SEVENTY-SECOND ANNUAL REVIEW OF THE MILLING SEASON IN SOUTHERN AFRICA (1996-1997)

GRE LIONNET

Sugar Milling Research Institute, University of Natal, Durban, 4041

Abstract

Performance, throughput and other relevant aspects of the sugar industries in South Africa, Malawi, Zimbabwe and Zambia are presented and discussed. The drought which dominated the past four seasons was finally broken and cane tonnage and quality, except for ash, returned to normal levels. The amount of soil in the cane delivered to the South African factories was again high and caused severe problems. In South Africa cane supply was erratic at some factories and overall time efficiency was low. Processing in the South African factories was generally good but molasses exhaustion was again difficult, due mostly to high viscosities. Four factories in the region experienced crystallisation problems in October 1996. Sugar quality in South Africa has been good. Some notes on pollution control in South Africa have been included.

Keywords: review, sugarcane, southern Africa, milling season

The cane crop

Cane variety and transport

The contributions of some of the main cane varieties in South Africa are shown in Table 1, and it is evident that N12 is now the most popular variety. In the Midlands, N12 and N16 account for 83% of the cane crushed, while in the north, N14 and N19 account for 82% of the crush. NCo376 is still an important variety at UF, FX, DL, MS and GD[1].

Table 1
Varietal statistics for the 1996-97 season.

Variety	% of cane crushed
NCo376	21,8
N12	23,9
N14	9,8
N19	7,5
N16	5,3
N17	2,5

[1]South African sugar factories: AK=Amatikulu, DL=Darnall, EN=Entumeni, ES=Eston, FX=Felixton, GD=Glendale, GH=Gledhow, KM=Komatipoort, ML=Malelane, MS=Maidstone, NB=Noodsberg, PG=Pongola, SZ=Sezela, UC=Union Co-op, UF=Umfolozi, UK=Umzimkulu.
Malawi sugar factories: DW=Dwangwa, NH=Sugar Corporation of Malawi, Nchalo.
Zambia sugar factory: NK=Nkambala.
Zimbabwe sugar factories: HV=Hippo Valley, TR=Triangle.

Recent trends in cane varieties in South Africa are shown in Figure 1. The usual data regarding type of vehicle and mode of transport are given in Table H.

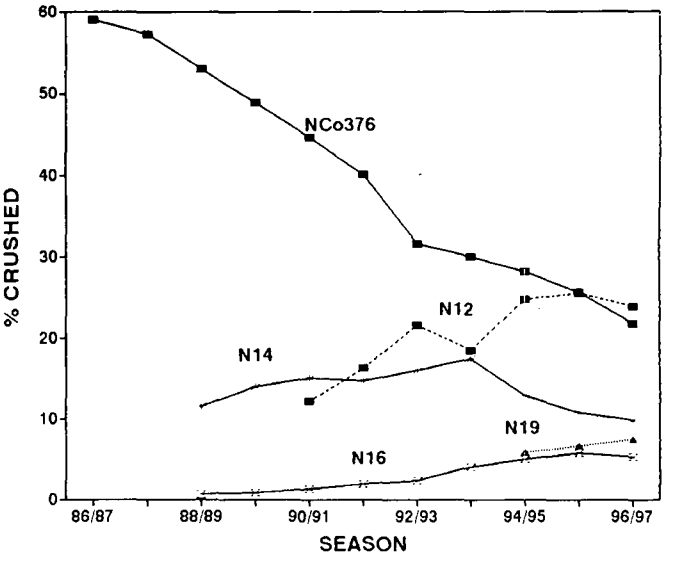

Figure 1. Varietal trends in the South African sugar industry from 1986-87 to 1996-97.

Burning

Nearly 88,5% of the cane crushed in South Africa was burnt this season, and the trends in cane burning are shown in Figure 2. Before the drought, between 70 and 75% of the cane was burnt but there was a large increase in 1992-93, the first recent drought season, with increases of about 20% at MS and SZ, and of between 5 and 10% at FX, AK, GH, DL and ME. Since then, the percentage of burnt cane has ranged from the mid to high eighties, reaching its highest recent level this season.

Cane supply

Cane supply problems were severe at a few factories and, as a result, time efficiencies and performances were affected. At ML and MS the cane tonnage estimates were reduced as the season progressed. In addition transport and harvesting problems occurred and these affected mill throughputs. Cane supply problems dominated the season both at ML and MS. The large crops that had been predicted did not materialise and the mills frequently ran out of cane.

SZ had cane supply problems early in 1996, whereas AK experienced severe cane delivery problems late in the season. Many no-cane stops were recorded and the AK factory had to

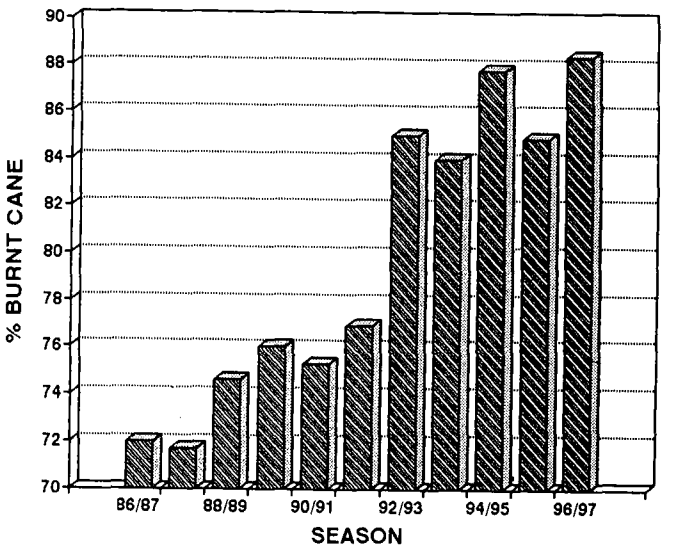

Figure 2. Percentage of the crop burnt in the South African sugar industry, 1986-87 to 1996-97.

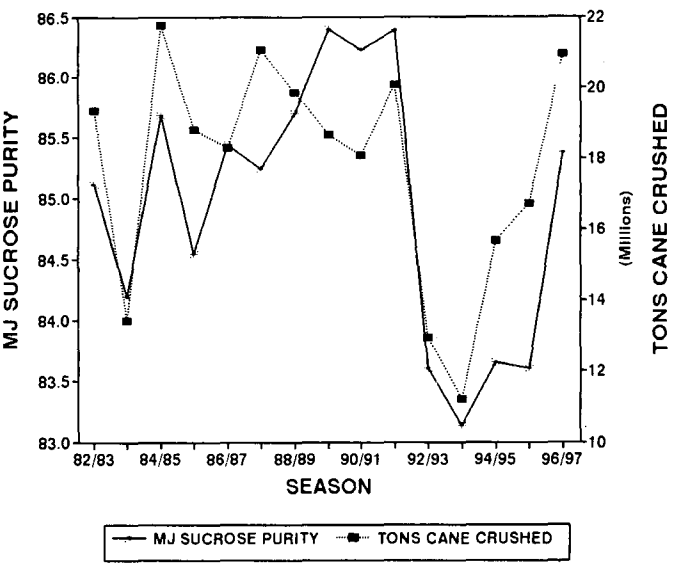

Figure 3. Mixed juice (MJ) sucrose purity and cane tonnage for the South African sugar industry, 1982-83 to 1996-97.

boil off twice in one week. At GH, a reduction in the amount of bundled cane caused supply problems, particularly at transport shift change-overs. Although UK had a record crop, cane supply was erratic especially during the second half of the season when rain disrupted cane deliveries. Early cane estimates also had to be reduced.

Cane quality and quantity

General

The 1996-97 season showed a welcome recovery after four drought affected seasons, with both cane quality and quantity showing significant improvements. The trends in two important parameters, namely mixed juice purity and cane tonnage, for the South African industry, are shown in Figure 3. After marked reductions during the four seasons of drought, cane tonnage has again reached pre-drought levels. The recovery in mixed juice purity was not as good, being about one unit lower than pre-drought levels.

The best cane quality in terms of estimated recoverable crystal (ERC) % cane and of mixed juice purity was at ML with values of 11,93 and 86,51 respectively, and at EN with values of 11,47 and 87,78. The season to-date ERC % cane and mixed juice purity values, for each mill, are shown in Figure 4, in descending order of magnitude. Only ML showed an ERC % cane value close to 12 and, except for EN and ES, all the high ERC values were in the northern and far northern factories. Only EN gave a mixed juice purity above 87. UC, which has in the past been the top cane quality factory, only ranked among the top five. The deterioration of cane quality at UC and NB has been attributed to the fact that the two year crop is still affected by the drought, the poor quality of some of the annual cane and the low success of ripeners this season. These trends are shown in Figure 5.

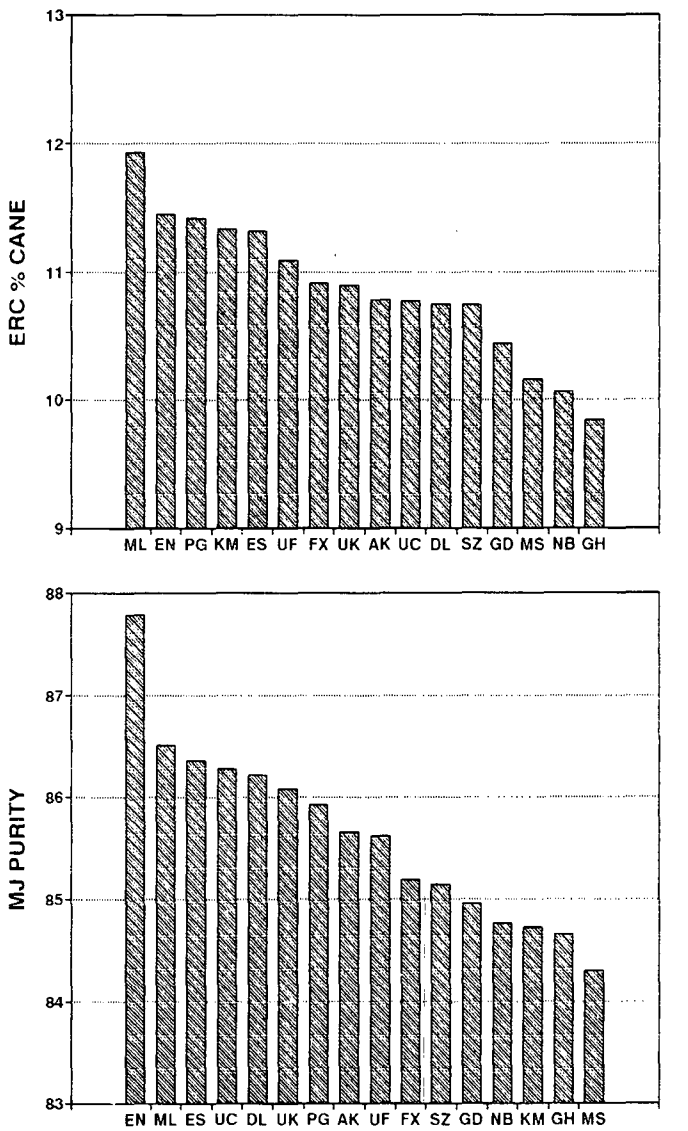

Figure 4. ERC % cane and mixed juice sucrose purity for South African sugar factories, 1996-97.

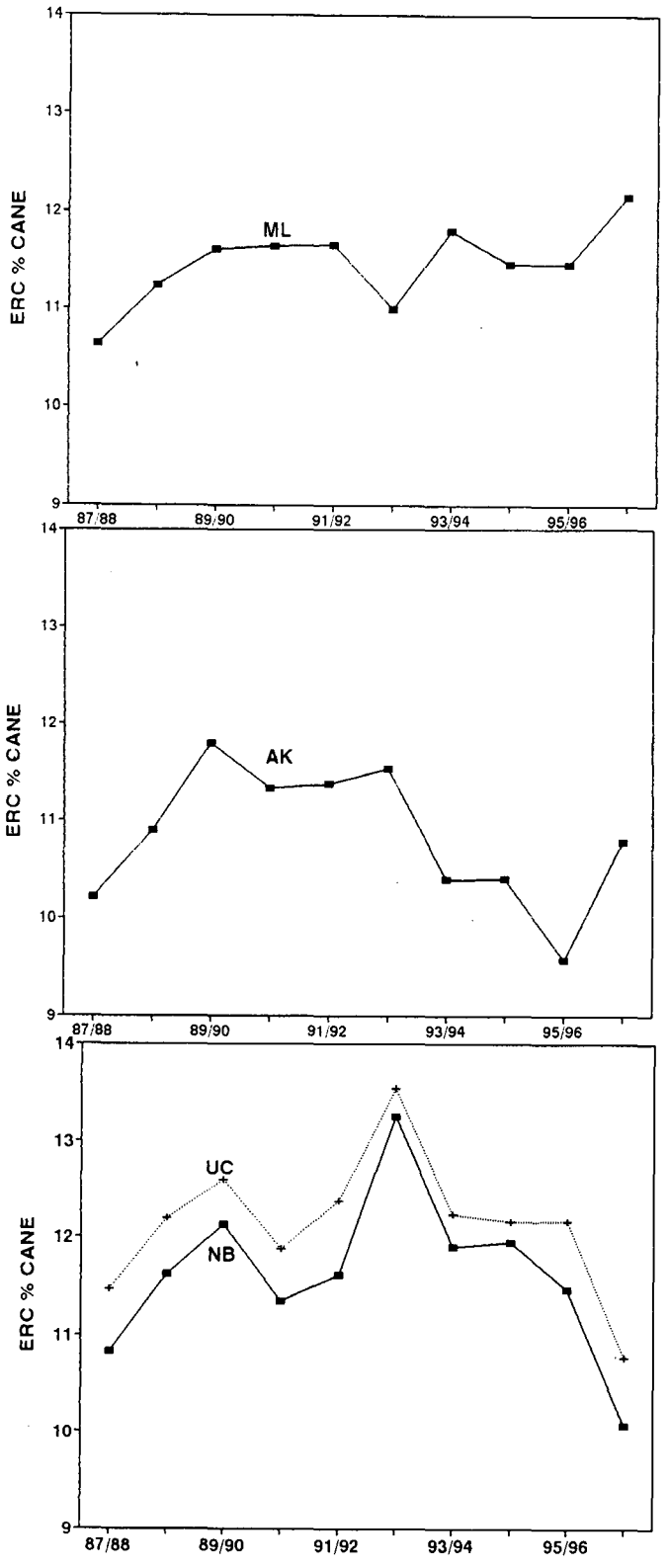

Figure 5. Trends in ERC % cane at selected South African sugar factories.

The very real cane quality improvements at ML have been attributed to the following two factors:

- the establishment of a local cane quality improvement scheme, using an ERC based system
- reduced cane delays as indicated by the decreased ethanol levels in cane of about 1 000 to 1 200 ppm on brix.

It must be noted, however, that cane supply problems did arise at ML. These are discussed later.

Significant cane quality improvements were reported by AK. This factory has also established a cane quality scheme based on an ERC/sucrose index, but with a conditional ash effect: when ash % cane is above an agreed limit, any bonus is forfeited. Agricultural workers have been included in mill visits. These approaches have worked well and ash % cane has decreased at AK, as will be shown later.

Cane quality was poor at GH with an ERC % cane of 9,86 and a mixed juice purity of 84,66. This seems to be due to the high percentage (about 90%) of coastal cane crushed at this factory.

Finally, sucrose % cane weekly values rose above 15% a number of times, as shown in Table 2. DW reported a high pol % cane of 15,05 for the season.

Table 2
High weekly sucrose % cane values at Malelane and Umfolozi mills, 1996-97.

Factory	Week ending	Sucrose % cane
ML	14.09.96	15,03
UF	14.09.96	15,27
ML	05.10.96	15,14
ML	12.10.96	15,01
UF	19.10.96	15,18

Ash % cane

The improved cane quality achieved this season has, unfortunately, not included ash % cane. In fact, the ash levels were comparable to those found during the droughts (Table 3). Ash % cane and ash % bagasse for each factory are shown in Figure 6. ES stands out with values of 2,77 and 5,89 respectively. It is generally accepted that serious boiler operational problems will occur when ash levels in bagasse exceed 5%.

Table 3
Mean ash % cane levels for the South African sugar industry, 1980-81 to 1996-97.

Period	Ash % cane
1980-81 to 1992-93 : pre-drought	1,40
1993-94 to 1995-96 : drought	1,80
1996-97 : normal	1,74

Ash related problems occurred at several factories. Some details follow:

NB: This was the second highest ash % cane value, and was accompanied by high levels of suspended solids in mixed juice (1,44%). Processing problems, particularly high mud levels in the clarifiers, were encountered.

UF: High ash levels in cane and the presence of silt caused severe flooding in the diffuser. The press water clarifier operated during the entire season and clarification was usually difficult.

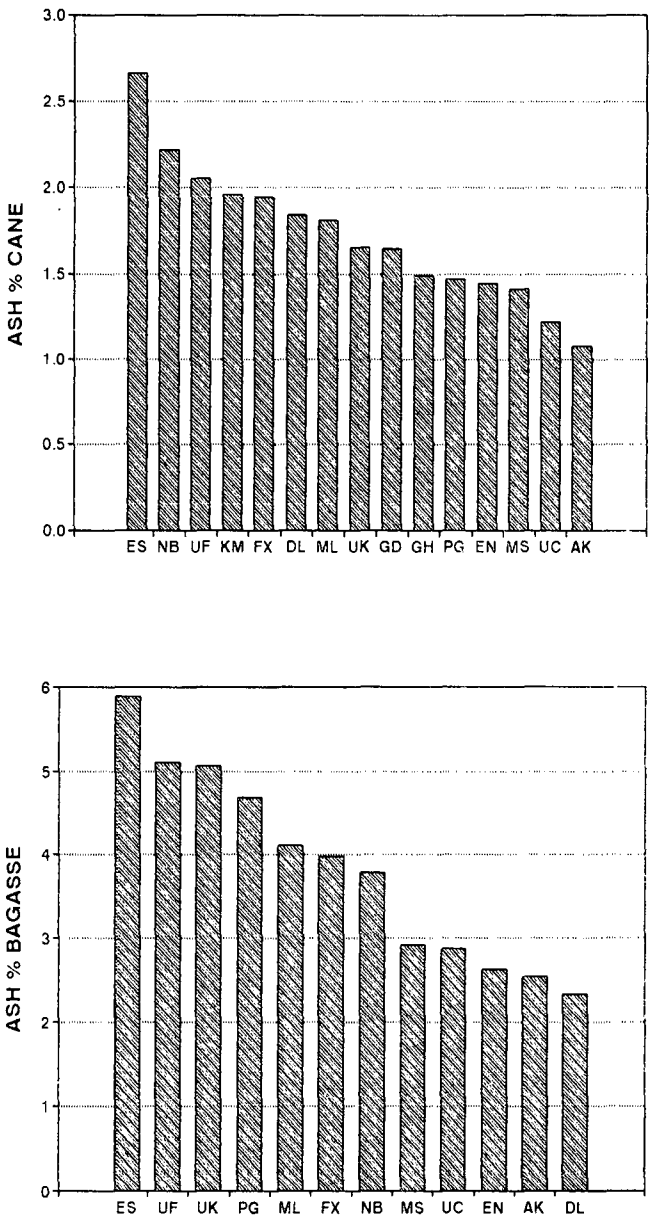

Figure 6. Ash % cane and ash % bagasse, South African sugar factories.

ML: Cane quality generally improved at ML. Unfortunately this did not apply to ash % cane (Figure 7). ML operated a simple sand separation system which reduced the ash content in cane by about 0,5 percentage unit. Only sand and trash tended to be separated. The factory, however, reported high wear on preparation equipment.

FX: Ash was a serious problem, particularly with cane from the flats which showed levels above 2%. Severe wear occurred on the preparation equipment and in the boilers.

MS: Two diffusers now operate. High ash levels in bagasse caused erosion of boiler tubes.

DL: It has been calculated that DL received 21 000 tons of sand this season and 376 rocks were found with the cane. Mill personnel removed six tons of sand per week from the mixed juice tanks. Heavy wear on cane preparation equipment was recorded.

GH: High hammer, knife and mill roll wear was experienced. This high wear resulted in additional mid-week stops a number of times during the season, together with the usual week-end stops so that knives and hammers could be replaced.

UC: A rock removal system was installed and commissioned. Under dry weather conditions the separator worked very efficiently. About 11 000 tons of waste material, namely rocks, sand, soil and leaves were removed, which is equivalent to about 1,6% of the mass of cane crushed. The benefits of the separator under dry weather conditions included:

- reduced ash % cane, the trends at UC being shown in Figure 8
- a reduction of about 25% in suspended solids in mixed juice
- less filtercake
- a reduction of ash in bagasse, by about 40%
- a very significant reduction in stops due to foreign matter in cane
- reduced wear on cane preparation equipment.

The separator has had a large impact on the pol factor, which has decreased to 97,63 against an industry average of 99,37. This effect will have to be addressed when this type of equipment is installed.

AK: A remarkable reduction in ash % cane was achieved. Levels have returned to those found in the 1980s (Figure 9). The main reasons for this improvement were stated to be:

- good communication with growers
- a cane quality bonus system including an ash constraint
- the operation of a simple sand removal system.

EN: Ash % cane has been reduced in comparison with the previous seasons, probably influenced by the Mill Group Board's decision to employ a cane quality manager.

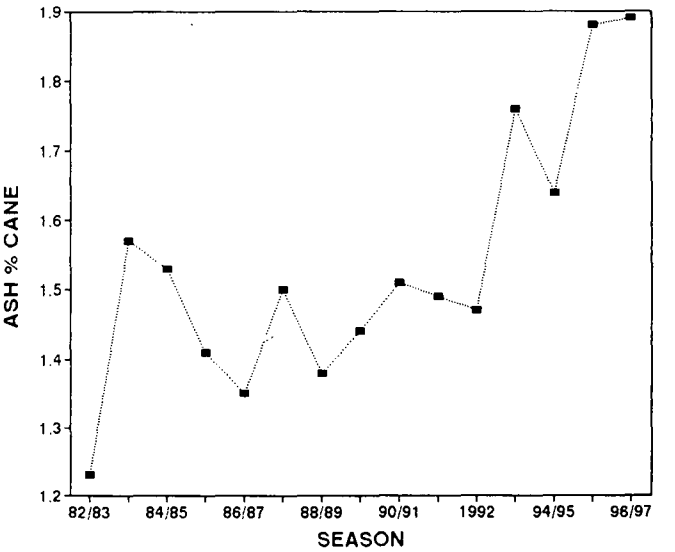

Figure 7. Ash % cane at Malelane, 1982-83 to 1996-97.

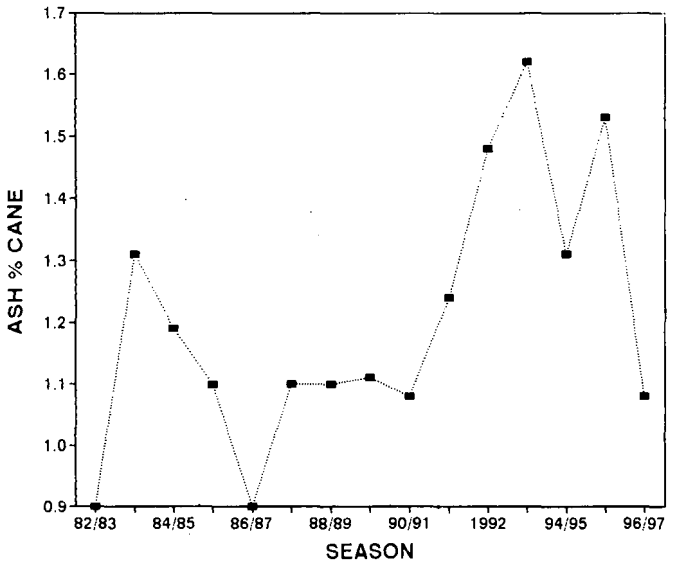

Figure 8. Ash % cane at Union Co-op, 1982-83 to 1996-97.

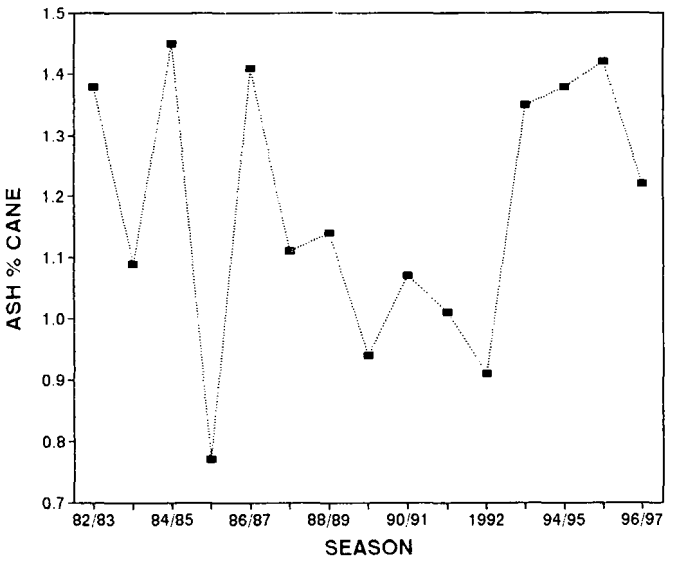

Figure 9. Ash % cane at Amatikulu, 1982-83 to 1996-97.

ES: Ash % cane was among the highest ever recorded in the industry. Cane preparation equipment and boiler operation were affected. The factory also suffered from repeated occurrences of foreign matter in the cane, including rocks, tramway lines, gum poles and tramp metal.

Mill performance

Cane and sugar tonnages

Cane crushed in South Africa exceeded 20 M tons; cane and sugar tonnages for the region are given in Table 4. The most significant changes, with respect to the past four seasons, are the increases in cane and sugar tonnages in South Africa. As shown in Table 5, a number of factories had record cane and/or sugar tonnages.

Table 4
Cane and sugar tonnages for the 1996-97 season.

Country	Tons cane	Tons sugar
South Africa	20 950 835	2 276 482
Zimbabwe	2 826 247	336 387
Malawi	1 859 842	215 306
Zambia	1 492 373	166 449

Table 5
Record seasonal cane and sugar tonnages in 1996-97.

Factory	Tons cane	Tons sugar
FX	2 657 958	296 739
EN	376 994	44 144
GD	425 137	44 223
UC	663 550	-
SZ	2 312 766	-
NH	1 198 041	-

Length of season and time efficiency

The season in South Africa started on 1 April 1996 at ES and ended on 2 February 1997 at UK. Its overall length was 307 days, the longest and shortest periods being 306 and 244 days at ES and GD, respectively.

Some mills crushed for up to five weeks after Christmas 1996 and, generally, crushing in January 1997 was not trouble free. Overall time efficiency, undetermined loss and cane to sugar ratio for December 1996, and for January 1997 for four different factories, are compared in Figure 10. In all but one instance the results were poorer in January.

Overall time efficiency (OTE) for the industry has been low at 76,48 during a season which has been free of serious climatic problems. Time efficiencies have been averaged for the four pre-drought seasons and for the four drought affected seasons and these results have been compared to those from the 1996-97 season (Table 6). It is evident that this season's time efficiencies (except for the scheduled stops) were, in fact, worse than the average for the drought seasons and are considerably worse than the pre-drought values. Both 'no cane' stops and 'other' stops were high. Monthly trends in OTE, no cane and other stops have been plotted in Figure 11. Rain in July had a marked effect on the no-cane stops, and this category of stops was again high from November onwards. Other stops were very high, particularly from October onwards. As a result, OTE was extremely poor after October. The best OTE in South Africa (83,37) was for the GH milling tandem, the lowest no cane stop (2,62) was at UF, and the lowest other stop (3,25) was at AK.

HV in Zimbabwe reported excellent OTE values with 91,90 and 91,58 for the two diffusers; no cane stops were very low (0,57%) and other stops were low at 4,62%. NH in Malawi reported low scheduled stops of 1,84%.

A new category of stop, namely 'foreign matter' stops, has been introduced this season. It has been defined as the stop (in hours) due to rocks, tramp iron, sand or any other clearly identifiable

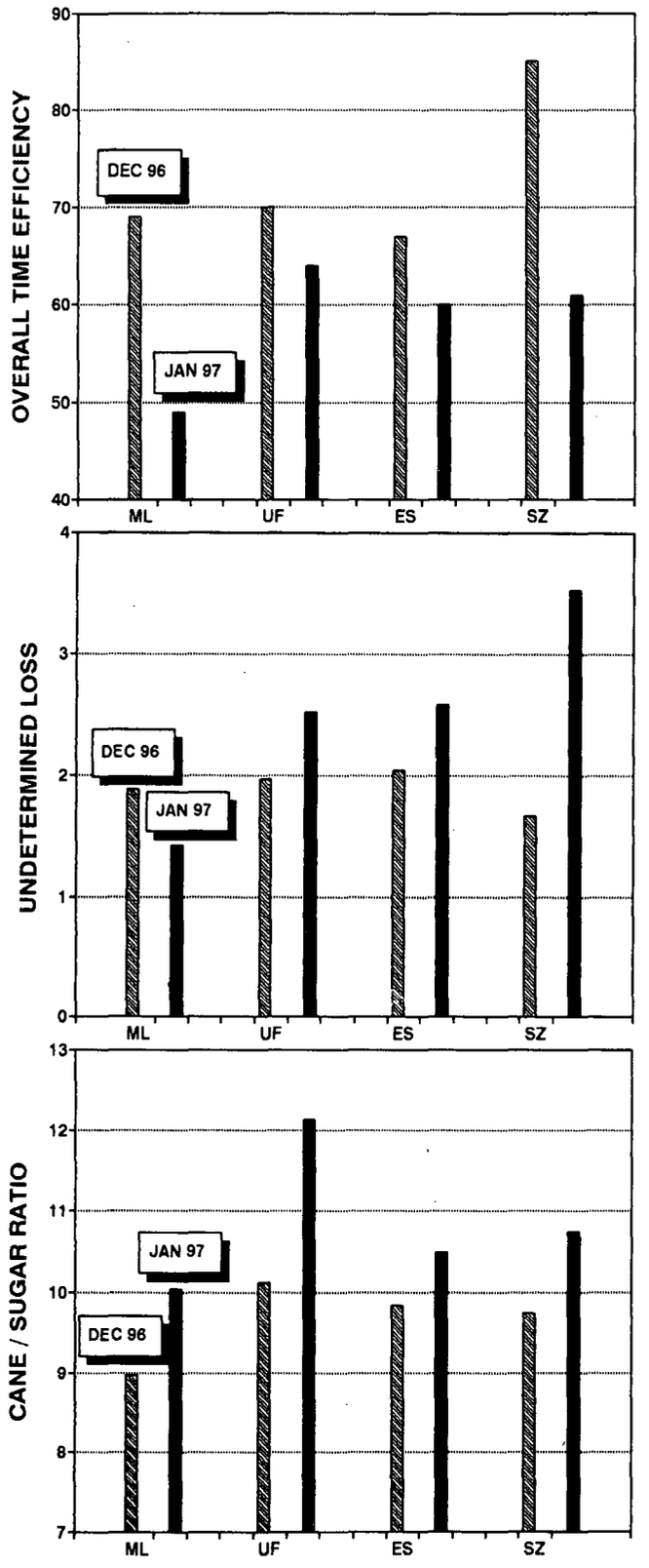

Figure 10. A comparison of OTE, undetermined loss and cane to sugar ratio, December 1996 versus January 1997, at four selected sugar factories.

foreign object, directly and immediately causing the stop, which was delivered with the cane. Such hours must not be included with the other stops. Foreign matter stops varied from a low 0,07% for the GH diffuser to a high 1,84% at DL. The industry average was 0,58%, which represents about 575 hours of

Table 6
A comparison of time efficiencies.

Category of stop	Four-season average		1996-97
	Pre-drought	Drought	
OTE	80,4	77,6	76,4
Scheduled stops (%)	7,2	9,4	6,5
No cane stops (%)	5,9	5,9	7,2
Other stops (%)	6,4	7,2	9,2

stoppages for the industry. At an industrial crushing rate of 276 tons of cane/hour, this represents about 159 000 tons of cane which could have been crushed, or about two and a half days of crush.

Other stops were high for a normal season. These stops have again been influenced by ash in cane and thus in bagasse, but many cases of mechanical problems have been reported. Some details are given below.

ML: The occurrence of tramp metal and rocks in cane was a serious problem and caused many short stops.

UF: Sand and silt were a problem. There were, however, serious mechanical breakdowns caused by the diffuser and by boiler grates.

PG: Sand caused problems and there were many mechanical problems at the boilers.

GH: Boiler grate and tube failures caused stops. Carrier chains also caused problems.

GD: There was a serious breakdown at the dewatering mill.

AK: Chain problems caused chokes, particularly at the high cane throughputs.

DL: Rocks and sand caused problems.

MS: Very high no-cane stops were reported. Sand caused problems.

NB: The bagasse carriers caused many stops. Sand in cane and high levels of suspended solids in mixed juice caused problems. There were also stops due to 'factory full'.

ES: This factory suffered from a number of problems. A fire in the bagasse handling section of the factory caused a 48 hour stop. Diffusion problems caused three long stops and the failure of the diffuser's head shaft bearing caused a seven day stop. The grate in boiler number two caused major problems, while the let-down valve needed frequent attention during the season.

Extraction plant

In South Africa, extraction (97,72) was marginally better than last season (97,69), but the trend with the corrected reduced extraction (CRE) was reversed, this season's value (97,67) being

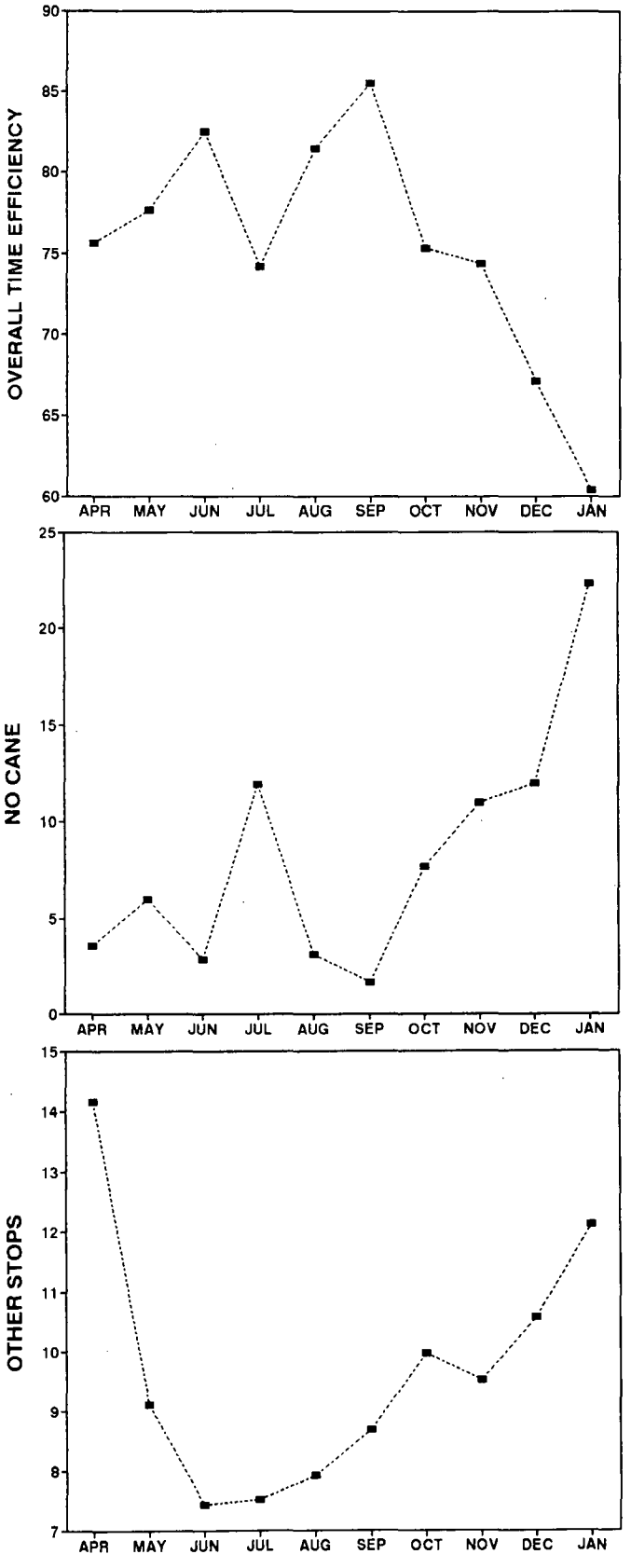

Figure 11. OTE, no cane and other stops for the South African sugar industry, 1996-97.

somewhat lower than last season's (97,80). This lower CRE could be due, at least partly, to cane throughput and imbibition levels, as shown in Table 7.

Table 7
Throughputs at the extraction plant.

Component	1996-97	1995-96
Tons cane	20 950 835	16 713 647
Tons cane per hour	276	268
Tons fibre per hour	41,2	41,4
Imbibition % fibre	337	356

NB removed its cane knives and installed a whole stalk shredder. After some commissioning problems this shredder performed well. Thirty-five tons of sugar beet were processed, over about two hours, with the normal cane throughput. The beet contained much sand and shredded easily but caused foaming at screens, gutters and tanks. There was a characteristic smell, but no other noticeable effects.

DW in Malawi reported a good pol extraction of 98,37 at an imbibition % fibre of 299.

Clarification and filtration

Generally, clarification and filtration ran well in South Africa this season. At UC the process benefitted from the rock removal system, less cake was produced and sucrose losses were lower than usual. However, the purity difference between clear juice and filtrate was high due to the small quantity of mud and filtrate in the system. Modifications to the clarifier at KM resulted in better juice removal and higher throughput, without carry-over, but mud and filtrate quantities were low and retention times were high. Mud removal at GH was changed to a gravity based system, which improved performance. Two bottom tanks, the contents of which affected the temperature profile at the bottom of the clarifiers, were removed and the turbidity of clear juice showed an immediate improvement.

Very high mud levels at NB, due to the high content of suspended solids of the mixed juice, disrupted clarification at this factory. Stop/start conditions at MS, due to the poor cane supply, affected mixed juice flow control which in turn impacted on clarification. In contrast to the situation at GH, the introduction of a gravity based mud removal system at MS resulted in serious mud flow problems and the system needs to be reassessed.

The syrup clarifier at MS performed well with respect to suspended matter removal. This gives stable sugar quality which is important at MS where raw sugar is packed. Furthermore, the pan boilers believe that the syrup clarifier reduces viscosity and that the massecuites boiled better.

Evaporation

The season has been characterised by high throughputs. As predicted from experimental work, mainly on the FX pilot evaporator, the evaporator trains coped well with the high juice

flow rates and rates of fouling were relatively low. FX, MS and PG introduced recycling on their Kestners, with good results. For example, heat transfer coefficients at FX reached 2,5 to 3,1 kW/m²/°C on first effects and 2,1 to 2,4 kW/m²/°C on second effects. FX handled a relatively large crush with no evaporator bottlenecks.

A number of factories used some form of chemical cleaning this season. In all cases sodium hydroxide was used at concentrations ranging from 30% (m/m) down to 15%. A wetting agent was included at the lower concentrations. Boiling in the vessels and spraying were both used. Two factories also used acid; sulphamic at 2 to 3% in one case and phosphoric at 6 to 10% in the other. The post-chemical procedures involved mechanical cleaning at one mill where the caustic strength was very low (2 to 4%) and a flush and inspect process elsewhere.

A rising film plate evaporator was tested at GD. Distribution of the cleaning liquid (sodium hydroxide) has needed attention.

Boiling house

Boiling house recovery (BHR) at 87,82 showed a good recovery but did not reach its pre-drought level of above 88,5. EN (90,75) and ML (89,87) showed the highest values. Sucrose lost in molasses (9,84) has also decreased but, as for BHR, not to its pre-drought level of about 9,0. The undetermined loss (1,81) was below two for the first time in five seasons. These trends are shown in Figure 12. EN and ML showed the lowest loss in molasses (7,34 and 8,04 respectively) while FX had the lowest (1,09) undetermined loss.

Target purity difference (TPD) has been disappointing this season at +4,7, which is the same as the average for the four drought seasons. The lowest TPD values were at KM (2,6) and DL (2,9) while four factories reported values between about +6 and +10. As was the case last season, molasses exhaustion was difficult. Several parameters which influence molasses exhaustion are compared in Table 8, where averages for the four normal seasons before the drought, the four drought seasons, and the values for the current season have been used.

Table 8
Data from current season compared with data from the four drought seasons and the four preceding normal seasons.

Parameter	Four-season average		1996-97
	Pre-drought	Drought	
TPD	3,9	4,8	4,7
Loss in molasses	9,0	11,4	9,8
Dry solids % molasses	78,2	77,2	78,0
Molasses factor	0,57	0,59	0,56
Tons non-sucrose in MJ/h	5,4	6,2	5,8
Viscosity of final molasses at 30°C and 74% dry solids (Pa.s)	3,4	5,8	6,0
C-crystal width (µm)	136	128	138
Elongation ratio	1,7	1,7	1,7

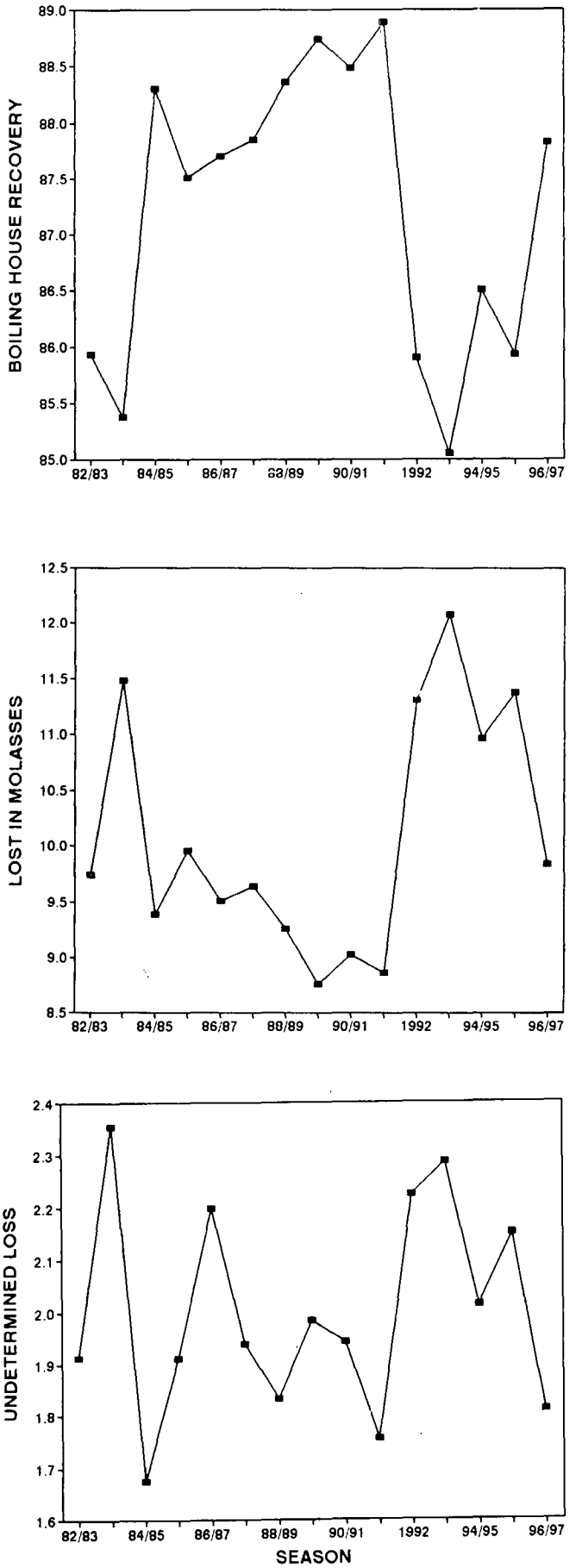

Figure 12. Boiling house recovery, sucrose loss in molasses and undetermined loss, South African sugar industry.

Dry solids in molasses, molasses factor (sucrose in final molasses/non-sucrose in mixed juice), C-crystal width and elongation ratio in 1996-97 all compared well with the pre-drought values, while the non-sucrose loading is somewhat higher. The final molasses viscosity was higher and was comparable to that reported during the drought seasons. Trends in the viscosity of final molasses are shown in Figure 13. Although the values are not absolute, there is a disturbing increase in the viscosity.

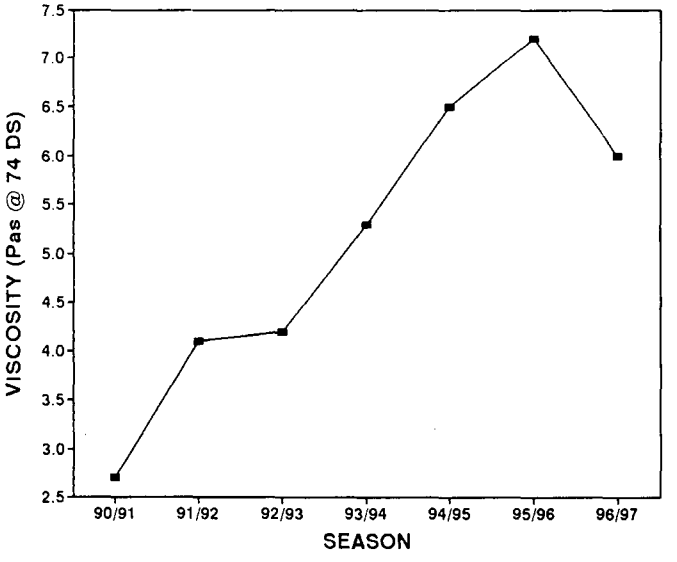

Figure 13. Trends in the viscosity of final molasses, South African sugar industry (DS = dry solids).

The somewhat poor performance at the boiling house is reflected in the corrected reduced boiling house recovery (CRB), which at 86,39 has not returned to its pre-drought level of about 86,7 as shown in Figure 14. The lower CRB value can probably be attributed to the poor TPD. Those factories which achieved low TPD values paid attention to C-crystal size and brix control. In all cases the addition of water at C-centrifugals was optimised. ML and KM made full use of the lower viscosities in the region, increasing C-massecuite brixes and lowering purities.

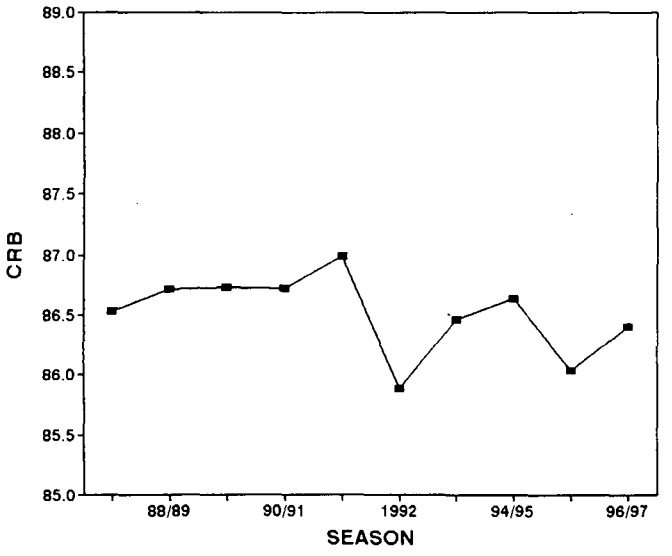

Figure 14. Trends in CRB, South African sugar factories.

NB installed four new continuous centrifugals, two with large diameter casings, on C-massecuite. The system allows C-sugar to be made and then used as A-footing, when B-sugar is affinated and fed to the refinery. Although not much used, this approach worked well when it was tried. PG's poor boiling house performance has been attributed to stop/start operations, Maillard type reactions and high viscosities.

Processing problems

Although the season was free of drought and of frost, processing problems were experienced late in the year at four factories.

At SZ, reduced evaporation rates, particularly at brixing, caused long boiling times and low final massecuite brixes. The problem was evident even on A-massecuites. Pan tubes fouled quickly and it was necessary to boil water in the pans every two days. Samples of A-massecuites examined at the Sugar Milling Research Institute (SMRI) showed the following:

- slow and sluggish boiling, even in a Rotavapor, under laboratory conditions
- decreased viscosity, lower Robert dextran levels and evidence of reaction intermediates of dextran hydrolysis as responses to dextranase treatment.

Further investigations at SZ showed:

- high ethanol in some direct analysis of cane (DAC) extracts, with values of 5 000 to 6 000 ppm on brix being common
- high lactic acid (550 to 800 ppm on brix) in mixed juice
- high concentrations of oligosaccharides (2 000 to 3 000 ppm 1-kestose on brix) in mixed juice.

These observations are indicative of serious cane deterioration problems.

Although no frost occurred at NB, end-of-season processing problems were as bad as those of last season. Viscosity increased and so did crystal elongation. An evaluation of dextranase treatment is being considered for next season.

At UC processing problems, particularly poor brixing in the pans, were present. One of the causes could be cane deterioration (as experienced at SZ) since ethanol levels rose to 5 000 to 10 000 ppm on brix in DAC extracts at that time.

A perplexing problem occurred at NK in October. Massecuites were slow boiling, high viscosities were evident and extremely high (4,3) crystal elongation was measured. Analysis of massecuites and molasses by the SMRI, however, did not show the expected high levels of dextran, gums or oligosaccharides. No causes could therefore be found for the problems.

Sugar quality

The average analysis of the total very high pol (VHP) sugar produced in South Africa was 99,38% pol, 0,13% moisture, 105 ppm starch and 1 430 ICUMSA colour units. Quality parameters for raw sugar sent to the SA Sugar Terminals (SAST) and to Hulett Refineries (HR) are shown in Table 9.

Table 9
Average analysis of sugar supplied to SA Sugar Terminals and Hulett Refineries.

Parameter	SAST	HR
Pol (%)	99,38	99,38
Moisture (%)	0,13	0,13
Colour of affinated crystal	721	-
Colour (ICUMSA)	1 479	1 344
Starch (ppm)	101	112
Ash (%)	0,14	0,15

Raw sugar quality has improved markedly, confirming the previous negative effect of drought. Affinated crystal colour is a good indicator of colour and quality. This analysis is available only for the sugar delivered to SAST but would still be reasonably representative of South African VHP sugar, and trends for the past 15 seasons are shown in Figure 15. It appears that this parameter is affected severely by drought and has now returned to its usual level.

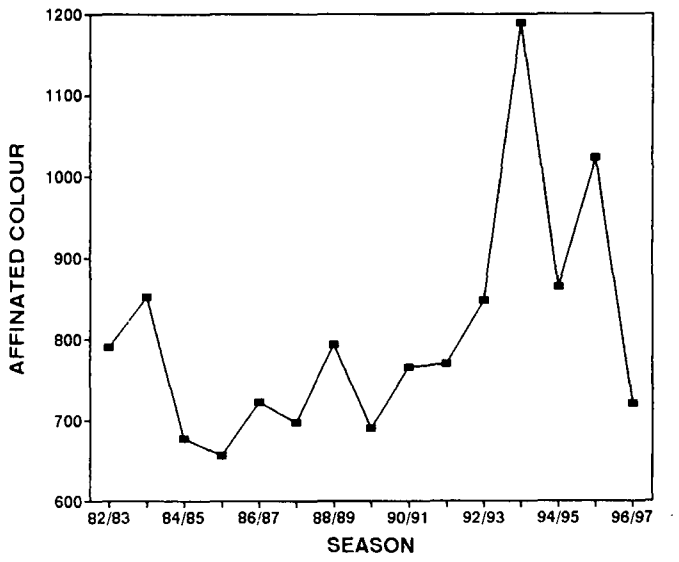

Figure 15. Affinated raw sugar colour, South African sugar industry.

The quality improvements shown by VHP sugar are also evident for South African refined sugar, the colour of which is shown in Figure 16. The remarkable improvements achieved in the past two seasons rival the lowest colours reached over the past 13 seasons. Four refineries, ML, NB, HR and UF, achieved colours below 45 for the season; 40 at ML, 34 at HR, 32 at UF and 35 at NB.

Two back end refineries have replaced conventional sulphur burners with liquid sulphur dioxide systems. Details are given in a paper by Moodley and Schorn (1997).

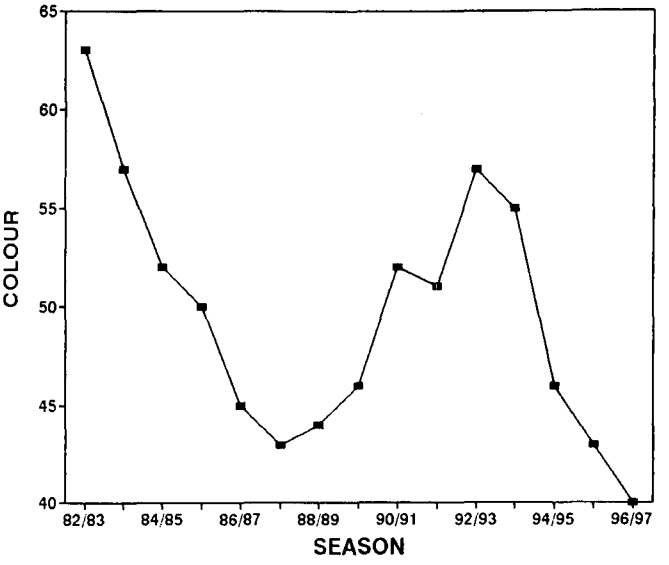

Figure 16. Refined sugar colour, South African sugar industry.

Pollution control

A survey of air pollution control equipment operating in South African factories during the season shows that 56 of the 63 boilers are fitted with scrubbers (36 wet and 20 dry). Based on maximum continuous ratings, this suggests that a minimum of 95,5% of flue gas is scrubbed. Most of the boilers without scrubbers are standby units that are not used extensively.

The successful control of air pollution from factories is a result of initiatives and investments which began in 1971 when the sugar milling sector, in co-operation with the Department of Health, established a Smoke Study Group to assist in the control of air pollution.

Water pollution control initiatives began in 1970 and have progressed to the current situation where 11 of the 16 South African factories have effluent treatment plants, while the remaining factories dispose of effluent through controlled irrigation.

Acknowledgements

The assistance of Mr M Achary and Mrs Y Naidoo in the analysis of the data and the preparation of the tables and graphs is gratefully acknowledged. Thanks are due to the SA Sugar Association Cane Testing Service, SA Sugar Terminals and the factories and refineries in southern Africa for the data supplied. The author is also indebted to many at the Sugar Milling Research Institute: Mrs A Dunsmore for sugar quality data, Dr BS Purchase, Mr MJ Reid and Mr A Wienese for their help in collecting information from the factories, and Mr D Walthew for information concerning evaporators. Finally, the author would like to thank Dr BS Purchase for the section on pollution control.

REFERENCES

Moodley, M and Schorn, PM (1997). Steps taken at Malelane to improve refined sugar quality. *Proc S Af Sug Technol Ass* 72 (in press).

Table B1

Cane crushed and sugar made, cane composition, throughputs and time accounts, performances and losses. South African sugar mills, 1996-97 season.

SYMBOLS OF FACTORIES	ML *	KM *	PG *	UF *	EN **	FX-A *	FX-B *	FX-AVE	AK *	DL	MS-A *	MS-B *	MS-AVE
TONS SUGAR MADE AND ESTIMATED	157561	103377	116009	125836	44144	-	-	296739	212292	149259	-	-	190264
Refined % total sugar	-	-	86.26	84.82	-	-	-	-	-	-	-	-	-
Moisture all sugar	0.11	0.09	0.06	0.05	0.07	-	-	0.12	0.17	0.15	-	-	0.11
Pol all sugar	99.30	99.54	99.80	99.88	99.41	-	-	99.46	99.35	99.34	-	-	99.38
Tons cane crushed total	1293927	905463	1047475	1185275	376994			2657958	1925846	1368524			1832811
Tons cane crushed per tandem						1352953	1305005				701825	1130986	
Season started on	15-May-96	21-May-96	09-Apr-96	11-Apr-96	17-Apr-96	-	-	18-Apr-96	11-Apr-96	18-Apr-96	-	-	22-Apr-96
Season completed on	30-Jan-97	25-Jan-97	26-Dec-96	26-Jan-97	21-Dec-96	-	-	19-Dec-96	19-Dec-96	21-Dec-96	-	-	22-Dec-96
Number of crushing days	260	249	261	290	248	-	-	245	252	247	-	-	244
TIME ACCOUNT													
Overal time efficiency %	68.24	76.73	78.55	68.62	77.39	81.65	78.98	80.32	82.13	77.82	68.17	75.64	71.94
Sched.stops% gross avail.time	6.04	4.20	6.04	5.08	9.51	7.61	6.92	7.27	8.20	7.11	3.72	3.94	3.83
Lack of cane % gross	15.83	13.38	3.23	2.62	6.87	3.06	5.95	4.50	6.23	7.13	18.03	11.25	14.60
Other stops % gross	8.30	5.09	11.91	23.52	6.04	7.60	8.02	7.81	3.25	6.10	9.71	8.64	9.17
Foreign matter % gross	1.59	0.60	0.27	0.16	0.19	0.08	0.13	0.10	0.20	1.84	0.37	0.53	0.45
Lost time % avail.crush.time	10.84	6.22	13.17	25.53	7.24	8.52	9.22	8.86	3.80	7.27	12.46	10.26	11.30
THROUGHPUTS PER CRUSHING HOUR													
Tons cane	309.24	215.01	216.42	250.06	81.74	282.28	285.14	567.36	387.62	296.34	179.70	255.64	440.07
Tons fibre	45.03	30.90	30.83	35.79	10.92	44.16	45.49	89.61	61.11	43.32	27.41	39.55	67.72
Tons brix in mixed juice	48.09	33.11	32.64	36.20	11.94	41.62	42.22	83.82	55.93	41.86	25.14	35.70	61.50
Tons sucrose in mixed juice	41.61	27.99	28.04	30.78	10.48	35.41	36.01	71.42	47.91	36.09	21.25	30.04	51.29
Tons non-suc. in mixed juice	6.49	5.13	4.60	5.42	1.46	6.20	6.21	12.41	8.02	5.77	3.89	5.66	9.66
Tons of sugar produced	37.66	24.55	23.97	26.55	9.57	-	-	63.34	42.73	32.32	-	-	45.68
COMPOSITION OF CANE CRUSHED													
Sucrose % cane	13.73	13.21	13.22	12.78	13.08	12.78	12.88	12.83	12.59	12.53	12.10	11.99	12.03
Pol % cane	13.59	13.02	13.08	12.63	12.95	12.65	12.76	12.70	12.47	12.41	11.95	11.84	11.89
Fibre % cane	14.78	14.42	14.34	15.13	14.36	15.75	16.06	15.90	15.95	15.67	15.50	15.71	15.63
Brix % cane	16.08	15.83	15.56	15.31	15.10	15.32	15.42	15.37	14.92	14.81	14.56	14.49	14.51
Ash % cane	1.89	2.06	1.47	2.05	1.44	1.92	1.97	1.94	1.08	1.84	1.30	1.44	1.39
ERC % cane	11.93	11.28	11.44	10.90	11.47	10.88	10.98	10.93	10.80	10.77	10.26	10.13	10.18
ERC % sucrose in cane	86.87	85.40	86.54	85.30	87.72	85.15	85.21	85.18	85.79	85.99	84.81	84.51	84.63
EXTRACTION													
Extraction (sucrose based)	98.00	98.56	98.04	96.27	98.08	98.15	98.04	98.09	98.18	97.21	97.76	98.00	97.91
Corrected reduced extraction	97.78	98.41	97.81	95.99	97.74	98.19	98.12	98.15	98.26	97.11	97.82	98.10	97.99
Imbibition % cane	58.71	50.05	38.66	40.99	56.31	58.20	57.63	57.92	51.88	50.16	54.31	50.75	52.11
Imbibition % fibre	403	348	271	286	421	372	361	367	329	343	356	328	339
Preparation index	92	92	90	90	88	92	92	92	93	92	89	90	89
Pol factor	99.16	99.59	99.13	98.24	99.23	99.33	100.03	99.67	100.18	99.92	99.78	99.86	99.83
Brix factor	100.59	100.71	100.63	100.50	100.39	101.84	102.65	102.23	101.29	101.05	100.89	101.06	101.00
RECOVERIES													
Boiling house recovery (suc.)	89.87	87.30	85.31	86.15	90.75	-	-	88.22	88.61	88.97	-	-	87.57
C. R. B.	87.46	86.98	83.72	85.13	87.03	-	-	87.33	87.21	86.74	-	-	87.16
Overall recovery (sucrose)	88.07	86.04	83.64	82.94	89.00	-	-	86.54	87.00	86.49	-	-	85.74
Ton cane per ton sugar	8.21	8.76	9.03	9.42	8.54	-	-	8.96	9.07	9.17	-	-	9.63
Ton cane per ton 96 pol sugar	7.94	8.45	8.69	9.05	8.25	-	-	8.65	8.77	8.86	-	-	9.31
BALANCES													
Suc. lost % suc.in cane													
- lost in bagasse (a)	2.00	1.44	1.96	3.73	1.92	-	-	1.91	1.82	2.79	-	-	2.09
- lost in filter cake (b)	0.61	0.10	0.18	0.44	0.19	-	-	0.17	0.06	0.53	-	-	0.31
- lost in final molasses (c)	8.04	10.53	10.58	10.93	7.34	-	-	10.29	9.21	8.54	-	-	10.14
- undetermined losses (d)	1.27	1.89	3.65	1.96	1.54	-	-	1.09	1.92	1.65	-	-	1.71
Boiling house losses(b+c+d)	9.92	12.51	14.40	13.33	9.08	-	-	11.55	11.19	10.72	-	-	12.17
Sum of all losses(a+b+c+d)	11.93	13.96	16.36	17.06	11.00	-	-	13.46	13.00	13.51	-	-	14.26
Non sucrose ratio	1.04	1.02	1.02	1.01	0.97	-	-	1.03	1.01	0.99	-	-	0.98
Fructose ratio FM/MJ	0.97	0.98	0.89	0.86	0.77	-	-	0.97	0.90	0.84	-	-	0.96
Glucose ratio FM/MJ	0.79	0.56	0.65	0.70	0.60	-	-	0.70	0.67	0.66	-	-	0.77

* Cane diffuser ** Bagasse diffuser

Table B1 (continued)
Cane crushed and sugar made, cane composition, throughputs and time accounts, performances and losses.
South African sugar mills, 1996-97 season.

SYMBOLS OF FACTORIES	GD **	GH-A *	GH-B	GH-AVE	NB	UC *	ES *	SZ-A *	SZ-B *	SZ-AVE	UK *	INDUSTRY
TONS SUGAR MADE AND ESTIMATED	44223	-	-	135729	134768	72131	100144	-	-	249146	144997	2276619
Refined % total sugar	-	-	-	100.00	100.00	-	-	-	-	-	-	20.97
Moisture all sugar	0.11	-	-	0.02	0.02	0.08	0.15	-	-	0.11	0.09	0.10
Pol all sugar	99.42	-	-	99.93	99.93	99.42	99.22	-	-	99.38	99.36	99.50
Tons cane crushed total	425137			1351681	1357536	663550	932640			2312766	1313252	20950835
Tons cane crushed per tandem		394551	957130					1169085	1143681			
Season started on	22-Apr-96	-	-	11-Apr-96	08-Apr-96	10-Apr-96	01-Apr-96	-	-	11-Apr-96	10-Apr-96	01-Apr-96
Season completed on	22-Dec-96	-	-	22-Dec-96	20-Dec-96	19-Dec-96	01-Feb-97	-	-	27-Jan-97	02-Feb-97	02-Feb-97
Number of crushing days	244	-	-	255	256	253	306	-	-	291	298	307
TIME ACCOUNT												
Overal time efficiency %	77.93	76.91	83.37	80.15	79.79	78.82	67.74	80.05	82.28	81.17	78.18	76.48
Sched.stops% gross avail.time	4.33	6.44	6.02	6.23	6.19	6.87	5.29	6.81	8.08	7.45	9.81	6.50
Lack of cane % gross	7.50	6.58	4.40	5.48	5.04	4.76	7.10	7.92	4.59	6.25	7.05	7.25
Other stops % gross	9.45	10.00	6.07	8.03	8.32	9.26	18.65	4.98	4.61	4.79	4.48	9.19
Foreign matter % gross	0.79	0.07	0.14	0.11	0.67	0.28	1.22	0.24	0.43	0.34	0.46	0.58
Lost time % avail.crush.time	10.81	11.50	6.78	9.10	9.44	10.52	21.59	5.85	5.31	5.58	5.42	10.73
THROUGHPUTS PER CRUSHING HOUR												
Tons cane	93.25	84.91	188.74	278.18	283.58	138.38	192.89	213.20	201.76	414.77	234.89	275.57
Tons fibre	13.80	13.70	28.90	43.26	39.36	17.64	29.34	32.47	30.67	63.11	35.59	41.20
Tons brix in mixed juice	13.09	11.70	25.15	37.44	38.57	19.40	27.96	30.83	28.95	59.76	33.59	39.73
Tons sucrose in mixed juice	11.12	9.85	21.34	31.19	32.70	16.74	24.09	26.24	24.57	50.80	28.81	33.93
Tons non-suc. in mixed juice	1.97	1.85	3.81	5.74	5.87	2.66	3.88	4.60	4.39	8.98	4.77	5.81
Tons of sugar produced	9.70	-	-	27.93	28.15	15.04	20.71	-	-	44.68	25.93	33.06
COMPOSITION OF CANE CRUSHED												
Sucrose % cane	12.33	11.83	11.53	11.62	11.85	12.41	12.98	12.57	12.44	12.51	12.52	12.60
Pol % cane	12.16	11.68	11.41	11.49	11.65	12.23	12.84	12.42	12.30	12.36	12.40	12.45
Fibre % cane	15.05	16.32	16.16	16.21	15.47	12.88	15.53	15.40	15.38	15.39	15.46	15.36
Brix % cane	14.85	14.27	13.80	13.94	14.21	14.54	15.33	15.04	14.93	14.99	14.85	15.00
Ash % cane	1.64	1.56	1.46	1.49	2.22	1.22	2.77	-	-	-	1.65	1.74
ERC % cane	10.46	10.00	9.80	9.86	10.07	10.79	11.18	10.72	10.58	10.65	10.75	10.78
ERC % sucrose in cane	84.85	84.49	84.96	84.82	84.99	86.94	86.13	85.28	85.07	85.18	85.83	85.59
EXTRACTION												
Extraction (sucrose based)	96.73	98.05	98.05	98.05	97.28	97.46	96.22	97.88	97.86	97.87	97.96	97.72
Corrected reduced extraction	96.66	98.24	98.17	98.20	97.12	96.90	96.15	97.89	97.88	97.88	97.96	97.67
Imbibition % cane	44.05	49.60	36.91	40.61	40.70	40.51	48.71	51.63	54.74	53.17	62.90	50.42
Imbibition % fibre	298	307	241	261	293	318	320	339	360	349	415	337
Preparation index	89	92	90	91	91	93	91	-	-	-	91	91
Pol factor	99.52	100.18	98.85	99.24	98.57	97.63	98.77	99.69	99.17	99.43	99.79	99.37
Brix factor	100.90	101.57	99.32	99.98	100.74	98.85	100.71	101.19	100.76	100.98	100.98	100.92
RECOVERIES												
Boiling house recovery (suc.)	86.73	-	-	88.07	86.03	89.34	85.31	-	-	87.45	89.43	87.82
C. R. B.	85.32	-	-	87.87	84.71	86.15	82.30	-	-	85.98	87.50	86.39
Overall recovery (sucrose)	83.89	-	-	86.35	83.69	87.07	82.08	-	-	85.60	87.61	85.82
Ton cane per ton sugar	9.61	-	-	9.96	10.07	9.20	9.31	-	-	9.28	9.06	9.20
Ton cane per ton 96 pol sugar	9.28	-	-	9.57	9.68	8.88	9.01	-	-	8.97	8.75	8.88
BALANCES												
Suc. lost % suc.in cane												
- lost in bagasse (a)	3.27	-	-	1.95	2.72	2.54	3.78	-	-	2.13	2.04	2.28
- lost in filter cake (b)	0.31	-	-	0.15	0.80	0.05	0.11	-	-	0.08	0.06	0.25
- lost in final molasses (c)	10.35	-	-	10.09	10.57	8.95	11.58	-	-	10.11	8.86	9.84
- undetermined losses (d)	2.18	-	-	1.46	2.21	1.39	2.45	-	-	2.09	1.44	1.81
Boiling house losses(b+c+d)	12.84	-	-	11.69	13.59	10.39	14.14	-	-	12.28	10.36	11.90
Sum of all losses(a+b+c+d)	16.11	-	-	13.65	16.31	12.93	17.92	-	-	14.40	12.39	14.18
Non sucrose ratio	0.97	-	-	1.01	1.03	1.00	1.03	-	-	1.00	0.99	1.01
Fructose ratio FM/MJ	0.83	-	-	0.86	0.88	0.83	0.91	-	-	0.95	0.92	0.91
Glucose ratio FM/MJ	0.57	-	-	0.65	0.68	0.44	0.77	-	-	0.75	0.73	0.69

* Cane diffuser ** Bagasse diffuser

Table B2
Cane crushed and sugar made, cane composition, throughputs and time accounts, performances and losses. Malawi and Zimbabwe sugar mills, 1996-97 season.

SYMBOLS OF FACTORIES	NH *	DW *	HV-A *	HV-B *	HV-AVE	TR-A *	TR-B	TR-AVE
TONS SUGAR MADE AND ESTIMATED	129308	85998	-	-	160844	-	-	175543
Refined % total sugar	40.01	58.77	-	-	0.00	-	-	0.00
Moisture all sugar	0.10	0.08	-	-	0.19	-	-	0.29
Pol all sugar	99.28	99.64	-	-	99.00	-	-	98.83
Tons cane crushed total	1198041	661801			1317380			1508867
Tons cane crushed per tandem			654928	662452		1081902	426965	
Season started on	16-Apr-96	14-May-96	-	-	10-May-96	-	-	03-Apr-96
Season completed on	06-Dec-96	03-Dec-96	-	-	17-Nov-96	-	-	18-Nov-96
Number of crushing days	234	203	-	-	191	-	-	229
TIME ACCOUNT								
Overal time efficiency %	82.75	82.26	91.90	91.58	91.74	85.56	54.20	71.30
Sched.stops% gross avail.time	1.84	4.60	3.20	2.84	3.02	7.08	28.91	17.01
Lack of cane % gross	5.06	8.70	0.61	0.52	0.57	1.03	7.04	3.77
Other stops % gross	9.90	4.40	4.17	5.06	4.62	6.33	9.71	7.87
Foreign mat. % gross	0.46	0.03	0.11	0.00	0.06	0.01	0.13	0.06
Lost time % avail.crush.time	10.68	5.08	4.34	5.24	4.79	6.89	15.19	9.94
THROUGHPUTS PER CRUSHING HOUR								
Tons cane	257.18	164.93	166.97	167.44	334.41	229.88	171.61	419.46
Tons fibre	39.95	25.48	25.24	25.31	50.55	34.15	24.80	61.84
Tons brix in mixed juice	37.95	27.87	26.52	26.88	53.40	35.15	25.48	63.61
Tons pol in mixed juice	32.42	24.41	22.78	23.11	45.89	30.00	21.78	51.78
Tons non-pol. in mixed juice	5.53	3.46	3.74	3.77	7.51	5.15	3.70	9.30
Tons of sugar produced	27.76	21.43	-	-	40.83	-	-	48.80
COMPOSITION OF CANE CRUSHED								
Pol % cane	12.96	15.05	13.94	14.10	14.02	13.31	13.16	13.27
Fibre % cane	15.71	15.45	15.28	15.29	15.29	15.08	15.00	15.06
Brix % cane	15.39	17.39	16.50	16.66	16.58	15.93	15.82	15.90
Ash % cane	-	-	0.60	0.60	0.60	-	-	-
ERC % cane	11.12	13.21	12.02	12.16	12.09	11.37	11.21	11.33
ERC % pol in cane	85.77	87.79	86.18	86.30	86.24	85.42	85.16	85.35
EXTRACTION								
Extraction (pol based)	97.26	98.37	97.85	97.92	97.89	98.01	96.44	97.57
Corrected reduced extraction	97.28	98.22	97.70	97.75	97.73	97.89	96.13	97.40
Imbibition % cane	43.60	46.21	58.78	61.25	60.02	53.88	52.98	53.62
Imbibition % fibre	281	299	389	405	397	363	367	364
Preparation index	91	90	92	92	92	92	92	92
Pol factor	-	100.30	100.08	100.08	100.08	-	-	-
Brix factor	-	101.68	100.81	100.81	100.81	-	-	-
RECOVERIES								
Boiling house recovery (pol)	85.01	87.48	-	-	88.08	-	-	88.80
Overall recovery (pol)	82.68	86.05	-	-	86.22	-	-	86.64
Ton cane per ton sugar	9.27	7.70	-	-	8.19	-	-	8.60
Ton cane per ton 96 pol sugar	8.96	7.41	-	-	7.94	-	-	8.35
BALANCES								
Pol lost % pol in cane								
- lost in bagasse (a)	2.74	1.63	-	-	2.11	-	-	2.43
- lost in filter cake (b)	0.05	0.15	-	-	0.05	-	-	0.17
- lost in final molasses (c)	12.40	-	-	-	8.15	-	-	8.67
- undetermined losses (d)	2.13	-	-	-	3.48	-	-	2.08
Boiling house losses(b+c+d)	14.58	-	-	-	11.67	-	-	10.93
Sum of all losses(a+b+c+d)	17.32	-	-	-	13.78	-	-	13.36
Non pol ratio	0.86	-	-	-	0.99	-	-	1.01

* Cane diffuser

Table C1
Analysis of bagasse, juices, filtercake, syrup and final molasses.
South African sugar mills, 1996-97 season.

SYMBOLS OF FACTORIES	ML *	KM *	PG *	UF *	EN **	FX-A *	FX-B *	FX-AVE	AK *	DL	MS-A *	MS-B *	MS-AVE
FINAL BAGASSE													
Pol % bagasse	0.85	0.71	0.92	1.53	0.92	0.69	0.69	0.69	0.72	1.11	0.78	0.67	0.71
Moisture % bagasse	53.40	45.00	47.79	51.28	49.31	52.58	54.72	53.67	49.07	51.19	54.83	55.13	55.02
Fibre % bagasse	44.97	53.41	50.51	46.04	48.90	45.73	43.60	44.65	49.38	46.62	43.54	43.41	43.46
Bagasse % cane	32.38	26.91	28.20	31.09	27.33	34.20	36.59	35.37	31.92	31.35	35.04	35.64	35.41
Ash % bagasse	4.22	4.11	4.69	5.11	2.62	-	-	3.97	2.53	2.33	-	-	2.92
LCV in kJ per kg bagasse ##	6345	8112	7415	6578	7503	-	-	6337	7577	7156	-	-	6267
MIXED JUICE													
Mixed juice % cane	126.33	123.14	110.46	109.90	128.98	123.99	121.04	122.54	119.96	118.81	119.28	115.11	116.70
Brix % mixed juice	12.31	12.51	13.65	13.17	11.33	11.89	12.23	12.06	12.03	11.89	11.73	12.13	11.97
Sucrose purity	86.51	84.52	85.92	85.02	87.78	85.09	85.30	85.19	85.66	86.22	84.54	84.15	84.30
Apparent purity	85.62	83.28	85.01	83.93	86.94	84.20	84.44	84.32	84.82	85.41	83.51	83.09	83.25
Purity difference(MJ - DAC)	-0.11	0.12	-0.32	-0.44	0.15	-0.46	-0.45	-0.45	0.35	0.64	0.48	0.34	0.40
(Gluc. + fruct.)/suc. ratio	5.04	5.73	5.35	5.83	4.16	-	-	4.85	4.45	4.97	-	-	5.41
Suspended solids % mixed juice	0.18	0.04	0.08	0.74	0.77	0.09	0.09	0.09	0.15	0.89	0.20	0.21	0.21
Pol/sucrose ratio	0.9897	0.9853	0.9894	0.9871	0.9904	0.9895	0.9899	0.9897	0.9902	0.9906	0.9879	0.9875	0.9876
CLARIFIED JUICE													
Brix % clarified juice	12.11	12.22	13.00	12.22	11.30	-	-	11.16	11.69	11.42	-	-	11.86
Apparent purity	84.56	83.37	85.31	83.58	86.13	-	-	83.08	84.14	85.46	-	-	82.50
Purity difference(CJ - MJ)	-1.06	0.09	0.30	-0.35	-0.81	-	-	-1.24	-0.68	0.05	-	-	-0.75
Average pH	7.2	7.1	6.9	7.1	7.1	-	-	7.0	7.1	7.0	-	-	6.9
FILTER CAKE													
Pol % filter cake	2.12	3.34	1.14	1.13	0.88	-	-	0.85	0.93	1.33	-	-	1.90
Moisture % filter cake	72.25	68.85	68.88	67.31	72.23	-	-	73.44	76.53	72.53	-	-	73.85
Filter cake % cane	3.96	0.38	2.05	5.00	2.90	-	-	2.50	0.85	5.00	-	-	1.99
Filter wash index	101.7	102.3	105.0	107.8	100.3	-	-	108.0	102.9	104.1	-	-	101.0
Purity diff.(CJ - filtrate)	2.35	5.99	-1.69	2.58	0.50	-	-	1.09	2.31	1.30	-	-	3.46
SYRUP													
Brix % syrup	64.70	65.72	61.98	63.91	65.49	-	-	63.35	66.76	60.33	-	-	67.22
Apparent purity	84.71	82.54	84.70	83.80	86.54	-	-	83.72	84.73	86.01	-	-	83.21
Purity difference(Syrup - MJ)	-0.91	-0.74	-0.31	-0.13	-0.40	-	-	-0.60	-0.09	0.60	-	-	-0.04
Average pH	6.1	5.9	6.1	6.2	6.2	-	-	6.0	6.2	6.3	-	-	6.0
FINAL MOLASSES													
Refracto brix	83.72	86.90	82.13	83.89	84.85	-	-	82.47	89.28	85.99	-	-	84.09
Pol/refracto brix purity	31.32	30.76	35.78	36.06	33.38	-	-	34.05	33.13	32.64	-	-	32.88
Suc/refracto brix purity	34.26	36.71	39.29	39.05	36.59	-	-	37.38	36.35	36.39	-	-	36.77
Sulphated ash %	14.55	16.64	13.66	14.15	14.69	-	-	14.57	15.81	15.76	-	-	14.18
(Gluc. + fruct.)/ash ratio	1.06	0.78	0.90	0.93	0.81	-	-	0.82	0.77	0.84	-	-	0.99
Fructose %	8.30	8.09	7.18	7.47	7.10	-	-	7.10	7.28	7.70	-	-	8.06
Glucose %	7.18	4.93	5.15	5.66	4.87	-	-	4.83	4.88	5.61	-	-	5.95
TPD based on molasses	3.7	2.6	7.6	5.7	4.0	-	-	4.3	3.5	2.9	-	-	4.8
TPD based on mixed juice	4.5	4.5	9.8	8.3	6.7	-	-	5.8	5.5	5.3	-	-	5.7
Final mol at 85 brix % cane	3.79	4.46	4.19	4.21	3.09	-	-	4.16	3.75	3.46	-	-	3.90
Pol/sucrose ratio	0.9142	0.8380	0.9107	0.9234	0.9123	-	-	0.9109	0.9112	0.8969	-	-	0.8941

* Cane diffuser
** Bagasse diffuser
LCV = 18309 - 31,14 Bx % bagasse - 207,63 moisture % bagasse - 196,05 ash % bagasse

Table C1 (continued)
Analysis of bagasse, juices, filtercake, syrup and final molasses.
South African sugar mills, 1996-97 season.

SYMBOLS OF FACTORIES	GD **	GH-A *	GH-B	GH-AVE	NB	UC *	ES *	SZ-A *	SZ-B *	SZ-AVE	UK *	INDUSTRY
FINAL BAGASSE												
Pol % bagasse	1.24	0.66	0.71	0.70	1.08	1.09	1.45	0.87	0.86	0.86	0.78	0.90
Moisture % bagasse	52.03	52.32	50.24	50.89	51.51	54.12	52.49	48.29	49.04	48.67	52.00	51.40
Fibre % bagasse	45.46	46.29	48.26	47.64	46.45	44.08	45.04	49.81	49.09	49.45	46.33	46.78
Bagasse % cane	32.55	34.86	31.73	32.64	29.88	28.91	33.78	30.57	30.97	30.77	32.71	31.96
Ash % bagasse	-	-	-	-	3.78	2.87	5.89	-	-	4.97	5.40	3.63
LCV in kJ per kg bagasse ##	-	-	-	-	6812	6456	6180	-	-	7173	6404	6798
MIXED JUICE												
Mixed juice % cane	111.49	114.74	105.18	107.97	110.81	111.60	114.93	121.06	123.77	122.40	130.19	118.46
Brix % mixed juice	12.59	12.01	12.67	12.46	12.28	12.56	12.61	11.95	11.59	11.77	10.98	12.17
Sucrose purity	84.96	84.17	84.86	84.66	84.77	86.28	86.14	85.09	84.85	84.97	85.79	85.38
Apparent purity	83.73	83.05	83.93	83.67	83.29	85.00	85.15	84.07	83.87	83.97	84.94	84.39
Purity difference(MJ - DAC)	0.74	0.07	0.86	0.63	-0.49	-0.18	-0.21	0.23	0.15	0.19	0.42	0.06
(Gluc. + fruct.)/suc. ratio	5.69	-	-	5.83	6.48	5.43	4.85	-	-	5.39	4.61	5.23
Suspended solids % mixed juice	0.22	0.16	0.81	0.61	1.44	0.13	0.28	0.14	0.14	0.14	0.24	0.35
Pol/sucrose ratio	0.9856	0.9867	0.9890	0.9883	0.9825	0.9851	0.9885	0.9880	0.9884	0.9882	0.9901	0.9883
CLARIFIED JUICE												
Brix % clarified juice	11.83	-	-	12.41	12.34	12.97	12.28	-	-	11.00	10.80	11.78
Apparent purity	83.44	-	-	83.45	83.35	83.83	84.60	-	-	83.70	84.46	83.88
Purity difference(CJ - MJ)	-0.29	-	-	-0.22	0.06	-1.17	-0.55	-	-	-0.27	-0.48	-0.51
Average pH	7.0	-	-	7.0	7.2	6.9	7.1	-	-	7.0	6.9	7.0
FILTER CAKE												
Pol % filter cake	1.94	-	-	0.63	1.39	0.93	1.94	-	-	0.94	0.77	1.29
Moisture % filter cake	-	-	-	68.09	74.52	74.14	71.44	-	-	75.07	71.67	72.19
Filter cake % cane	1.97	-	-	2.69	6.87	0.71	0.72	-	-	1.00	1.00	2.48
Filter wash index	106.4	-	-	100.4	99.5	96.9	102.7	-	-	107.0	101.7	103.3
Purity diff.(CJ - filtrate)	4.13	-	-	-0.26	0.48	3.39	3.07	-	-	0.98	0.90	1.36
SYRUP												
Brix % syrup	61.58	-	-	65.59	65.57	65.77	62.04	-	-	65.11	67.56	64.74
Apparent purity	83.97	-	-	83.32	83.84	84.66	84.50	-	-	84.07	85.04	84.22
Purity difference(Syrup - MJ)	0.24	-	-	-0.35	0.55	-0.34	-0.65	-	-	0.10	0.10	-0.17
Average pH	6.2	-	-	6.0	6.1	6.2	6.2	-	-	6.0	6.1	6.1
FINAL MOLASSES												
Refracto brix	79.25	-	-	80.53	83.07	79.55	79.44	-	-	80.32	80.10	82.97
Pol/refracto brix purity	34.56	-	-	32.63	32.54	30.67	40.38	-	-	33.53	32.93	33.56
Suc/refracto brix purity	39.05	-	-	35.99	37.08	37.22	42.92	-	-	37.53	36.19	37.28
Sulphated ash %	13.78	-	-	14.40	12.64	12.61	10.79	-	-	12.90	13.43	14.07
(Gluc. + fruct.)/ash ratio	0.85	-	-	0.86	1.15	0.90	1.08	-	-	1.04	0.92	0.92
Fructose %	7.15	-	-	7.24	8.72	7.97	6.89	-	-	7.93	7.25	7.61
Glucose %	4.51	-	-	5.17	5.75	3.44	4.75	-	-	5.49	5.08	5.31
TPD based on molasses	5.9	-	-	3.4	5.9	4.4	9.8	-	-	5.1	3.9	4.7
TPD based on mixed juice	8.5	-	-	6.0	8.5	7.9	11.7	-	-	6.7	5.8	6.6
Final mol at 85 brix % cane	3.84	-	-	3.83	3.98	3.51	4.12	-	-	3.96	3.61	3.91
Pol/sucrose ratio	0.8851	-	-	0.9067	0.8775	0.8241	0.9408	-	-	0.8937	0.9100	0.9003

* Cane diffuser
** Bagasse diffuser
LCV = 18309 - 31,14 Bx % bagasse - 207,63 moisture % bagasse - 196,05 ash % bagasse

Table C2
Analysis of bagasse, juices, filtercake, syrup and final molasses.
Malawi and Zimbabwe mills, 1996-97 season.

SYMBOLS OF FACTORIES	NH *	DW *	HV-A *	HV-B *	HV-AVE	TR-A *	TR-B	TR-AVE
FINAL BAGASSE								
Pol % bagasse	1.08	0.83	0.96	0.96	0.96	0.84	1.47	1.02
Moisture % bagasse	50.96	45.77	49.39	48.76	49.08	50.50	51.53	50.80
Fibre % bagasse	47.12	52.56	48.61	49.27	48.94	47.44	45.42	46.86
Bagasse % cane	32.96	29.40	31.10	30.68	30.89	31.32	31.82	31.46
Ash % bagasse	-	-	-	-	1.93	-	-	-
LCV in kJ per kg bagasse ##	-	-			7681			-
MIXED JUICE								
Mixed juice % cane	110.64	116.80	127.67	130.57	129.13	122.56	121.16	122.17
Brix % mixed juice	13.34	14.47	12.44	12.30	12.37	12.48	12.25	12.41
Apparent purity	85.42	87.59	85.91	85.97	85.94	85.34	85.50	85.39
Purity difference(MJ - DAC)	0.00	-0.12	0.81	0.74	0.78	-0.16	0.00	-0.12
Suspended solids % mixed juice	0.16	0.00	0.13	0.13	0.13	0.18	0.45	0.26
CLARIFIED JUICE								
Brix % clarified juice	12.57	14.12	-	-	12.06	-	-	11.94
Apparent purity	85.12	87.75	-	-	85.66	-	-	84.50
Purity difference(CJ - MJ)	-0.30	0.16	-	-	-0.28	-	-	-0.89
Average pH	7.1	6.7	-	-	6.9	-	-	6.9
FILTER CAKE								
Pol % filter cake	1.62	1.10	-	-	1.21	-	-	0.94
Moisture % filter cake	71.86	73.89	-	-	75.75	-	-	-
Filter cake % cane	0.37	2.02	-	-	0.53	-	-	2.42
Filter wash index	106.1	102.5	-	-	102.5	-	-	104.0
Purity diff.(CJ - filtrate)	5.82	-	-	-	2.40	-	-	1.82
SYRUP								
Brix % syrup	64.99	60.74	-	-	56.51	-	-	66.07
Apparent purity	86.30	88.26	-	-	86.07	-	-	84.95
Purity difference(Syrup - MJ)	0.88	0.67	-	-	0.13	-	-	-0.44
Average pH	6.6	6.2	-	-	6.2	-	-	6.1
FINAL MOLASSES								
Refracto brix	79.78	-	-	-	86.99	-	-	83.49
Pol/refracto brix purity	47.40	-	-	-	35.02	-	-	35.04
Purity difference(true-target)	10.00	-	-	-	7.87	-	-	-
Reducing sugars % #	9.37	-	-	-	14.85	-	-	-
Sulphated ash %	17.09	-	-	-	15.87	-	-	-
Reducing sugars/ash ratio	0.55	-	-	-	0.94	-	-	-
Final mol at 85 brix % cane	3.99	-	-	-	3.84	-	-	3.86

* Cane diffuser
\# Reducing sugars determined by Lane & Eynon method.
LCV = 18309 - 31,14 Bx % bagasse - 207,63 moisture % bagasse - 196,05 ash % bagasse

Table D1
Massecuites, exhaustions, clarifying agents and additional fuels.
South African mills, 1996-97 season.

SYMBOLS OF FACTORIES	ML	KM	PG	UF	EN	FX	AK	DL	MS	GD	GH	NB	UC	ES	SZ	UK	INDUSTRY
A - MASSECUITE																	
m3 per ton brix in mixed juice	1.16	0.80	1.19	1.09	0.99	1.00	0.99	0.97	0.99	0.97	1.18	1.26	1.00	1.08	1.02	0.99	1.04
Ref brix of massecuite	94.54	93.28	91.78	91.49	91.71	93.25	93.06	93.17	92.78	92.75	92.47	92.86	92.76	91.74	92.91	92.79	92.83
Purity of massecuite	84.75	82.72	86.28	85.77	87.22	85.54	84.92	85.52	83.74	83.87	84.58	85.50	85.03	83.60	84.11	83.92	84.81
Purity of A - molasses	66.85	65.13	71.07	70.51	70.65	68.94	65.68	66.90	65.08	66.48	68.46	67.63	66.85	68.22	65.40	64.33	67.26
Purity drop	17.90	17.59	15.21	15.26	16.57	16.60	19.24	18.62	18.66	17.39	16.12	17.87	18.18	15.38	18.71	19.59	17.55
Exhaustion	63.71	60.98	60.94	60.33	64.73	62.48	66.02	65.78	63.81	61.86	60.43	64.57	64.50	57.89	64.29	65.44	63.22
Pty of A-mass - purity syrup	0.04	0.18	1.58	1.97	0.68	1.82	0.19	-0.49	0.53	-0.10	1.26	1.66	0.37	-0.90	0.04	-1.12	0.60
Pty of remelt	84.10	83.69	84.63	85.95	88.25	88.45	85.00	83.62	84.99	85.73	85.09	84.12	85.51	82.36	84.22	81.20	84.87
B - MASSECUITE																	
m3 per ton brix in mixed juice	0.44	0.35	0.57	0.49	0.32	0.37	0.28	-	0.15	0.36	0.43	0.46	0.34	0.38	0.31	0.33	0.36
Ref brix of massecuite	96.93	96.51	93.91	94.56	93.99	95.29	94.99	95.62	94.28	94.65	95.19	95.62	95.28	93.57	93.55	94.40	94.91
Purity of massecuite	67.71	65.23	71.74	70.08	72.36	71.44	67.37	65.92	65.68	66.38	68.41	68.08	68.70	68.60	66.62	64.69	68.49
Purity of B - molasses	45.66	42.73	50.90	47.62	49.99	48.09	43.14	46.86	45.93	43.89	43.49	46.03	42.84	49.70	42.78	43.33	45.90
Purity drop	22.05	22.50	20.84	22.46	22.37	23.35	24.23	19.06	19.75	22.49	24.92	22.05	25.86	18.90	23.84	21.36	22.60
Exhaustion	59.93	60.23	59.16	61.19	61.82	62.96	63.25	54.41	55.61	60.38	64.46	60.01	65.85	54.77	62.54	58.27	60.98
C - MASSECUITE																	
m3 per ton brix in mixed juice	0.22	0.13	0.40	0.27	0.23	0.31	0.25	0.25	0.26	0.25	0.26	0.27	0.24	0.25	0.26	0.26	0.26
Ref brix of massecuite	98.31	97.89	97.31	96.83	96.18	97.29	97.22	96.50	96.51	96.57	97.08	97.02	97.78	95.56	96.31	96.69	96.95
Purity of massecuite	50.03	51.05	52.63	53.50	55.10	56.66	54.16	53.66	54.20	48.53	52.38	52.42	50.55	54.98	53.39	51.06	53.41
Purity of C - molasses	31.32	30.76	35.78	36.06	33.38	34.05	33.13	32.64	32.88	34.56	32.63	32.54	30.67	40.38	33.53	32.93	33.56
Crystal content	26.78	28.69	25.53	26.41	31.36	33.36	30.58	30.11	30.66	20.61	28.46	28.59	28.04	23.40	28.77	26.13	28.96
Exhaustion	54.45	57.40	49.85	50.98	59.17	60.51	58.07	58.16	58.61	43.98	55.96	56.22	56.72	44.53	55.95	52.93	55.93
TOTAL VOLUME ALL RAW MASSECUITES																	
m3 per ton brix in mixed juice	1.81	1.28	2.16	1.85	1.54	1.68	1.52	-	1.40	1.58	1.87	1.98	1.58	1.71	1.59	1.58	1.64
WHITE SUGAR MASSECUITES																	
Kg sugar per m3 massecuite	616	-	698	682	-	-	-	-	-	-	564	428	-	-	-	-	380
Tons limestone per 1000 tons white sugar	-	-	74.28	-	-	-	-	-	-	-	32.82	-	-	-	-	-	-
Tons coke/1000 tons white sugar	-	-	9.70	-	-	-	-	-	-	-	4.81	-	-	-	-	-	-
Tons phos acid/1000 tons white sugar	-	-	-	-	-	-	-	-	-	-	-	1.34	-	-	-	-	-
Tons sulphur/1000 tons white sugar	0.08	-	0.09	5.22	-	-	-	-	-	-	0.07	0.31	-	-	-	-	-
Phos. acid ppm mixed juice	-	-	-	-	8.29	-	16.32	-	-	-	-	2.38	47.26	5.04	21.90	-	-
Flocculant ppm mixed juice	1.36	1.61	5.14	2.51	2.62	4.16	2.56	2.16	4.92	9.84	3.80	6.93	3.90	5.82	5.57	-	3.77
Tons lime per 1000 tc	1.88	0.31	-	1.21	0.74	0.74	0.66	0.52	0.08	0.54	-	0.75	0.49	0.65	0.63	-	0.58
Enzyme ppm sugar	0.00	0.00	0.00	0.00	22.29	0.00	0.00	5.02	3.15	10.18	18.32	0.00	0.00	1.71	8.32	-	3.30
ADDITIONAL FUELS PER 1000 TC																	
Tons of coal	57.17	5.57	19.95	24.10	7.53	9.03	1.86	0.64	17.06	6.63	8.83	6.94	12.17	7.12	0.00	0.86	-
Tons of wood	0.00	0.05	0.34	0.00	0.27	0.04	0.12	0.30	0.02	1.40	0.00	0.06	0.60	0.65	0.00	0.00	-
Converted into bagasse **	228.68	22.36	80.22	96.42	30.45	36.15	7.60	2.93	68.25	28.20	35.31	27.83	49.40	29.28	0.00	3.43	-

** 1 TON COAL EQUIVALENT TO 4 TONS OF BAGASSE
1 TON FIREWOOD EQUIVALENT TO 1,2 TONS OF BAGASSE

Table D2
Massecuites, exhaustions, clarifying agents and additional fuels.
Malawi and Zimbabwe mills, 1996-97 season.

SYMBOLS OF FACTORIES	NH	DW	HV	TR
A - MASSECUITE				
m3 per ton brix in mixed juice	1.33	1.28	1.03	0.90
Ref brix of massecuite	92.59	92.11	91.08	92.72
Purity of massecuite	86.08	90.35	87.31	83.95
Purity of A - molasses	73.42	78.75	70.55	65.63
Purity drop	12.66	11.60	16.76	18.32
Exhaustion	55.33	60.42	65.18	63.49
Purity of A-mass - pty syrup	-0.22	2.09	1.24	-1.00
Purity of remelt	98.08	92.62	88.30	83.68
B - MASSECUITE				
m3 per ton brix in mixed juice	-	0.68	-	-
Ref brix of massecuite	93.98	93.18	-	-
Purity of massecuite	70.70	72.32	-	-
Purity of B - molasses	56.55	45.54	-	-
Purity drop	14.15	26.78	-	-
Exhaustion	46.06	67.99	-	-
C - MASSECUITE				
m3 per ton brix in mixed juice	0.38	-	-	-
Ref brix of massecuite	96.20	-	-	-
Purity of massecuite	62.73	-	-	-
Purity of C - molasses	47.40	-	35.02	35.04
Crystal content	28.04	-	-	-
Exhaustion	46.46	-	-	-
TOTAL VOLUME ALL RAW MASSECUITES				
m3 per ton brix in mixed juice	-	-	-	-
WHITE SUGAR MASSECUITES				
Kg sugar per m3 massecuite	440	551	-	-
Tons phos acid/1000 tons white sugar	0.30	-	-	-
Tons sulphur/1000 tons white sugar	0.17	0.17	-	-
Phos. acid ppm mixed juice	4.7	-	-	-
Flocculant ppm mixed juice	4.9	1.9	1.5	1.9
Tons lime per 1000 tc	0.8	1.2	-	-
Enzyme ppm sugar	0.0	0.0	0.0	0.0
ADDITIONAL FUELS PER 1000 TC				
Tons of coal	-	-	-	3.98
Tons of wood	1.42	-	10.44	-
Converted into bagasse **	1.70	-	12.53	15.93

** 1 TON COAL EQUIVALENT TO 4 TONS OF BAGASSE
1 TON FIREWOOD EQUIVALENT TO 1,2 TONS OF BAGASSE

Table E
Comparative manufacturing data for South African mills.
1992-93 to 1996-97 seasons.

Season	1996/97	1995/96	1994/95	1993/94	1992/93
Throughput and time efficiency					
Tons cane per hour	275.57	268.50	246.90	249.90	252.34
Tons fibre per hour	41.20	41.35	37.19	39.55	37.86
Time efficiency	76.48	75.45	78.76	76.77	79.37
Cane					
Sucrose % cane	12.60	11.87	12.54	12.53	13.82
Fibre % cane	15.36	15.84	15.49	16.23	15.40
Mixed juice					
Sucrose purity	85.38	83.60	83.66	83.14	83.61
(Gluc. + Fruct.)/ash in M.J.	1.24	1.29	1.26	1.03	1.41
Milling					
Imbibition % fibre	337	356	366	380	387
Extraction (sucrose based)	97.72	97.69	97.87	97.75	97.81
Pol % bagasse	0.90	0.83	0.83	0.83	0.93
Moisture % bagasse	51.40	51.70	51.27	51.52	51.92
Bagasse % cane	31.96	33.01	32.05	33.88	32.48
LCV bagasse kJ/kg	6798	6696	6878	6952	6989
Avail. kJ in bag./kg brix in M.J.	15069	15941	15025	15985	14034
Recoveries					
Boiling house recovery (sucrose based)	87.82	85.93	86.50	85.05	85.90
Overall recovery (sucrose based)	85.82	83.94	84.66	83.14	84.02
Tons cane per ton sugar	9.20	9.99	9.37	9.56	8.57
Filter cake					
Pol % filter cake	1.29	1.01	0.88	0.92	1.04
Filter cake % cane	2.48	2.59	3.18	3.35	3.36
Final molasses					
Brix % final molasses	82.97	81.72	82.20	82.01	81.18
Sucrose/brix purity	37.28	37.34	36.87	38.21	37.38
Tons fin.molasses at 85 bx % cane	3.91	4.25	4.39	4.66	4.92
Average sugar polarisation	99.50	99.47	99.44	99.58	99.59
Sucrose lost % sucrose in cane					
Lost in bagasse	2.28	2.31	2.13	2.25	2.19
Lost in filter cake	0.25	0.22	0.22	0.25	0.25
Lost in final molasses	9.84	11.37	10.97	12.07	11.31
Undetermined losses	1.81	2.15	2.02	2.29	2.23
Lost in boiling house	11.90	13.74	13.21	14.61	13.79
Total losses	14.18	16.06	15.34	16.86	15.98
M3 massecuite per ton Bx in M.J.					
A - massecuite	1.04	1.00	0.98	1.00	1.00
B - massecuite	0.36	0.34	0.36	0.36	0.34
C - massecuite	0.26	0.29	0.29	0.31	0.29
Total	1.64	1.63	1.63	1.67	1.63
Exhaustion of massecuites					
A - massecuite	63.22	63.20	64.79	63.79	64.42
B - massecuite	60.98	58.62	59.87	58.38	59.84
C - massecuite	55.93	55.77	56.40	52.89	54.00
Brix of syrup	64.74	64.36	64.93	64.47	65.35

Table F
Average manufacturing results over monthly periods.
South African mills, 1996-97 season.

End of month period		27 APR 1996	1 JUN 1996	29 JUN 1996	27 JULY 1996	31 AUG 1996	28 SEP 1996	2 NOV 1996	30 NOV 1996	28 DEC 1996	1 FEB 1997	1 MAR 1997
Tons of sugar made and estimated	Month	77865	265847	287694	258849	364135	296894	314300	223748	133822	53465	0
	To-date	77865	343712	631406	890255	1254390	1551284	1865584	2089332	2223154	2276619	2276619
Tons cane crushed	Month	895178	2680812	2558277	2276468	3168867	2524219	2772947	2104038	1365751	604268	0
	To-date	895178	3575990	6134267	8410735	11579602	14103821	16876768	18980806	20346557	20950835	20950835
Tons cane crushed per hour actual crushing	Month	245.33	276.09	288.53	287.40	289.31	284.60	274.01	263.32	252.15	239.99	0.00
	To-date	245.33	267.69	276.00	279.00	281.66	282.18	280.80	278.75	276.79	275.57	275.57
Sucrose % cane	Month	10.71	11.49	12.83	13.00	13.14	13.44	13.13	12.41	11.95	11.17	0.00
	To-date	10.71	11.30	11.93	12.22	12.47	12.65	12.73	12.69	12.64	12.60	12.60
Fibre % cane	Month	15.18	14.96	14.34	14.79	14.80	15.15	16.25	16.66	16.58	16.42	0.00
	To-date	15.18	15.01	14.73	14.75	14.76	14.83	15.07	15.24	15.33	15.36	15.36
Tons cane per ton sugar	Month	11.50	10.08	8.89	8.79	8.70	8.50	8.82	9.40	10.21	11.30	0.00
	To-date	11.50	10.40	9.72	9.45	9.23	9.09	9.05	9.08	9.15	9.20	9.20
Extraction (sucrose based)	Month	97.39	97.65	97.83	97.80	97.75	97.86	97.79	97.62	97.49	97.23	0.00
	To-date	97.39	97.59	97.70	97.73	97.73	97.76	97.76	97.75	97.73	97.72	97.72
Imbibition % fibre	Month	340	334	334	330	336	344	338	336	343	355	0
	To-date	340	335	335	334	334	336	336	336	337	337	337
Pol % bagasse	Month	0.87	0.86	0.93	0.93	0.96	0.92	0.87	0.86	0.86	0.89	0.00
	To-date	0.87	0.86	0.89	0.90	0.92	0.92	0.91	0.90	0.90	0.90	0.90
Moisture % bagasse	Month	52.37	51.93	51.35	51.05	51.32	51.09	50.96	51.23	52.08	51.75	0.00
	To-date	52.37	52.04	51.77	51.58	51.51	51.43	51.35	51.33	51.39	51.40	51.40
Boiling house recovery (sucrose based)	Month	82.89	87.91	89.17	88.99	89.03	88.99	87.81	87.32	83.79	80.96	0.00
	To-date	82.89	86.72	87.82	88.16	88.41	88.52	88.40	88.28	88.00	87.82	87.82
Overall recovery (sucrose based)	Month	80.73	85.84	87.23	87.04	87.03	87.09	85.87	85.24	81.68	78.71	0.00
	To-date	80.73	84.63	85.80	86.15	86.41	86.54	86.42	86.30	86.00	85.82	85.82
Mixed juice sucrose purity	Month	82.57	83.64	85.77	85.95	86.99	86.46	85.90	85.01	83.70	81.24	0.00
	To-date	82.57	83.39	84.44	84.87	85.47	85.66	85.70	85.62	85.50	85.38	85.38
Pol/suc. ratio in mixed juice	Month	0.9752	0.9830	0.9843	0.9879	0.9873	0.9926	0.9940	0.9932	0.9905	0.9832	0.0000
	To-date	0.9752	0.9811	0.9826	0.9841	0.9850	0.9865	0.9877	0.9883	0.9885	0.9883	0.9883
Sucrose/brix purity in final molasses	Month	37.86	35.92	35.89	36.38	37.51	36.92	38.13	38.15	38.95	39.69	0.00
	To-date	37.86	36.44	36.22	36.26	36.58	36.64	36.90	37.04	37.18	37.28	37.28
Sucrose lost in final molasses % sucrose in cane	Month	12.87	10.39	8.95	8.85	8.76	8.93	9.75	10.52	11.75	15.97	0.00
	To-date	12.87	10.97	10.07	9.72	9.44	9.35	9.41	9.53	9.67	9.84	9.84
Undetermined lost sucrose % sucrose in cane	Month	3.52	1.16	1.43	1.67	1.74	1.62	1.92	1.58	3.73	1.93	0.00
	To-date	3.52	1.72	1.59	1.61	1.65	1.64	1.69	1.68	1.81	1.81	1.81
Pol/sucrose ratio FM	Month	0.8812	0.8609	0.8509	0.8630	0.8964	0.9269	0.9344	0.9419	0.9352	0.9234	0.0000
	To-date	0.8812	0.8665	0.8603	0.8610	0.8705	0.8807	0.8901	0.8963	0.8993	0.9003	0.9003

Table G
Cane varieties and rainfall (mm).
Percentage by weight, 1996-97 season.

MILL	N 11	N 12	N 13	N 14	N 16	N 17	N 18	N 19	N 22	N 23	N 24	N 25	N 52/219	N 55/805	NCo 293	NCo 310	NCo 376	NCo 382	MIXED VARIETY	UNKNOWN AND OTHER	% BURNT	* RAINFALL mm
ML	-	-	-	53.8	-	1.4	-	26.1	8.3	0.4	6.0	1.1	-	-	-	-	-	-	0.3	2.7	100.0	332.0
KM	-	-	-	63.7	-	0.5	-	21.9	4.5	0.1	0.9	1.2	-	-	-	-	-	-	0.2	7.2	100.0	275.7
PG	-	-	-	37.9	-	1.8	-	41.4	3.1	1.1	1.5	2.0	-	-	-	-	0.1	-	1.1	10.0	100.0	388.0
UF	-	4.6	-	10.2	-	15.6	0.6	23.6	1.3	0.1	0.1	-	-	-	-	1.7	31.9	-	8.6	1.8	98.6	449.4
EN	-	39.3	0.5	0.8	9.1	0.6	-	-	-	-	-	-	-	-	0.4	-	19.7	-	-	29.6	98.3	473.0
FX	0.1	4.2	-	3.5	0.1	5.3	0.5	8.7	0.3	0.1	-	-	-	-	-	-	31.7	-	2.3	43.2	83.2	699.0
AK	-	22.7	0.1	1.3	1.6	2.8	0.1	2.7	-	-	-	-	-	0.1	-	0.1	24.7	-	7.0	36.7	92.7	466.0
DL	-	22.5	0.6	2.3	8.6	1.9	0.4	1.1	-	-	-	-	-	0.1	-	-	59.5	-	2.8	0.1	67.2	475.0
MS	0.1	30.0	0.2	0.9	11.1	1.4	0.1	0.6	-	-	-	-	-	0.3	0.3	-	36.5	-	7.2	11.3	84.6	574.0
GD	-	8.1	0.1	4.7	8.6	1.7	0.1	1.7	-	-	-	-	-	-	-	-	69.2	-	4.5	1.3	90.7	386.0
GH	-	24.2	0.1	1.9	5.3	2.7	0.3	0.5	-	-	-	-	-	0.2	-	0.1	27.5	-	1.6	35.6	79.3	470.0
NB	0.9	66.6	0.1	0.2	16.4	-	-	-	-	-	-	-	-	-	1.0	-	0.5	0.1	0.2	14.0	99.7	427.0
UC	1.4	68.7	0.1	0.1	24.4	-	-	-	0.1	-	-	-	-	-	0.3	-	1.2	-	0.1	3.6	74.7	444.0
ES	0.1	64.0	0.1	0.4	8.8	0.3	-	-	0.1	-	-	-	-	-	0.7	-	3.3	-	0.8	21.6	93.3	730.0
SZ	-	26.4	-	0.5	4.3	0.1	-	-	-	-	-	-	-	0.5	-	0.7	15.8	-	6.2	45.5	83.2	819.0
UK	-	36.4	0.2	2.6	3.1	0.1	-	-	-	-	-	-	-	-	0.2	-	17.5	-	1.7	37.9	89.4	978.1
Average SA Mills	0.1	23.9	0.1	9.8	5.3	2.5	0.2	7.5	1.0	0.1	0.5	0.2	-	0.1	0.2	0.2	21.8	-	3.3	23.1	88.4	
NH	-	-	-	87.7	-	0.3	-	3.3	-	-	-	-	-	-	-	-	0.5	-	3.7	4.6	-	207
DW	-	-	-	35.0	-	1.5	-	11.5	-	-	-	-	0.2	-	-	-	22.3	-	1.7	27.7	-	226
HV	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-	-	94.8	-	0.2	0.1	-	27.9
TR	-	-	-	16.7	-	-	-	-	-	-	-	-	-	-	-	-	81.6	-	1.3	0.4	-	49.6

* Rainfall during the crushing season

Table H
Transport summary for South African mills.
Percentage of cane transported, 1996-97 season.

MILLS	ML	KM	PG	UF	EN	FX	AK	DL	MS	GD	GH	NB	UC	ES	SZ	UK	AVERAGE
SOUTH AFRICAN RAILWAYS	-	-	-	-	-	18.1	-	-	-	-	-	-	-	-	-	-	2.3
TRAMS	-	-	-	61.1	-	-	-	-	-	-	-	-	-	-	-	-	3.4
ARTICULATED TRUCK DRIVEN VEHICLES																	
- Interlink	-	-	1.6	26.6	20.2	64.4	66.1	0.9	73.1	5.8	48.6	35.3	13.4	95.6	75.5	56.5	44.7
- Tri-Axle	-	-	-	-	-	-	1.0	19.8	5.6	6.6	19.1	0.1	1.3	-	-	-	3.3
- Hilo	94.0	99.9	17.6	4.9	5.3	5.1	2.2	48.7	0.5	51.6	27.4	10.2	8.2	1.5	11.0	3.7	20.7
RIGID CHASSIS VEHICLES																	
- Truck	-	-	-	-	-	-	-	-	-	0.8	-	11.6	23.8	0.2	12.6	36.6	5.2
- Lorry	-	-	-	-	12.1	-	0.1	2.4	0.1	10.6	0.1	6.7	25.9	-	0.7	0.4	2.0
TRACTOR DRIVEN VEHICLES																	
- Hilo	-	-	10.8	2.7	-	-	9.5	1.1	2.2	-	-	14.1	6.4	2.5	-	1.6	3.1
- Rig	-	-	-	0.8	62.2	12.0	20.3	25.4	3.8	23.8	4.6	20.3	10.5	-	-	0.4	9.0
- Interlink	5.9	-	69.7	3.5	-	-	0.4	1.3	14.3	0.4	-	1.3	10.0	-	-	0.4	5.8

Table J
Comparative data of reporting.
South African mills, 1925 to 1996.

PERIOD (SEASON)	Percent Cane		Cane /Sugar Ratio		Extraction	Pol % fibre in Bagasse	Percent Bagasse		Imbibition Percent		Mixed Juice		Final Molasses Suc/brix Purity	Boiling House Recovery	Overall Recovery
	Pol	Fibre	Tel Quel	96 Pol Sugar	Pol based		Pol	Moisture	Cane	Fibre	Purity Pol based	Reducing Sugar/ Pol ratio	Chem.suc.	Pol based	Pol based
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
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
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
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
1977	12.83	15.79	9.12	8.80	95.87	3.51	1.56	52.55	45.6	302	84.39	5.67	38.3	88.52	84.96
1978	12.64	15.22	9.07	8.77	96.63	2.95	1.35	51.59	45.4	314	85.36	5.27	38.0	89.58	86.55
1979	12.96	15.49	8.85	8.54	96.92	2.70	1.23	52.04	49.1	333	85.40	5.11	38.3	89.48	86.73
1980	13.34	15.95	8.73	8.42	96.89	2.73	1.24	52.10	52.2	344	84.80	5.25	38.7	88.17	85.42
1981 onwards data are sucrose based	Sucrose				Sucrose based						Sucrose based	(GL+FR)/ suc.ratio	Sucrose based	Sucrose based	Sucrose based
1981	12.30	16.13	9.50	9.18	97.02	2.38	1.10	51.57	52.4	341	85.67	6.94	37.1	87.75	85.14
1982	12.86	15.61	9.10	8.79	97.02	2.57	1.19	51.35	51.5	345	85.12	5.59	36.6	87.64	85.03
1983	12.33	16.15	9.74	9.40	97.02	2.37	1.08	52.68	55.0	356	84.20	5.69	38.2	85.37	82.83
1984	12.27	15.62	9.43	9.11	97.42	2.12	0.99	51.35	51.5	344	85.69	5.28	37.0	88.23	85.96
Average 1975 - 1984	12.66	15.71	9.23	8.91	96.57	2.90	1.31	52.20	48.8	324	84.98	5.57	37.9	88.25	85.22
1985	13.13	15.38	8.88	8.57	97.47	2.25	1.04	51.64	52.9	358	84.55	6.28	36.3	87.51	85.30
1986	12.80	15.24	9.08	8.76	97.66	2.03	0.95	51.27	54.3	368	85.44	5.44	36.7	87.70	85.65
1987	12.00	15.23	9.67	9.33	97.63	1.94	0.91	51.24	52.6	357	85.25	5.76	36.8	87.84	85.76
1988	12.61	15.44	9.16	8.83	97.60	2.04	0.96	50.92	53.0	355	85.70	5.43	36.8	88.33	86.21
1989	13.17	15.07	8.72	8.41	97.67	2.11	0.98	51.61	53.5	366	86.40	4.94	35.7	88.74	86.67
1990	12.91	15.14	8.92	8.60	97.75	1.98	0.92	51.62	54.1	368	86.23	5.00	37.0	88.50	86.51
1991	13.04	14.93	8.77	8.42	97.95	1.85	0.87	47.07	54.4	375	86.39	4.80	37.1	88.88	87.06
1992	13.82	15.40	8.57	8.23	97.81	1.79	0.93	51.92	58.1	387	83.61	6.49	37.4	85.92	84.05
1993	12.53	16.23	9.56	9.22	97.75	1.78	0.83	51.52	60.1	380	83.14	5.55	38.2	85.05	83.14
1994	12.54	15.49	9.37	8.99	97.87	1.77	0.83	51.27	55.1	366	83.66	6.14	36.9	86.50	84.66
Average 1985 - 1994	12.86	15.36	9.07	8.74	97.72	1.95	0.92	51.01	54.8	368	85.04	5.58	37.0	87.50	85.50
1995	11.73	15.84	9.99	9.64	97.69	1.78	0.83	51.70	54.9	356	83.60	6.09	37.3	85.93	83.94
1996	12.60	15.36	9.20	8.88	97.72	1.92	0.90	51.40	50.4	337	85.38	5.23	37.3	87.82	85.82
Average 1995 - 1996	12.17	15.60	9.60	9.26	97.71	1.85	0.87	51.55	52.7	347	84.49	5.66	37.3	86.88	84.88