# FIFTY-SECOND ANNUAL REVIEW OF THE MILLING SEASON IN SOUTHERN AFRICA (1976 - 1977)

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## Introduction

This fifty-second annual review contains the same type of information as the preceding reports with very few changes in the data listed in the main tables. The changes are commented on in the appropriate sections of the text.

All data listed have been calculated from figures as supplied by the mills with the exception of sugar weights which were supplied by the South African Sugar Association. The Cane Varieties and Cane Transport tables were obtained from the Sugar Industry Central Board as were pol, brix and fibre factors.

In Mozambique, only four mills out of six reported their results and it has therefore not been possible to calculate industrial averages for that country. Because of difficult communications, some figures which appeared doubtful and could not be checked have been blanked off.

The list of symbols used to designate each mill remains unchanged and a key to the symbols can be found in Table 1 of the 1973/74 Review.

## Highlights of the 1976/1977 season

*South Africa*

Following the closing down of Renishaw (RN), the number of mills in operation during the 1976/77 season was reduced to 18. They did however process a record tonnage of cane (19 220 660 tons) and produced 2 041 520 tons of sugar. This is the first time that sugar production has exceeded the two million ton mark.

Refined sugar produced by the five back end refineries and excluding the production of Huletts central refinery accounted for 21% of total production. The back end refineries increased their total production of white sugar by 36 000 tons.

The local market absorbed 1 159 190 tons of the season's sugar production and 882 330 tons were exported.

The large cane crop was a result of above average rainfall during all months except June, September, November and December. The February 1977 rainfall of 306% of long term average caused severe floods in Zululand.

The downward trend in cane quality continued. Pol % cane was the lowest ever recorded. Mixed juice purity was the lowest since 1969 while fibre % cane was high. Complaints on the amount of sand and trash delivered with cane were fairly general.

In spite of the poor quality cane, extraction (95,48) improved slightly over the previous season. This is a very creditable performance if one takes into account the fact that average crushing rate (211,84 tch) also increased by 20,5 tons of cane per hour.

Boiling house recovery (88,99) was also higher than in 1975/76 and the low molasses purity (38,2) set a new record.

The improvements in factory performance could not however compensate for the very poor quality cane and the cane to sugar ratio (9,41) was the highest since the early 1930's.

*Mozambique*

Of the four mills that reported their 1976/77 results, all except MA produced about the same amount of sugar as in 1975/76. MA doubled its production during the past season.

Cane quality appears to have been slightly better than for the previous season. Extraction was still very low except for LB which reported 94,75. Boiling House recovery was good at IC (89,18) but low for the other mills.

*Swaziland*

The total sugar production of Swaziland fell by about 4 000 tons to 208 281 tons. This reduction was due to a lower production by UR (94 308 tons) while MH produced a higher tonnage (113 973 tons) than in 1975/76.

Pol in cane was lower than during the previous season at both mills but mixed juice purity was about the same at MH and slightly higher at UR. The cane to sugar ratio was 9,14 at MH and 9,41 at UR.

Once again MH reports an exceptionally high time efficiency (84,33) in spite of its throughput of 208 tch with six 1 676 mm mills which makes it the most highly loaded mill in Southern Africa. MH's pol losses in final molasses (7,27) were also among the lowest of all the mills listed in these tables.

*Malawi*

The tonnage of cane crushed by NH increased by 237 551 tons and sugar production (84 232 tons) was 30% higher than for the previous season in spite of a marked decline in cane quality.

Pol in cane (12,58) was one full point lower than in 1975/76 and erc % cane (10,64) one and a half points lower. Tons cane per tons of sugar increased from 8,57 to 9,42.

Factory performance was disappointing. Extraction was 94,88 on the diffuser tandem and 92,70 on the mills and boiling house recovery was 87,40. The boiling house recovery must have been influenced by the low mixed juice purity (83,26). There was a slight improvement in final molasses purity (40,08) which was nullified by an increase in the proportion of molasses to cane and sucrose losses in final molasses (10,00) were 13% higher than for the 1975/76 season.

## The Weather

The abundant rainfall during 1976 had a favourable effect on cane production but adversely affected its sugar content. The South African Sugar Experiment Station comments on the weather are :

"Growing conditions over the whole industry were generally good throughout the year with lack of moisture rarely being a limiting factor to crop growth. Poor growth was mostly due to waterlogged conditions and low temperatures coupled with overcast days.

"Monthly rainfall for the industry was generally considerably higher than the long term mean: 21% above in May, 1976 to 138% above in February, 1977 when Zululand received 306%

of its long term average for the month. The exceptions were June, September, November and December, when 7%, 75%, 91% and 88% of the long term mean was recorded respectively. Rainfall distribution was not always favourable and crops on shallow soils showed definite drought symptoms at times.

"Sucrose levels tended to be rather low, even as the season progressed, without the cause being entirely apparent. This gave rise to some concern which was somewhat alleviated by yields exceeding estimates slightly. A severe frost in June, 1976 adversely affected growth in the Midlands, particularly north of Pietermaritzburg, and introduced a major fire hazard. Overall crop damage was estimated at 35% with 60% in some areas. The effect of this frost was still very much in evidence in older cane, even after good rains in October, 1976 promoted satisfactory growth in most areas. Strong winds and fluctuating temperatures were a feature of November, 1976 when some damage was caused to mature cane when the lodging induced by excessively heavy rainfall was aggravated. Weed control was also becoming a problem from January, 1977 as a result of the excessive rainfall."

## Cane varieties

The percentages by weight of different varieties crushed are listed in Table G.

In South Africa, NCo 376 is by far the most popular variety and now accounts for 61,7% of all cane, an increase of about 5% since the previous season. Other varieties which make up an appreciable percentage of production are N55/805 (10,4%), NCo 310 (7,0%) and NCo 293 (5,2%). The proportion of all three of these varieties has declined since 1975/76.

The predominance of NCo 376 is even more marked in Swaziland where it is 90,1% of the cane at MH and 91,2% at UR. In Malawi on the other hand NCo 310 is the dominant variety with 82,6% of the cane. Only BZ and IC in Mozambique have reported on varieties and they both rely very heavily on NCo 376.

## Cane transport

A summary of cane transport for South African mills is listed in Table H. For the first time chopped cane bins are listed. Although from a transport point of view these bins at UF are conveyed to the mills on tramways, it was considered useful to list them separately to be able to follow progress of chopper harvesting. At UF it accounted for 16,4% of the cane.

The proportion of cane transported by South African Railways and by tractor has remained practically unchanged. Lorry haulage has gone up by about 1% while tram transport decreased by 2%. The main difference from the previous season has been an increase of 3,7% in the proportion of cane transported by Hilo and the disappearance of bogie trucks which were previously used by IL.

## Sugar production and quality

For the first time sugar production in South Africa passed the two million tons mark. The season's total of 2 041 520 tons exceeded the 1972/73 record by 126 919 tons and was 240 432 tons higher than for the 1975/76 season.

Final production of different types of sugar separated into local and export markets is listed in Table A. Production of the five back-end refineries listed as Local Market White has gone up by 36 000 tons since the previous season. The local market has also absorbed an additional 14 000 tons of brown sugar. Export has gone up by 212 000 tons of sugar. The sugar equivalent of the high test molasses used to coat VHP sugar to bring down its polarisation was 6 250 tons.

There has been a reduction of about 15 000 tons in the weight of raws used for the production of refined sugar for export.

Average polarisation of all sugar produced by the mills was 99,42 and moisture content 0,12.

The addition of amylase to the third effect of the evaporator to control the starch level of sugar is now standard practice throughout the industry and the weights of enzyme used per 100 tons of sugar are listed in Tables $D_1$ and $D_2$. The average for South African mills was 3,49 kg/100 tons of sugar with very high values reported by GD (15,86) and IL (9,25). Both these mills report that very abnormal increases in enzyme addition were required from September to the end of the season to keep the starch level of sugar within specifications.

Diffusers appear to have a favourable effect on the starch content of sugars probably because the temperature, pH and long retention time favour the activity of the natural enzymes in cane. UC produced the sugar with the lowest starch level without adding any artificial enzymes. ML also did not use any enzyme but since they refine their own sugar, the starch content of their raws is not known. The next two lowest users of enzymes were PG and AK, both diffuser factories.

An increase in the gums content of sugars has been noted. Plots of gums level against month of the year indicate a seasonal effect which can be very strong for some mills. Gums content is at its lowest in August and increases sharply towards the end of the season.

## Cane quality

The decline in cane quality over the past 50 years was commented upon in the fifty-first annual review. Unfortunately this decline has continued during the past season.

Pol % cane (12,43) was even lower than in 1975/76 (12,60) and mixed juice purity (84,47) was also lower by 0,23 points. Fibre % cane (15,52) was slightly lower but could not compensate for the decline in the other two parameters with the results that erc % pol in cane was only 84,84 and erc % cane 10,55 as against 10,69 for the previous season.

A better appreciation of the drop in cane quality is obtained when last season's data are compared to 10 year average figures listed in Table J. An extract of these figures is tabulated below.

The very long season has had an adverse effect on average cane quality as is illustrated in Fig. 1, in which monthly variations in pol % cane and erc % cane were plotted. It is not however the main reason for the low pol in cane as shown in

**TABLE 1**
**Comparative cane quality data 1925 to 1976**

| | Average 1925 to 1934 | Average 1935 to 1944 | Average 1945 to 1954 | Average 1955 to 1964 | Average 1965 to 1974 | 1976/77* |
|---|---|---|---|---|---|---|
| Sucrose % cane | 13,19 | 13,53 | 13,79 | 13,53 | 13,16 | 12,43 |
| Fibre % cane | 15,78 | 15,30 | 16,06 | 15,49 | 15,22 | 15,52 |
| Mixed juice purity | 85,09 | 86,01 | 85,95 | 85,24 | 84,80 | 84,47 |

* 1976/77 pol % cane.

Note: All figures uncorrected for changes in analytical procedures.

Table 2 in which pol % cane values for the peak month of September have been listed from 1970 to 1976.

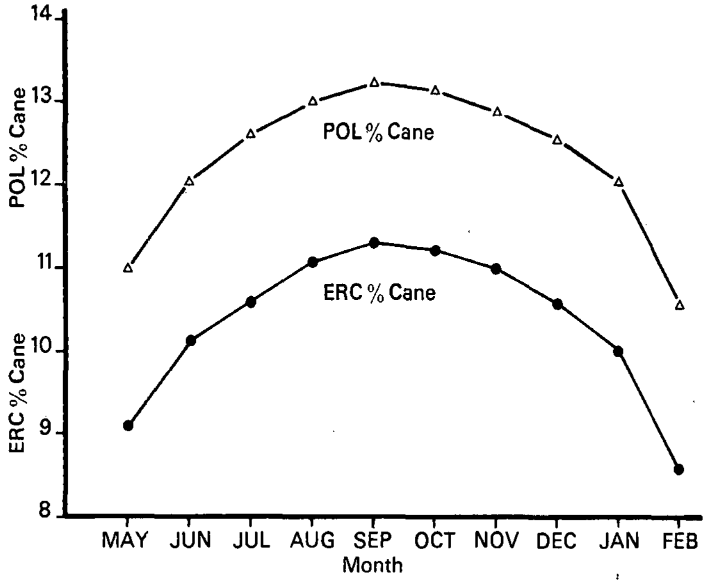


**FIGURE 1**

TABLE 2
September monthly average pol % cane

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 |
|---|---|---|---|---|---|---|---|
| Pol % cane | 14,41 | 13,45 | 14,56 | 14,05 | 14,29 | 13,09 | 13,24 |

From the milling point of view, the decline in cane quality is certainly the most important technical challenge facing the industry. The figures listed above only reveal part of the story as sand, soil and extraneous matter content of the cane were of as much concern as pol % cane and purity to mill personnel. Unfortunately these impurities were not systematically logged at the mills and their effect on factory operation can only be roughly estimated.

The best quality cane was milled by EN. It had a pol of 13,16, a fibre content of 14,01, a mixed juice purity of 86,17 and yielded an erc % cane of 11,44. If one compares these figures with those listed in Table 1 it is evident that although fibre and purity bettered the long term industrial average, the pol % cane of even EN cane was comparatively low. GD and DL had the next best cane (erc % cane 11,34 and 11,08 respectively). The Midlands (JB and UC) maintained their unenviable position as the suppliers of the poorest quality cane and had several weekly average juice purities below 80 as a result of frost.

Values for erc % cane are now listed in Tables $B_1$ and $B_2$. This parameter which is calculated by multiplying pol % cane by erc % pol in cane is an indication of the recoverable sugar content of cane. It has been discussed in previous annual reviews.

The factors a, b and c used to calculate erc during the past four seasons are listed in Table 3.

TABLE 3
Factors for erc for the past four seasons

| | 1973/74 | 1974/75 | 1975/76 | 1976/77 |
|---|---|---|---|---|
| Factor a | 0,987037 | 0,986288 | 0,988149 | 0,989817 |
| Factor b | 0,466333 | 0,461679 | 0,460233 | 0,449613 |
| Factor c | 0,037198 | 0,037831 | 0,037143 | 0,036257 |

The 1976/77 factors should be used to calculate erc* during the next season.

It will be noted that while factors a and c have changed only in the third decimal place, there has been a more important change in factor b which has decreased by 2,3%. Since factor b multiplies the non-pol content of cane, this decrease indicates that during the past season, in spite of the low juice purities, losses in final molasses were lower than in 1975/76.

## Cane throughput, crushing capacity and time efficiency

For the second year in succession there has been a significant increase (from 191 to 212) in the industrial average tons cane crushed per hour. This increase in crushing rate is partly due to the closing down of another small mill (Renishaw) but there was also a noticeable increase in the industry's crushing capacity. In 1975/76 it was 3 493 tons of cane per hour and for the season under review it had jumped to 3 731 tch, an increase in capacity of 238 tch. This additional capacity is equivalent to that of a large mill.

The largest increase in capacity (87 tch) is reported by SZ which installed a diffuser in parallel to its milling train to enable the mill to process cane diverted from RN.

Although the industrial average time efficiency (75,22) was slightly higher than for the previous season, this improvement is a reflection of a more regular cane supply rather than better mechanical and operational efficiency. This is illustrated in Fig. 2 in which scheduled stops, lack of cane stops, other stops and total stops are plotted. Other stops are the sum of mechanical and operational stops. The other terms are self explanatory.

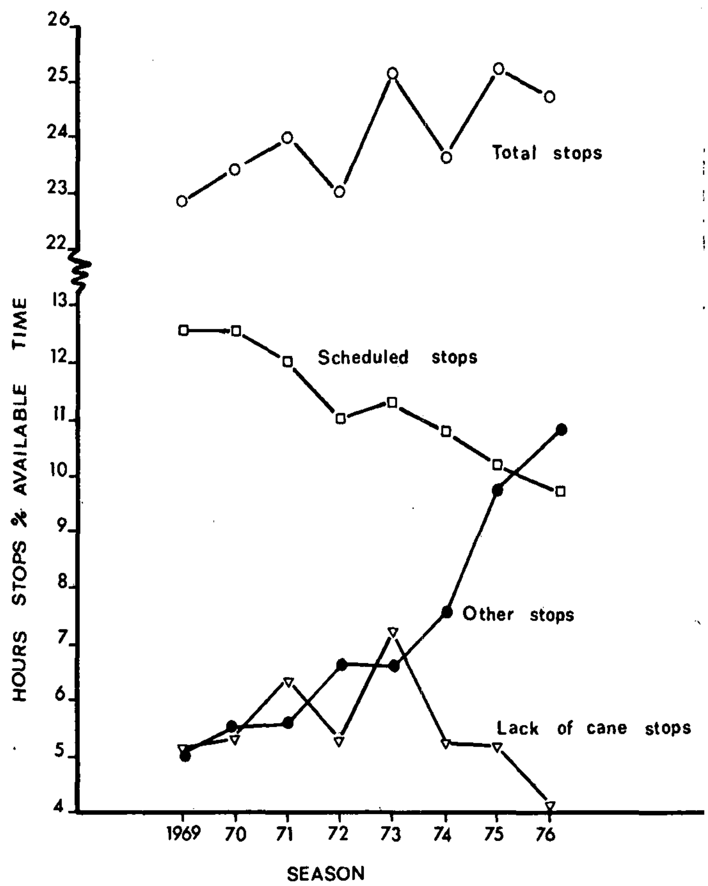


**FIGURE 2** Factory stops 1969-1976.

There has been an improvement in stops for lack of cane during the past three seasons and also a steady decline in the

* erc = 0,989817 S − 0,449613 N − 0,036257 F.

time lost for scheduled stops. Unfortunately these improvements have, to a large extent, been nullified by the very steep rise in other stops which have increased by 120% since 1969. The net result is that total stops have increased by 6,5% since 1969 and now stand at 24,8% of available time.

At a time when the industry is faced with having to process larger crops and the capital cost of providing additional grinding capacity is rocketing, it would appear that more attention should be paid to improving time efficiency. The major expansion which the industry has gone through during the past years may provide an explanation for the increase in lost time but it should not be taken as an excuse. Some mills (SZ, DL) have gone through important expansion work during the past off season and have nevertheless maintained good time efficiency.

It must be a cause for concern that during the past season four mills (21% of the crushing capacity of the industry) had a time efficiency of less than 70%. Of these four mills only one (UK) was involved in major expansion before the season. In that particular mill loss of crushing capacity due to delay in the commissioning of new plant was followed by failure of a turbo alternator which supplied 66% of the factory's power. The fact that the factory's three phase supply (380V) was the same as the usual urban voltage enabled portable diesel generators to be used while the alternator was being repaired and allowed the factory to continue crushing at a reduced rate.

A major fire which started in the transformer station put EM mill out of action for several days and reduced what would have been an outstanding time efficiency. This accident has drawn attention to the vulnerability of sugar mills to fire damage and the need for a fire fighting organisation.

The crushing capacity of UF was curtailed by a flood in late February which washed away the tramway bridge across the Umfolozi river over which the factory obtains the main part of its cane supply. The mill had to close down several weeks earlier than planned.

**TABLE 4**
**Milling performance data**
(In decreasing order of Corrected Reduced Extraction)

| Factory | Cor. Red. Ext. | Extraction | Pol% Bag | Moist % Bag | Imb % Fibre |
|---|---|---|---|---|---|
| SZ (B)* | 96,94 | 96,97 | 1,10 | 54,48 | 385 |
| JB | 96,61 | 96,81 | 1,24 | 51,54 | 308 |
| EM* | 96,42 | 95,90 | 1,36 | 51,90 | 245 |
| ME | 96,37 | 96,50 | 1,35 | 51,44 | 264 |
| DL | 96,26 | 96,29 | 1,38 | 53,44 | 261 |
| TS (B) | 96,10 | 96,04 | 1,35 | 55,39 | 244 |
| MV | 95,67 | 95,61 | 1,64 | 50,84 | 286 |
| EN* | 95,61 | 96,31 | 1,53 | 55,10 | 299 |
| FX (B) | 95,54 | 95,06 | 1,64 | 53,00 | 289 |
| UC* | 95,46 | 95,94 | 1,47 | 55,43 | 261 |
| AK* | 95,43 | 95,62 | 1,66 | 52,71 | 315 |
| Ind. Ave. | 95,40 | 95,48 | 1,66 | 53,20 | 281 |
| FX (A) | 95,27 | 94,92 | 1,75 | 52,63 | 272 |
| SZ (A) | 95,23 | 95,19 | 1,68 | 53,68 | 326 |
| GH | 95,07 | 94,94 | 1,80 | 52,67 | 251 |
| IL | 94,84 | 95,53 | 1,80 | 53,82 | 260 |
| PG* | 94,53 | 94,87 | 2,06 | 51,58 | 335 |
| ML* | 94,52 | 94,21 | 1,97 | 53,91 | 265 |
| TS (A) | 94,43 | 94,39 | 1,87 | 55,54 | 274 |
| UF (B) | 94,21 | 95,17 | 2,02 | 53,80 | 227 |
| UK | 94,04 | 94,38 | 2,10 | 53,82 | 293 |
| UF (A)* | 93,12 | 93,95 | 2,35 | 54,76 | 305 |
| GD | 92,81 | 94,04 | 2,60 | 51,52 | 282 |

*** Diffuser.**

**Cane preparation and extraction**

The importance of good cane preparation is recognised by all mills and illustrated by Preparation Index (PI) values in Table $B_1$. Ten mills report PI's of 90 and over with only three below 85 and none lower than 82.

The best preparation is at AK which has made a special effort in optimising cane knives and shredder work. With an average PI of 94 AK is not very far from the maximum achievable in practice which was found by the SMRI to be 96.

The milling performance data of all mills are listed in decreasing order of corrected reduced extraction in Table 4. The best extraction (96,97) was reported by the diffuser tandem at SZ. This is a new addition to the factory. It consists of two cane knives, one shredder, one 1 676 mm mill, a BMA bagasse diffuser and two 1 676 mm dewatering mills and was operating at about 90% of rated capacity. This tandem reached 98,07 weekly average corrected reduced extraction during a week in January. JB with a six mill tandem had the second best extraction (96,81) and also reported average extractions of over 97 for several weeks. EM, ME, DL and TS (B tandem) all reported corrected reduced extractions of over 96 and pol in bagasse below 1,4.

Average imbibition rate was 281% on fibre and both SZ and JB obtained their good extraction with high imbibition rates (SZ(B): 385, JB: 308). Of the other mills mentioned above, EM reports an imbibition % fibre of only 245 thus proving that good results can be obtained with a diffuser at a moderate imbibition rate and ME, DL and TS had imbibition rates of 264, 261 and 244 respectively, all of which are below industrial average. On the other hand some heavy imbibition users like SZ (A) (326), PG (335) and UF (A) (305) had below average extraction and analysis of the results does not help in determining what should be the optimum imbibition level.

There has been a slight decrease (0,32) in industrial average moisture % bagasse (53,20) from the preceding season. This decrease may appear to be negligible but it does represent the result of a trend which has been noticeable in a number of mills during the season. The lowest moisture in bagasse (50,84) has been reported by MV and six of the mills (including two diffuser tandems) had below 52% moisture for the season. The improved results are attributed to better arcing techniques and to more emphasis on welding the tips and sides of the mill groovings during scheduled stops when better roughening can be obtained than when the mill is working. Good examples of the improvement achieved by this technique are provided by AK and EM. The first of these mills (AK) had a moisture of 54,38 in 1975/76 and 52,71 in 1976/77 in spite of an increase in grinding rate of 52 tch. EM started the season with a monthly average moisture of 52,89 for May and ended it with 49,58 for February.

A novel approach to the problem of increasing capacity and at the same time keeping down moisture in bagasse has been adopted by UK where the six mill tandem has been increased by a seventh unit. The conveyors feeding the last mill have been so designed that it can be operated either as a seventh mill or in parallel with the sixth. The teething problems encountered by UK have not made it possible to assess the merits of this layout during the past season.

Another interesting development in milling which has been tried at TS in 1976 is the use of a perforated underfeed feeder drum. The drum is hollow and fitted with a double screw scroll to take out any bagasse which is deposited on the inner surface. The object of this development was to provide better drainage for dewatering mills after diffusers which have to handle very wet bagasse. The trial was carried out in a straight milling tandem and proved a success.

Last expressed juice brix and purities have been dropped from Table $C_1$ because they are no longer reported by most South African mills. They have been replaced by the corresponding figures for residual juice which are obtained by analysis of the cold digested bagasse extract.

### Clarification and filtration

Two more short retention time clarifiers have been commissioned at SZ during the 1976/77 season bringing the total number of clarifiers of this type in the industry to six. Efforts to reduce the retention time in conventional type clarifiers have continued. ME has been successful in optimising clarification during the past season by modifying their Rapidorr clarifiers and ensuring a steady mixed juice flow. Towards the end of the season they processed 225 tons juice per hour in one 7,3 m Rapidorr instead of the three units previously used. The modifications to the clarifier consisted in fitting a ring type draw off main and multiple draw off points which have become almost standard by now. Additional modifications were also carried out. Three juice draw off boxes were placed symmetrically round the clarifier circumference, the scum tank level was increased by about 15 cm and mud draw off was increased by using both the pumps and gravity overflow pipes.

In general clarification seems to have been easier than in the past. Even the South Coast mills, which always report clarification problems towards the end of the season, experienced no difficulties in 1976/77 although they had to process some very poor quality cane which adversely affected boiling house work.

This general improvement in clarification may be due to better filter work and reduced recirculation of impurities with filtration. This has been very noticeable at UK where an increase in capacity and a modernisation of the filter station have eliminated clarification problems.

Pol % filter cake average 1,39 (1,33) and filter cake % cane 4,27 (4,62). Previous season's figures are bracketed. The increase in pol may very well be the result of the decrease in weight. In several mills there is not enough bagacillo added to filter feed and, as a result, pol in cake is high and retention is low. An extreme example of this is provided by UC with a pol % cake of 3,88 and filter cake % cane of only 0,96. The fact that UC has a cane diffuser also contributed to reducing the weight of filter cake. The other cane diffuser factories, AK and ML reported filter cake % cane of 2,99 and 2,43 respectively.

The pH of clear juice and syrup has decreased steadily over the past seasons as shown in Fig. 3. Unless there is evidence of an increase in reducing sugars pol ratio and a drop in purity between mixed juice and syrup it is advisable to use the minimum amount of lime and ideally the pH of clear juice should be 7,0. The pH of syrup is however difficult to measure and should only be read after the electrodes have been immersed in the syrup for about half an hour, a practice rarely followed for routine measurements. This has been discussed by Perk[1] who has pointed out that attempts to raise the pH of syrup by working at a higher clarified juice pH may well have the opposite effect.

### Boiling house

The most interesting development in this field during the past season has been the commissioning of a Fives Lille continuous pan at TS. This pan has been very easy to commission

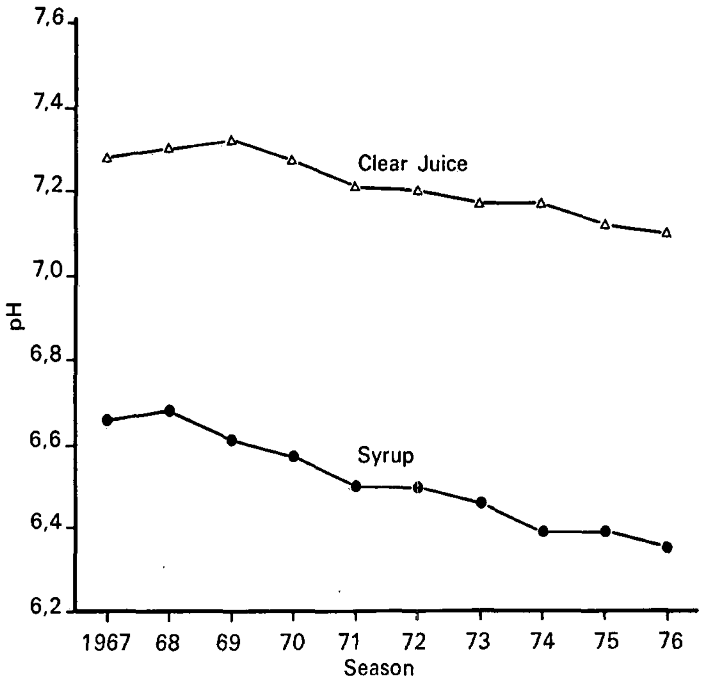

**FIGURE 3** pH Clear juice and syrup.

and to operate but did suffer from serious capacity limitations during the first months of the season. Poor circulation was found to be the cause of the low throughput and after injection of vapour in each compartment was started, the pan was able to process all C massecuites boiled at TS during the last months of the season. Grain was first established in batch pans and then transferred to the continuous pan in which it was grown from 0,1 mm to 0,2 – 0,25 mm. The continuous pan was operated without stopping and cleaning for up to two months. It has not affected molasses exhaustion and TS was one of the few factories which consistently equalled or bettered the target formula.

Table $D_1$ shows that there has been a slight increase in the volume of A, B and C massecuites boiled per ton of brix in mixed juice. The lowest values are again reported by MV where volume of massecuites boiled were 84% of industrial average for A, 60% for B and 70% for C. MV also reported the largest drop in purity between A massecuite and A molasses (21,77). Comparison of purity drops for B and C massecuite show that MV's were not exceptionally good. It must therefore be concluded that the low massecuite volume per ton of cane was essentially due to good A massecuite exhaustion obtained as a result of cooling A massecuite.

There have not been appreciable changes in the brix of massecuites which averaged 92,33 for A, 94,03 for B and 96,28 for C. The range of brix is narrow for all massecuites and the season's results show that the best C massecuite exhaustions are obtained at average brix. ME reports the highest exhaustion (61,93) with a brix of 96,55.

Table 5 lists the boiling house results of all South African factories in decreasing order of boiling house recovery. Also listed are: final molasses and undetermined losses, molasses % cane, molasses purity, molasses factor (sucrose in final molasses % non pol in mixed juice) and non pol ratio.

This blunderbuss approach to an assessment of boiling house work is an indication of the need for a reliable boiling house evaluation formula. To quote the ISSCT system of Chemical Control[2].

"There is an old saying in the medical sphere that if there are many remedies for a complaint, none of them is satis-

**TABLE 5**
**Boiling house data**
(In order of decreasing boiling house recovery)

| Factory | Boiling House Recovery | Final Mol. (Pol) losses % Pol in Cane | Undet. losses (Pol) % Pol In Cane | Mol. at 85 Bx % Cane | Purity Final Molasses | Mol. Factor (suc. in mol. % non pol in mixed juice) | Non pol ratio | Mixed Juice Purity |
|---|---|---|---|---|---|---|---|---|
| MV . . . | 91,42 | 7,33 | 0,50 | 3,23 | 36,81 | 50,30 | 0,94 | 85,48 |
| TS . . . | 91,00 | 7,30 | 0,74 | 3,14 | 35,59 | 48,53 | 0,94 | 85,47 |
| UF . . . | 90,68 | 8,12 | 0,12 | 3,34 | 39,22 | 51,63 | 0,86 | 84,84 |
| JB . . . | 90,58 | 7,26 | 1,17 | 3,67 | 34,28 | 43,81 | 0,96 | 82,25 |
| ME . . . | 90,57 | 7,21 | 1,46 | 3,38 | 36,44 | 45,30 | 0,90 | 83,61 |
| DL . . . | 90,54 | 7,65 | 1,08 | 3,61 | 37,14 | 56,66 | 1,05 | 86,01 |
| GD . . . | 89,73 | 8,12 | 1,13 | 3,53 | 37,20 | 54,55 | 0,98 | 85,83 |
| Ind. Ave. | 88,99 | 8,45 | 1,58 | 3,60 | 38,23 | 54,94 | 0,97 | 84,47 |
| FX . . . | 88,96 | 8,12 | 1,62 | 3,34 | 38,73 | 52,82 | 0,91 | 84,63 |
| GH . . . | 88,84 | 8,00 | 2,11 | 3,28 | 39,23 | 57,14 | 0,94 | 86,00 |
| IL . . . | 88,78 | 8,19 | 1,94 | 3,45 | 39,94 | 56,82 | 0,95 | 85,39 |
| UK . . . | 88,54 | 7,90 | 2,43 | 3,17 | 38,93 | 54,03 | 0,90 | 86,13 |
| SZ . . . | 88,37 | 8,39 | 2,22 | 3,41 | 38,82 | 53,33 | 0,90 | 84,59 |
| AK . . . | 88,30 | 8,95 | 1,90 | 3,80 | 39,10 | 54,42 | 0,94 | 83,97 |
| EM . . . | 88,23 | 9,80 | 1,08 | 3,80 | 38,92 | 57,67 | 0,96 | 84,43 |
| PG . . . | 88,14 | 9,52 | 1,62 | 4,27 | 39,63 | 59,07 | 1,01 | 83,32 |
| EN . . . | 86,76 | 9,80 | 1,74 | 3,77 | 40,46 | 54,98 | 0,95 | 86,17 |
| UC . . . | 85,46 | 11,22 | 2,41 | 3,98 | 39,62 | 63,74 | 0,87 | 82,00 |
| ML . . . | 84,68 | 11,12 | 2,95 | 4,85 | 39,33 | 58,10 | 0,96 | 81,13 |

factory. Similar conditions seem to apply to methods of expression of the standard of efficiency of the boiling house."

The main reason for this state of confusion is the fact that the bulk of the boiling house losses, which occur in molasses, depend on the impurities introduced into the factory with mixed juice. Unfortunately all these impurities do not have the same melassigenic properties and although the formulae which are used correct for the sum of the impurities in mixed juice they make no allowance for these different properties.

Bearing these limitations in mind an additional imperfect formula has been used in Fig. 4. It is reduced boiling house recovery which has been recommended by ISSCT and is defined as the boiling house recovery which would have been obtained under existing conditions if the factory had worked with a mixed juice of a standard purity of 85. It is of limited accuracy but can be used to evaluate trends when there have been fluctuations in juice purity. Fig. 4 shows the industrial average boiling house recoveries and reduced boiling house recoveries for the past five seasons. The reduced BHR curve shows a consistent improvement which, in the case of the BHR curve, has been masked by drops in juice purity.

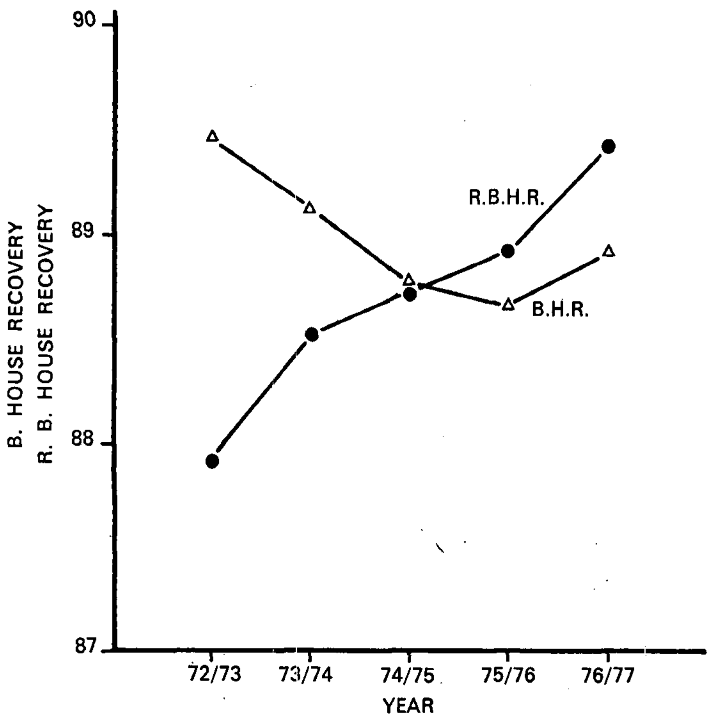


**FIGURE 4** B.H.R. and reduced B.H.R. 1972 to 1976.

On the basis of boiling house recovery, MV and UF have kept the same position as they had last season, namely first and third while TS has replaced DL in the second place, JB has moved to fourth and ME to fifth place. These five factories are also in the lead if one lists them in order of molasses factor. There is therefore every indication that they do better boiling house work than the others. The effect of the correction for impurities in juice is of course more marked for extremes in purities. Thus JB with a mixed juice purity of 82,25 moves up to first position in molasses factor (43,81) rating.

The non pol ratios listed in Table 5 cannot be used as a measure of boiling house performance. High and low values are reported by factories among the top five and bottom five of the boiling house recovery column. Non pol ratio can however give an indication of excessive molasses production.

The average final molasses purity (suc/ref brix) of 38,23 is the lowest ever recorded. It may be at least partially due to the fact that the average reducing sugar content of molasses (18,18) was the highest reported for at least the past five seasons.

The brix of final molasses has gone down considerably during the past years as shown in Table 6.

**TABLE 6**
**Refractometer brix of final molasses**

| | 1971/72 | 1972/73 | 1973/74 | 1974/75 | 1975/76 | 1976/77 |
|---|---|---|---|---|---|---|
| Ind. Ave. . | 88,16 | 87,16 | 86,19 | 85,60 | 84,14 | 83,23 |

The lower brix molasses, which has created problems for the molasses trade, is due to the relatively large amount of water which must be added to continuous centrifugals if they are to be operated at maximum capacity. Extreme final molasses brix values* are reported by DL (87,19) and ME (79,78), two mills with above average molasses purities. It seems that molasses brix is a function of available centrifugal capacity rather than good work.

At the request of the Factory Control Advisory Committee the factory balances in Tables $B_1$ and $B_2$ only list the pol balance. Sucrose lost in final molasses % pol in cane is however still reported in Tables $C_1$ and $C_2$.

## Overall factory performance

The Factory Performance Index (FPI) of all South African mills is listed in Table 7. FPI is still the best measure of the relative performance of factories. It must be stressed however that it is not an absolute value and should not be used for comparing performance from one season to the next.

**TABLE 7**
**Factory performance index (1976-1977)**
**(Decreasing order)**

| | | | |
|---|---|---|---|
| JB | 104,66 | GH | 99,41 |
| ME | 102,87 | AK | 99,40 |
| MV | 102,38 | UC | 98,55 |
| TS | 101,26 | PG | 98,51 |
| DL | 101,06 | IL | 98,33 |
| EM | 100,56 | GD | 97,53 |
| UF | 99,97 | ML | 97,08 |
| FX | 99,86 | UK | 96,89 |
| SZ | 99,85 | EN | 96,31 |

JB (104,66) has now taken first position from MV (102,38) which has dropped down to third place. ME (102,87) has maintained No. 2 position which it held in 1975/76. TS (101,26) has moved ahead of DL (101,06) and EM (100,56) is a newcomer among the above average factories. What is perhaps significant is that the number of above average factories has dropped from 9 to 6 and the first factory was 4,66 points above average, a record figure. This indicates that the improvement in overall factory work was due to the very good performance of a few factories rather than to a general improvement of the industry as a whole.

## Boilers and fuels

A number of new boilers have been commissioned during the past season (GH, IL, UK) and the now familiar complaints of late commissioning, start up problems etc., have become the rule rather than the exception.

Sand in bagasse has now become the major problem in boiler operation and maintenance both by its direct effects (erosion of tubes, conveyors, etc., production of slag) and by its indirect effect on high moisture content of bagasse and the difficulties of burning properly a fuel high in both ash and moisture. The situation is at its worst in cane diffusion factories where most of the sand in cane is held in the bagasse bed. The progress in bagasse dewatering reported earlier in this report should reduce combustion problems.

Additional fuels used are reported in Table $D_1$ and $D_2$. As usual these figures should be interpreted with caution. A number of mills use part of their bagasse for other purposes than providing fuel for the raw sugar factory. These have been marked with an asterisk in the tables. Others convert an appreciable part of the bagasse into electricity for pumping, domestic uses, etc. (UF, GD, UC) while still others operate back-end refineries (ML, PG, GH, EN, SZ). With the increases in the price of coal, the mills are now fuel conscious and the amount of additional fuel used will no doubt decrease. The cost of storing and reclaiming bagasse for start ups and holding steam during stops has led to the anomalous situation that factories such as UF, IL, DL and UK, which have bagasse surpluses, are still burning additional fuel.

Two definite contributors to better fuel economy have been the use of 3rd effect vapour for juice heating and evaporation to a higher syrup brix. Average syrup brix has increased from 64,51 to 65,52 and GH with a syrup brix of 70,81 shows that there is still room for improvement. The amount of steam used in pans could also be brought down by a reduction in the volume of massecuite per ton of cane as discussed earlier in the report. A reduction of 24% in the total volume of massecuite boiled as reported by MV would be equivalent to an overall saving in steam demand of about 4%, assuming a demand of 18% steam on cane for boiling massecuite in the pans.

The calorific value of bagasse listed in Tables $C_1$, $C_2$ and E have been calculated using the following formula:

LCV = 17795 — 42 pol % bagasse — 201 moisture % bagasse.

Recent research has shown that because of the high degree of contamination of bagasse by soil in some mills, a formula including ash as an independent variable is more accurate. The recommended formula is:

LCV = 18309 — 31,14 brix % bagasse — 207,63 moisture % bagasse — 196,05 ash % bagasse.

It has not been possible to use the new formula because ash % bagasse was not determined on a routine basis during the season.

## Acknowledgements

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## REFERENCES

1. Perk, C. G. M. (1962) Thirty-seventh Annual Summary of Laboratory Reports of Sugar Factories in Southern Africa. Season 1961-1962. SASTA Proc 1962 p.7.
2. Anon. (1955) System of Cane Sugar Factory Control, ISSCT.

* Molasses brix (87,90) reported by TS is not comparable with that of other mills, because the molasses is deaerated before weighing and sampling.

# TABLE A

## SOUTH AFRICAN SUGAR ASSOCIATION FINAL SUGAR PRODUCTION 1976/77 SEASON

(Metric tons)

| Mill | Local Market | | | Export Market | | | Total |
|---|---|---|---|---|---|---|---|
| | White | Refinery Raws | Brown | Very High Pol | Sugar for HT Molasses Production | Raws for Refined Export | |
| Malelane | 123 539 | — | 1 990 | — | — | — | 125 529 |
| Pongola | 59 952 | — | 31 937 | — | — | — | 91 889 |
| Umfolozi | — | 23 | 12 967 | 119 264 | — | — | 132 254 |
| Empangeni | — | 108 049 | 240 | 13 533 | 6 250 | 3 604 | 131 696 |
| Felixton | — | 57 131 | 140 | 47 026 | — | — | 104 297 |
| Entumeni | 13 858 | 1 130 | 2 127 | 10 253 | — | — | 27 368 |
| Amatikulu | — | 58 566 | 234 | 159 234 | — | — | 218 034 |
| Glendale | — | 28 320 | 39 | 28 | — | — | 28 387 |
| Darnall | — | 117 881 | 247 | 46 981 | — | — | 165 109 |
| Gledhow | 152 255 | 8 594 | — | 2 353 | — | — | 163 202 |
| Melville | — | 17 838 | 58 | 28 475 | — | — | 46 371 |
| Jaagbaan | — | 9 731 | — | 99 884 | — | — | 109 615 |
| Union Co-op | — | 41 537 | 122 | 4 421 | — | — | 46 080 |
| Tongaat | — | 61 196 | 450 | 130 592 | — | — | 192 238 |
| Mount Edgecombe | — | 24 695 | 92 313 | 5 566 | — | — | 122 574 |
| Illovo | — | 6 828 | 25 406 | 38 856 | — | — | 71 090 |
| Sezela | 79 135 | 5 222 | 66 | 102 373 | — | — | 186 796 |
| Umzimkulu | — | 4 329 | 11 045 | 63 617 | — | — | 78 991 |
| Total | 428 739 | 551 070 | 179 381 | 872 476 | 6 250 | 3 604 | 2 041 520 |

## TABLE B[1]

## CANE CRUSHED AND SUGAR MADE, CANE COMPOSITION, SOUTH AFRICAN MILLS

| SYMBOLS OF FACTORIES | ML | PG | UF A | UF B | EM | FX A | FX B | EN | AK |
|---|---|---|---|---|---|---|---|---|---|
| **Tons sugar made*** | 125 529 | 91 889 | 132 254 | | 131 696 | 104 299 | | 27 368 | 218 034 |
| Percentage of white sugar made | 98 | 65 | — | | — | — | | 51 | — |
| Average pol of all sugars | 99,59 | 99,43 | 99,24 | | 99,33 | 99,24 | | 99,69 | 99,35 |
| Tons crystal made in raw house | 126 792 | 91 491 | 130 719 | | 130 151 | 103 197 | | 27 337 | 215 391 |
| **Tons of cane crushed — Total** | 1 239 105 | 851 396 | 1 187 695 | | 1 253 997 | 996 838 | | 248 174 | 2 030 437 |
| **Tons of cane crushed — Per tandem** | | | 352 045 | 835 650 | | 641 588 | 355 250 | | |
| Season started on | 6.5.76 | 23.4.76 | 18.5.76 | | 22.4.76 | 29.4.76 | | 20.4.76 | 22.4.76 |
| Season completed on | 12.3.77 | 29.1.77 | 8.2.77 | | 13.2.77 | 21.2.77 | | 18.12.76 | 18.2.77 |
| Number of crushing days | 311 | 288 | 267 | | 293 | 299 | | 243 | 302 |
| **Time account** | | | | | | | | | |
| Hours crushing % available hours | 61,49 | 65,34 | 66,22 | 76,56 | 80,30 | 80,59 | 75,47 | 79,00 | 76,73 |
| Hours scheduled stops % available hours | 7,59 | 13,52 | 3,20 | 4,03 | 10,29 | 9,72 | 10,27 | 10,95 | 9,97 |
| Hours lack of cane % available hours | 10,01 | 4,14 | 3,92 | 1,29 | 1,69 | 2,54 | 3,02 | 2,50 | 1,89 |
| Hours other stops % available hours | 20,91 | 17,00 | 26,66 | 18,11 | 7,72 | 7,15 | 11,23 | 7,55 | 11,41 |
| **Throughputs per hour actual crushing** | | | | | | | | | |
| Tons of cane crushed | 270,47 | 193,55 | 83,44 | 170,56 | 219,19 | 111,26 | 69,01 | 54,01 | 366,34 |
| Tons of fibre milled | 43,29 | 28,09 | 11,48 | 22,24 | 36,81 | 17,52 | 11,24 | 7,22 | 53,80 |
| Tons of brix processed | 39,96 | 28,28 | 36,44 | | 30,68 | 24,83 | | 7,94 | 52,65 |
| Tons of sugar produced | 27,40 | 20,89 | 28,28 | | 23,01 | 18,88 | | 5,96 | 39,33 |
| **Composition of cane crushed** | | | | | | | | | |
| Pol % cane | 12,72 | 12,83 | 13,01 | 12,79 | 12,32 | 12,28 | 12,35 | 13,16 | 12,62 |
| Fibre % cane | 16,30 | 14,98 | 14,74 | 13,96 | 17,43 | 17,29 | 17,19 | 14,01 | 15,14 |
| Brix % cane | 15,97 | 15,62 | 15,86 | 15,39 | 15,09 | 14,79 | 15,18 | 15,55 | 15,45 |
| Tons cane per ton sugar | 9,87 | 9,27 | 8,98 | | 9,53 | 9,55 | | 9,07 | 9,31 |
| Tons cane per ton 96° sugar | 9,52 | 8,95 | 8,69 | | 9,21 | 9,24 | | 8,73 | 9,00 |
| ERC % pol in cane | 82,81 | 84,95 | 84,98 | 85,86 | 83,71 | 84,62 | 83,57 | 86,90 | 84,52 |
| ERC % cane | 10,53 | 10,90 | 11,06 | 10,98 | 10,32 | 10,39 | 10,32 | 11,43 | 10,67 |
| **Performance** | | | | | | | | | |
| Imbibition % cane | 42,44 | 48,66 | 42,02 | 29,65 | 41,07 | 42,82 | 47,14 | 39,88 | 46,23 |
| Imbibition % fibre | 265 | 335 | 305 | 227 | 245 | 272 | 289 | 299 | 315 |
| Java ratio | — | 80,88 | 77,29 | 77,11 | 76,82 | 75,72 | 75,96 | 81,01 | — |
| Extraction | 94,21 | 94,87 | 93,95 | 95,17 | 95,90 | 94,92 | 95,06 | 96,31 | 95,62 |
| Corrected reduced extraction | 94,52 | 94,53 | 93,12 | 94,21 | 96,42 | 95,27 | 95,54 | 95,61 | 95,43 |
| Preparation index | 90 | 89 | 82 | | 85 | 86 | | 92 | 94 |
| Fibre factor | 100,22 | 100,16 | 100,00 | 100,00 | 100,72 | 100,64 | 100,65 | 100,43 | 100,44 |
| Pol factor | 100,04 | 99,84 | 98,70 | 99,22 | 99,94 | 99,32 | 98,78 | 99,61 | 98,90 |
| Brix factor | 102,4 | 100,8 | 100,8 | | 101,0 | 100,3 | 102,0 | 100,6 | 100,9 |
| Pol % fibre in bagasse | 4,60 | 4,54 | 5,04 | | 3,01 | 3,88 | | 3,63 | 3,77 |
| Boiling house recovery | 84,15 | 88,14 | 90,68 | | 88,23 | 88,96 | | 86,76 | 88,41 |
| Overall recovery | 79,32 | 83,61 | 85,96 | | 84,61 | 84,49 | | 83,56 | 84,54 |
| Factory performance index | 96,71 | 98,55 | 100,01 | | 100,63 | 99,83 | | 96,36 | 99,52 |
| **Pol balance** | | | | | | | | | |
| Lost in bagasse (*a*) | 5,79 | 5,13 | 5,20 | | 4,10 | 5,03 | | 3,69 | 4,38 |
| Lost in filter cake (*b*) | 0,37 | 0,11 | 0,60 | | 0,41 | 0,74 | | 1,21 | 0,33 |
| Lost in final molasses (*c*) | 11,12 | 9,52 | 8,12 | | 9,80 | 8,12 | | 9,80 | 8,95 |
| Undetermined losses (*d*) | 2,95 | 1,62 | 0,12 | | 1,08 | 1,62 | | 1,74 | 1,90 |
| Boiling house losses ($b+c+d$) | 14,44 | 11,25 | 8,84 | | 11,29 | 10,48 | | 12,75 | 11,18 |
| Sum of all losses ($a+b+c+d$) | 20,23 | 16,38 | 14,04 | | 15,39 | 15,51 | | 16,44 | 15,56 |

* Figures supplied by S.A. Sugar Association

## THROUGHPUTS AND TIME ACCOUNTS, PERFORMANCE AND LOSSES (Season 1976 - 1977)

| GD | DL | GH | MV | JB | UC | TS A | TS B | ME | IL | SZ A | SZ B | UK | Totals and Averages |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 387 | 165 109 | 163 202 | 46 371 | 109 615 | 46 080 | 192 238 | | 122 574 | 71 090 | 186 796 | | 78 991 | 2 041 520 |
| — | — | 93 | — | — | — | — | | — | — | 42 | | — | 21 |
| 99,38 | 99,42 | 99,92 | 99,36 | 99,41 | 99,46 | 99,46 | | 98,74 | 99,25 | 99,67 | | 99,37 | 99,42 |
| 28 074 | 164 460 | 164 315 | 45 918 | 108 421 | 45 681 | 190 591 | | 120 290 | 70 264 | 186 400 | | 78 173 | 2 027 666 |
| 253 823 | 1 469 217 | 1 564 246 | 426 775 | 1 061 415 | 483 214 | 1 823 113 | | 1 133 232 | 660 163 | 1 803 426 | | 734 334 | 19 220 600 |
| — | — | — | — | — | — | 624 497 | 1 198 616 | — | — | 1 278 135 | 525 291 | — | — |
| 6.5.76 | 27.4.76 | 12.4.76 | 22.4.76 | 1.4.76 | 3.5.76 | 14.4.76 | | 21.4.76 | 17.5.76 | 26.4.76 | | 19.7.76 | 1.4.76 |
| 7.2.77 | 11.2.77 | 3.2.77 | 30.1.77 | 9.12.76 | 23.2.77 | 10.2.77 | | 30.1.77 | 30.1.77 | 20.2.77 | | 27.2.77 | 12.3.77 |
| 278 | 291 | 292 | 284 | 253 | 297 | 303 | | 252 | 258 | 301 | | 224 | 254 |
| 79,72 | 80,20 | 81,95 | 78,40 | 77,91 | 66,21 | 76,70 | 83,81 | 79,86 | 73,71 | 75,50 | 73,99 | 67,94 | 75,22 |
| 9,75 | 9,18 | 12,81 | 10,15 | 7,90 | 9,80 | 3,04 | 4,76 | 10,72 | 9,55 | 11,72 | 12,52 | 12,93 | 9,67 |
| 1,21 | 3,85 | 0,91 | 5,30 | 8,24 | 5,38 | 8,22 | 1,32 | 5,62 | 6,09 | 3,96 | 2,90 | 4,45 | 4,16 |
| 9,32 | 6,77 | 4,33 | 6,15 | 5,95 | 18,61 | 12,04 | 10,11 | 3,80 | 10,65 | 8,82 | 10,59 | 14,68 | 10,96 |
| 49,61 | 262,20 | 266,64 | 80,22 | 224,74 | 105,12 | 111,94 | 196,61 | 210,67 | 144,45 | 234,02 | 105,94 | 200,91 | 211,84 |
| 6,56 | 39,89 | 40,94 | 12,19 | 31,08 | 13,83 | 16,65 | 29,56 | 30,45 | 19,37 | 34,91 | 15,91 | 29,18 | 31,46 |
| 7,15 | 37,73 | 36,42 | 11,09 | 30,94 | 14,22 | 41,58 | | 29,72 | 20,37 | 46,95 | | 28,16 | 29,78 |
| 5,54 | 29,46 | 27,82 | 8,72 | 23,19 | 10,02 | 32,53 | | 22,79 | 15,56 | 35,22 | | 21,61 | 22,51 |
| 13,16 | 12,85 | 12,37 | 12,35 | 11,70 | 11,57 | 12,03 | 12,09 | 12,22 | 12,61 | 12,06 | 12,55 | 12,79 | 12,43 |
| 13,65 | 15,77 | 16,09 | 15,70 | 14,87 | 13,96 | 15,63 | 15,64 | 15,12 | 14,08 | 15,55 | 15,57 | 15,22 | 15,52 |
| 15,82 | 15,24 | 14,81 | 14,91 | 14,55 | 14,57 | 14,44 | 14,41 | 14,96 | 15,14 | 14,63 | 15,20 | 15,28 | 15,10 |
| 8,95 | 8,90 | 9,58 | 9,20 | 9,68 | 10,49 | 9,48 | | 9,24 | 9,28 | 9,65 | | 9,30 | 9,41 |
| 8,64 | 8,59 | 9,21 | 8,89 | 9,36 | 10,12 | 9,15 | | 8,99 | 8,98 | 9,30 | | 8,98 | 9,09 |
| 86,12 | 86,14 | 85,38 | 85,03 | 83,39 | 82,90 | 85,24 | 85,63 | 84,38 | 85,84 | 84,69 | 84,99 | 85,87 | 84,80 |
| 11,34 | 11,07 | 10,56 | 10,50 | 9,76 | 9,59 | 10,25 | 10,35 | 10,31 | 10,82 | 10,22 | 10,67 | 10,98 | 10,55 |
| 37,32 | 39,76 | 38,55 | 43,53 | 42,63 | 34,29 | 40,79 | 36,68 | 38,18 | 34,80 | 48,68 | 57,90 | 42,50 | 41,73 |
| 282 | 261 | 251 | 286 | 308 | 261 | 274 | 244 | 264 | 260 | 326 | 385 | 293 | 281 |
| 80,33 | 78,49 | 78,00 | 76,31 | 79,99 | — | 77,33 | 77,15 | 78,36 | 80,31 | — | — | 78,71 | 78,15 |
| 94,04 | 96,29 | 94,94 | 95,61 | 96,81 | 95,94 | 94,39 | 96,04 | 96,50 | 95,53 | 95,19 | 96,97 | 94,38 | 95,48 |
| 92,81 | 96,26 | 95,07 | 95,67 | 96,61 | 95,46 | 94,43 | 96,10 | 96,37 | 94,84 | 95,23 | 96,94 | 94,04 | 95,40 |
| 88 | 91 | 81 | 84 | 89 | 90 | 91 | | 90 | 90 | 90 | | 90 | 89 |
| 100,12 | 100,14 | 102,59 | 100,22 | 103,87 | 100,11 | 102,11 | 100,30 | 103,03 | 100,72 | 99,93 | 100,00 | 100,32 | 100,88 |
| 99,99 | 99,07 | 98,93 | 99,19 | 99,40 | 93,43 | 97,90 | 99,19 | 99,66 | 99,13 | 99,03 | 100,45 | 99,68 | 99,16 |
| 101,1 | 99,6 | 100,0 | 100,0 | 100,5 | 97,7 | 99,2 | 99,6 | 100,6 | 100,0 | 99,4 | 101,2 | 100,5 | 100,4 |
| 5,93 | 3,13 | 4,08 | 3,57 | 2,70 | 3,57 | 3,64 | | 2,96 | 4,20 | 3,49 | | 4,95 | 3,79 |
| 89,73 | 90,29 | 88,78 | 91,42 | 90,65 | 85,46 | 91,00 | | 90,57 | 88,78 | 88,37 | | 88,54 | 88,99 |
| 84,38 | 86,95 | 84,28 | 87,41 | 87,75 | 81,99 | 86,89 | | 87,40 | 84,81 | 84,59 | | 83,56 | 84,97 |
| 97,62 | 100,88 | 99,39 | 102,41 | 104,77 | 98,60 | 101,30 | | 102,90 | 98,34 | 99,88 | | 96,94 | 100,00 |
| 5,96 | 3,71 | 5,06 | 4,39 | 3,19 | 4,06 | 4,52 | | 3,50 | 4,47 | 4,27 | | 5,62 | 4,52 |
| 0,41 | 0,39 | 0,49 | 0,37 | 0,69 | 0,32 | 0,55 | | 0,43 | 0,59 | 0,54 | | 0,48 | 0,48 |
| 8,12 | 7,65 | 8,00 | 7,33 | 7,26 | 11,22 | 7,30 | | 7,21 | 8,19 | 8,39 | | 7,90 | 8,45 |
| 1,13 | 1,08 | 2,11 | 0,50 | 1,17 | 2,41 | 0,74 | | 1,46 | 1,94 | 2,22 | | 2,43 | 1,58 |
| 9,66 | 9,12 | 10,60 | 8,20 | 9,12 | 13,95 | 8,95 | | 9,10 | 10,72 | 11,15 | | 10,81 | 10,51 |
| 15,62 | 12,83 | 15,66 | 12,59 | 12,31 | 18,01 | 13,11 | | 12,60 | 15,19 | 15,42 | | 16,43 | 15,03 |

# TABLE C[1]

## ANALYSIS OF BAGASSE, JUICES, FILTER SOUTH AFRICAN MILLS

| SYMBOLS OF FACTORIES | ML | PG | UF A | UF B | EM | FX A | FX B | EN | AK |
|---|---|---|---|---|---|---|---|---|---|
| **Final bagasse** | | | | | | | | | |
| Pol % bagasse | 1,97 | 2,06 | 2,35 | 2,02 | 1,36 | 1,75 | 1,64 | 1,53 | 1,66 |
| Moisture % bagasse | 53,91 | 51,58 | 54,76 | 53,80 | 51,90 | 52,63 | 53,00 | 55,10 | 52,71 |
| Fibre % bagasse | 42,88 | 45,27 | 41,09 | 42,61 | 45,15 | 44,08 | 43,88 | 42,22 | 44,05 |
| Bagasse % cane | 37,32 | 32,06 | 33,48 | 30,60 | 37,20 | 35,72 | 37,12 | 31,65 | 33,34 |
| LCV in kJ per kg bagasse | 6 875 | 7 340 | 6 690 | 6 897 | 7 305 | 7 143 | 7 072 | 6 654 | 7 131 |
| **First expressed juice** | | | | | | | | | |
| Brix | — | 18,59 | 19,43 | 19,05 | 18,32 | 18,56 | 18,82 | 18,34 | — |
| Apparent purity | — | 85,35 | 86,65 | 87,06 | 87,57 | 87,36 | 86,37 | 88,54 | — |
| **Residual juice** | | | | | | | | | |
| Apparent purity | 61,51 | 65,41 | 56,57 | 55,49 | 53,19 | 53,11 | 52,76 | 57,32 | 51,24 |
| Purity drop | — | 19,94 | 30,08 | 31,57 | 34,38 | 34,25 | 33,61 | 31,22 | — |
| **Mixed juice** | | | | | | | | | |
| Mixed juice % cane | 105,11 | 116,61 | 108,54 | 99,05 | 103,87 | 107,11 | 110,03 | 108,24 | 112,89 |
| Brix | 14,06 | 12,53 | 13,33 | 14,42 | 13,48 | 12,71 | 12,75 | 13,59 | 12,73 |
| Apparent purity | 81,13 | 83,32 | 84,47 | 85,20 | 84,43 | 85,57 | 83,68 | 86,17 | 83,97 |
| Purity drop | — | 2,03 | 2,18 | 1,86 | 3,14 | 1,79 | 2,69 | 2,37 | — |
| Reducing sugars/pol ratio | 8,38 | 6,32 | 4,04 | | 4,12 | 4,54 | | 3,96 | 5,28 |
| Suspended solids % mixed juice | 0,29 | 0,40 | 0,91 | 0,93 | 0,61 | 1,45 | 0,82 | 0,60 | 0,40 |
| **Clarified juice** | | | | | | | | | |
| Brix | 13,78 | 11,88 | 14,01 | | 13,21 | 11,82 | | 13,86 | 12,27 |
| Apparent purity | 81,35 | 82,49 | 85,76 | | 84,31 | 84,58 | | 86,19 | 84,47 |
| Reducing sugars/pol ratio | 8,16 | 6,61 | 4,24 | | 4,24 | 4,27 | | 3,88 | 4,96 |
| Average pH | 7,10 | 7,32 | 6,90 | | 6,97 | 6,80 | | 7,34 | 7,01 |
| **Filter cake** | | | | | | | | | |
| Pol % filter cake | 1,94 | 0,53 | 1,55 | | 1,17 | 1,46 | | 3,94 | 1,40 |
| Filter cake % cane | 2,43 | 2,61 | 5,00 | | 4,35 | 6,29 | | 4,04 | 2,99 |
| **Syrup** | | | | | | | | | |
| Brix | 62,56 | 69,72 | 65,83 | | 65,82 | 65,45 | | 61,29 | 64,57 |
| Apparent purity | 80,95 | 82,90 | 86,39 | | 84,43 | 85,86 | | 86,62 | 84,77 |
| Reducing sugars/pol ratio | 9,42 | 5,04 | 4,36 | | 4,33 | 3,12 | | 4,72 | 4,82 |
| Average pH | 6,13 | 6,36 | 6,20 | | 6,17 | 6,20 | | 6,89 | 6,41 |
| **Final molasses** | | | | | | | | | |
| Refracto brix | 83,04 | 83,49 | 81,95 | | 84,80 | 78,86 | | 83,89 | 82,94 |
| Pol/refracto brix purity | 34,33 | 33,63 | 36,82 | | 37,43 | 35,20 | | 40,23 | 35,02 |
| Sucrose/refracto brix purity | 39,33 | 39,63 | 39,22 | | 38,92 | 38,73 | | 40,46 | 39,10 |
| Percentage reducing sugars | 24,64 | 18,42 | 16,17 | | 16,49 | 16,69 | | 13,30 | 17,46 |
| Percentage sulphated ash | 11,13 | 13,71 | 14,78 | | 14,68 | 13,43 | | 11,16 | 12,89 |
| Reducing sugars/ash ratio | 2,21 | 1,34 | 1,09 | | 1,12 | 1,24 | | 1,19 | 1,35 |
| Molasses at 85 refracto brix % cane | 4,85 | 4,27 | 3,34 | | 3,80 | 3,34 | | 3,77 | 3,80 |
| Sucrose lost in molasses % pol in cane | 12,73 | 11,22 | 8,65 | | 10,20 | 8,94 | | 9,86 | 9,99 |

## CAKE, SYRUP AND FINAL MOLASSES
## (Season 1976 - 1977)

| GD | DL | GH | MV | JB | UC | TS | | ME | IL | SZ | | UK | Averages |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | | | A | B | | |
| 2,60 | 1,38 | 1,80 | 1,64 | 1,24 | 1,47 | 1,87 | 1,35 | 1,35 | 1,80 | 1,68 | 1,10 | 2,10 | 1,66 |
| 51,52 | 53,44 | 52,67 | 50,84 | 51,54 | 55,43 | 55,54 | 55,39 | 51,44 | 53,82 | 53,68 | 54,48 | 53,82 | 53,20 |
| 43,85 | 44,08 | 44,03 | 45,86 | 45,88 | 41,31 | 41,25 | 42,30 | 45,85 | 42,85 | 43,12 | 43,35 | 42,48 | 43,78 |
| 30,16 | 34,51 | 34,87 | 33,13 | 30,14 | 31,85 | 36,07 | 35,54 | 31,53 | 31,30 | 34,60 | 34,64 | 34,19 | 33,96 |
| 7 329 | 6 995 | 7 133 | 7 507 | 7 384 | 6 591 | 6 552 | 6 606 | 7 398 | 6 901 | 6 935 | 6 798 | 6 890 | 7 032 |
| 18,79 | 18,57 | 18,02 | 18,43 | 17,35 | — | 17,75 | 17,89 | 18,05 | 17,96 | — | — | 18,40 | 18,26 |
| 87,22 | 88,17 | 88,05 | 87,85 | 84,29 | — | 87,64 | 87,62 | 86,43 | 87,38 | — | — | 88,32 | 87,17 |
| 56,22 | 55,76 | 54,40 | 49,55 | 48,03 | 45,96 | 58,30 | 58,30 | 49,93 | 54,06 | 52,50 | 50,93 | 56,60 | 54,99 |
| 31,00 | 32,41 | 33,65 | 38,30 | 36,26 | — | 29,34 | 29,32 | 36,50 | 33,32 | — | — | 31,72 | 32,18 |
| 107,16 | 105,25 | 103,68 | 110,39 | 112,49 | 102,44 | 104,72 | 101,73 | 106,65 | 103,51 | 114,08 | 123,25 | 108,31 | 107,73 |
| 13,46 | 13,67 | 13,17 | 12,52 | 12,24 | 13,21 | 12,68 | 13,44 | 13,23 | 13,62 | 11,85 | 11,72 | 12,94 | 13,05 |
| 85,83 | 86,01 | 86,00 | 85,48 | 82,25 | 82,00 | 85,50 | 85,45 | 83,61 | 85,39 | 84,90 | 84,27 | 86,13 | 84,47 |
| 1,39 | 2,16 | 2,05 | 2,37 | 2,04 | — | 2,14 | 2,17 | 2,82 | 1,99 | — | — | 2,19 | 2,70 |
| 5,08 | 5,17 | 4,68 | 4,77 | 8,09 | 6,04 | 5,64 | | 6,75 | 7,35 | 5,09 | | 5,01 | 5,58 |
| 0,40 | 0,53 | 0,71 | 0,46 | 0,92 | 0,78 | 0,72 | 0,60 | 0,62 | 0,65 | 0,56 | 0,45 | 0,65 | 0,62 |
| 13,16 | 12,42 | 12,85 | 11,86 | 12,00 | 13,49 | 12,33 | | 12,33 | 13,39 | 11,40 | | 12,49 | 12,70 |
| 86,21 | 86,33 | 85,98 | 85,92 | 82,48 | 82,51 | 85,14 | | 83,93 | 85,39 | 85,02 | | 87,03 | 84,73 |
| 5,22 | 5,00 | 4,68 | 4,71 | 7,37 | 5,80 | 5,15 | | 6,70 | 6,77 | 5,04 | | 4,31 | 5,41 |
| 7,05 | 6,90 | 7,13 | 7,10 | 7,10 | 7,40 | 7,28 | | 7,10 | 7,14 | 7,10 | | 7,05 | 7,10 |
| 1,09 | 1,09 | 1,17 | 1,06 | 1,73 | 3,88 | 1,34 | | 1,16 | 1,66 | 1,56 | | 1,11 | 1,39 |
| 5,00 | 4,58 | 5,12 | 4,29 | 4,66 | 0,96 | 5,00 | | 4,52 | 4,48 | 4,21 | | 5,52 | 4,27 |
| 64,45 | 65,87 | 70,81 | 64,11 | 62,05 | 62,47 | 67,74 | | 65,80 | 65,89 | 66,91 | | 67,37 | 65,52 |
| 86,65 | 86,48 | 85,92 | 86,29 | 83,03 | 82,82 | 85,46 | | 84,80 | 85,19 | 85,62 | | 87,06 | 85,02 |
| 4,76 | 4,74 | 4,66 | 5,14 | 6,16 | 5,77 | 4,97 | | 6,49 | 6,52 | 4,86 | | 3,92 | 5,23 |
| 6,55 | 6,30 | 6,44 | 6,47 | 6,30 | 7,20 | 6,14 | | 6,00 | 6,27 | 6,40 | | 6,20 | 6,35 |
| 81,96 | 87,19 | 82,01 | 82,47 | 81,68 | 81,07 | 87,90 | | 79,78 | 81,18 | 83,74 | | 83,25 | 83,23 |
| 35,65 | 32,18 | 35,47 | 32,99 | 27,20 | 38,38 | 32,97 | | 30,68 | 35,21 | 35,50 | | 37,85 | 34,36 |
| 37,20 | 37,14 | 39,23 | 36,81 | 34,28 | 39,62 | 35,59 | | 36,44 | 39,94 | 38,82 | | 38,93 | 38,23 |
| 16,77 | 17,19 | 18,97 | 17,02 | 19,03 | 15,05 | 20,66 | | 19,91 | 18,02 | 15,96 | | 14,62 | 18,18 |
| 15,32 | 14,56 | 13,78 | 14,67 | 13,01 | 11,78 | 15,06 | | 13,52 | 12,99 | 13,80 | | 13,16 | 13,52 |
| 1,09 | 1,18 | 1,38 | 1,16 | 1,46 | 1,28 | 1,37 | | 1,47 | 1,39 | 1,16 | | 1,11 | 1,34 |
| 3,53 | 3,61 | 3,28 | 3,23 | 3,67 | 3,98 | 3,14 | | 3,38 | 3,45 | 3,41 | | 3,17 | 3,60 |
| 8,47 | 8,87 | 8,83 | 8,17 | 9,15 | 11,58 | 7,88 | | 8,57 | 9,29 | 9,21 | | 8,21 | 9,41 |

# TABLE D[1]

## MASSECUITES, EXHAUSTIONS, CLARIFYING AGENTS AND ADDITIONAL FUELS SOUTH AFRICAN MILLS (Season 1976 - 1977)

| SYMBOLS OF FACTORIES | ML | PG | UF | EM | FX | EN | AK | GD | DL | GH | MV | JB | UC | TS | ME | IL | SZ | UK | Averages |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Brix in mixed juice % cane** | 14,06 | 14,61 | 14,38 | 14,14 | 13,77 | 14,71 | 14,37 | 14,43 | 14,39 | 13,65 | 13,81 | 13,77 | 13,55 | 13,44 | 14,11 | 14,10 | 13,79 | 14,02 | 14,06 |
| **A-massecuite** | | | | | | | | | | | | | | | | | | | |
| m³ per ton brix in mixed juice | 1,43 | 1,10 | 0,98 | 1,05 | 0,98 | 1,32 | 0,99 | 1,04 | 0,98 | 1,02 | 0,89 | 1,13 | 1,01 | 1,09 | 1,01 | 1,15 | 1,08 | 0,95 | 1,06 |
| Brix of massecuite | 92,51 | 92,90 | 92,55 | 92,49 | 92,27 | 91,11 | 91,78 | 91,55 | 92,87 | 91,76 | 92,53 | 91,99 | 92,52 | 93,07 | 92,81 | 93,15 | 91,83 | 92,30 | 92,33 |
| Purity of massecuite | 82,03 | 85,65 | 87,48 | 85,10 | 86,00 | 86,62 | 86,66 | 87,67 | 86,61 | 89,62 | 86,72 | 83,06 | 83,89 | 85,12 | 84,77 | 86,38 | 87,01 | 86,43 | 85,93 |
| Purity of A-molasses | 68,58 | 69,44 | 71,14 | 71,97 | 69,70 | 74,54 | 67,47 | 72,62 | 69,52 | 71,82 | 64,95 | 67,10 | 68,16 | 69,19 | 68,83 | 70,31 | 70,76 | 70,36 | 69,80 |
| Purity drop | 13,45 | 16,21 | 16,34 | 13,13 | 16,30 | 12,08 | 19,19 | 15,05 | 17,09 | 17,80 | 21,77 | 15,96 | 15,73 | 15,93 | 15,94 | 16,07 | 16,25 | 16,07 | 16,13 |
| Exhaustion* | 52,18 | 61,93 | 64,72 | 55,04 | 62,55 | 54,78 | 68,07 | 62,70 | 64,74 | 70,48 | 71,62 | 58,40 | 59,24 | 60,74 | 60,32 | 62,67 | 63,87 | 62,73 | 62,16 |
| **Purity A-massecuite–purity syrup** | 1,08 | 2,75 | 1,09 | 0,67 | 0,04 | 0,00 | 1,89 | 1,02 | 0,13 | 3,70 | 0,43 | 0,03 | 1,07 | —0,34 | —0,03 | 1,19 | 1,39 | —0,63 | 0,91 |
| **B-massecuite** | | | | | | | | | | | | | | | | | | | |
| m³ per ton brix in mixed juice | 0,57 | 0,39 | 0,39 | 0,44 | 0,41 | 0,59 | 0,35 | 0,47 | 0,35 | 0,35 | 0,24 | 0,43 | 0,46 | 0,38 | 0,39 | 0,44 | 0,41 | 0,33 | 0,40 |
| Brix of massecuite | 94,94 | 94,31 | 93,87 | 93,90 | 94,35 | 95,96 | 94,94 | 93,49 | 94,26 | 93,85 | 94,28 | 93,78 | 93,36 | 93,58 | 93,94 | 93,23 | 93,36 | 93,61 | 94,03 |
| Purity of massecuite | 69,56 | 70,76 | 70,90 | 71,41 | 70,60 | 75,02 | 69,04 | 71,92 | 69,39 | 72,44 | 64,80 | 66,78 | 67,55 | 69,41 | 68,83 | 70,47 | 71,06 | 71,15 | 70,06 |
| Purity of B-molasses | 44,93 | 46,81 | 48,58 | 51,11 | 49,40 | 52,83 | 44,35 | 50,77 | 45,83 | 48,07 | 41,67 | 40,85 | 47,53 | 46,89 | 46,12 | 47,85 | 48,32 | 47,14 | 47,17 |
| Purity drop | 24,63 | 23,65 | 22,32 | 20,30 | 21,20 | 22,19 | 24,69 | 21,15 | 23,56 | 24,37 | 23,13 | 25,93 | 20,02 | 22,52 | 22,71 | 22,62 | 22,74 | 24,01 | 22,89 |
| Exhaustion* | 64,30 | 62,84 | 61,22 | 58,15 | 59,34 | 62,71 | 64,26 | 59,73 | 62,68 | 64,78 | 61,19 | 65,64 | 56,48 | 61,09 | 61,24 | 61,55 | 61,92 | 63,84 | 61,84 |
| **C-massecuite** | | | | | | | | | | | | | | | | | | | |
| m³ per ton brix in mixed juice | 0,43 | 0,29 | 0,22 | 0,26 | 0,25 | 0,23 | 0,26 | 0,21 | 0,22 | 0,24 | 0,19 | 0,24 | 0,27 | — | 0,28 | 0,31 | 0,29 | 0,25 | 0,27 |
| Brix of massecuite | 96,46 | 96,10 | 95,54 | 97,10 | 97,03 | 96,64 | 97,10 | 95,66 | 97,64 | 95,96 | 96,68 | 96,16 | 94,15 | 96,17 | 96,55 | 95,87 | 96,06 | 96,10 | 96,28 |
| Purity of massecuite | 57,30 | 53,81 | 52,26 | 53,45 | 53,70 | 56,72 | 53,05 | 53,34 | 51,79 | 54,17 | 48,58 | 46,44 | 52,96 | 53,24 | 53,76 | 52,96 | 54,35 | 56,30 | 53,23 |
| Purity of C-molasses | 34,33 | 33,63 | 36,82 | 37,43 | 35,20 | 40,23 | 35,02 | 35,65 | 32,18 | 35,47 | 32,99 | 27,20 | 38,38 | 32,97 | 30,68 | 35,21 | 35,50 | 37,85 | 34,36 |
| Purity drop | 22,97 | 20,18 | 15,44 | 16,02 | 18,50 | 16,49 | 18,03 | 17,69 | 19,61 | 18,70 | 15,59 | 19,24 | 14,58 | 20,27 | 23,08 | 17,75 | 18,85 | 18,45 | 18,87 |
| Crystal content** | 33,04 | 29,22 | 23,35 | 24,86 | 27,70 | 26,77 | 26,94 | 26,30 | 28,23 | 27,81 | 22,49 | 25,41 | 22,27 | 29,08 | 32,14 | 26,26 | 28,07 | 28,53 | 27,68 |
| Exhaustion* | 61,04 | 56,50 | 46,76 | 47,90 | 53,16 | 48,64 | 52,30 | 51,54 | 55,83 | 53,50 | 47,87 | 56,91 | 44,67 | 56,80 | 61,93 | 51,73 | 53,77 | 52,73 | 54,00 |
| **White sugar massecuites** | | | | | | | | | | | | | | | | | | | |
| Kg sugar per m³ | 582 | 589 | — | — | — | 560 | — | — | — | 734 | — | — | — | — | — | — | 583 | — | 629 |
| **Total volume all raw massecuites** | | | | | | | | | | | | | | | | | | | |
| m³ per ton brix in mixed juice | 2,43 | 1,78 | 1,59 | 1,75 | 1,64 | 2,14 | 1,60 | 1,72 | 1,55 | 1,61 | 1,32 | 1,80 | 1,74 | — | 1,68 | 1,90 | 1,78 | 1,53 | 1,73 |
| **Clarifying agents** | | | | | | | | | | | | | | | | | | | |
| Tons limestone per 1 000 TC | — | 3,54 | — | — | — | — | — | — | — | 4,24 | — | — | — | — | — | — | 2,36 | — | — |
| Tons coke per 1 000 TC | — | 0,49 | — | — | — | — | — | — | — | 0,47 | — | — | — | — | — | — | 0,29 | — | — |
| Tons lime per 1 000 TC | 2,06 | 1,18 | 0,53 | 0,77 | 0,66 | 1,04 | 0,69 | 0,59 | 0,76 | 1,25 | 0,51 | 0,59 | 0,92 | 0,46† | 0,65 | 0,57 | 1,78 | 0,46 | 0,85 |
| Tons sulphur per 1 000 TC | 0,028 | 0,005 | — | — | — | — | — | — | — | 0,002 | — | — | — | — | — | — | 0,004 | — | — |
| Phos. acid ppm mixed juice | — | — | — | — | — | 45,73‡ | — | — | — | — | — | 27,89 | 54,08 | — | — | 1,77 | — | — | — |
| Flocculants ppm mixed juice | 3,38 | 2,32 | 4,84 | 1,30 | 3,97 | 4,84 | 1,00 | 1,84 | 1,24 | 2,28 | 0,48 | 7,51 | 10,29 | 0,29 | 2,15 | 8,20 | 1,63 | 0,24 | 3,21 |
| Enzymes kg per 100 tons sug. | — | 0,63 | 4,53 | 2,17 | 3,45 | 2,38 | 0,96 | 15,86 | 1,46 | 1,93 | 3,45 | 2,33 | — | 1,94 | 2,29 | 9,25 | 1,00 | 2,21 | 3,49 |
| **Additional fuels per 1 000 TC** | | | | | | | | | | | | | | | | | | | |
| Tons of fuel oil | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tons of coal | 50,07 | 15,26 | 3,16 | 3,05 | 45,92 | 20,77 | 5,12 | 12,48 | — | 19,77 | 2,45 | — | 17,88 | 5,73 | 0,34 | 2,55 | 8,62 | 0,90 | — |
| Tons of wood | — | — | — | 2,54 | — | 8,94 | 0,25 | 2,27 | 1,72 | 1,17 | 1,37 | 1,63 | 0,43 | — | 0,17 | 1,86 | 0,11 | 1,57 | — |
| Converted into bagasse*** | 200,28§ | 61,04 | 12,64 | 15,25 | 183,69§ | 93,81 | 20,73§ | 52,65 | 2,06 | 80,48 | 11,44§ | 1,96 | 72,04 | 22,92§ | 1,56 | 12,43 | 34,57§ | 5,48 | 55,74 |

$$\text{* Exhaustion} = \frac{10\,000\,(\text{Pty massecuite} - \text{Pty run off})}{\text{Pty massecuite}\,(100 - \text{Pty run off})}$$

$$\text{** Crystal content} = \frac{(\text{Pty massecuite} - \text{Pty run off})}{100 - \text{Pty run off}} \times \text{Bx massecuite}$$

*** 1 m³ fuel oil is equivalent to 5,5 tons of bagasse of 6 978 kJ/kg
1 ton fuel oil is equivalent to 6 tons of bagasse of 6 978 kJ/kg
1 ton coal is equivalent to 4 tons of bagasse of 6 978 kJ/kg
1 ton firewood is equivalent to 1,2 tons of bagasse of 6 978 kJ/kg

† Includes 522 tons carbide sludge
‡ Used for refining
§ Factory exported bagasse

# TABLE B[2]

## CANE CRUSHED AND SUGAR MADE, CANE COMPOSITION, THROUGHPUTS AND TIME ACCOUNTS, PERFORMANCES AND LOSSES
## MOZAMBIQUE, SWAZILAND AND MALAWI MILLS
## (Season 1976 - 1977)

| SYMBOLS OF FACTORIES | LB | BZ | IC | MA | MH | UR | NH A | NH B |
|---|---|---|---|---|---|---|---|---|
| **Tons sugar made** | 48 721 | 25 074 | 35 386 | 23 216 | 113 973 | 94 308 | 84 232 | |
| Percentage of white sugar made | 80 | 45 | 55 | 50 | — | 10 | 30 | |
| Average pol of all sugars made | 99,26 | 98,60 | 99,00 | 98,67 | 98,64 | 98,70 | 97,00 | |
| Tons crystal made in raw house | 48 430 | 24 601 | 34 964 | 22 823 | 111 615 | 92 440 | 80 382 | |
| **Tons of cane crushed — Total** | 494 699 | 241 095 | 342 501 | 227 085 | 1 041 510 | 887 749 | 793 730 | |
| **Tons of cane crushed — Per tandem** | — | — | — | — | — | — | 344 950 | 448 780 |
| Season started on | 7.6.77 | 19.6.76 | 23.6.76 | 21.7.76 | 3.5.76 | 1.5.76 | 26.3.76 | |
| Season completed on | 4.12.76 | 4.12.76 | 14.1.77 | 17.12.76 | 5.1.77 | 18.12.76 | 7.12.76 | |
| Number of crushing days | 181 | 156 | 206 | 150 | 226 | 214 | 215 | |
| **Time account** | | | | | | | | |
| Hours crushing % available hours | 67,15 | 71,66 | 64,46 | 51,54 | 84,33 | 79,12 | 72,10 | 71,59 |
| Hours scheduled stops % available hours | 15,21 | 6,88 | 16,40 | 3,52 | 6,09 | 7,70 | 9,26 | 9,11 |
| Hours lack of cane % available hours | 11,38 | 13,23 | 5,65 | 8,44 | 2,31 | 5,01 | 6,57 | 6,04 |
| Hours other stops % available hours | 6,26 | 8,23 | 13,49 | 36,50 | 7,27 | 8,18 | 12,07 | 13,26 |
| **Throughputs per hour actual crushing** | | | | | | | | |
| Tons of cane crushed | 170,57 | 83,81 | 108,18 | 127,48 | 208,17 | 202,01 | 79,43 | 106,61 |
| Tons of fibre milled | 24,39 | 13,22 | 14,84 | 19,50 | 30,60 | 27,38 | 12,04 | 15,77 |
| Tons of brix processed | 23,35 | 11,91 | 15,09 | 19,63 | 29,98 | 28,28 | 26,33 | |
| Tons of sugar produced | 16,80 | 8,71 | 11,18 | 13,03 | 22,77 | 21,47 | 19,75 | |
| **Composition of cane crushed** | | | | | | | | |
| Pol % cane | 12,29 | 13,16 | 12,42 | 13,43 | 12,85 | 12,42 | 12,53 | 12,62 |
| Fibre % cane | 14,30 | 15,77 | 14,36 | 15,30 | 14,88 | 13,55 | 15,16 | 14,79 |
| Brix % cane | 14,57 | 16,15 | 15,22 | 17,11 | 15,73 | 14,93 | 15,07 | 15,39 |
| Tons cane per ton sugar | 10,15 | 9,62 | 9,68 | 9,78 | 9,14 | 9,41 | 9,42 | |
| Tons cane per ton 96° sugar | 9,82 | 9,36 | 9,38 | 9,52 | 8,90 | 9,15 | 9,32 | |
| ERC % pol in cane | 85,96 | 83,91 | 84,15 | 81,96 | 84,23 | 85,46 | 84,98 | 84,32 |
| ERC % cane | 10,56 | 11,04 | 10,45 | 11,01 | 10,82 | 10,61 | 10,65 | 10,64 |
| **Performance** | | | | | | | | |
| Imbibition % cane | 31,27 | 24,88 | 32,95 | 26,92 | 24,67 | 26,92 | 34,43 | 32,78 |
| Imbibition % fibre | 219 | 158 | 240 | 176 | 168 | 199 | 227 | 222 |
| Java ratio | 80,12 | 77,59 | 77,81 | 75,02 | 81,49 | 80,05 | 79,70 | 79,24 |
| Extraction | 94,75 | 89,78 | 92,35 | 91,90 | 92,31 | 94,55 | 94,88 | 92,70 |
| Corrected reduced extraction | 94,42 | 89,91 | 91,48 | 91,62 | 91,89 | 93,80 | 94,86 | 92,43 |
| Pol % fibre in bagasse | 4,51 | 8,53 | 6,92 | 7,11 | 6,72 | 4,99 | 5,35 | |
| Boiling house recovery | 83,95 | 86,78 | 89,18 | 81,73 | 90,97 | 89,26 | 87,40 | |
| Overall recovery | 79,54 | 77,91 | 82,36 | 75,11 | 83,97 | 84,40 | 81,84 | |
| Factory performance index | 92,66 | 92,39 | 97,68 | 91,31 | 98,98 | 98,08 | 95,17 | |
| **Pol balance** | | | | | | | | |
| Lost in bagasse (a) | 5,25 | 10,22 | 7,65 | 8,10 | 7,69 | 5,45 | 6,36 | |
| Lost in filter cake (b) | 1,01 | 0,80 | 0,35 | 0,71 | 0,42 | 0,51 | 0,43 | |
| Lost in final molasses (c) | — | S 7,91 | S 8,46 | 12,05 | 7,27 | 9,04 | 9,84 | |
| Undetermined losses (d) | — | 3,15 | 1,18 | 4,03 | 0,65 | 0,61 | 1,53 | |
| Boiling house losses (b + c + d) | — | 11,86 | 9,99 | 16,79 | 8,34 | 10,16 | 11,80 | |
| Sum of all losses (a + b + c + d) | — | 22,08 | 17,64 | 24,89 | 16,03 | 15,61 | 18,16 | |

## TABLE C[2]

### ANALYSIS OF BAGASSE, JUICES, FILTER CAKE, SYRUP AND FINAL MOLASSES MOZAMBIQUE, SWAZILAND AND MALAWI (Season 1976 - 1977)

| SYMBOLS OF FACTORIES | LB | BZ | IC | MA | MH | UR | NH A | NH B |
|---|---|---|---|---|---|---|---|---|
| **Final Bagasse** | | | | | | | | |
| Pol % bagasse | 2,05 | 3,74 | 3,15 | 3,01 | 3,01 | 2,18 | 1,74 | 2,57 |
| Moisture % bagasse | 51,89 | 50,80 | 50,34 | 52,96 | 51,24 | 53,37 | 56,49 | 55,17 |
| Fibre % bagasse | 45,32 | 43,81 | 45,45 | 42,30 | 44,72 | 43,62 | 41,20 | 41,26 |
| Bagasse % cane | 31,55 | 36,00 | 30,18 | 36,17 | 32,87 | 31,07 | 36,81 | 35,87 |
| LCV in kJ per kg bagasse | 7 279 | 7 427 | 7 546 | 7 023 | 7 370 | 6 977 | 6 367 | 6 598 |
| **First expressed juice** | | | | | | | | |
| Brix | 17,50 | 19,83 | S 18,73 | 21,16 | 18,89 | 18,18 | 18,42 | 18,64 |
| Apparent purity | 87,66 | 85,53 | 85,21 | 84,59 | 83,48 | 85,37 | 85,34 | 85,41 |
| **Last expressed juice** | | | | | | | | |
| Brix | — | — | S 4,12 | — | S 4,04 | — | 3,35 | 3,39 |
| Apparent purity | — | — | 74,86 | — | 74,47 | — | 75,22 | 71,98 |
| Purity drop | — | — | 10,35 | — | 9,01 | — | 10,12 | 13,43 |
| Residual juice purity | — | — | — | — | — | 72,40 | — | — |
| Purity drop | — | — | — | — | — | 12,97 | — | — |
| **Mixed juice** | | | | | | | | |
| Mixed juice % cane | 99,72 | 88,88 | 102,77 | 90,75 | 91,80 | 95,85 | 97,63 | 96,91 |
| Brix | 13,73 | 15,99 | 13,57 | 16,97 | 15,69 | 14,60 | 14,56 | 14,55 |
| Apparent purity | 85,06 | 83,14 | 82,22 | 80,14 | 82,40 | 83,91 | 83,61 | 82,91 |
| Purity drop | 2,60 | 2,39 | 2,99 | 4,45 | 1,08 | 1,46 | 1,73 | 2,50 |
| Reducing sugars/pol ratio | 5,32 | 12,53 | 6,30 | 4,78 | 6,70 | 6,39 | 7,02 | |
| **Clarified juice** | | | | | | | | |
| Brix | — | 15,43 | S 13,60 | — | S 15,46 | 14,60 | 14,10 | |
| Apparent purity | — | 83,41 | 83,82 | — | 84,35 | 84,40 | 86,17 | |
| Reducing sugars/pol ratio | 4,82 | 11,58 | 5,90 | 4,31 | 6,50 | 5,52 | 5,02 | |
| Average pH | — | 6,70 | 7,10 | — | 6,80 | — | 7,00 | |
| **Filter cake** | | | | | | | | |
| Pol % filter cake | 1,98 | 2,52 | 1,28 | 1,90 | 2,06 | 1,26 | 1,76 | |
| Filter cake % cane | 6,29 | 4,19 | 3,44 | 5,00 | 2,60 | 5,01 | 3,07 | |
| **Syrup** | | | | | | | | |
| Brix | 62,39 | 55,95 | S 60,00 | 61,70 | 63,41 | 63,50 | 62,84 | |
| Apparent purity | 83,65 | 84,45 | 84,60 | 78,78 | 84,27 | 84,70 | 84,39 | |
| Reducing sugars/pol ratio | 4,33 | 7,76 | 6,08 | 6,85 | 5,83 | 5,40 | 5,07 | |
| Average pH | — | 6,50 | 6,64 | — | 6,10 | 6,20 | 6,40 | |
| **Final molasses** | | | | | | | | |
| Refracto brix | — | 84,60 | S 92,79 | — | 86,13 | 86,80 | 77,51 | |
| Pol/refracto brix purity | — | 40,74 | S 37,74 | — | 33,72 | 35,56 | 38,25 | |
| Sucrose/refracto brix purity | 42,51 | 43,10 | S 38,85 | — | 34,78 | 38,13 | 40,08 | |
| Percentage reducing sugars | — | 17,15 | 19,54 | — | 19,08 | 19,09 | 13,57 | |
| Percentage sulphated ash | — | — | 12,84 | — | — | 13,60 | 13,79 | |
| Reducing sugars/ash ratio | — | — | 1,52 | — | — | 1,40 | 0,98 | |
| Molasses at 85 refracto brix % cane | 3,09 | 3,00 | S 3,27 | S 4,38 | 3,26 | 3,71 | 3,81 | |
| Suc lost in final molasses % pol in cane | 9,08 | 8,35 | 8,71 | — | 7,50 | 9,69 | 10,00 | |

S = Spindle brix

## TABLE D[2]

## MASSECUITES, EXHAUSTIONS, CLARIFYING AGENTS AND ADDITIONAL FUELS MOZAMBIQUE, SWAZILAND AND MALAWI MILLS (Season 1976 - 1977)

| SYMBOLS OF FACTORIES | BZ | IC | MH | UR | NH |
|---|---|---|---|---|---|
| **Brix in mixed juice % cane** | 14,21 | 13,95 | 14,40 | 13,99 | 14,16 |
| **A-massecuite** | | | | | |
| $m^3$ per ton brix in mixed juice | 0,79 | 0,91 | 1,07 | 0,81 | 0,84 |
| Brix of massecuite | 90,97 | S 93,08 | 92,68 | S 92,40 | 91,05 |
| Purity of massecuite | 84,80 | 84,94 | 84,44 | 85,10 | 84,32 |
| Purity of A-molasses | 70,16 | 69,39 | 67,71 | 66,30 | 68,71 |
| Purity drop | 14,64 | 15,55 | 16,73 | 18,80 | 15,61 |
| Exhaustion | 57,86 | 59,81 | 61,17 | 65,55 | 59,17 |
| **Purity of A-massecuite — Purity of syrup** | 0,35 | 0,34 | 0,17 | 1,30 | 0,07 |
| **B-massecuite** | | | | | |
| $m^3$ per ton brix in mixed juice | 0,43 | 0,35 | 0,33 | 0,45 | 0,34 |
| Brix of massecuite | 90,45 | S 94,52 | 93,60 | S 94,70 | 92,97 |
| Purity of massecuite | 75,69 | 73,48 | 72,60 | 73,00 | 73,51 |
| Purity of B-molasses | 58,19 | 51,73 | 47,72 | 48,70 | 51,74 |
| Purity drop | 17,50 | 21,75 | 25,18 | 24,30 | 21,77 |
| Exhaustion | 55,30 | 61,32 | 66,34 | 64,89 | 61,37 |
| **C-massecuite** | | | | | |
| $m^3$ per ton brix in mixed juice | 0,31 | 0,24 | 0,24 | 0,32 | 0,30 |
| Brix of massecuite | 92,96 | S 97,16 | 96,87 | S 99,20 | 96,31 |
| Purity of massecuite | 63,07 | 59,87 | 58,58 | 54,20 | 60,33 |
| Purity of C-molasses | 40,74 | 37,74 | 33,72 | 35,56 | 38,25 |
| Purity drop | 22,33 | 22,13 | 24,86 | 18,64 | 22,08 |
| Crystal content | 35,03 | 34,54 | 36,33 | 28,69 | 34,44 |
| Exhaustion | 59,75 | 59,37 | 64,03 | 53,37 | 59,27 |
| **White sugar massecuites** | | | | | |
| kg sugar per $m^3$ | 557 | 525 | — | — | 562 |
| **Total volume of all raw massecuites** | | | | | |
| $m^3$ per ton brix in mixed juice | 1,53 | 1,50 | 1,64 | 1,58 | 1,48 |
| **Clarifying agents** | | | | | |
| Tons lime per 1 000 TC | 1,90 | 1,07 | 0,76 | 1,20 | 1,77 |
| Tons sulphur per 1 000 TC | 0,09 | 0,15 | — | 0,003* | — |
| Phosphoric acid ppm MJ | 1,87 | — | — | — | 25,00* |
| Flocculents ppm MJ | 2,80 | 1,14 | 0,64 | 1,54 | 9,44 |
| Kg enzymes per 100 T. sugar | — | 4,24 | 0,95 | — | — |
| **Additional fuels per 1 000 TC** | | | | | |
| Tons of fuel oil | — | — | — | — | 0,59 |
| Tons of coal | — | — | 1,53 | 3,96 | — |
| Tons of wood | 41,48 | — | — | — | 9,08 |
| Converted into bagasse | 49,78 | — | 6,12 | 15,84 | 14,44 |

S = Spindle brix * For refining

# TABLE E
## COMPARATIVE MANUFACTURING DATA OF RECENT YEARS
## (South African Mills)

| SEASON | 1976/77 | 1975/76 | 1974/75 | 1973/74 | 1972/73 |
|---|---|---|---|---|---|
| **Cane** | | | | | |
| Pol % cane | 12,43 | 12,60 | 13,08 | 13,08 | 13,26 |
| Fibre % cane | 15,52 | 15,67 | 15,59 | 15,64 | 14,82 |
| **Juice** | | | | | |
| Brix of first expressed juice | 18,26 | 18,52 | 19,16 | 18,99 | 18,95 |
| Purity of first expressed juice | 87,17 | 87,19 | 87,31 | 87,84 | 88,67 |
| Purity of mixed juice | 84,47 | 84,70 | 85,01 | 85,66 | 86,66 |
| Reducing sugars/pol ratio (mixed juice) | 5,58 | 5,31 | 5,05 | 4,70 | 4,17 |
| **Milling** | | | | | |
| Imbibition % fibre | 281 | 279 | 286 | 288 | 279 |
| Imbibition % cane | 41,7 | 43,7 | 42,8 | 45,0 | 41,4 |
| Extraction | 95,48 | 95,38 | 95,49 | 95,55 | 95,55 |
| Pol % bagasse | 1,66 | 1,68 | 1,73 | 1,69 | 1,75 |
| Moisture % bagasse | 53,20 | 53,52 | 53,10 | 53,19 | 52,85 |
| Bagasse % cane | 33,96 | 34,59 | 34,18 | 34,33 | 33,70 |
| LCV bagasse kJ/kg | 7 032 | 6 967 | 7 049 | 7 033 | 7 099 |
| Available kJ in bagasse/kg Bx mixed juice | 16 984 | 16 983 | 16 348 | 16 537 | 16 183 |
| **Recoveries** | | | | | |
| Boiling house recovery | 88,99 | 88,68 | 88,76 | 89,13 | 89,48 |
| Overall recovery | 84,97 | 84,58 | 84,76 | 85,17 | 85,50 |
| Tons cane per ton sugar | 9,41 | 9,33 | 8,97 | 8,93 | 8,77 |
| **Filter cake** | | | | | |
| Pol % filter cake | 1,39 | 1,33 | 1,28 | 1,30 | 1,34 |
| Filter cake % cane | 4,27 | 4,62 | 4,70 | 4,85 | 4,77 |
| **Final molasses** | | | | | |
| Gravity purity | 38,23 | 38,75 | 38,39 | 39,16 | 40,03 |
| Weight @ 85 Bx % cane | 3,60 | 3,64 | 3,71 | 3,52 | 3,30 |
| **Average sugar polarisation** | 99,42 | 99,49 | 99,50 | 99,45 | 99,46 |
| **Sucrose balance*** | | | | | |
| Lost in filter cake | 0,48 | 0,49 | 0,46 | 0,48 | 0,48 |
| Lost in final molasses | 8,45 | 9,52 | 9,26 | 8,96 | 8,46 |
| Undetermined losses | 1,58 | 0,79 | 1,01 | 0,94 | 1,11 |
| Lost in boiling house | 10,51 | 10,80 | 10,73 | 10,39 | 10,05 |
| Lost in bagasse | 4,52 | 4,62 | 4,51 | 4,45 | 4,45 |
| Total losses | 15,03 | 15,42 | 15,24 | 14,83 | 14,50 |
| **m³ massecuite per ton brix mixed juice** | | | | | |
| A-massecuite | 1,06 | 1,05 | 1,04 | 1,04 | 1,01 |
| B-massecuite | 0,40 | 0,38 | 0,36 | 0,36 | 0,36 |
| C-massecuite | 0,24 | 0,28 | 0,27 | 0,27 | 0,23 |
| **Total** | 1,70 | 1,71 | 1,67 | 1,67 | 1,60 |
| **Exhaustion of massecuites** | | | | | |
| A-massecuite | 62,16 | 62,74 | 63,59 | 64,43 | 64,10 |
| B-massecuite | 61,84 | 61,44 | 62,09 | 60,48 | 60,57 |
| C-massecuite | 54,00 | 54,32 | 56,08 | 56,00 | 54,87 |
| **Purity rise** | | | | | |
| A-massecuite purity | 85,93 | 86,30 | 86,83 | 87,61 | 88,22 |
| Syrup purity | 85,02 | 85,06 | 85,82 | 86,82 | 87,36 |
| Rise | 0,91 | 1,24 | 1,01 | 0,79 | 0,86 |
| **Brix of syrup** | 65,52 | 64,51 | 64,72 | 64,20 | 63,22 |

* 1976/77 Pol balance

# TABLE F

## AVERAGE MANUFACTURING RESULTS BY MONTHLY PERIODS FOR SOUTH AFRICAN MILLS

### (Season 1976 - 1977)

| END OF MONTHLY PERIOD | | May 1 1976 | May 29 1976 | June 26 1976 | July 31 1976 | Aug. 28 1976 | Oct. 2 1976 | Oct 30 1976 | Nov. 27 1976 | Jan. 1 1977 | Jan. 29 1977 | Feb. 26 1977 | Mar. 12 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tons sugar made and estimated | Month | 41 894 | 150 745 | 204 696 | 273 067 | 226 686 | 280 513 | 221 187 | 203 987 | 221 601 | 163 889 | 52 375 | 881 |
| | To-date | 41 894 | 192 638 | 397 334 | 670 401 | 897 087 | 1 177 599 | 1 398 786 | 1 602 773 | 1 824 374 | 1 988 263 | 2 040 638 | 2 041 520 |
| Tons cane crushed . . . . | Month | 476 331 | 1 620 364 | 1 963 991 | 2 508 849 | 2 015 640 | 2 465 773 | 1 963 143 | 1 848 119 | 2 074 921 | 1 628 784 | 622 485 | 32 201 |
| | To-date | 476 331 | 2 096 695 | 4 060 686 | 6 569 535 | 8 585 175 | 11 050 947 | 13 014 090 | 14 862 209 | 16 937 130 | 18 565 914 | 19 188 399 | 19 220 600 |
| Tons cane crushed per hour actual crushing . . . . | Month | 220,27 | 206,79 | 215,62 | 216,39 | 213,04 | 209,77 | 209,00 | 202,88 | 209,92 | 209,76 | 235,26 | — |
| | To-date | 220,27 | 209,71 | 212,52 | 213,98 | 213,76 | 212,86 | 212,27 | 211,05 | 211,18 | 211,05 | 211,76 | 211,84 |
| Pol % cane . . . . . . | Month | 10,52 | 10,99 | 12,05 | 12,59 | 13,00 | 13,24 | 13,16 | 12,87 | 12,57 | 12,01 | 10,56 | — |
| | To-date | 10,52 | 10,88 | 11,45 | 11,88 | 12,15 | 12,39 | 12,51 | 12,55 | 12,55 | 12,51 | 12,44 | 12,43 |
| Fibre % cane . . . . . | Month | 15,37 | 15,27 | 15,00 | 14,92 | 15,04 | 15,17 | 15,68 | 15,97 | 16,24 | 16,40 | 16,59 | — |
| | To-date | 15,37 | 15,29 | 15,15 | 15,06 | 15,06 | 15,08 | 15,17 | 15,27 | 15,39 | 15,48 | 15,52 | 15,52 |
| Tons cane per ton 96° sugar . | Month | 10,98 | 10,37 | 9,26 | 8,87 | 8,58 | 8,48 | 8,57 | 8,74 | 9,03 | 9,60 | 11,71 | — |
| | To-date | 10,98 | 10,50 | 9,86 | 9,46 | 9,24 | 9,05 | 8,98 | 8,95 | 8,96 | 9,01 | 9,08 | 9,09 |
| Corrected reduced extraction . | Month | 95,92 | 95,65 | 95,51 | 95,33 | 95,05 | 95,06 | 95,36 | 95,42 | 95,62 | 95,62 | 95,60 | — |
| | To-date | 95,92 | 95,71 | 95,62 | 95,51 | 95,40 | 95,32 | 95,33 | 95,34 | 95,37 | 95,40 | 95,40 | 95,40 |
| Imbibition % fibre . . . . | Month | 291 | 275 | 279 | 274 | 279 | 283 | 284 | 283 | 285 | 281 | 283 | — |
| | To-date | 291 | 279 | 279 | 277 | 278 | 279 | 280 | 280 | 281 | 281 | 281 | 281 |
| Pol extraction . . . . . | Month | 95,64 | 95,47 | 95,68 | 95,64 | 95,42 | 95,44 | 95,56 | 95,44 | 95,47 | 95,28 | 94,81 | — |
| | To-date | 95,64 | 95,51 | 95,60 | 95,61 | 95,56 | 95,54 | 95,54 | 95,53 | 95,52 | 95,50 | 95,48 | 95,48 |
| Pol % bagasse . . . . . | Month | 1,35 | 1,48 | 1,59 | 1,68 | 1,80 | 1,81 | 1,72 | 1,69 | 1,61 | 1,58 | 1,51 | — |
| | To-date | 1,35 | 1,45 | 1,52 | 1,58 | 1,63 | 1,67 | 1,68 | 1,68 | 1,67 | 1,66 | 1,66 | 1,66 |
| Moisture % bagasse . . . | Month | 54,23 | 53,61 | 53,26 | 53,13 | 53,35 | 53,16 | 52,94 | 53,17 | 53,08 | 53,14 | 53,21 | — |
| | To-date | 54,23 | 53,75 | 53,52 | 53,37 | 53,36 | 53,32 | 53,26 | 53,25 | 53,23 | 53,22 | 53,20 | 53,20 |
| Boiling house recovery . . | Month | 86,94 | 88,19 | 89,92 | 89,94 | 90,17 | 89,55 | 89,11 | 89,38 | 88,56 | 87,45 | 81,89 | — |
| | To-date | 86,94 | 87,92 | 88,94 | 89,34 | 89,55 | 89,55 | 89,48 | 89,47 | 89,36 | 89,20 | 89,00 | 88,99 |
| Overall recovery . . . . | Month | 83,15 | 84,20 | 86,03 | 86,01 | 86,05 | 85,47 | 85,15 | 85,31 | 84,55 | 83,32 | 77,65 | — |
| | To-date | 83,15 | 83,97 | 85,02 | 85,42 | 85,58 | 85,55 | 85,49 | 85,47 | 85,35 | 85,18 | 84,98 | 84,97 |
| Mixed juice purity . . . . | Month | 81,98 | 82,80 | 84,08 | 83,92 | 85,02 | 85,33 | 85,86 | 85,64 | 84,55 | 83,80 | 81,44 | — |
| | To-date | 81,98 | 82,62 | 83,36 | 83,58 | 83,94 | 84,27 | 84,52 | 84,66 | 84,64 | 84,58 | 84,48 | 84,47 |
| RS/pol ratio . . . . . | Month | 7,40 | 6,60 | 5,89 | 5,98 | 5,46 | 4,95 | 4,96 | 5,01 | 5,38 | 5,76 | 6,54 | — |
| | To-date | 7,40 | 6,78 | 6,30 | 6,17 | 5,99 | 5,75 | 5,62 | 5,54 | 5,52 | 5,54 | 5,57 | 5,58 |
| Purity of final molasses . . | Month | 37,07 | 37,01 | 37,00 | 36,73 | 37,13 | 38,65 | 39,37 | 39,49 | 39,02 | 38,61 | 42,25 | — |
| | To-date | 37,07 | 37,03 | 37,01 | 36,90 | 36,96 | 37,34 | 37,65 | 37,87 | 38,03 | 38,08 | 38,23 | 38,23 |
| Pol lost in final molasses % pol in cane . . . . | Month | 9,82 | 7,68 | 7,74 | 7,64 | 7,60 | 8,34 | 8,08 | 8,34 | 8,95 | 9,22 | — | — |
| | To-date | 9,82 | 8,15 | 8,34 | 8,06 | 7,94 | 8,04 | 8,04 | 8,08 | 8,26 | 8,34 | 8,52 | 8,45 |
| Undetermined lost pol % pol in cane . . . . . . | Month | 2,04 | 3,05 | 1,46 | 1,56 | 1,31 | 1,15 | 1,87 | 1,30 | 1,50 | 2,26 | — | — |
| | To-date | 2,04 | 2,83 | 1,73 | 1,66 | 1,57 | 1,47 | 1,53 | 1,50 | 1,43 | 1,50 | 1,50 | 1,58 |

# TABLE G

## CANE VARIETIES AND RAINFALL
## (Season 1976 - 1977)

| SYMBOLS OF FACTORIES | CANE VARIETIES CRUSHED (Percentage by weight) | | | | | | | | | | | | | | | | | | | | RAINFALL during 1976 mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NCo 376 | NCo 310 | NCo 293 | N 50/211 | NCo 382 | CO 331 | NCo 339 | NCo 292 | NCo 334 | N 51/539 | N 51/168 | N 53/216 | CB 36/14 | CB 38/22 | N 55/805 | N 6 | N 52/219 | N 8 | Mixed Vari's | Un-known | |
| ML . . . . . . . | 88,8 | 1,5 | | | 0,1 | | | | 6,8 | | | | | | 0,1 | | | | 0,1 | 2,1 | 275 |
| PG . . . . . . . | 71,1 | 19,9 | | | | | | | 1,8 | | | | 0,2 | | | | 0,1 | | 6,2 | 0,2 | 568 |
| UF . . . . . . . | 11,0 | 43,5 | | | 6,0 | | 0,6 | | | 0,1 | | | 0,6 | | 16,3 | 0,1 | | | 21,1 | | 1 371 |
| EM . . . . . . . | 45,4 | 16,8 | | 0,1 | 3,9 | | 0,1 | | | | 0,5 | 0,3 | 0,1 | | 10,5 | 0,1 | | 0,2 | 0,3 | 20,9 | 1 861 |
| FX . . . . . . . | 37,2 | 23,7 | | 0,1 | 3,1 | | | | | | 0,1 | 0,7 | 0,2 | | 16,6 | 0,7 | | 0,2 | 1,0 | 15,8 | 1 810 |
| EN . . . . . . . | 80,2 | 0,4 | 11,1 | | 0,4 | | | | | | | 1,4 | 1,4 | 0,2 | 4,4 | 0,1 | | | | | 1 299 |
| AK . . . . . . . | 73,9 | 1,4 | | | 0,1 | | | | | | | 0,1 | 0,3 | | 7,2 | | | | 1,1 | 15,4 | 1 602 |
| GD . . . . . . . | 85,6 | 5,9 | 0,5 | 0,1 | | 2,1 | | | | | | | | | 5,4 | | | | | | 1 185 |
| DL . . . . . . . | 77,2 | 1,1 | 0,6 | | 0,1 | | | | | | | 0,3 | 0,1 | | 17,8 | | | | 2,1 | 0,3 | 1 399 |
| GH . . . . . . . | 69,3 | 0,8 | 0,6 | | 0,4 | | 0,1 | | | | | 0,9 | 0,7 | | 13,7 | | | | 9,5 | 3,4 | 1 523 |
| MV . . . . . . . | 57,5 | 0,3 | | | | | | | | | | | 0,7 | | 2,6 | | | | 38,4 | 0,2 | 1 458 |
| JB . . . . . . . | 20,6 | | 39,3 | 0,6 | 22,4 | 0,6 | | | | | | 2,1 | 4,0 | | 1,3 | 0,5 | | | 1,4 | 6,6 | 1 051 |
| UC . . . . . . . | 14,5 | 0,2 | 68,3 | | 13,9 | 0,1 | | | | | | 0,6 | 0,9 | | | | | | | 0,9 | 1 059 |
| TS . . . . . . . | 75,8 | 1,1 | 0,1 | 0,1 | 0,6 | | | | | | | 0,2 | 0,2 | | 15,9 | 0,1 | | | 5,2 | | 1 261 |
| ME . . . . . . . | 52,6 | 3,4 | 3,3 | 0,1 | 0,1 | | | | | | | 0,1 | 0,1 | | 21,5 | | | | 14,2 | 4,2 | 1 559 |
| IL . . . . . . . | 56,1 | 1,1 | 18,5 | 0,1 | 3,8 | | | 0,3 | | | | 1,1 | 2,4 | | 8,8 | 2,2 | | | 1,0 | 4,0 | 1 436 |
| SZ . . . . . . . | 83,3 | 2,3 | 0,4 | | 0,2 | | | 0,1 | | | | 0,4 | 0,2 | | 9,2 | 0,6 | | | 0,7 | 2,0 | 1 733 |
| UK . . . . . . . | 77,4 | 1,2 | 6,0 | | 0,1 | | | | | | | 0,2 | 0,2 | | 10,9 | 0,5 | | | 0,4 | 2,5 | 1 852 |
| Average South African Mills | 61,7 | 7,0 | 5,2 | | 2,6 | | | | 0,5 | | | 0,4 | 0,6 | | 10,4 | 0,2 | | | 5,1 | 5,3 | — |
| BZ . . . . . . . | 90,0 | 5,0 | | | | | | | | | | | | | | | | | | 5,0 | — |
| IC . . . . . . . | 86,1 | | | | | | | | | | | | | 6,4 | | | | | | 7,5 | 999 |
| MH . . . . . . . | 90,1 | | | | | | | | 9,4 | | | | | | | | 0,4 | | | 0,1 | 1 040 |
| UR . . . . . . . | 91,2 | 2,3 | | | | | | | 4,4 | | | | | | | | 0,1 | | 2,0 | | 751 |
| NH . . . . . . . | 14,0 | 82,6 | | | | | | | | | | | | | | | | | 3,4 | | 906 |

# TABLE H

## TRANSPORT SUMMARY SOUTH AFRICAN MILLS
## (Season 1976 - 1977)
## Percent of Cane Transported

| MILLS | ML | PG | UF | EM | FX | EN | AK | GD | DL | GH | MV | JB | UC | TS | ME | IL | SZ | UK | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South African Railways . . . . . . . . | 13,6 | | 34,2 | 29,9 | 58,0 | | 8,3 | | | 14,1 | | 12,2 | 9,3 | | 18,9 | 3,1 | | | 12,1 |
| Chopped Cane Bins . . . . . . . . | | | 16,4 | | | | | | | | | | | | | | | | 1,0 |
| Tram . . . . . . . . . . . . . . | | 99,9 | 47,2 | 36,7 | 41,8 | | | | | | | | | | | | | | 11,9 |
| Hilo . . . . . . . . . . . . . . | 86,3 | | | 14,3 | | | 68,3 | 33,8 | 74,3 | 61,7 | 46,0 | 38,2 | 12,9 | 90,5 | 68,1 | 95,1 | 95,4 | 12,7 | 53,6 |
| Lorry . . . . . . . . . . . . . . | | | | 0,8 | | | 3,0 | 31,3 | 8,4 | 2,4 | 21,1 | 27,8 | 61,4 | 1,5 | 12,1 | 0,1 | 4,3 | 16,2 | 7,2 |
| Tractor . . . . . . . . . . . . . | | | 2,1 | 18,1 | | 11,5 | 20,3 | 34,8 | 17,2 | 21,6 | 32,7 | 21,4 | 16,3 | 7,9 | 0,8 | 1,5 | 0,2 | 5,9 | 11,5 |
| Trailer . . . . . . . . . . . . . | | | | | | 88,4 | | | | | | 0,1 | | | | | | 64,9 | 2,4 |

# TABLE J

## COMPARATIVE DATA OF REPORTING S.A. MILLS FROM 1925 ONWARDS

| PERIOD (SEASON) | Percent Cane | | Cane/Sugar Ratio | | Extraction | Pol % Fibre in Bagasse | Percent Bagasse | | Imbibition Percent | | Mixed Juice | | Final Molasses Purity | Boiling House Recovery | Overall Recovery |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sucrose | Fibre | Tel Quel | 96 Pol Sugar | | | Pol | Moisture | Cane | Fibre | Purity | Reducing Sugar Ratio | | | |
| Average 1925-1934 | 13,19 | 15,78 | 9,86 | 9,64 | 89,83 | 8,86 | 3,88 | 50,57 | 27,6 | 175 | 85,09 | 3,65 | 45,3 | 83,67 | 75,12 |
| Average 1935–1944 | 13,53 | 15,30 | 8,96 | 8,73 | 92,05 | 7,05 | 3,11 | 51,60 | 32,6 | 213 | 86,01 | 3,22 | 43,3 | 88,36 | 81,34 |
| 1945 | 14,28 | 15,99 | 8,29 | 8,08 | 93,28 | 6,01 | 2,77 | 50,19 | 35,0 | 219 | 86,23 | 3,38 | 42,0 | 89,29 | 83,30 |
| 1946 | 14,21 | 16,21 | 8,36 | 8,14 | 93,07 | 6,08 | 2,79 | 50,32 | 35,2 | 217 | 85,86 | 3,30 | 41,8 | 89,12 | 82,94 |
| 1947 | 13,32 | 15,80 | 8,84 | 8,60 | 93,94 | 5,53 | 2,54 | 50,46 | 34,4 | 218 | 86,24 | 2,95 | 41,1 | 89,61 | 83,73 |
| 1948 | 13,89 | 15,90 | 8,55 | 8,31 | 93,32 | 5,81 | 2,67 | 50,53 | 34,1 | 214 | 85,92 | 3,67 | 41,5 | 89,14 | 83,19 |
| 1949 | 13,52 | 16,19 | 8,76 | 8,52 | 92,94 | 5,82 | 2,66 | 50,84 | 33,7 | 208 | 86,22 | 3,11 | 41,4 | 89,68 | 83,35 |
| 1950 | 14,19 | 15,80 | 8,32 | 8,09 | 93,33 | 6,02 | 2,72 | 51,22 | 32,8 | 206 | 86,40 | 3,12 | 40,5 | 89,63 | 83,65 |
| 1951 | 13,33 | 16,29 | 8,98 | 8,73 | 92,98 | 5,74 | 2,57 | 51,71 | 35,0 | 215 | 84,92 | 3,52 | 40,3 | 88,72 | 82,50 |
| 1952 | 13,87 | 16,10 | 8,50 | 8,27 | 93,00 | 6,02 | 2,65 | 52,53 | 34,9 | 217 | 86,25 | 2,92 | 39,3 | 89,96 | 83,66 |
| 1953 | 13,93 | 16,31 | 8,55 | 8,32 | 92,67 | 6,25 | 2,75 | 52,47 | 32,7 | 200 | 85,61 | 3,66 | 39,5 | 89,36 | 82,81 |
| 1954 | 13,34 | 16,03 | 8,87 | 8,65 | 92,40 | 6,32 | 2,75 | 52,92 | 30,7 | 191 | 85,86 | 3,28 | 39,3 | 90,04 | 83,20 |
| Average 1945–1954 | 13,79 | 16,06 | 8,60 | 8,36 | 93,04 | 5,95 | 2,69 | 51,32 | 33,8 | 210 | 85,95 | 3,29 | 40,7 | 89,46 | 83,23 |
| 1955 | 13,87 | 15,74 | 8,51 | 8,28 | 92,32 | 6,76 | 2,91 | 53,18 | 32,1 | 204 | 85,96 | 3,40 | 39,6 | 90,51 | 83,56 |
| 1956 | 13,35 | 15,81 | 8,87 | 8,62 | 92,93 | 5,98 | 2,60 | 53,12 | 35,2 | 222 | 85,49 | 3,32 | 39,9 | 89,79 | 83,44 |
| 1957 | 13,11 | 15,38 | 8,93 | 8,67 | 93,36 | 5,66 | 2,47 | 53,06 | 34,5 | 224 | 85,10 | 3,69 | 38,5 | 90,43 | 84,42 |
| 1958 | 13,12 | 15,92 | 9,09 | 8,82 | 92,87 | 5,89 | 2,55 | 52,38 | 32,9 | 207 | 84,46 | 4,30 | 39,1 | 89,49 | 83,11 |
| 1959 | 13,66 | 15,92 | 8,74 | 8,44 | 92,86 | 6,16 | 2,66 | 53,26 | 34,6 | 218 | 85,52 | 3,51 | 40,3 | 89,42 | 83,04 |
| 1960 | 13,69 | 15,22 | 8,70 | 8,41 | 93,35 | 5,98 | 2,60 | 53,01 | 36,2 | 238 | 85,63 | 3,31 | 40,3 | 89,40 | 83,45 |
| 1961 | 13,75 | 14,52 | 8,51 | 8,26 | 94,21 | 5,50 | 2,43 | 52,54 | 36,7 | 253 | 86,04 | 3,31 | 39,5 | 89,72 | 84,53 |
| 1962 | 13,29 | 15,49 | 8,97 | 8,73 | 94,15 | 5,02 | 2,24 | 52,17 | 41,2 | 266 | 83,36 | 5,11 | 39,6 | 87,81 | 82,67 |
| 1963 | 13,55 | 15,50 | 8,66 | 8,42 | 94,08 | 5,16 | 2,29 | 52,46 | 39,8 | 258 | 85,30 | 3,44 | 39,4 | 89,60 | 84,30 |
| 1964 | 13,90 | 15,38 | 8,42 | 8,20 | 94,16 | 5,23 | 2,34 | 52,64 | 39,4 | 256 | 85,52 | 3,32 | 39,9 | 89,65 | 84,42 |
| Average 1955–1964 | 13,53 | 15,49 | 8,75 | 8,49 | 93,43 | 5,73 | 2,51 | 52,78 | 36,3 | 235 | 85,24 | 3,67 | 39,6 | 89,58 | 83,69 |
| 1965 | 12,99 | 15,57 | 9,20 | 8,97 | 93,99 | 5,00 | 2,20 | 52,98 | 40,6 | 261 | 84,22 | 3,73 | 39,9 | 87,67 | 82,40 |
| 1966 | 13,72 | 15,09 | 8,63 | 8,40 | 94,22 | 5,24 | 2,29 | 53,52 | 39,9 | 262 | 85,06 | 3,63 | 40,6 | 88,38 | 83,27 |
| 1967 | 12,92 | 15,01 | 9,28 | 9,06 | 94,15 | 5,04 | 2,19 | 53,47 | 39,2 | 261 | 83,41 | 3,81 | 38,8 | 87,52 | 82,33 |
| 1968 | 13,11 | 15,32 | 9,06 | 8,83 | 94,74 | 4,51 | 1,98 | 53,32 | 41,1 | 268 | 83,60 | 4,23 | 39,4 | 87,40 | 82,72 |
| 1969 | 12,88 | 15,03 | 9,10 | 8,86 | 94,98 | 4,30 | 1,89 | 53,30 | 41,2 | 274 | 84,25 | 4,17 | 38,3 | 88,58 | 84,13 |
| 1970 | 13,61 | 15,34 | 8,64 | 8,34 | 95,41 | 4,06 | 1,80 | 53,07 | 43,2 | 285 | 84,99 | 3,80 | 38,9 | 88,57 | 84,51 |
| 1971 | 12,97 | 14,82 | 8,93 | 8,63 | 95,91 | 3,58 | 1,61 | 52,66 | 41,1 | 277 | 85,14 | 4,20 | 39,4 | 89,41 | 85,76 |
| 1972 | 13,26 | 14,82 | 8,77 | 8,47 | 95,55 | 3,98 | 1,75 | 52,85 | 41,3 | 279 | 86,66 | 4,17 | 40,0 | 89,48 | 85,50 |
| 1973 | 13,08 | 15,64 | 8,93 | 8,62 | 95,55 | 3,87 | 1,69 | 53,19 | 45,0 | 288 | 85,66 | 4,70 | 39,2 | 89,13 | 85,17 |
| 1974 | 13,08 | 15,59 | 8,97 | 8,65 | 95,49 | 3,94 | 1,73 | 53,10 | 44,6 | 286 | 85,01 | 5,05 | 38,4 | 88,76 | 84,76 |
| Average 1965–1974 | 13,16 | 15,22 | 8,95 | 8,68 | 95,00 | 4,35 | 1,91 | 53,15 | 41,7 | 274 | 84,80 | 4,15 | 39,3 | 88,49 | 84,06 |
| 1975 | 12.60 | 15,67 | 9,33 | 9,00 | 95,38 | 3,87 | 1,68 | 53,52 | 43,7 | 279 | 84,70 | 5,31 | 38,8 | 88,68 | 84,58 |
| 1976 | 12,43 | 15,52 | 9,41 | 9,08 | 95,48 | 3,79 | 1,66 | 53,20 | 41,7 | 281 | 84,47 | 5,58 | 38,2 | 88,99 | 84,97 |