-Diffusion:

The fact that the overall results of the two factories applying this combined process did not come up to expectation was caused by the milling section of the plants, viz. in the case of the Dalton installation due to unsatisfactory performance of the first mill and in the event of the Entumeni by the first mill as well as by the de-watering mills.

The number of circulation compartments, i.e. the length of the diffusers in question was so chosen that a low pol % bagasse can be achieved if the preceding mill squeezes out 65% of the cane juice (in the case of cane with 13% fibre). When the mill fails to do this then a low pol % bagasse can only be achieved by the use of an excessive amount of water, or by increasing the number of circulations.

With respect to the effect of the performance of the milling part on the overall result we refer to the graphs by Bruniche-Olsen in his article in the August 1966 issue of 'Sugar and Azucar'.

Dalton in particular had in the beginning to put up with unsatisfactorily knived cane and crushing slowly with a 'high speed' mill did not improve matters. When the blockage of the backend of the factory gradually cleared, the crushing rate could be increased which improved performance materially. However, the season was too short to turn the unsatisfactory figures of the beginning of the season into a satisfactory average for the whole season.

Entumeni, like Dalton, in the first week of the season had a full house, caused by crushing of drought- and frost-stricken cane. The many hours of stoppages caused by full house meant that the bagasse stayed too long in the diffuser with a resulting abnormal low sucrose % bagasse figure due to inversion and fermentation. Later, difficulties were encountered with the first mill, while the setting of the de-watering mills led to a very high moisture content of the last bagasse. Though the average pol % bagasse is flattered by the figures of the first weeks the average would have been better if the performance of the de-watering mills had come up to standard.

In anticipation of improved performance of the milling section of the two milling-cum-diffusion plants in the coming season we would mention here what the first season has brought to the fore:

(*a*) that provided the temperature is not raised higher than 70° C. part of the starch in juice is removed by the diffuser;

(*b*) that soil adhering to the cane *can* interfere with the percolation of the juice through the bagasse layer in the diffuser;

(*c*) that a proper control should be carried out on the pH and the reducing sugars/sucrose ratios of all circulating juices; and

(*d*) that the diluted juice squeezed out by the de-watering mills should be limed to at least a pH of 9.5 for flocculation, otherwise difficulties will be encountered with the juice percolation.

Experience has shown that the return of the alkaline overflow of the diffuser clarifier is not always sufficient to maintain a pH high enough to prevent inversion of sucrose and consequent corrosion of the mild steel parts of the diffuser; additional injections of milk of lime along the line of diffuser pumps seems to be required.

The Milling Tandems:

The score board with regard to "Lost Juice" reads as follows:

Season	1966/67	1965/66	1964/65	1963/64	1962/63
ME . .	27	25	39	34	31
DL . .	29	29	30	28	27
TS . .	31	30	35	32	38
IL . .	33	34	31	37	40
AK . .	33	33½	—	—	—

Holding itself extremely well between its stronger rivals is Illovo's tandem, composed of six units of 'a certain age' and the mills driven in pairs by three piston engines.

Hulett's Mount Edgecombe 21-roller tandem is at present in the lead. Though it has the advantage over Darnall's tandem by having one unit more, it has the disadvantage of a smaller and weaker part in the middle of the train.

Amatikulu, also a 21-roller tandem and of stronger and bigger construction than all the other tandems, gained ½% in lost juice compared with the previous season.

C. BOILING HOUSE PERFORMANCE

The Assessment of Recoverable Sucrose:

The Committee for Chemical Control decided in 1950 to introduce another yardstick to evaluate boiling house performance other than the figure of "B.H. Recovery". As this new yardstick, called the Boiling House performance, was based on and derived from the wellknown formula "S-0.4(B-S)", the background of Dr. Winter's formula should be known to prevent incorrect conclusions being drawn.

In the Java Sugar Archief Dr. Winter pointed out that the old formula "S—(B—S)" gave a figure for 'expected sugar in the bags' which was 25% lower than the actually bagged sugar. The next year (1897) therefore he proposed to use in future the formula "S—0.4(B—S)" which would lead to a sugar weight closer to the actual weight of the bagged sugar. We draw attention to the fact that the result of the formula was then still "Tons of Sugar" and not as at present "Tons of Crystal in Sugar". In addition we have to point out that the formula covers all losses incurred, viz. sucrose losses in filter cake, in final molasses and 'undetermined'. Winter derived the formula from *a statistical investigation* into the results of a number of efficiently operating Java factories over a number of years. In his publications he never mentions that the constant 0.4 was related to or based on a final molasses purity of (100—0.4)/(1—0.4)=28.56°. Winter only stated that the formula was easy to memorise viz. "subtract 0.4-times NS or (B—S) from the sucrose, and you arrive at the expected weight of the sugar, taking muscovado at its full weight and jelly sugar at half its weight."

Because processing methods gradually improved and more sugar was recovered, the time came when the Winter yield was also exceeded, like before 1897 when more sugar was made than indicated by the formula 'S—(B—S)'. In 1930 therefore it was decided to raise the standard. This was easily achieved by assuming that from then on the result of the formula would indicate "Tons recoverable crystal in sugar" instead of "Tons of recoverable sugar". This change in indication raised the standard by about 5%. However, before very long the carbonatation factories started to exceed "Winter" again. This was caused by better understanding of the carbonatation procedure resulting in a higher NS removal (mainly due to a lower lime salt content in the clarified juice). Even carbonatation factories with final molasses purities far above 28.57° purity made more than 100% "Winter".

When the Chemical Control Committee decided to introduce the Winter formula it was with a variable factor, which was on average about 0.1 higher than Winter's constant factor of 0.4. The factor introduced by the Committee varied slightly according to the mixed juice purity and was based on the opinion that a lower mixed juice purity would be accompanied by a higher reducing sugars/ash quotient in the final molasses.

In the following two tables the B.H.P. figures calculated the official way are compared with the B.H.P. obtained when, instead of the variable factor, a constant factor of 0.5 is used. For further simplification the crystal content of the sugar is also calculated with a constant factor, i.e. 0.6, instead of the variable factor adjusted to the final molasses purity obtained.

These two tables are drawn up to demonstrate how small the difference is if instead of the variable Winter factor a constant factor of 0.5 is applied. The change over to a factor of 0.6 for the sugar end is considered to be more appropriate in view of the different degrees of exhaustion of the final molasses and also because of the different ways of expressing purity, i.e. apparent purity and gravity purity based on spindle Brix and apparent and gravity purity based on refracto-brix.

Comparison of the B.H.P. calculated the official way and when using the constant factors 0.5 and 0.6

Season	Purity of Mixed Juice	Official B.H.P.	New B.H.P.
1965/66 . . .	84.22	95.65	96.12
1963/64 . . .	85.30	97.19	97.39
1962/63 . . .	83.36	96.61	96.92
1961/62 . . .	84.31	97.01	97.17

Mill	Official Calculation	Using constant factors	Difference
PG	95.68	95.76	+0.08
UF	95.47	96.14	+0.67
EM	95.84	96.44	+0.60
FX	95.28	96.65	+0.37
EN	92.64	92.84	+0.20
AK	98.06	98.43	+0.37
DK	96.06	96.05	+0.01
GD	96.38	96.70	+0.32
DL	97.13	97.66	+0.53
GH	96.60	97.04	+0.44
MV	95.82	95.92	+0.10
JB	86.98	87.57	+0.59
UC	92.20	92.91	+0.71
TS	97.08	97.29	+0.21
ME	96.95	97.52	+0.57
IL	94.89	95.10	+0.25
RN	96.07	95.95	−0.12
SZ	95.74	95.79	+0.05
UK	96.14	95.97	−0.17
LB	95.05	95.21	+0.16
MR	95.15	95.86	+0.71
UR	97.24	97.78	+0.54
MH	96.27	96.36	+0.09
TR	97.29	97.47	+0.18

The comparison shows that the variable factor is not the cause of low B.H.P. recorded during the past season. It is particularly low when compared with the average result recorded in 1957/58 i.e. 98.5% B.H.P. In the latter season there was one Mill which made 100.0% B.H.P. i.e. Sezela with a final molasses purity of 34.1°, while another factory made 99.7% B.H.P. i.e. Illovo with 33.4° final molasses purity.

FINAL MOLASSES PURITIES

Seeing these low final molasses purities and high B.H.P. figures makes us realise why the B.H.P. was again this season so low, viz. too high sucrose losses in final molasses. These high losses are not always caused by a high final molasses purity alone, but sometimes also by the combination of a high purity and a larger quantity of molasses than commensurate with the mixed juice purity.

COMPARISON OF FINAL MOLASSES PURITIES

Mill	Spindle Brix Apparent Gravity		Refracto Brix Apparent Gravity	
PG	38.91	—	—	—
UF	41.29	41.58	—	—
EM	—	39.84	41.30	42.76
FX	—	39.35	—	42.53
EN	43.13	—	—	—
AK	—	37.72	38.04	40.32
DK	39.87	40.62	—	—
GD	33.88	—	—	—
DL	—	39.73	42.00	42.50
GH	—	39.72	—	—
MV	40.40	41.24	—	—
JB	—	41.52	—	—
UC	43.78	—	—	—
TS	39.90	41.16	—	—
ME	—	37.85	40.97	40.47
IL	36.60	39.16	—	—
RN	40.71	—	—	—
SZ	41.46	41.65	—	—
UK	37.54	40.35	—	—
LB	39.61	40.32	—	—
MR	36.37	39.87	—	—
UR	36.00	39.90	—	—
MH	38.61	—	—	—
TR	32.64	36.68	—	—

For proper evaluation of the obtained purities, these purities should be compared with the Target Purity according to the D.D. formula. In this respect the fact should not be overlooked that the D.D. formula is based on the composition of the obtained final molasses and not on the composition of the original mixed juice. This implies that when the R.S./Ash quotient is adversely affected by a too high pH during processing, the final molasses purity will go up, but so does the Target Purity. A small difference between 'Obtained purity' and 'Target purity' is, therefore, not synonymous with a good clarification technique.

NON-SUCROSE ACCOUNT

The loss in final molasses is not only governed by the purity but also by the quantity of final molasses, the latter being dependent on the purities of mixed juice and final molasses and the amount of non-sucrose added, formed and removed during processing of the mixed juice.

Though the composition of the non-sucrose in mixed juice is quite different from that in final molasses, the only check we have on non-sucrose formation and non-sucrose removal is by comparing the two quantities we "calculate" by subtracting tons sucrose from tons Brix in mixed juice as well in total final molasses. The ratio of these two quantities for all factories (which recorded their final molasses weights) is shown below:

Mill	Ratio
PG	0.84
UF	0.81
EM	0.85 (0.755)
FX	0.88 (0.805)
EN	0.91
AK	0.83 (0.74)
DK	0.77
GD	1.02
DL	0.78 (0.701)
GH	0.82
MV	0.89
JB	0.92
UC	0.90
TS	0.83
ME	0.82 (0.736)
IL	0.85
RN	0.86
SZ	0.86
UK	N.A.
Mean	0.84
LB	0.78
MR	0.73
UR	0.82
MH	0.87
TR	0.91

N.B.—The ratios between brackets are based on refracto-brix as far as the final molasses is concerned.

Actually this ratio is an unsatisfactory yardstick, not only because the composition of the NS at the beginning and at the end are quite different, but also because we know beforehand that °Brix and purity of mixed juice are disputable. An investigation carried out in Queensland revealed that the rise in purity from mixed to clarified juice is for the greater part the result of a more correct Brix determination in clarified juice than in mixed juice; the assessment of the Brix in mixed juice being affected by suspended matter. In his conclusion Clayton (26th Conference of the Q.S.S.C.T.) says: "*as for the clarification process, what efforts have been wasted in the careful measurement of purity rise.*"

When we peruse the previous table (notwithstanding its shortcomings) we see that the ratio ranges from 0.72 to 1.02. It is obvious that a combination of a low or normal ratio and a low final molasses purity will lead to a high B.H.P. figure.

N.B. Cane grown under "normal" conditions, as for instance in the years between 1956 to 1960, gave an average value of 0.81.

REDUCING SUGARS ACCOUNT

The reducing sugars account gives us a fair insight into processing conditions as it can indicate destruction of reducing sugars by high pH or their formation by low pH. There is, however, the complication that both reactions, i.e. formation and destruction, are also governed by time and temperatures and the issue is further complicated owing to the phenomenon that the H-ion and the OH-ion concentration *both* increase with an increase in temperature (I.S.J. 1966; p. 361). It can therefore happen that inversion and reducing sugars destruction take place simultaneously as owing to a higher temperature both concentrations (the H-ion as well as the OH-ion concentration) increased. A prolonged residence time under such conditions is therefore to be condemned.

During the discussions of one of our first Annual Summaries we remarked that we should try to find which pH of the clear juice led to the highest B.H.P. adding at the same time that we had found that this pH was 7.3 to 7.4, i.e. higher than usually assumed as being the 'best' pH. In this respect the investigations of Schlegel (Zeitschr. Zuckerind. 1963; p. 14) should be mentioned. Schlegel has found that a pH of 7.4 measured at 20°C drops to 6.2 and the pOH from 6.6 to 5.9 when beet juice is heated to 110°C. This finding implies that at a vapour pressure of 6 psig in the first vessel or pre-evaporator the H-ion concentration increases 16-fold and the OH-ion concentration 5-fold compared with conditions at 20°C. This 'complication' should always be kept in mind, also when perusing the reducing sugars tables.

REDUCING SUGARS ACCOUNT TABLE

N.B.—Reducing Sugars present in mixed juice=100%

Mill	Percentages of R.S. present in:		
	Clear Juice	Syrup	Total Final Molasses
PG	92	75	N.A.
UF	90	92	109
EM	94	89	98
FX	89	85	N.A.
EN	98	66	N.A.
AK	98	86	111
DK	N.A.	95	101
GD	99	85	N.A.
DL	97	94	93
GH	68	75	66
MV	96	103	110
JB	93	70	109
UC	N.A.	71	N.A.
TS	93	90	98
ME	99	100	107
IL	102	79	99
RN	87	65	N.A.
SZ	88	72	128
UK	103	104	N.A.
LB	97	70	94
MR	102	83	63
TR	93	87	82
MH	100	80	N.A.
UR	103	79	N.A.

There are a number of figures which require further investigation. For example: the low percentage of reducing sugars in syrup at PG, EN, GH, JB, UC, RN, SZ and LB, the low R.S. percentage in total final molasses at GH, and MR and the high R.S. percentage in total final molasses at SZ. With regard to the high percentage of R.S. in MV's syrup we know that a purity drop as well as inversion takes place in the vapour cell.

THE NS CIRCULATION RATIO

$$\frac{\text{Tons NS in C-massecuite}}{\text{Tons NS in weighed Final Molasses}}$$

When this item was introduced in the 35th Annual Summary, it was stated that:

"The quantity of C-massecuite depends on different factors such as juice purity, the C-massecuite purity and last but not least on the purity of the (pre-cured) C-sugar."

In the Annual Report "1960" of the Mauritius Sugar Research Institute the following table is published by J. D. de R. de Saint Antoine:

Influence of C-sugar Purity on Volume of C-massecuite

Purity C-sugar	Cu ft/hour C-massecuite	% Increase in volume of C-m.c. for C-sugar purities below 90°
94.0	100.8	—
90.0	105.1	—
86.0	110.8	5.4
82.0	118.1	12.4
78.0	128.1	21.9
74.0	142.5	35.6
70.0	174.8	56.8

N.B.—The table is based on the following assumptions: Purities of Syrup, C-massecuite and Final Molasses respectively 87.5°, 56.0° and 36.5°. Crushing Rate=100 t.c.h.

The following table shows the NS-circulation ratios in the system "C-massecuite/C-sugar/final molasses" for the last seven years:

Non-Sucrose Circulation Table

Mill	1966	1965	1964	1963	1962	1961	1960
PG	124	100	126	132	121	114	117
UF	139	125	148	159	123	105	122
EM	134	119	137	132	114	125	121
FX	135	124	152	130	114	124	134
EN	106	120	111	121	111	124	126
AK	133	143	129	126	125	119	132
DK	153	142	163	155	130	129	131
GD	110	132	142	144	118	N.A.	108
DL	143	131	124	116	104	118	121
GH	121	119	121	137	111	144	144
MV	136	124	141	135	121	111	132
JB	N.A.	—	—	—	—	—	—
UC	124½	—	—	—	—	—	—
TS	137	138	146	143	N.A.	N.A.	N.A.
ME	148½	117	132	139	132	140	130
IL	146	115	146	172	147	137	140
RN	126	115	166	130	100	114	117
SZ	187	N.A.	125	133	120	127	126
UK	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
LB	200	165	137	151	148	144	—
MR	142	135	156	155	146	N.A.	—
MH	106	N.A.	N.A.	121	106	102	—
UR	147	128	115	143	115	108	—
TR	141½	—	—	—	—	—	—

Some percentages require further investigation, e.g. the low percentage of GD (110%) in connection with the high non-sucrose ratio (1.02) indicates a too high final molasses weight. It is recommended that this weight be checked.

Needless to say the NS circulation can not be reduced by double-curing as double curing does not reduce the NS returned to the C-massecuite by the pre-cured sugar. Whether we use the C-sugar, single- or double-cured, as a footing in the form of a magma, or whether we dissolve the C-sugar in water, clear juice or syrup, the magnitude of the NS circulation remains the same as long as the purity of the pre-cured C-sugar is not altered.

EXHAUSTION OF THE STRIKES:

The following tables are compiled from figures recorded in Tables 4 and 5 at the end of this Summary.

Mill	Recovered Crystal per 100 parts sucrose in massecuite			
	A-m.c.	B-m.c.	C-m.c.	Mean
PG	63.0	62.8	58.8	61.5
UF	63.4	52.3	53.2	56.3
EM	61.1	60.8	54.2	58.7
FX	64.3	57.3	53.0	58.2
EN	57.9	52.2	54.9	55.0
AK	68.8	63.6	57.7	63.4
DK	69.6	60.0	59.5	63.0
GD	66.5	51.2	52.0	56.6
DL	61.9	58.5	51.9	57.4
GH	66.6	60.5	58.2	61.8
MV	60.7	65.9	51.9	59.5
JB	59.9	55.8	55.0	56.9
UC	64.8	59.6	55.4	59.9
TS	67.1	58.2	55.0	60.0
ME	59.8	50.7	50.7	53.7
IL	56.1	60.7	64.1	60.3
RN	62.0	60.6	59.1	60.6
SZ	56.6	55.9	56.7	56.4
UK	62.1	59.6	52.8	58.5
LB	59.9	51.9	53.8	55.2
MR	61.5	63.9	58.9	61.4
MH	60.6	58.2	62.0	60.3
UR	61.1	61.5	61.3	61.3
TR	65.3	64.7	68.3	66.1

The highest mean value was obtained by TR, i.e. 66.1% while the lowest was booked by ME i.e. 53.7. In this connection it would be interesting to compare the exhaustion figures with the cu. ft. of massecuites boiled; however, some factories remelted, others did not, which makes comparison impracticable.

CU. FT. OF MASSECUITES

The last column of the table (purity rise) indicates the difference between the degrees purity of A-mc. and syrup; a negative sign denoting that the purity of the A-mc. was lower than that of the syrup.

The highest number of cu. ft. massecuites is recorded by MR i.e. 91 cu. ft. per ton of Brix in mixed juice (MR applies the Illovo boiling system "for producing millwhite at a defecation factory"). The lowest number of cu. ft. is boiled by GD applying the single-magma system.

Mill	Cu. ft. of Massecuite per ton of Brix of Mixed Juice				
	A-m.c.	B-m.c.	C-m.c.	Total	Purity Rise
PG	26.6	9.20	7.80	43.7	+0.45
UF	31.6	9.95	9.21	47.0	+1.09
EM	35.4	11.37	9.44	56.2	+1.49
FX	28.4	8.52	9.09	46.0	+0.65
EN	25.2	10.38	8.56	44.7	+0.01
AK	29.6	8.24	7.80	45.6	+1.09
DK	28.6	9.59	9.11	47.3	+2.37
GD	20.1	10.31	8.13	38.5	−1.80
DL	29.3	9.79	7.98	47.0	+2.10
GH	25.7	11.94	8.47	46.1	+2.40
MV	35.8	12.06	8.56	56.4	+1.40
JB	N.A.	N.A.	N.A.	N.A.	−0.27
TS	24.7	11.24	8.73	44.9	+0.20
ME	32.8	16.55	8.89	58.3	+1.00
IL	43.0	13.66	10.04	66.7	+2.55
RN	24.6	11.74	7.81	44.2	−1.40
SZ	22.3	12.85	11.97	47.1	−1.73
LB	34.3	19.70	12.57	66.6	−2.00
MR	69.2	14.41	9.73	91.0	+1.28
UR	29.0	10.67	10.39	50.1	+1.90
MH	20.8	13.4	7.89	42.2	−2.69
TR	36.0	8.32	10.96	55.0	+3.35

Before concluding the chapter "Boiling House Performance", we want to refer back to the first table of this chapter showing the B.H.P. figures obtained by all factories. Hereunder follow the five Mills with the highest B.H.P. percentages, giving their final molasses purities, undetermined sucrose losses and, last but not least their NS ratios.

Mill	B.H.P.	Final Molasses Purity	Undetermined Sucrose Losses	NS Ratio
AK	98.1	37.7	0.89	0.83
TR	97.3	36.7	1.37	0.91
DL	97.1	39.7	1.24	0.78
TS	97.1	41.2	0.39	0.83
UR	97.0	39.9	0.73	0.82

N.B.—The refracto-sucrose purities of AK and DL were converted to gravity purities in order to make them comparable with those of the other Mills.

We draw special attention to the fact that (with the exception of TR) all Mills in the table above show low or normal NS-ratio figures, which indicate that these Mills did *not* produce more final molasses than commensurate with their mixed juice purities. TR shows a high NS-ratio indeed, i.e. 0.91, but since the molasses purity is low, it did not prevent TR recording a good B.H.P. figure.

VACUUM IN THE LAST VESSEL OF THE EVAPORATOR

Condenser tests carried out by the Bureau of Experiment Stations (Brisbane, Queensland) showed that the last Vessel gave off more vapour at 26″ Hg vacuum than at 27″. This result recalls the statement of Claassens that the optimum vacuum for the last vessel is 25″ as a higher vacuum increases the viscosity of the syrup too much and a lower vacuum reduces the temperature drop across the heating surface too far.

Estimated viscosities of syrup of different Brix at vacua from 27″ to 24″ Hg (the B.P.E. has been taken into account)

Vacuum	27″	26″	25″	24″
55° Brix .	8.0	6.9	5.8	4.7
60° „ .	14.0	11.8	9.7	8.5
65° „ .	27.6	22.8	18.0	15.8
70° „ .	65.0	52.0	39.0	32.0

The above table reveals why Queensland's Mills would experience more the effect of vacuum on the capacity of the last vessel than S.A. Mills, the average density of the syrup in Queensland Mills being about 68° Brix against 60° for S.A. Mills.

Season S.A.	Average ° Brix	Season S.A.	Average ° Brix
1950	54.5	1960	56.9
1951	53.2	1961	57.8
1952	53.8	1962	57.9
1953	55.0	1963	58.1
1954	54.2	1964	58.8
1955	55.1	1965	59.3
1956	54.5	1966	60.4
1957	55.2		
1958	55.7		
1959	57.0		

According to this table the average density of the S.A. Mills increased from 1950 to 1966 by 5° Brix. However, this should be only the beginning as another 5° Brix rise is required to arrive at the target density of 65° Brix.

Replacement of the sulphitation process by the defecation method by raw sugar Mills and the installation of bigger evaporators with vapour bleeding brought about the first rise of 5° Brix. The second rise of 5° Brix depends for a great part in bringing up the backend. In this respect it should be mentioned that even sulphitation factories can achieve an average density of 65° Brix if they use a spare last vessel which can be put into operation (clean) on a Wednesday. Even better is a completely interchangeable outfit as, for instance, at Umfolozi.

TABLE 1

SUGAR PRODUCTION 1966-1967 SEASON
(Subject to final adjustment)

SHORT TONS

MILL	LOCAL MARKET			General Export Raws	Japanese Assortment	Canadian Assortment and Umzimkulu	TOTAL
	Raws for Refining	Whites	Golden Brown				
Darnall . .	44,876	—	375	64,917	43,468	—	153,636
Amatikulu . .	34,533	—	282	77,048	50,307	—	162,170
Felixton . .	73,830	—	1,660	34,534	42	—	110,066
Empangeni . .	110,165	—	4,967	8,403	—	—	123,535
Mt. Edgecombe	52,882	—	1,171	41,650	—	25,985	121,688
Tongaat . .	94,965	—	504	100,705	—	—	196,174
Melville. . .	1,898	394	3,052	29,548	—	6,907	41,799
Illovo . . .	5,526	—	4,164	61,006	10,830	—	81,526
Jaagbaan . .	53,443	—	10	—	—	—	53,453
Umfolozi . .	—	—	13,168	27,917	128,628	—	169,713
Glendale . .	22,986	—	121	—	—	—	23,107
Sezela . . .	17,346	82,265	16,730	20,191	—	—	136,532
Renishaw . .	—	4,640	40,764	—	—	—	45,404
Pongola . .	—	28,495	43,565	—	—	—	72,060
Gledhow . .	534	113,062	3,500	33,806	—	—	150,902
Umzinkulu . .	1,253	—	70	—	—	73,462	74,785
Doornkop . .	—	—	3,210	24,975	14,059	—	42,244
Dalton (U.C.) .	763	—	27	2,334	10,926	—	14,050
Entumeni . .	—	9,008	2,276	10,295	—	—	21,579
TOTALS . .	515,000	237,864	139,616	537,329	258,260	106,354	1,794,423

TABLE 2 **CANE CRUSHED, SUGARS MADE, CANE**

SYMBOL INDICATING THE FACTORY	PG	UF	EM	FX	EN	AK	DK
Crushing Season started on	10.5.66	29.4.66	14.4.66	28.4.66	21.7.66	13.4.66	16.5.66
Crushing Season ended on	10.12.66	1.2.67	21.2.67	18.2.67	15.3.67	20.2.67	5.2.67
Tons Cane Crushed	**601,298**	**1,378,463**	**1,102,396**	**981,322**	**196,346**	**1,379,623**	**354,125**
CANE COMPOSITION							
Ducrose % Cane	14.36	14.48	13.78	13.42	13.38	13.57	14.14
Fibre % Cane	13.91	13.05	15.89	16.22	13.37	15.90	15.13
Java Ratio	79.54	80.46	77.67	77.86	80.15	78.45	78.87
Tons Cane per Ton Sugar	8.34	8.12	8.92	8.91	9.08	8.51	8.38
Tons Cane per Ton 96° Sugar	8.10	7.96	8.67	8.67	8.80	8.30	8.18
CANE VARIETIES CRUSHED							
Co.331	0.05	0.67	0.10	0.55	0.33	0.08	1.79
N:Co.310	92.70	82.12	82.84	37.87	5.34	88.78	13.95
N:Co.293	0.68	0.11	0.14	0.01	34.02	0.41	13.33
N:Co.339	0.12	1.24	0.54	1.21	1.03	0.07	0.18
N:Co.376	5.68	6.80	11.70	39.13	52.37	8.60	58.40
N:Co.382	0.20	7.93	1.43	10.73	2.39	0.68	6.58
N:50/211	0.25	0.81	2.62	3.50	4.41	1.02	3.93
Remainder	0.32	0.32	0.63	7.00	0.11	0.36	1.80
TOTAL RAINFALL YEAR 1966 (inches)	26.00	22.91	30.75	40.85	36.17	29.79	33.11
Tons Sugar Made	**72,060**	**169,712**	**123,535**	**110,079**	**21,628**	**162,170**	**42,244**
Millwhite or Refined Sugar Made	40%	Nil	Nil	Nil	42	Nil	Nil
Average Pol of All Sugars Made	98.96	97.90	98.82	98.80	99.02	98.34	98.26
TIME ACCOUNT							
Hours crushed % Hours Mill Open	90.26	96.52	87.87	92.02	83.29	85.26	92.78
Hours Cane Shortage % H.M.O.	4.45	0.09	1.70	1.77	2.12	1.98	6.30
THROUGHPUTS per hour actual crushing							
Tons cane crushed	154.24	215.54	187.41	171.79	46.63	250.92	71.14
Tons fibre milled	21.45	28.13	29.78	27.86	6.24	39.89	10.76
Tons brix processed	24.10	34.47	28.44	25.62	6.94	37.91	10.74
Tons sugar bagged	18.48	26.54	21.00	19.27	5.14	29.49	8.49
SUCROSE BALANCE							
Lost in bagasse (A)	6.52	4.94	8.03	5.69	4.59	5.61	7.27
Lost in filter cake (B)	1.21	1.43	0.69	0.49	1.12	0.55	0.42
Lost in final molasses (C)	7.77	9.75	9.68	9.19	10.84	7.76	7.13
Undetermined Losses (D)	1.93	0.63	1.26	2.02	1.91	0.89	2.26
BOILING HOUSE LOSSES (B)+(C)+(D)	10.91	11.81	11.63	11.70	13.87	9.20	9.81
SUM OF ALL LOSSES (A)+(B)+(C)+(D	17.43	16.75	19.66	17.39	18.46	14.81	17.08
Overall Recovery	**82.57**	**83.25**	**80.34**	**82.61**	**81.54**	**85.19**	**82.92**

VARIETIES, THROUGHPUTS and SUCROSE BALANCE

GD	DL	GH	MV	JB	UC	TS	ME	IL	RN	SX	UK	Totals and Means
4.5.66	28.4.66	7.5.66	7.5.66	10.5.66	1.8.66	27.4.66	11.5.66	29.4.66	24.5.66	26.6.66	25.6.66	13.4.66
26.2.67	26.2.67	1.3.67	20.1.67	26.2.67	28.1.67	12.2.67	1.3.67	19.3.67	27.2.67	4.3.67	1.3.67	19.3.67
210,251	**1,270,869**	**1,363,472**	**355,086**	**545,771**	**141,882**	**1,702,458**	**1,077,945**	**709,163**	**389,510**	**1,164,815**	**620,831**	**15,545,625**
13.28	13.85	13.50	13.93	12.84	12.26	13.43	13.12	13.53	13.92	14.27	14.27	13.72
14.92	15.02	15.61	15.10	13.72	14.45	15.76	15.52	15.15	16.37	14.31	14.65	15.09
79.28	79.50	79.04	80.09	80.02	77.93	78.14	78.82	78.45	78.20	79.50	80.12	79.06
9.10	8.27	8.86	8.52	10.23	9.98	8.68	8.86	8.69	8.58	8.29	8.30	8.63
8.87	8.09	8.59	8.28	9.95	9.78	8.42	8.62	8.48	8.32	8.05	8.08	8.40
6.49	2.66	0.74	4.32	13.90	15.80	0.61	2.90	2.78	0.46	1.35	1.57	1.83
8.45	26.87	7.63	7.11	0.21	0.38	8.86	3.50	14.72	9.60	6.16	12.57	33.63
4.86	0.93	1.33	0.50	56.26	53.47	1.66	9.65	27.06	1.76	2.38	3.08	5.98
0.13	0.84	1.33	5.98	Nil	Nil	2.04	0.83	1.34	0.18	0.30	0.66	0.97
42.45	45.92	58.23	37.60	13.30	9.93	32.63	33.82	42.50	78.76	76.03	80.26	36.45
1.02	1.79	3.41	1.42	14.82	19.23	6.86	4.75	8.18	8.96	3.77	0.45	4.89
4.29	5.76	3.96	7.50	0.20	0.99	9.55	4.78	1.95	1.64	3.13	0.99	3.56
32.31	15.23	23.37	35.57	1.31	0.20	37.79	54.90	1.47	3.64	6.88	0.42	12.69
24.19	35.02	30.23	30.45	31.85	35.13	25.42	32.93	31.74	29.42	33.68	31.44	29.98
23,111	**153,638**	**153,920**	**41,799**	**53,716**	**14,210**	**196,172**	**121,688**	**81,581**	**45,404**	**140,467**	**74,785**	**1,801,856**
Nil	Nil	75	Nil	Nil	Nil	Nil	Nil	Nil	10	60	Nil	13
98.51	98.15	98.95	98.50	98.00	98.00	98.85	98.66	98.35	98.83	98.95	98.62	98.58
78.27	93.23	93.61	83.97	68.61	79.19	89.95	88.45	86.74	85.33	81.24	86.62	87.19
9.00	4.09	1.46	7.04	11.10	2.03	6.17	7.10	7.09	8.65	1.67	5.12	4.68
43.54	207.84	234.39	81.16	153.96	50.23	277.67	197.09	118.11	80.45	272.00	140.12	163.24
6.50	31.22	36.59	12.25	21.13	7.26	43.75	30.60	17.90	13.17	38.92	20.53	24.63
6.34	32.55	34.55	12.27	22.27	6.95	41.44	29.61	17.90	11.90	42.17	20.87	24.81
4.79	25.12	26.46	9.55	15.15	5.03	31.97	22.25	13.59	9.38	32.80	16.88	18.92
7.61	4.30	6.74	6.33	5.65	5.41	5.18	4.17	4.50	7.12	5.91	7.80	5.78
0.24	0.68	1.17	0.54	1.17	0.48	0.69	0.31	0.47	0.97	1.26	0.76	0.82
9.49	8.10	8.55	8.65	11.25	11.96	8.86	8.94	8.32	7.48	8.79	6.74	8.75
1.14	1.24	0.80	1.21	6.79	2.07	0.39	1.71	3.07	1.48	0.42	1.48	1.38
10.87	10.02	10.52	10.40	19.21	14.51	10.04	10.96	11.86	9.93	10.47	8.98	10.75
18.48	14.32	17.26	16.73	24.86	19.92	15.22	15.13	16.36	17.05	16.38	16.78	16.23
81.52	**85.68**	**82.74**	**83.27**	**75.14**	**80.08**	**84.78**	**84.87**	**83.64**	**82.95**	**83.62**	**83.22**	**83.27**

TABLE 3 **BOILING HOUSE PERFORMANCE, LOST ABSOLUTE JUICE %**

SYMBOL INDICATING FACTORY	PG	UF	EM	FX	EN	AK	DK
Boiling House Performance	**95.68**	**95.47**	**95.71**	**95.28**	**92.64**	**98.06**	**96.06**
Boiling House Recovery	88.33	87.58	87.35	87.59	85.46	90.26	89.42
Lost Absolute Juice % Fibre	**47.22**	**36.96**	**47.69**	**34.13**	**35.80**	**32.98**	**45.86**
Imbibition % Fibre	269	261	296	250	297	308	234
Specific Feed Rate*	38	28	60	39	—	54	52
SUCROSE EXTRACTION	93.48	95.06	91.97	94.31	95.41	94.39	92.72
Imbibition % Cane	37.40	34.10	47.11	40.57	39.68	49.04	35.49
FINAL BAGASSE							
Sucrose % Bagasse	2.94	2.32	2.87	2.05	1.89	2.12	2.93
Moisture % Bagasse	52.35	54.63	54.83	53.62	56.09	53.00	53.01
Fibre % Bagasse	43.60	42.25	41.26	43.52	41.22	44.22	43.15
Bagasse % Cane	31.89	30.89	38.51	37.25	32.45	35.96	35.07
L.C.V. of Bagasse (btu per lb)	**3,074**	**2,888**	**2,861**	**2,980**	**2,770**	**3,033**	**3,017**
Available btu per lb Brix	**6,276**	**5,423**	**7,258**	**7,440**	**6,037**	**7,218**	**7,007**
Brixfree Water % Fibre	32	23	25	21	31	16	26
Imbibition Efficiency	45	41	52	42	43	44	58
Dilution Ratio	**67**	**80**	**72**	**81**	**84**	**81**	**69**
FIRST EXPRESSED JUICE							
Degrees Brix	20.72	20.75	20.81	19.86	19.11	19.76	20.31
Degrees Purity	87.16	86.72	85.30	86.75	87.30	87.53	88.27
LAST EXPRESSED JUICE							
Degrees Brix	3.23	2.24	3.42	2.14	2.06	2.22	3.92
Degrees Purity	72.45	74.04	73.58	72.03	67.70	75.91	76.55
Purity Drop	**14.71**	**12.68**	**11.72**	**14.72**	**19.60**	**11.62**	**11.72**
MIXED JUICE							
Degrees Brix	14.81	15.93	13.97	14.44	13.89	13.36	15.04
Degrees Apparent Purity	86.02	83.64	—	—	—	—	86.84
Degrees Gravity Purity	85.89	—	83.54	84.83	85.70	84.77	86.82
Purity Drop	**1.14**	**3.08**	**1.76**	**1.92**	**1.60**	**2.76**	**1.43**
Reducing Sugars/Sucrose Ratio	3.09	3.35	3.90	3.90	2.94	3.36	2.92
CLARIFIED JUICE							
Degrees Brix	15.46	16.08	13.01	13.22	14.43	11.38	15.29
Apparent Purity	87.13	84.81	85.47	85.42	85.30	86.41	87.44
Reducing Sugars/Sucrose Ratio	2.87	3.19	3.71	3.50	2.93	3.28	—
Average pH	**7.25**	**7.12**	**7.33**	**7.10**	**7.17**	**7.48**	**7.00**
FILTER CAKE							
Sucrose % Cake	4.00	4.12	1.66	1.01	3.94	1.31	1.18
Cake % Cane	4.35	5.00	5.73	6.50	3.80	5.71	5.00
SYRUP							
Degrees Brix	62.82	61.78	63.20	61.48	59.17	60.14	59.49
Apparent Purity	86.17	85.36	85.72	86.36	84.80	87.15	87.54
Reducing Sugars/Sucrose Ratio	2.36	3.25	3.49	3.34	1.96	2.90	2.76
Average pH	**6.91**	**6.45**	**6.52**	**6.50**	**6.67**	**6.64**	**6.50**

*Specific Feed Rate=Lbs of Fibre milled per hour, per cu. ft. of Total Roller Volume.

FIBRE, ANALYSIS OF Bagasse, Juices, Syrup, Filter Cake and Purity Drops

GD	DL	GH	MV	JB	UC	TS	ME	IL	RN	SZ	UK	Means
96.38	**97.13**	**96.60**	**95.82**	**86.98**	**92.20**	**97.08**	**95.95**	**94.89**	**96.07**	**95.74**	**96.20**	**95.96**
88.24	89.54	88.71	88.89	79.64	84.66	89.41	88.56	87.59	89.31	88.87	90.30	88.38
50.11	**28.78**	**44.09**	**40.06**	**42.81**	**37.34**	**30.92**	**27.30**	**32.93**	**43.09**	**41.77**	**50.67**	**37.91**
284	368	199	285	269	222	214	300	281	193	230	178	262
53	52	58	46	28	—	46	51	49	63	48	54	—
92.39	95.70	93.26	93.67	94.35	94.59	94.82	95.83	95.50	92.88	94.09	92.20	94.22
42.35	55.24	31.01	42.97	36.90	32.08	33.79	46.65	42.64	31.66	33.00	26.04	39.60
2.97	1.80	2.52	2.51	2.33	2.00	1.98	1.65	1.75	2.65	2.54	3.12	2.29
51.98	52.21	53.11	53.63	52.61	52.75	52.47	50.85	53.74	52.49	53.32	54.98	53.52
43.89	43.42	43.26	43.06	44.05	44.39	44.92	46.76	43.54	43.86	43.17	41.05	43.66
33.99	33.18	36.08	35.06	31.19	32.56	35.08	33.20	34.81	37.33	33.15	35.68	34.56
3,105	**3,107**	**3,016**	**2,969**	**3,063**	**3,056**	**3,081**	**3,227**	**2,975**	**3,067**	**3,088**	**2,842**	**2,985**
7,244	**6,583**	**7,382**	**6,884**	**6,602**	**7,190**	**7,244**	**7,128**	**6,831**	**7,741**	**6,600**	**6,810**	**6,787**
21	17	15	23	27	33	27	16	25	21	24	N.R.	24
42	34	40	35	45	73	55	47	43	48	52	N.R.	47
62	**83**	**70**	**75**	**70**	**76**	**82**	**83**	**82**	**71**	**73**	**70**	**75**
19.50	20.01	19.58	19.88	18.80	18.32	19.82	19.31	19.87	20.17	20.27	20.05	19.84
85.90	87.04	86.40	87.40	85.32	85.86	86.73	86.28	86.76	88.20	88.55	88.88	86.97
3.09	1.60	2.56	2.01	2.73	3.70	2.59	2.11	2.09	3.07	3.19	4.17	2.74
71.90	71.20	69.80	76.20	68.60	70.70	76.05	68.89	64.59	74.30	72.73	78.90	72.43
14.00	**15.84**	**16.60**	**11.20**	**16.82**	**15.16**	**10.68**	**17.39**	**22.17**	**13.90**	**15.82**	**9.98**	**14.54**
13.46	12.83	15.53	14.01	13.69	13.91	15.12	13.24	14.06	15.08	15.53	16.46	14.66
84.22	—	—	—	—	83.74	—	—	84.85	87.36	86.41	88.40 }	85.06
—	84.61	85.41	86.30	83.71	83.76	85.35	83.70	85.20	—	86.61	88.46 }	
1.68	**2.43**	**1.00**	**1.10**	**1.61**	**2.12**	**1.38**	**2.58**	**1.91**	**0.80**	**2.14**	**0.48**	**1.91**
4.77	3.32	4.01	2.94	5.11	4.48	3.85	3.70	4.26	3.35	2.98	2.61	3.62
13.27	12.24	14.36	13.24	13.55	14.19	14.50	11.45	13.64	16.89	15.81	16.63	14.15
84.80	85.33	86.00	87.70	83.54	83.76	86.40	85.12	86.66	87.90	86.59	88.82	86.03
4.74	3.24	2.75	2.84	4.83	3.36	3.61	3.69	4.36	2.96	2.67	2.70	3.63
7.20	**7.50**	**7.26**	**7.30**	**7.40**	**7.10**	**7.10**	**7.56**	**7.26**	**N.A.**	**7.28**	**7.40**	**7.28**
1.09	1.62	2.61	1.51	3.35	1.98	1.89	0.73	1.79	2.43	3.47	2.73	2.16
3.00	5.87	6.04	5.00	4.50	3.00	4.87	5.53	3.54	5.54	5.18	4.00	5.21
61.39	60.26	54.86	60.58	58.48	60.97	60.90	62.16	62.07	54.29	61.40	57.39	60.35
85.10	85.60	86.20	86.70	82.97	83.85	86.50	84.97	86.18	88.20	86.66	88.50	86.03
4.07	3.15	3.03	3.05	3.60	3.21	3.48	3.74	3.40	2.20	2.17	2.68	3.05
6.90	**6.90**	**7.12**	**6.90**	**6.30**	**6.40**	**6.30**	**6.85**	**6.66**	**N.A.**	**6.83**	**6.80**	**6.68**

TABLE 4 **DATA regarding Boiling,**

SYMBOLS INDICATING FACTORY	PG	UF	EM	FX	EN	AK	DK
Brix in Mixed Juice % Cane	**15.62**	**16.45**	**15.18**	**14.92**	**14.89**	**15.11**	**15.10**
A-MASSECUITE							
Cu. ft. per ton of brix*	26.62	31.56	35.42	28.42	25.16	29.58	28.60
Brix of massecuite	92.12	93.16	91.59	92.57	90.43	93.28	93.71
Purity of massecuite	86.62	86.45	87.21	86.91	84.90	88.24	89.91
Purity of A-molasses	70.54	70.01	72.61	70.32	70.30	70.04	73.07
Drop in purity	16.08	16.44	14.60	16.59	14.60	18.20	16.84
EXHAUSTION	63.00	63.41	61.12	64.31	57.90	68.84	69.60
PURITY A-m.c.—PURITY SYRUP	**+0.45**	**+1.09**	**+1.49**	**+ 0.65**	**+ 0.01**	**+1.09**	**+2.37**
B-MASSECUITE							
Cu. ft. per ton brix*	9.24	9.95	11.37	8.52	10.38	8.24	9.59
Brix of massecuite	94.98	95.63	92.96	93.03	92.41	94.58	93.84
Purity of massecuite	74.39	72.00	73.91	71.55	71.30	71.58	75.13
Purity of B-molasses	51.96	55.11	52.63	51.78	54.30	47.83	54.75
Drop in purity	22.43	16.89	21.28	19.77	17.00	23.75	20.38
EXHAUSTION	62.76	52.26	60.78	57.30	52.20	63.60	59.95
C-MASSECUITE							
Cu. ft. per ton brix*	7.80	9.21	9.44	9.09	8.56	7.80	9.11
Brix of massecuite	98.45	98.44	94.56	94.33	94.80	95.62	97.18
Purity of massecuite	60.72	60.03	60.57	61.15	62.7	59.23	62.06
Purity of C-molasses	38.91	41.29	41.30	42.53	43.1	38.04	39.87
Drop in purity	21.81	18.74	19.27	18.62	19.6	21.19	21.19
EXHAUSTION	58.80	53.17	54.20	52.98	54.9	57.74	59.46
CRYSTAL % MASSECUITE	35.15	31.42	31.04	30.56	32.6	32.70	35.86
TOTAL CU. FT. OF ALL MASSECUITES							
Per ton of Sugar made	56.92	67.78	76.33	61.20	60.46	58.63	59.87
Per ton of brix*	43.66	47.02	56.20	46.03	44.72	45.63	47.29
FINAL MOLASSES							
Degrees Brix (undiluted)	94.07	94.40	87.23	88.04	88.38	87.13	89.70
Apparent Purity	38.91	41.29	41.54	—	43.13	37.25	39.87
Gravity Purity	—	41.58	—	—	—	—	40.62
Refracto/Sucrose Purity	—	—	42.76	42.53	—	40.32	—
Reducing Sugars (%)	—	12.32	12.95	—	—	14.63	12.59
Sulphated Ash (%)	—	14.84	15.41	—	—	15.22	—
Reducing Sugars/Ash Ratio	—	0.83	0.84	—	—	0.96	—
Molasses of 85° Brix % Cane	3.37	3.99	3.67	3.41	3.97	3.08	2.97
CLARIFYING AGENTS							
Per 1,000 *tons Cane:*							
Tons Limestone	2.92	—	—	—	—	—	—
Tons Coke	0.34	—	—	—	—	—	—
Per ton Cane:							
Lb Lime	1.32	1.11	1.37	1.29	5.25	1.08	1.06
Lb Sulphur	0.01	Nil	Nil	Nil	2.16	Nil	Nil
p.p.m. Juice:							
Phosphoric Paste	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Separan	1.42	2.70	0.56	Traces	1.19	Nil	1.41

* Per ton of Brix in Mixed Juice.

EXHAUSTION=Parts Recovered Crystallised Sucrose per 100 Parts Massecuite.

Final Molasses and Chemical Consumption

GD	DL	GH	MV	JB	UC	TS	ME	IL	RN	SZ	UK	Mean
14.57	**15.66**	**14.74**	**15.12**	**14.47**	**13.84**	**14.92**	**15.03**	**15.16**	**14.79**	**15.51**	**14.87**	**15.20**
20.06	29.28	25.72	35.77	N.A.	27.76	24.73	32.85	43.05	24.64	22.26	30.87	29.02
93.16	93.2	92.46	91.41	92.11	92.10	92.6	93.9	90.42	91.63	92.40	92.48	92.35
83.29	87.7	88.6	88.1	82.7	86.06	86.7	86.0	88.73	86.8	84.93	86.91	86.68
62.56	73.1	72.2	74.4	65.7	68.50	68.2	71.2	77.56	71.4	70.98	71.54	70.74
20.73	14.6	16.4	13.7	17.0	17.56	18.5	14.8	11.17	15.4	13.95	15.37	15.94
66.48	61.9	66.6	60.7	59.9	64.78	67.1	59.8	56.10	62.0	56.60	62.14	62.85
− 1.80	**+2.10**	**+ 2.40**	**+1.40**	**—0.27**	**+2.21**	**+0.20**	**+1.00**	**+ 2.55**	**− 1.40**	**− 1.73**	**− 1.59**	**+ 0.65**
10.31	9.79	11.94	12.06	N.A.	11.74	11.24	16.55	13.66	11.74	12.85	8.61	10.30
95.51	94.1	94.53	94.17	93.89	93.58	94.5	95.2	92.31	94.80	95.42	95.54	94.26
71.32	74.2	73.6	74.9	72.5	73.24	73.2	70.6	77.10	74.1	72.06	71.92	73.08
54.80	54.4	52.4	50.4	53.8	52.48	53.3	54.2	56.95	53.0	53.23	50.88	53.06
16.52	19.8	21.2	24.5	18.7	20.76	19.9	16.4	20.15	21.1	18.83	21.04	20.02
51.24	58.5	60.5	65.9	55.8	59.65	58.2	50.7	60.71	60.6	55.87	59.56	58.36
8.13	7.98	8.47	8.56	N.A.	10.94	8.73	8.89	10.04	7.81	11.97	6.48	8.83
97.84	95.7	96.36	96.74	95.95	94.22	97.4	97.4	96.02	96.64	99.91	98.73	96.65
54.23	60.1	61.3	59.3	61.2	63.57	59.6	58.0	61.64	62.7	61.93	58.98	60.47
36.23	42.0	39.8	41.2	41.5	43.78	39.9	40.5	36.60	40.7	41.34	39.92	40.45
18.00	18.1	21.5	18.1	19.7	19.79	19.7	17.5	25.04	22.0	20.59	19.06	20.02
52.05	51.9	58.2	51.9	55.0	55.37	55.0	50.7	64.07	59.1	56.68	53.79	55.59
27.62	29.9	34.4	29.8	32.3	33.17	31.9	28.6	37.92	35.8	35.07	31.32	32.49
51.02	60.96	60.22	72.40	N.A.	69.73	57.90	77.60	87.94	56.08	60.54	56.75	64.02
38.48	47.05	46.12	56.39	N.A.	50.44	44.93	58.31	66.74	44.19	47.07	43.96	48.15
93.51	85.6	91.88	90.67	85.06	86.79	91.78	85.19	87.25	93.68	92.26	86.65	**93.45
36.23	42.0	—	—	—	43.78	39.90	40.47	36.60	40.71	41.46	37.54	
—	—	39.72	41.24	41.52	—	41.16	—	39.16	—	41.65	40.35	**40.65
—	42.5	—	—	—	—	—	40.97	—	—	—	—	
—	17.4	10.21	12.94	12.36	—	13.96	13.76	15.33	—	14.54	10.98	—
—	—	—	—	—	—	12.18	12.94	10.28	—	12.93	14.00	—
—	—	—	—	—	—	1.15	1.06	1.49	—	1.12	0.78	—
4.09	3.10	3.16	3.43	4.09	3.94	3.43	3.37	3.38	3.01	3.54	2.20	**3.47
—	—	7.75	—	—	—	—	—	—	—	5.37	—	—
—	—	0.99	—	—	—	—	—	—	—	0.54	—	—
1.24	0.85	5.28	1.10	N.A.	1.21	1.35	1.24	1.16	4.73	6.67	0.90	—
Nil	Nil	1.21	Nil	Nil	Nil	Nil	Nil	Nil	1.59	1.65	Nil	—
Nil	42.99	Nil	Nil	N.A.	Nil	Nil	Nil	Nil	106	Nil	219	—
4.39	2.43	Nil	5.74	N.A.	2.48	0.29	2.63	8.01	Nil	Nil	N.A.	—

**Converted into Spindle Brix.

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TABLE 5 **DATA OF MILLS AFFILIATED to the S.M.R.I.**

NAME OF MILL	Luabo	Marromeu	Mhlume	Ubombo R.	Triangle
The season started on	23rd May	9th May	23rd May	1st May	1st May
Closing date of reporting	15th Oct.	28th Nov.	19th Jan.	30th Dec.	23rd Jan.
TONS (2,000 lbs) CANE CRUSHED	446,512	604,001	705,402	693,268	1,103,313
TONS SUGAR MANUFACTURED	51,496	66,784	81,385	78,012	130,400
Tons Cane crushed per hour	153	169	140	143	228
Overall Time Efficiency %	96	93	83	94	79
Percentage of White Sugar made	71	58	3	7	10
SUCROSE % CANE	13.91	13.71	13.68	13.29	14.09
FIBRE % CANE	13.81	13 36	13 32	14.32	13.59
Tons Cane per ton Sugar	8.67	9.04	8 67	8 89	8.46
JUICES					
Purity First Expressed Juice	86.69	84.90	87.77	85.51	86.00
Purity Last Expressed Juice	71.10	76.19	75.51	72.33	76.30
Purity Drop	15.59	8.71	12.26	13.18	9.70
Purity of Mixed Juice	85.38	82.93	85.79	83.73	84.51
Red. Sugars/Sucrose Ratio	4.09	3.96	3 85	5.04	5.91
MILLING AND BAGASSE					
Imbibition % Fibre	234.21	171.73	176.95	187.08	212.76
LOST ABSOLUTE JUICE % FIBRE	43.46	52.97	47.72	36.09	51.07
Imbibition % Cane	32.34	22.94	23.57	26.80	28.92
SUCROSE EXTRACTION	94.19	92.44	93.49	94.75	92.65
Sucrose % Bagasse	2.52	3.39	2.98	2.21	3.27
Moisture % Bagasse	52.28	51.84	51.40	51.50	52 80
Lower Calorific Value (btu/lb)	**3,088**	**3,110**	**3,155**	**3,161**	**3,029**
Available btu per lb Brix	**6,443**	**6,220**	**6,316**	**6,624**	**6,205**
RECOVERIES					
BOILING HOUSE PERFORMANCE	95.05	95.14	96.27	96.99	97.29
Boiling House Recovery	87.36	86.36	88.87	88.46	89.15
Overall Recovery	82.29	79.83	83.09	83.82	82.60
SUCROSE BALANCE					
Lost in Filter Cake	0.83	1.14	0.48	0.62	0.33
Lost in Final Molasses	8.14	8.90	7.82	9.58	8.39
Undetermined Losses	2.93	2.57	2.10	0.73	1.37
Lost in Boiling House	11.20	12.61	10.40	10.93	10.05
Lost in Bagasse	5.81	7.56	6.51	5.25	7.35
TOTAL OF ALL LOSSES	17.71	20.17	16.91	16.18	17.40
Filter Cake % Cane	5.00	4.57	2.47	5.00	2.25
Sucrose % Filter Cake	2.31	3.42	2.63	1.71	1.80
GRAVITY PURITY OF FINAL MOLASSES	40.32	39.87	—	39.90	36.68
Apparent Purity	39.61	36.37	38.61	36.00	32.64
Degrees Brix of Final Molasses	94.01	91.72	88.72	90.70	93.91
Weight at 85° Brix % Cane	3.30	3.60	3.12	3.78	3.82
DENSITY OF SYRUP (°BRIX)	59.10	64.50	57.67	59.60	57.18
CU. FT. MASSECUITE PER TON BRIX					
A-massecuite	34.34	69.17	20.82	29.03	35.96
B-massecuite	19.70	14.41	13.43	10.67	8.32
C-massecuite	12.57	9.73	7.89	10.39	10.96
TOTAL	66.60	90.97	42.15	50.09	54.96
CRYSTAL % SUCROSE IN MASSECUITE					
A-massecuite	59.91	61.52	60.64	61.1	65.28
B-massecuite	51.92	63.91	58.16	61.5	64.67
C-massecuite	53.76	58.89	62.00	61.3	68.26
Crystal % C-massecuite	31.42	34.09	36.39	36.3	41.65
Purity of Evaporation Syrup	84.82	85.00	86.88	84.1	84.90
Purity of A-massecuite	82.82	86.28	84.19	86.0	88.25
Difference in Purity	−2.00	+1.28	−2.69	+1.9	+3.35

TABLE 6 **AVERAGE MANUFACTURING RETURNS** by Monthly Periods (SEASON 1966-1967) for South African Mills

END OF MONTHLY PERIOD		April 30 1966	May 28 1966	July 2 1966	July 30 1966	August 27 1966	October 1 1966	October 29 1966	Nov. 26 1966	Dec. 31 1966	January 28 1967	March 4 1967	March 19 1967
TONS CANE CRUSHED	Month	107,235	907,266	1,659,097	1,557,944	1,607,049	2,071,038	1,639,423	1,651,179	1,808,639	1,435,552	978,209	59,875
	To-date	107,235	1,077,501	2,736,717	4,294,661	5,901,710	7,972,748	9,612,171	11,263,350	13,071,989	14,507,541	15,485,750	15,545,625
TONS SUGAR MADE AND ESTIMATED	Month	10,403	104,173	191,048	187,161	195,088	254,645	200,226	195,043	207,980	155,716	92,625	5,806
	To-date	10,403	114,576	305,605	492,766	687,854	942,499	1,142,725	1,337,768	1,545,748	1,701,464	1,794,089	1,001,856
TONS CANE CRUSHED PER HOUR	Month	188	162	168	165	162	163	169	168	150	168	168	27
	To-date	188	165	166	166	165	164	165	165	163	164	164	163
SUCROSE % CANE	Month	13.04	12.91	13.45	14.13	14.28	14.45	14.34	14.06	13.48	13.16	11.84	11.97
	To-date	13.04	12.83	13.20	13.54	13.74	13.93	14.00	14.00	13.93	13.86	13.73	13.72
FIBRE % CANE	Month	15.80	14.85	14.83	14.67	14.74	14.88	15.01	15.11	15.46	15.64	15.93	15.69
	To-date	15.80	14.07	14.87	14.80	14.78	14.81	14.84	14.88	14.96	15.03	15.09	15.09
TONS CANE PER TON SUGAR	Month	10.30	9.31	8.68	8.32	8.24	8.13	8.19	8.47	8.70	9.22	10.56	10.31
	To-date	10.30	9.40	8.95	8.72	8.58	8.46	8.41	8.42	8.46	8.53	8.63	8.63
LOST ABSOLUTE JUICE % FIBRE	Month	41	36	36	37	36	39	37	37	40	41	41	36
	To-date	41	37	36	36	36	37	37	37	36½	37	38	38
IMBIBITION % FIBRE	Month	340	271	270	227	263	256	263	248	267	259	256	275
	To-date	340	278	273	247	269	266	265	263	263	263	262	262
EXTRACTION	Month	93.15	94.44	94.61	94.47	94.44	94.43	94.30	94.26	93.79	93.75	93.40	94.83
	To-date	93.15	94.29	94.49	94.48	94.47	94.46	94.44	94.42	94.32	94.26	94.22	94.22
SUCROSE % BAGASSE	Month	2.26	2.11	2.16	2.32	2.45	2.28	2.43	2.33	2.41	2.25	2.11	1.67
	To-date	2.26	2.13	2.16	2.21	2.28	2.28	2.30	2.30	2.32	2.31	2.30	2.29
MOISTURE % BAGASSE	Month	54.00	52.81	52.98	52.65	53.11	52.16	53.55	53.40	53.54	53.54	53.76	55.11
	To-date	54.00	53.54	53.25	53.03	53.05	52.81	52.93	53.00	53.08	53.13	53.52	53.52
BOILING HOUSE PERFORMANCE	Month	93.90	95.14	97.14	96.58	96.75	95.67	96.25	96.05	95.47	95.87	95.17	94.31
	To-date	93.90	95.01	96.33	96.35	96.46	96.25	96.25	96.22	96.03	96.01	95.97	95.96
BOILING HOUSE RECOVERY	Month	84.45	86.81	88.79	89.82	88.29	88.87	89.35	88.05	88.05	87.87	86.36	84.23
	To-date	84.45	86.58	87.95	88.66	88.55	88.64	88.76	88.66	88.57	88.51	88.39	88.38
OVERALL RECOVERY	Month	78.67	81.96	84.00	84.86	83.38	83.95	84.26	82.92	82.58	82.35	80.66	79.87
	To-date	78.67	81.65	83.10	83.76	83.66	83.74	83.83	83.69	83.54	83.43	83.28	83.27
PURITY OF MIXED JUICE	Month	80.77	83.31	84.91	85.51	85.50	85.55	85.93	85.78	84.96	84.71	83.10	84.25
	To-date	80.77	83.06	84.20	84.69	84.92	85.09	85.23	85.31	85.27	85.18	85.06	85.06
REDUCING SUGARS/SUCROSE RATIO	Month	6.46	4.38	3.44	3.37	3.50	3.37	3.18	3.24	4.00	4.09	4.78	4.48
	To-date	6.46	4.59	3.80	3.67	3.59	3.53	3.44	3.41	3.53	3.75	3.62	3.63
SUCROSE IN FINAL MOLASSES % SUCROSE IN CANE	Month	12.08	10.16	8.20	8.41	8.56	8.21	8.41	8.64	9.04	8.69	10.56	10.10
	To-date	12.08	10.34	9.02	8.79	8.72	8.37	8.56	8.57	8.63	8.64	8.74	8.75
UNDETERMINED LOST SUCROSE % SUCROSE IN CANE	Month	1.76	1.66	1.76	0.77	1.70	1.39	0.77	1.82	1.27	1.77	1.33	—
	To-date	1.76	1.64	1.71	1.25	1.38	1.59	1.19	1.37	1.34	1.37	1.38	1.38
GRAVITY PURITY OF FINAL MOLASSES	Month	40.09	42.12	39.50	41.20	40.70	42.30	40.57	42.02	41.20	41.60	—	40.90
	To-date	40.09	41.88	40.51	40.76	40.60	40.99	40.92	41.08	41.09	41.14	40.65*	40.65*
FINAL MOLASSES OF 85° BRIX % CANE	Month	4.31	3.66	3.29	3.39	3.59	3.30	3.50	3.48	3.48	3.64	—	—
	To-date	4.31	3.73	3.46	3.43	3.48	3.43	3.44	3.44	3.44	3.46	3.47	3.47*
MONTHLY RAINFALL (INCHES)		2.17	2.81	1.18	0.39	1.69	1.88	2.06	3.61	3.66	6.13	4.96	N.A.
TOTAL RAINFALL FROM JANUARY 1st		12.36	15.51	16.64	17.05	18.78	20.78	22.68	26.26	29.98	6.13	11.12	N.A.

* Refracto Brix converted to Spindle Brix Purities.

TABLE 7 **COMPARATIVE MANUFACTURING DATA of RECENT YEARS (S.A. MILLS)**

SEASON	1966/67	1965/66	1964/65	1963/64	1962/63
CANE					
Sucrose % Cane	13.72	12.99	13.90	13.55	13.30
Fibre % Cane	15.09	15.57	15.38	15.50	15.49
JUICES					
Brix° First Expressed Juice	19.84	19.27	20.27	19.78	19.69
Purity of First Expressed Juice	86.97	86.30	87.54	87.37	85.52
Purity of Last Expressed Juice	72.43	72.30	74.30	72.66	71.49
DROP in Purity	14.54	14.00	13.24	14.71	14.03
Purity of Mixed Juice	85.06	84.22	85.52	85.30	83.36
Reducing Sugars/Sucrose Ratio	3.63	3.73	3.32	3.44	5.10
MILLING					
Imbibition % Fibre	262.00	260.53	256.00	258.26	266.16
LOST ABSOLUTE JUICE % FIBRE	37.91	37.58	36.98	37.47	37.36
Imbibition % Cane	39.60	40.57	39.37	39.84	41.24
EXTRACTION	94.22	93.99	94.16	94.08	94.15
Sucrose % Bagasse	2.29	2.20	2.34	2.29	2.24
Moisture % Bagasse	53.52	52.98	52.64	52.46	52.17
Bagasse % Cane	34.56	35.42	34.36	34.92	34.70
Lower Calorific Value (btu/lb)	**2,985**	**3,033**	**3,061**	**3,066**	**3,105**
Available btu per lb Brix	**6,788**	**7,414**	**6,870**	**7,166**	**7,173**
RECOVERIES					
BOILING HOUSE PERFORMANCE	95.96	95.65	97.07	97.19	96.29
Boiling House Recovery	88.38	87.67	89.65	89.60	87.80
Overall Recovery	83.27	82.40	84.52	84.30	82.66
Tons Cane per Ton Sugar	8.63	9.20	8.42	8.63	8.96
FILTER CAKE					
Sucrose % Cake	2.16	1.57	1.30	1.37	1.26
Filter Cake % Cane	5.21	5.62	5.25	5.57	5.29
FINAL MOLASSES					
GRAVITY PURITY	40.65*	39.91	39.87	39.45	39.63
Degree Brix	93.45*	91.72	91.58	91.21	89.17
Weight at 85° Brix % Cane	3.47*	3.59	3.33	3.15	3.91
AVERAGE SUGAR POLARIZATION	98.58	98.49	98.60	98.51	98.62
SUCROSE BALANCE					
Lost in Filter Cake	0.82	0.68	0.52	0.56	0.50
Lost in Final Molasses	8.75	9.38	8.13	7.79	9.92
Undetermined Losses	1.38	1.53	1.09	1.43	1.08
LOST IN BOILING HOUSE	10.95	11.59	9.73	9.78	11.50
Lost in Bagasse	5.78	6.01	5.84	5.92	5.84
TOTAL OF ALL LOSSES	16.73	17.60	15.58	15.70	17.34
CU. FT. OF MASSECUITES PER TON BRIX					
A-massecuite	29.02	27.89	27.79	26.67	24.69
B-massecuite	10.30	11.78	11.27	11.03	13.02
C-massecuite	8.83	9.14	7.98	7.92	9.36
TOTAL	48.15	48.81	47.03	45.62	47.07
EXHAUSTION OF MASSECUITES					
A-massecuite	62.85	62.78	62.45	62.18	64.52
B-massecuite	58.36	59.53	60.39	60.54	59.76
C-massecuite	55.59	56.37	56.80	56.95	57.00
PURITY RISE					
A-massecuite purity	86.68	85.91	86.68	86.10	85.01
Syrup purity	86.03	85.06	86.70	86.38	84.26
RISE	+0.65	+0.85	−0.02	−0.28	+0.75
DENSITY (°BRIX) OF SYRUP	60.35	59.33	58.77	58.06	57.80

**Converted into Spindle Brix.

TABLE 8 **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	96° Sugar			Sucrose	Moisture	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	93.33	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	3.63	40.6	96.0	88.38	83.27

Discussion

Mr. du Toit: It is stated in the paper that "richness of the juice also has its effect on sucrose extraction, a richer juice leading to a higher extraction figure".

Mr. Christianson, in a statistical analysis some years ago found no correlation between sucrose in cane and percentage extraction.

Mr. Dowes Dekker (reading the paper on behalf of Mr. Perk): The intention was to point out that it is more difficult for a mill crushing high sucrose cane to improve its extraction than it is for a mill crushing low sucrose cane. This is open to argument and the time has come when further data should be obtained in this connection.

Mr. Buchanan: As milling is a combination of juice dilution and juice expression then the state of dilution of the juice coming into the mill will have an effect on extraction, and this clearly is what Mr. Perk is referring to.

Mr. Covas: Mr. Perk mentions cubic foot of massecuite per ton of mixed juice. Luabo's figure appears high but the factory produced mill white sugar only and had to convert all 'B' massecuites to white and triple cure them, causing additional circulation in the system. 'C' massecuites could not be double cured and were remelted and returned to the pan floor.

Dr. Graham: Why is Mr. Perk using extraction as a yardstick for evaluation the effectiveness of the extraction process whereas the S.M.R.I. has always advocated lost absolute juice % fibre as a far more reliable figure.

He mentions enzymatic loss of sucrose in the diffuser but it is not certain that there are many enzymes or bacteria present at that stage because of scalding at the head of the diffuser. Destruction of sucrose in the diffuser is more likely to be tied up with pH. In tests recently carried out at the S.M.R.I. very much higher inversion rates have occurred than would have been predicted by Stadler's Table.

He mentions the poor dewatering mill performance at Entumeni but what effect would a drop in moisture from 56% to 53% have on extraction?

Dr. Douwes Dekker: Mr. Perk is not particularly concerned with the reduced extraction figure but has included it because others may be interested in it.

Regarding a drop in moisture content of final bagasse having an effect on extraction, this is an important point requiring further investigation.