
We quote from the Experiment Station's Weather Reports:

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

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

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

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

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Season</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tons Sugar</td>
<td>1,933,279</td>
<td>2,269,604</td>
<td>3,954,446</td>
<td>1,001,784</td>
<td>1,794,423</td>
</tr>
<tr>
<td>Tons Cane</td>
<td>10,721,263</td>
<td>10,970,338</td>
<td>11,722,031</td>
<td>9,266,324</td>
<td>15,545,625</td>
</tr>
<tr>
<td>Ratio</td>
<td>9.01</td>
<td>8.66</td>
<td>8.42</td>
<td>9.21</td>
<td>8.66</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Season</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tons Sugar</td>
<td>1,395,446</td>
<td>1,265,921</td>
<td>1,082,525</td>
<td>908,803</td>
<td>1,627,869</td>
</tr>
<tr>
<td>Tons Cane</td>
<td>11,752,031</td>
<td>10,661,207</td>
<td>9,751,707</td>
<td>8,406,269</td>
<td>14,102,756</td>
</tr>
<tr>
<td>Ratio</td>
<td>8.66</td>
<td>8.42</td>
<td>9.01</td>
<td>9.21</td>
<td>8.66</td>
</tr>
</tbody>
</table>

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

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

**COMPARISON OF THE RESULTS OF THE OPTIMUM PERIODS**

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

<table>
<thead>
<tr>
<th>Season</th>
<th>Time</th>
<th>% of Crop</th>
<th>Percent Cane</th>
<th>Cane to Sugar Ratio</th>
<th>Purity of Mixed Juice</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Balance of Crop</td>
<td>31</td>
<td>12.98</td>
<td>14.63</td>
<td>9.18</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>13.75</td>
<td>14.52</td>
<td>8.51</td>
</tr>
<tr>
<td>1962/63</td>
<td>Optimum Period</td>
<td>56</td>
<td>13.77</td>
<td>15.32</td>
<td>8.58</td>
</tr>
<tr>
<td></td>
<td>Balance of Crop</td>
<td>44</td>
<td>12.65</td>
<td>15.73</td>
<td>9.63</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>13.30</td>
<td>15.50</td>
<td>8.96</td>
</tr>
<tr>
<td>1963/64</td>
<td>Optimum Period</td>
<td>59</td>
<td>13.91</td>
<td>15.38</td>
<td>8.36</td>
</tr>
<tr>
<td></td>
<td>Balance of Crop</td>
<td>41</td>
<td>13.02</td>
<td>15.66</td>
<td>9.06</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>13.55</td>
<td>15.50</td>
<td>8.63</td>
</tr>
<tr>
<td>1964/65</td>
<td>Optimum Period</td>
<td>60</td>
<td>14.41</td>
<td>15.20</td>
<td>8.06</td>
</tr>
<tr>
<td></td>
<td>Balance of Crop</td>
<td>40</td>
<td>13.17</td>
<td>15.62</td>
<td>9.01</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>13.90</td>
<td>15.38</td>
<td>8.38</td>
</tr>
<tr>
<td>1965/66</td>
<td>Optimum Period</td>
<td>67</td>
<td>13.10</td>
<td>15.44</td>
<td>9.06</td>
</tr>
<tr>
<td></td>
<td>Balance of Crop</td>
<td>33</td>
<td>12.76</td>
<td>15.83</td>
<td>9.50</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>12.99</td>
<td>15.57</td>
<td>9.20</td>
</tr>
<tr>
<td></td>
<td>Balance of Crop</td>
<td>45</td>
<td>13.20</td>
<td>15.50</td>
<td>9.02</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>13.72</td>
<td>15.09</td>
<td>8.63</td>
</tr>
</tbody>
</table>

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

The highest sucrose content for the Optimum Period, i.e. 14.45%, was obtained in the 1955/56 season. In the Optimum Periods of 1960/61 and 1961/62 the sucrose content was 14.11% and in the 1964/65 season it was as high as 14.41%, a near approach to the 1955/56 record. This year's sucrose content is just the average of the six years period shown in the table. In addition we draw attention to the variations in the percentages of cane crushed in the Optimum Periods. The “highest ever” was recorded in the period 1928-34 when an average 76% of the cane crop was harvested in the Optimum Periods. A percentage as low as 56% was recorded in 1962/63. This season's 55 per cent is just as unsatisfactory for grower and mill engineers as in 1962/63.

**VARIETAL CHANGES**

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Co.331</td>
<td>8.89</td>
<td>6.32</td>
<td>4.41</td>
<td>2.70</td>
<td>1.83</td>
</tr>
<tr>
<td>N:Co.310</td>
<td>54.00</td>
<td>50.75</td>
<td>46.91</td>
<td>40.15</td>
<td>33.63</td>
</tr>
<tr>
<td>N:Co.292</td>
<td>2.28</td>
<td>2.03</td>
<td>1.32</td>
<td>0.89</td>
<td>0.41</td>
</tr>
<tr>
<td>N:Co.293</td>
<td>4.62</td>
<td>4.93</td>
<td>3.72</td>
<td>4.51</td>
<td>5.98</td>
</tr>
<tr>
<td>N:Co.339</td>
<td>3.67</td>
<td>3.23</td>
<td>2.57</td>
<td>1.76</td>
<td>0.97</td>
</tr>
<tr>
<td>N:Co.376</td>
<td>12.98</td>
<td>12.37</td>
<td>9.77</td>
<td>8.32</td>
<td>6.45</td>
</tr>
<tr>
<td>N:Co.382</td>
<td>1.92</td>
<td>1.81</td>
<td>2.87</td>
<td>3.35</td>
<td>4.89</td>
</tr>
<tr>
<td>N:20/2111</td>
<td>0.22</td>
<td>1.23</td>
<td>2.84</td>
<td>3.52</td>
<td>3.56</td>
</tr>
</tbody>
</table>

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

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

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

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

**TIME ACCOUNTS AND CRUSHING RATES OF SOUTH AFRICAN SUGAR MILLS**

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

The sequence in which the Mills completed their crushing season was as follows: 10th December PG; 20th January MV; 28th January UC; 1st February UF; 5th February DK; 12th February TS; 18th
February FX; 20th February AK; 21st February EM; 26th February GD, DL and JB; 27th February RN; 1st March GH, ME and UK; 4th March SZ; 15th March EN and 19th March IL.

<table>
<thead>
<tr>
<th>Season</th>
<th>1964/65</th>
<th>1965/66</th>
<th>1966/67</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Tons Cane Crushed</td>
<td>11,752,031</td>
<td>9,266,324</td>
<td>15,545,625</td>
</tr>
<tr>
<td>Total Crushing Hours</td>
<td>85,266</td>
<td>67,090</td>
<td>95,229</td>
</tr>
<tr>
<td>Mean Crushing Rate</td>
<td>138 tch</td>
<td>138 tch</td>
<td>163 tch</td>
</tr>
<tr>
<td>No. of Mills Crushing</td>
<td>17</td>
<td>17</td>
<td>19</td>
</tr>
<tr>
<td>Average of Days Crushing</td>
<td>209 days</td>
<td>164 days</td>
<td>209 days</td>
</tr>
<tr>
<td>Total Hours Mills Open</td>
<td>92,457</td>
<td>76,751</td>
<td>109,216</td>
</tr>
<tr>
<td>Average Length of Season</td>
<td>37½ weeks</td>
<td>31½ weeks</td>
<td>40 weeks</td>
</tr>
<tr>
<td>Mean Time Efficiency</td>
<td>92%</td>
<td>87½%</td>
<td>87%</td>
</tr>
<tr>
<td>Hours of Stoppage due to Cane in short supply in % of Hours Mills Open</td>
<td>3½%</td>
<td>6%</td>
<td>5%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Season</th>
<th>Total Tons Cane Crushed</th>
<th>Sum of Crushing Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950/51</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>1951/52</td>
<td>84.2%</td>
<td>99.6%</td>
</tr>
<tr>
<td>1952/53</td>
<td>100.1%</td>
<td>102.9%</td>
</tr>
<tr>
<td>1953/54</td>
<td>108.8%</td>
<td>104.9%</td>
</tr>
<tr>
<td>1954/55</td>
<td>128.8%</td>
<td>117.6%</td>
</tr>
<tr>
<td>1955/56</td>
<td>139.6%</td>
<td>128.1%</td>
</tr>
<tr>
<td>1956/57</td>
<td>131.8%</td>
<td>130.2%</td>
</tr>
<tr>
<td>1957/58</td>
<td>150.0%</td>
<td>135.8%</td>
</tr>
<tr>
<td>1958/59</td>
<td>179.6%</td>
<td>143.6%</td>
</tr>
<tr>
<td>1959/60</td>
<td>159.8%</td>
<td>144.8%</td>
</tr>
<tr>
<td>1960/61</td>
<td>151.5%</td>
<td>130.9%</td>
</tr>
<tr>
<td>1961/62</td>
<td>164.4%</td>
<td>136.4%</td>
</tr>
<tr>
<td>1962/63</td>
<td>187.9%</td>
<td>149.6%</td>
</tr>
<tr>
<td>1963/64</td>
<td>192.1%</td>
<td>161.5%</td>
</tr>
<tr>
<td>1964/65</td>
<td>205.8%</td>
<td>171.4%</td>
</tr>
<tr>
<td>1965/66</td>
<td>162.3%</td>
<td>185.7%</td>
</tr>
<tr>
<td>1966/67</td>
<td>272.3%</td>
<td>227.7%</td>
</tr>
<tr>
<td>1967/68</td>
<td>Estimated at: 240%</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

Air Conditioning

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

NEWLY INTRODUCED FEATURES

(a) The Rabe Process:

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

(b) Milling-cum-Diffusion:

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

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

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

(c) Starch Removal.

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

(d) Further Development of the Rabe Process.

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

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

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

B. OPERATION OF THE MILLING TANDEM:

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

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

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

(a) the specific feed rate, being the number of lbs fibre milled per hour divided by the cubic feet of Total Roller Volume of the tandem concerned;

(b) the imbibition per 100 fibre;

(c) the reduced extraction of Noel Deerr, i.e. the extraction figure converted to cane with a standard fibre content. We chose as "standard" 15 3/4 % fibre in cane as this is the average percentage of fibre for S.A. conditions and using the average percentage will reduce the magnitude of the corrections to be applied, which will improve the accuracy of the results;

(d) the sucrose content of the first expressed juice as the richness of the cane juice also affects the extraction which can be obtained;

(e) the drop in purity from first to last expressed juice as a reduction of 0.1 % in pol in bagasse (in the region of 2.0 % pol in bagasse) raises the extraction figure by 1/4 to 3/4 depending on the fibre content of the cane.

<table>
<thead>
<tr>
<th>Mill</th>
<th>Lost Absolute Juice % Fibre</th>
<th>Specific Feed Rate (lbs/hr at T.R.V.)</th>
<th>Imbibition % Fibre</th>
<th>Reduced Extraction (for 100 fibre)</th>
<th>Purity from First to Last Expressed Juice</th>
<th>Sucrose % First Expressed Juice</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>27</td>
<td>51</td>
<td>300</td>
<td>98.84</td>
<td>17.39</td>
<td>16.66</td>
</tr>
<tr>
<td>DL</td>
<td>29</td>
<td>52</td>
<td>368</td>
<td>95.54</td>
<td>15.84</td>
<td>17.42</td>
</tr>
<tr>
<td>TS</td>
<td>31</td>
<td>46</td>
<td>214</td>
<td>94.92</td>
<td>10.68</td>
<td>17.19</td>
</tr>
<tr>
<td>IL</td>
<td>33</td>
<td>49</td>
<td>281</td>
<td>95.38</td>
<td>22.17</td>
<td>17.24</td>
</tr>
<tr>
<td>AK</td>
<td>35</td>
<td>54</td>
<td>308</td>
<td>94.51</td>
<td>11.62</td>
<td>17.30</td>
</tr>
<tr>
<td>FX</td>
<td>34</td>
<td>39</td>
<td>250</td>
<td>94.61</td>
<td>14.72</td>
<td>17.23</td>
</tr>
<tr>
<td>EN</td>
<td>36</td>
<td>57</td>
<td>297</td>
<td>94.55</td>
<td>19.60</td>
<td>16.68</td>
</tr>
<tr>
<td>UR</td>
<td>36</td>
<td>60</td>
<td>187</td>
<td>94.24</td>
<td>13.18</td>
<td>16.73</td>
</tr>
<tr>
<td>UF</td>
<td>37</td>
<td>58</td>
<td>261</td>
<td>93.96</td>
<td>12.68</td>
<td>17.99</td>
</tr>
<tr>
<td>UC</td>
<td>37</td>
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</tr>
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<td>16.04</td>
<td></td>
<td></td>
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<tr>
<td>LB</td>
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<td>56</td>
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<td>15.59</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>16.60</td>
<td>16.92</td>
</tr>
<tr>
<td>DK</td>
<td>46</td>
<td>52</td>
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<td>92.51</td>
<td>11.72</td>
<td>17.93</td>
</tr>
<tr>
<td>MH</td>
<td>48</td>
<td>53</td>
<td>177</td>
<td>92.23</td>
<td>12.26</td>
<td>16.94</td>
</tr>
<tr>
<td>EM</td>
<td>48</td>
<td>60</td>
<td>296</td>
<td>92.20</td>
<td>11.71</td>
<td>17.75</td>
</tr>
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<td>PG</td>
<td>47</td>
<td>38</td>
<td>269</td>
<td>92.60</td>
<td>14.71</td>
<td>18.06</td>
</tr>
<tr>
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<td>50</td>
<td>53</td>
<td>284</td>
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<td>14.68</td>
<td>16.73</td>
</tr>
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<td>178</td>
<td>91.66</td>
<td>9.98</td>
<td>17.82</td>
</tr>
<tr>
<td>TR</td>
<td>51</td>
<td>54</td>
<td>213</td>
<td>91.43</td>
<td>9.70</td>
<td>17.58</td>
</tr>
<tr>
<td>MR</td>
<td>53</td>
<td>63</td>
<td>172</td>
<td>91.01</td>
<td>8.71</td>
<td>16.05</td>
</tr>
</tbody>
</table>

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

(a) Noel Deerr's formula is only an approximation; and

(b) the correction of Noel Deerr as well as the origi-
nal extraction are both based on pol instead of on "Brix". The natural drop in purity from first to last expressed juice as well as any loss of sucrose due to inversion, enzymatic or bacteriological action flatter the results. In this respect Brix Extraction and Reduced Brix Extraction are better figures, because there is not a pronounced drop in Brix from first to last expressed juice and the Brix is only affected when enzymatic or bacteriological action leads to gaseous products.

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

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

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

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

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

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

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

(a) that provided the temperature is not raised higher than 70° C. part of the starch in juice is removed by the diffuser;
(b) that soil adhering to the cane can interfere with the percolation of the juice through the bagasse layer in the diffuser;
(c) that a proper control should be carried out on the pH and the reducing sugars/sucrose ratios of all circulating juices; and
(d) that the diluted juice squeezed out by the de-watering mills should be limed to at least a pH of 9.5 for flocculation, otherwise difficulties will be encountered with the juice percolation.

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

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>27</td>
<td>25</td>
<td>30</td>
<td>34</td>
<td>31</td>
</tr>
<tr>
<td>DL</td>
<td>29</td>
<td>29</td>
<td>30</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>TS</td>
<td>31</td>
<td>30</td>
<td>35</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>TL</td>
<td>33</td>
<td>34</td>
<td>31</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>AK</td>
<td>33</td>
<td>33½</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

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

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

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

**C. BOILING HOUSE PERFORMANCE**

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

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

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

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

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

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

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

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

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

### Table: Official Calculation, Using constant factors, Difference

<table>
<thead>
<tr>
<th>Mill</th>
<th>Official Calculation</th>
<th>Using constant factors</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG</td>
<td>95.68</td>
<td>95.76</td>
<td>+0.08</td>
</tr>
<tr>
<td>UF</td>
<td>95.47</td>
<td>96.14</td>
<td>+0.67</td>
</tr>
<tr>
<td>EM</td>
<td>95.84</td>
<td>96.44</td>
<td>+0.60</td>
</tr>
<tr>
<td>FX</td>
<td>95.28</td>
<td>96.65</td>
<td>+0.37</td>
</tr>
<tr>
<td>EN</td>
<td>92.64</td>
<td>98.84</td>
<td>+0.20</td>
</tr>
<tr>
<td>AK</td>
<td>98.06</td>
<td>98.43</td>
<td>+0.37</td>
</tr>
<tr>
<td>DK</td>
<td>96.06</td>
<td>96.05</td>
<td>+0.01</td>
</tr>
<tr>
<td>GD</td>
<td>96.38</td>
<td>96.70</td>
<td>+0.32</td>
</tr>
<tr>
<td>DL</td>
<td>97.13</td>
<td>97.66</td>
<td>+0.53</td>
</tr>
<tr>
<td>GH</td>
<td>96.60</td>
<td>97.04</td>
<td>+0.44</td>
</tr>
<tr>
<td>MV</td>
<td>95.82</td>
<td>95.92</td>
<td>+0.10</td>
</tr>
<tr>
<td>JB</td>
<td>86.98</td>
<td>87.57</td>
<td>+0.59</td>
</tr>
<tr>
<td>UC</td>
<td>92.20</td>
<td>92.91</td>
<td>+0.71</td>
</tr>
<tr>
<td>TS</td>
<td>97.08</td>
<td>97.29</td>
<td>+0.21</td>
</tr>
<tr>
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<td>96.95</td>
<td>97.52</td>
<td>+0.57</td>
</tr>
<tr>
<td>IL</td>
<td>94.89</td>
<td>95.10</td>
<td>+0.25</td>
</tr>
<tr>
<td>RN</td>
<td>96.07</td>
<td>95.95</td>
<td>-0.12</td>
</tr>
<tr>
<td>SZ</td>
<td>95.74</td>
<td>95.79</td>
<td>-0.05</td>
</tr>
<tr>
<td>UK</td>
<td>96.14</td>
<td>95.97</td>
<td>-0.17</td>
</tr>
<tr>
<td>LB</td>
<td>95.05</td>
<td>95.21</td>
<td>+0.16</td>
</tr>
<tr>
<td>MR</td>
<td>95.15</td>
<td>95.86</td>
<td>+0.71</td>
</tr>
<tr>
<td>UR</td>
<td>97.24</td>
<td>97.78</td>
<td>+0.54</td>
</tr>
<tr>
<td>MH</td>
<td>96.27</td>
<td>96.36</td>
<td>+0.09</td>
</tr>
<tr>
<td>TR</td>
<td>97.29</td>
<td>97.47</td>
<td>+0.18</td>
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</table>

### FINAL MOLASSES PURITIES

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

<table>
<thead>
<tr>
<th>Mill</th>
<th>Spindle Brix</th>
<th>Refracto Brix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apparent Gravity</td>
<td>Apparent Gravity</td>
</tr>
<tr>
<td>PG</td>
<td>38.91</td>
<td>41.30</td>
</tr>
<tr>
<td>UF</td>
<td>41.29</td>
<td>42.76</td>
</tr>
<tr>
<td>EM</td>
<td>39.84</td>
<td>42.53</td>
</tr>
<tr>
<td>FX</td>
<td>39.35</td>
<td>—</td>
</tr>
<tr>
<td>EN</td>
<td>43.13</td>
<td>38.04</td>
</tr>
<tr>
<td>AK</td>
<td>37.72</td>
<td>40.32</td>
</tr>
<tr>
<td>DK</td>
<td>39.87</td>
<td>42.00</td>
</tr>
<tr>
<td>GD</td>
<td>33.88</td>
<td>42.50</td>
</tr>
<tr>
<td>DL</td>
<td>39.73</td>
<td>—</td>
</tr>
<tr>
<td>GH</td>
<td>39.72</td>
<td>—</td>
</tr>
<tr>
<td>MV</td>
<td>40.40</td>
<td>42.47</td>
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<tr>
<td>JB</td>
<td>41.52</td>
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<tr>
<td>UC</td>
<td>43.78</td>
<td>—</td>
</tr>
<tr>
<td>TS</td>
<td>39.90</td>
<td>40.97</td>
</tr>
<tr>
<td>ME</td>
<td>37.85</td>
<td>40.47</td>
</tr>
<tr>
<td>IL</td>
<td>36.60</td>
<td>39.16</td>
</tr>
<tr>
<td>RN</td>
<td>40.71</td>
<td>—</td>
</tr>
<tr>
<td>SZ</td>
<td>41.46</td>
<td>—</td>
</tr>
<tr>
<td>UK</td>
<td>37.54</td>
<td>—</td>
</tr>
<tr>
<td>LB</td>
<td>39.61</td>
<td>—</td>
</tr>
<tr>
<td>MR</td>
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<tr>
<td>UR</td>
<td>36.00</td>
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</tr>
<tr>
<td>MH</td>
<td>38.61</td>
<td>—</td>
</tr>
<tr>
<td>TR</td>
<td>32.64</td>
<td>36.68</td>
</tr>
</tbody>
</table>

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

NON-SUCROSE ACCOUNT

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

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

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

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

Actually this ratio is an unsatisfactory yardstick, not only because the composition of the NS at the beginning and at the end are quite different, but also because we know beforehand that "Brix and purity of mixed juice are disputable. An investigation carried out in Queensland revealed that the rise in purity from non-sucrose formation and destruction, are also both reactions, the H-ion and the OH-ion concentration increase.

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

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

REDUCING SUGARS ACCOUNT

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

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

### REDUCING SUGARS ACCOUNT TABLE

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

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

### THE NS CIRCULATION RATIO

**Tons NS in C-masseucite**

Tons NS in weighed Final Masseucite

When this item was introduced in the 35th Annual Summary, it was stated that: "The quantity of C-masseucite depends on different factors such as juice purity, the C-masseucite purity and last but not least on the purity of the (pre-cured) C-sugar."

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

#### Influence of C-sugar Purity on Volume of C-masseucite

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

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

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

#### Non-Sucrose Circulation Table

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PG</td>
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<td>126</td>
<td>132</td>
<td>121</td>
<td>114</td>
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<tr>
<td>UF</td>
<td>139</td>
<td>125</td>
<td>148</td>
<td>159</td>
<td>123</td>
<td>105</td>
<td>122</td>
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<tr>
<td>EM</td>
<td>134</td>
<td>119</td>
<td>137</td>
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<td>114</td>
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<td>121</td>
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<tr>
<td>FX</td>
<td>135</td>
<td>124</td>
<td>152</td>
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<td>AK</td>
<td>133</td>
<td>143</td>
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<tr>
<td>DK</td>
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<td>142</td>
<td>163</td>
<td>155</td>
<td>130</td>
<td>129</td>
<td>131</td>
</tr>
<tr>
<td>GD</td>
<td>110</td>
<td>132</td>
<td>142</td>
<td>144</td>
<td>116</td>
<td>N.A.</td>
<td>108</td>
</tr>
<tr>
<td>DL</td>
<td>143</td>
<td>131</td>
<td>124</td>
<td>116</td>
<td>104</td>
<td>118</td>
<td>121</td>
</tr>
<tr>
<td>GH</td>
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<td>119</td>
<td>121</td>
<td>137</td>
<td>111</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>MV</td>
<td>136</td>
<td>124</td>
<td>141</td>
<td>155</td>
<td>121</td>
<td>111</td>
<td>132</td>
</tr>
<tr>
<td>JB</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>132</td>
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<td>137</td>
<td>140</td>
</tr>
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<td>RN</td>
<td>126</td>
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<td>166</td>
<td>130</td>
<td>100</td>
<td>114</td>
<td>117</td>
</tr>
<tr>
<td>SZ</td>
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<td>N.A.</td>
<td>123</td>
<td>133</td>
<td>120</td>
<td>127</td>
<td>126</td>
</tr>
<tr>
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<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>LB</td>
<td>200</td>
<td>165</td>
<td>137</td>
<td>151</td>
<td>148</td>
<td>144</td>
<td>-</td>
</tr>
<tr>
<td>MR</td>
<td>142</td>
<td>135</td>
<td>156</td>
<td>155</td>
<td>146</td>
<td>N.A.</td>
<td>-</td>
</tr>
<tr>
<td>MH</td>
<td>106</td>
<td>N.A.</td>
<td>N.A.</td>
<td>121</td>
<td>106</td>
<td>102</td>
<td>-</td>
</tr>
<tr>
<td>UR</td>
<td>147</td>
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<td>143</td>
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<td>141</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Proceedings of The South African Sugar Technologists' Association — April 1967

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

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

EXHAUSTION OF THE STRIKES:

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

<table>
<thead>
<tr>
<th>Mill</th>
<th>Recovered Crystal per 100 parts sucrose in massecuite</th>
<th>A-m.c.</th>
<th>B-m.c.</th>
<th>C-m.c.</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG</td>
<td>63.0</td>
<td>62.8</td>
<td>58.8</td>
<td>61.5</td>
<td></td>
</tr>
<tr>
<td>UF</td>
<td>63.4</td>
<td>52.3</td>
<td>53.2</td>
<td>56.3</td>
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</tr>
<tr>
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<td>61.1</td>
<td>60.8</td>
<td>54.2</td>
<td>58.7</td>
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</tr>
<tr>
<td>FX</td>
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<td>57.3</td>
<td>53.0</td>
<td>58.2</td>
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<td>54.9</td>
<td>55.0</td>
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<tr>
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<td>59.5</td>
<td>63.0</td>
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<td>52.0</td>
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<td></td>
</tr>
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<td>58.5</td>
<td>51.9</td>
<td>57.4</td>
<td></td>
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<td>58.2</td>
<td>61.8</td>
<td></td>
</tr>
<tr>
<td>MV</td>
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<td>65.9</td>
<td>51.9</td>
<td>59.5</td>
<td></td>
</tr>
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<td>55.0</td>
<td>56.9</td>
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</tr>
<tr>
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<td>55.4</td>
<td>59.9</td>
<td></td>
</tr>
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<td>67.1</td>
<td>58.2</td>
<td>55.0</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
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<td>59.8</td>
<td>50.7</td>
<td>50.7</td>
<td>53.7</td>
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<tr>
<td>IL</td>
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<td>64.1</td>
<td>60.3</td>
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<td>52.8</td>
<td>58.5</td>
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<td>59.9</td>
<td>51.9</td>
<td>53.8</td>
<td>55.2</td>
<td></td>
</tr>
<tr>
<td>MR</td>
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<td>63.9</td>
<td>58.9</td>
<td>61.4</td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>60.6</td>
<td>58.2</td>
<td>62.0</td>
<td>60.3</td>
<td></td>
</tr>
<tr>
<td>UR</td>
<td>61.1</td>
<td>61.5</td>
<td>61.3</td>
<td>61.3</td>
<td></td>
</tr>
<tr>
<td>TR</td>
<td>65.3</td>
<td>64.7</td>
<td>68.3</td>
<td>66.1</td>
<td></td>
</tr>
</tbody>
</table>

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

CU. FT. OF MASSECUITES

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

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

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

<table>
<thead>
<tr>
<th>Mill</th>
<th>B.H.P.</th>
<th>Final Molasses Purity</th>
<th>Undetermined Sucrose Losses</th>
<th>NS Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK</td>
<td>98.1</td>
<td>37.7</td>
<td>0.89</td>
<td>0.83</td>
</tr>
<tr>
<td>TR</td>
<td>97.3</td>
<td>39.7</td>
<td>1.37</td>
<td>0.91</td>
</tr>
<tr>
<td>DL</td>
<td>97.1</td>
<td>39.7</td>
<td>1.24</td>
<td>0.78</td>
</tr>
<tr>
<td>TS</td>
<td>97.1</td>
<td>41.2</td>
<td>0.39</td>
<td>0.83</td>
</tr>
<tr>
<td>UR</td>
<td>97.0</td>
<td>39.9</td>
<td>0.73</td>
<td>0.82</td>
</tr>
</tbody>
</table>

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

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

VACUUM IN THE LAST VESSEL

OF THE EVAPORATOR

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

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

<table>
<thead>
<tr>
<th>Vacuum</th>
<th>27°</th>
<th>26°</th>
<th>25°</th>
<th>24°</th>
</tr>
</thead>
<tbody>
<tr>
<td>55° Brix</td>
<td>8.0</td>
<td>6.9</td>
<td>5.8</td>
<td>4.7</td>
</tr>
<tr>
<td>60°</td>
<td>14.0</td>
<td>11.8</td>
<td>9.7</td>
<td>8.5</td>
</tr>
<tr>
<td>65°</td>
<td>27.6</td>
<td>22.8</td>
<td>18.0</td>
<td>15.8</td>
</tr>
<tr>
<td>70°</td>
<td>65.0</td>
<td>52.0</td>
<td>39.0</td>
<td>32.0</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Season</th>
<th>Average ° Brix</th>
<th>Season</th>
<th>Average ° Brix</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>54.5</td>
<td>1960</td>
<td>56.9</td>
</tr>
<tr>
<td>1951</td>
<td>53.2</td>
<td>1961</td>
<td>57.8</td>
</tr>
<tr>
<td>1952</td>
<td>53.8</td>
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<td>57.9</td>
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<td>55.0</td>
<td>1963</td>
<td>58.1</td>
</tr>
<tr>
<td>1954</td>
<td>54.2</td>
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<tr>
<td>1959</td>
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</table>

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

Replacement of the sulphitation process by the defecation method by raw sugar Mills and the installation of bigger evaporators with vapour bleeding brought about the first rise of 5° Brix. The second rise of 5° Brix depends for a great part in bringing up the backend. In this respect it should be mentioned that even sulphitation factories can achieve an average density of 65° Brix if they use a spare last vessel which can be put into operation (clean) on a Wednesday. Even better is a completely interchangeable outfit as, for instance, at Umfolozi.
### TABLE 1

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

**SHORT TONS**

<table>
<thead>
<tr>
<th>MILL</th>
<th>LOCAL MARKET</th>
<th>Golden Brown</th>
<th>General Export Raws</th>
<th>Japanese Assortment</th>
<th>Canadian Assortment and Umzimkulu</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td></td>
<td>Raws for Refining</td>
<td>Whites</td>
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<td>4,967</td>
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<tr>
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<td>504</td>
<td>100,705</td>
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<td>10</td>
<td>—</td>
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<td>Umfolozi</td>
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<td>—</td>
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<td>27,917</td>
<td>128,628</td>
<td>169,713</td>
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<td>121</td>
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<tr>
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<td>40,764</td>
<td>—</td>
<td>—</td>
<td>45,404</td>
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<td>—</td>
<td>28,495</td>
<td>43,565</td>
<td>—</td>
<td>—</td>
<td>72,060</td>
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<td>Gledhow</td>
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<td>3,500</td>
<td>33,806</td>
<td>—</td>
<td>150,902</td>
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<td>—</td>
<td>70</td>
<td>—</td>
<td>73,462</td>
<td>74,785</td>
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<td>3,210</td>
<td>24,975</td>
<td>14,059</td>
<td>—</td>
<td>42,244</td>
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<td>Dalton (U.C.)</td>
<td>763</td>
<td>—</td>
<td>27</td>
<td>2,334</td>
<td>10,926</td>
<td>14,050</td>
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<td>9,008</td>
<td>2,276</td>
<td>10,295</td>
<td>—</td>
<td>21,579</td>
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<td>237,864</td>
<td>139,616</td>
<td>537,329</td>
<td>258,260</td>
<td>1,794,423</td>
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## TABLE 2  CANE CRUSHED, SUGARS MADE, CANE

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<tr>
<th>SYMBOL INDICATING THE FACTORY</th>
<th>PG</th>
<th>UF</th>
<th>EM</th>
<th>FX</th>
<th>EN</th>
<th>AK</th>
<th>DK</th>
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<tbody>
<tr>
<td>Crushing Season started on</td>
<td>10.56</td>
<td>29.46</td>
<td>14.46</td>
<td>28.46</td>
<td>21.76</td>
<td>13.46</td>
<td>16.56</td>
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<tr>
<td>Crushing Season ended on</td>
<td>10.12</td>
<td>6.27</td>
<td>21.27</td>
<td>18.27</td>
<td>15.37</td>
<td>20.27</td>
<td>5.27</td>
</tr>
<tr>
<td>Tons Cane Crushed</td>
<td>601,298</td>
<td>1,378,463</td>
<td>1,102,396</td>
<td>981,322</td>
<td>196,346</td>
<td>1,379,623</td>
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</tbody>
</table>

### CANE COMPOSITION

<table>
<thead>
<tr>
<th></th>
<th>Ducrose % Cane</th>
<th>Fibre % Cane</th>
<th>Java Ratio</th>
<th>Tons Cane per Ton Sugar</th>
<th>Tons Cane per Ton 96° Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13.91</td>
<td>13.05</td>
<td>15.89</td>
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<td>13.37</td>
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<tr>
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<td>80.46</td>
<td>77.67</td>
<td>77.86</td>
<td>80.15</td>
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<tr>
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<td>8.34</td>
<td>8.12</td>
<td>8.92</td>
<td>8.91</td>
<td>9.08</td>
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<tr>
<td></td>
<td>8.10</td>
<td>7.96</td>
<td>8.67</td>
<td>8.67</td>
<td>8.80</td>
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### CANE VARIETIES CRUSHED

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<tr>
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<th>Co.331</th>
<th>N-Co.310</th>
<th>N-Co.293</th>
<th>N-Co.339</th>
<th>N-Co.376</th>
<th>N-Co.382</th>
<th>N-Co.50/211</th>
<th>Remainder</th>
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<tr>
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<td>0.25</td>
<td>0.32</td>
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<td>82.12</td>
<td>0.11</td>
<td>1.24</td>
<td>6.00</td>
<td>7.93</td>
<td>0.81</td>
<td>0.32</td>
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<td>0.54</td>
<td>11.70</td>
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<tr>
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<td>0.01</td>
<td>1.21</td>
<td>39.13</td>
<td>10.73</td>
<td>3.50</td>
<td>7.00</td>
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<td>5.34</td>
<td>0.04</td>
<td>1.03</td>
<td>52.37</td>
<td>2.39</td>
<td>4.41</td>
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<td>0.07</td>
<td>8.60</td>
<td>0.68</td>
<td>1.02</td>
<td>0.36</td>
</tr>
</tbody>
</table>

### TOTAL RAINFALL YEAR 1966 (inches)

|                  | 26.00  | 22.91  | 30.75  | 40.85  | 36.17  | 29.79  | 33.11 |

### Tons Sugar Made

|                  | 72,060 | 169,712 | 123,535 | 110,079 | 21,628 | 162,170 | 42,244 |

### Millwhite or Refined Sugar Made

|                  | 40%    | Nil     | Nil     | Nil     | 42%    | Nil     | Nil |

### Average Pol of All Sugars Made

|                  | 98.96  | 97.90  | 98.82  | 98.80  | 99.02  | 98.34  | 98.26 |

### TIME ACCOUNT

|                  | 90.26  | 96.52  | 87.87  | 92.02  | 83.29  | 85.26  | 92.78 |
|                  | 4.45   | 0.09   | 1.70   | 1.77   | 2.12   | 1.98   | 6.30  |

### THROUGHPUTS per hour actual crushing

|                  | 154.24 | 215.54 | 187.41 | 171.79 | 46.63  | 250.92 | 71.14 |
|                  | 21.45  | 28.13  | 29.78  | 27.86  | 6.24   | 39.89  | 10.76 |
|                  | 24.10  | 34.47  | 28.44  | 25.62  | 6.94   | 37.91  | 10.74 |
|                  | 18.48  | 26.54  | 21.00  | 19.27  | 5.14   | 29.49  | 8.49  |

### SUCROSE BALANCE

|                  | 6.52   | 4.94   | 8.03   | 5.69   | 4.59   | 5.61   | 7.27  |
|                  | 1.21   | 1.43   | 0.69   | 0.49   | 1.12   | 0.55   | 0.42  |
|                  | 7.77   | 9.75   | 9.68   | 9.19   | 10.84  | 7.76   | 7.13  |
|                  | 1.93   | 0.63   | 1.26   | 2.02   | 1.91   | 0.89   | 2.26  |
|                  | 10.91  | 11.81  | 11.63  | 11.70  | 13.87  | 9.20   | 9.81  |
|                  | 17.43  | 16.75  | 19.66  | 17.39  | 18.46  | 14.81  | 17.08 |
|                  | 82.57  | 83.25  | 80.54  | 82.61  | 85.54  | 85.19  | 82.92 |

### BOILING HOUSE LOSSES (B)+(C)+(D)

<p>|                  | 82.57  | 83.25  | 80.54  | 82.61  | 85.54  | 85.19  | 82.92 |</p>
<table>
<thead>
<tr>
<th>VARIETIES, THROUGHPUTS and SUCROSE BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GD</td>
</tr>
<tr>
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</tr>
<tr>
<td>4.56</td>
</tr>
<tr>
<td>210,251</td>
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<tr>
<td>14.92</td>
</tr>
<tr>
<td>79.28</td>
</tr>
<tr>
<td>9.10</td>
</tr>
<tr>
<td>8.87</td>
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<tr>
<td>6.49</td>
</tr>
<tr>
<td>8.45</td>
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<tr>
<td>4.86</td>
</tr>
<tr>
<td>0.13</td>
</tr>
<tr>
<td>42.45</td>
</tr>
<tr>
<td>1.02</td>
</tr>
<tr>
<td>4.29</td>
</tr>
<tr>
<td>32.31</td>
</tr>
<tr>
<td>24.19</td>
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<tr>
<td>23,111</td>
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<td>9.00</td>
</tr>
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<td>43.54</td>
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<td>1.14</td>
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<tr>
<td>18.48</td>
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<tr>
<td>81.52</td>
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</table>

<table>
<thead>
<tr>
<th>SYMBOL INDICATING FACTORY</th>
<th>PG</th>
<th>UF</th>
<th>EM</th>
<th>FX</th>
<th>EN</th>
<th>AK</th>
<th>DK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling House Performance</td>
<td>95.68</td>
<td>95.47</td>
<td>95.71</td>
<td>95.28</td>
<td>92.64</td>
<td>98.06</td>
<td>96.06</td>
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<tr>
<td>Boiling House Recovery</td>
<td>88.33</td>
<td>87.38</td>
<td>87.35</td>
<td>85.59</td>
<td>85.46</td>
<td>90.26</td>
<td>89.42</td>
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<tr>
<td>Lost Absolute Juice % Fibre</td>
<td>47.22</td>
<td>36.96</td>
<td>47.69</td>
<td>34.13</td>
<td>35.80</td>
<td>32.98</td>
<td>45.86</td>
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<tr>
<td>Imbibition % Fibre</td>
<td>38</td>
<td>28.00</td>
<td>60.00</td>
<td>39</td>
<td>---</td>
<td>54</td>
<td>52</td>
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<td>Specific Feed Rate*</td>
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<td>91.97</td>
<td>94.31</td>
<td>95.41</td>
<td>94.39</td>
<td>92.72</td>
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<tr>
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<td>34.10</td>
<td>47.11</td>
<td>40.57</td>
<td>39.68</td>
<td>49.04</td>
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<td>Sucrose % Bagasse</td>
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<td>2.87</td>
<td>2.05</td>
<td>1.89</td>
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<td>54.83</td>
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<td>56.09</td>
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<td>42.25</td>
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<td>43.52</td>
<td>41.22</td>
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<td>43.15</td>
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<td>30.89</td>
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<td>37.25</td>
<td>32.45</td>
<td>35.36</td>
<td>35.07</td>
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<td>L.C.V. of Bagasse (btu per lb)</td>
<td>3,074</td>
<td>2,888</td>
<td>2,861</td>
<td>2,980</td>
<td>2,770</td>
<td>3,033</td>
<td>3,017</td>
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<tr>
<td>Available btu per lb Brix</td>
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<td>7,440</td>
<td>6,037</td>
<td>7,218</td>
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<td>23</td>
<td>23</td>
<td>21</td>
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<td>16</td>
<td>26</td>
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<td>52</td>
<td>42</td>
<td>43</td>
<td>44</td>
<td>58</td>
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<td>Dilution Ratio</td>
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<td>72</td>
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<td>84</td>
<td>81</td>
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<tr>
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<td>2.14</td>
<td>2.06</td>
<td>2.22</td>
<td>3.92</td>
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<td>72.03</td>
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<td>11.72</td>
<td>14.72</td>
<td>19.60</td>
<td>11.62</td>
<td>11.72</td>
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<td>Degrees Apparent Purity</td>
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<td>---</td>
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<td>86.84</td>
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<tr>
<td>Degrees Gravity Purity</td>
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<td>84.83</td>
<td>85.70</td>
<td>84.77</td>
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<tr>
<td>Purity Drop</td>
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<td>1.94</td>
<td>1.76</td>
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<td>Refracto/Sucrose Purity</td>
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<td>42.53</td>
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<td>40.32</td>
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<td>12.95</td>
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<td>12.59</td>
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<td>Reducing Sugars/Ash Ratio</td>
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<td>0.84</td>
<td>—</td>
<td>—</td>
<td>0.96</td>
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<td>Molasses of 85° Brix % Cane</td>
<td>3.37</td>
<td>3.99</td>
<td>3.67</td>
<td>3.41</td>
<td>3.97</td>
<td>3.08</td>
<td>2.97</td>
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<td>Tons Coke</td>
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<td>Lb Lime</td>
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<td>1.11</td>
<td>1.37</td>
<td>1.29</td>
<td>5.25</td>
<td>1.08</td>
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<td>Nil</td>
<td>Nil</td>
<td>2.16</td>
<td>Nil</td>
<td>Nil</td>
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<td>p.p.m. Juice:</td>
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<td>Phosphoric Paste</td>
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<td>Nil</td>
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<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
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<tr>
<td>Separan</td>
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<td>0.56</td>
<td>Traces</td>
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<td>Nil</td>
<td>1.41</td>
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</table>

* Per ton of Brix in Mixed Juice.

EXHAUSTION=Parts Recovered Crystallised Sucrose per 100 Parts Massecuite.
### Final Molasses and Chemical Consumption

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<th>GD</th>
<th>DL</th>
<th>GH</th>
<th>MV</th>
<th>JB</th>
<th>UC</th>
<th>TS</th>
<th>ME</th>
<th>IL</th>
<th>RN</th>
<th>SZ</th>
<th>UK</th>
<th>Mean</th>
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<tr>
<td>14.57</td>
<td>15.66</td>
<td>14.74</td>
<td>15.12</td>
<td>14.47</td>
<td>13.84</td>
<td>14.92</td>
<td>15.03</td>
<td>15.16</td>
<td>14.79</td>
<td>15.51</td>
<td>14.87</td>
<td>15.2</td>
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| 20.06 | 29.28 | 25.72 | 35.77 | N.A. | 27.76 | 24.73 | 32.85 | 43.05 | 24.64 | 22.26 | 30.87 | 29.02 |
| 93.16 | 93.2 | 92.46 | 91.41 | 92.11 | 92.10 | 92.6 | 93.9 | 90.42 | 91.63 | 92.40 | 92.48 | 92.35 |
| 83.29 | 87.7 | 88.6 | 88.1 | 82.7 | 86.06 | 86.7 | 86.0 | 88.73 | 86.8 | 84.93 | 86.91 | 86.68 |
| 62.36 | 73.1 | 72.2 | 74.4 | 65.7 | 68.50 | 68.2 | 71.2 | 77.56 | 71.4 | 70.98 | 71.54 | 70.74 |
| 20.73 | 14.6 | 16.4 | 13.7 | 17.0 | 17.56 | 18.5 | 14.8 | 11.17 | 15.4 | 13.95 | 15.37 | 15.94 |
| 66.48 | 61.9 | 66.6 | 60.7 | 59.9 | 64.78 | 67.1 | 59.8 | 56.10 | 62.0 | 56.60 | 62.14 | 62.85 |

- -2.10 +2.40 +1.40 -0.27 +2.21 +0.20 +1.00 +2.55 -1.40 -1.73 -1.59 +0.65

| 95.51 | 94.1 | 94.53 | 94.17 | 93.89 | 93.58 | 94.5 | 95.2 | 92.31 | 94.80 | 95.42 | 95.54 | 94.26 |
| 71.32 | 74.2 | 73.6 | 74.9 | 72.5 | 73.24 | 73.2 | 70.6 | 77.10 | 74.1 | 72.06 | 71.92 | 73.08 |
| 54.80 | 54.4 | 52.4 | 50.4 | 53.8 | 52.48 | 53.3 | 54.2 | 56.95 | 53.0 | 53.23 | 50.88 | 53.06 |
| 16.32 | 19.8 | 21.2 | 24.5 | 18.7 | 20.76 | 19.9 | 16.4 | 20.15 | 21.1 | 18.83 | 21.04 | 20.02 |
| 51.24 | 58.5 | 60.5 | 65.9 | 55.8 | 59.65 | 58.2 | 50.7 | 60.71 | 60.6 | 55.87 | 59.56 | 58.36 |

| 8.13 | 7.98 | 8.47 | 8.56 | N.A. | 10.94 | 8.73 | 8.89 | 10.04 | 7.81 | 11.97 | 6.48 | 8.83 |
| 97.84 | 95.7 | 96.36 | 96.74 | 95.95 | 94.22 | 97.4 | 97.4 | 96.02 | 96.64 | 99.91 | 98.73 | 96.65 |
| 54.23 | 60.1 | 61.3 | 59.3 | 61.2 | 63.57 | 59.6 | 58.0 | 61.64 | 62.7 | 61.93 | 58.98 | 60.47 |
| 36.23 | 42.0 | 39.8 | 41.2 | 41.5 | 43.78 | 39.9 | 40.5 | 36.60 | 40.7 | 41.34 | 39.92 | 40.45 |
| 18.00 | 18.1 | 21.3 | 18.1 | 19.7 | 19.79 | 19.7 | 17.5 | 25.04 | 22.0 | 20.59 | 19.06 | 20.02 |
| 52.05 | 51.9 | 58.2 | 51.9 | 55.0 | 55.37 | 55.0 | 50.7 | 64.07 | 59.1 | 56.68 | 53.79 | 55.59 |
| 27.62 | 29.9 | 34.4 | 29.8 | 32.3 | 33.17 | 31.9 | 28.6 | 37.92 | 35.8 | 35.07 | 31.32 | 32.49 |

| 51.02 | 60.96 | 60.22 | 72.40 | N.A. | 69.73 | 57.90 | 77.60 | 87.94 | 56.08 | 60.54 | 56.75 | 64.02 |
| 38.48 | 47.05 | 46.12 | 56.39 | N.A. | 50.44 | 44.93 | 58.31 | 66.74 | 44.19 | 47.07 | 43.96 | 48.15 |

| 93.51 | 85.6 | 91.88 | 90.67 | 85.06 | 86.79 | 91.78 | 85.19 | 87.25 | 93.68 | 92.26 | 86.65 | **93.45** |
| 36.23 | 42.0 | N.A. | N.A. | 43.78 | 39.90 | 40.47 | 36.60 | 40.71 | 41.46 | 37.54 | N.A. | N.A. |
| N.A. | 39.72 | 41.24 | 41.52 | N.A. | 41.16 | N.A. | 39.16 | N.A. | 41.65 | 40.35 | **40.65** | N.A. |
| N.A. | 42.5 | N.A. | N.A. | N.A. | 49.07 | N.A. | N.A. | N.A. | 14.54 | 10.98 | N.A. | N.A. |
| N.A. | 17.4 | 10.21 | 12.94 | 12.36 | N.A. | 13.96 | 13.76 | 15.33 | N.A. | 14.54 | 10.98 | N.A. |
| N.A. | N.A. | N.A. | N.A. | N.A. | 12.18 | 12.94 | 10.28 | N.A. | 12.93 | 14.00 | N.A. | N.A. |
| N.A. | N.A. | N.A. | N.A. | N.A. | 1.15 | 1.06 | 1.49 | 1.12 | 0.78 | N.A. | N.A. | N.A. |
| 4.09 | 3.10 | 3.16 | 3.43 | 4.09 | 3.94 | 3.43 | 3.37 | 3.38 | 3.01 | 3.54 | 2.20 | **3.47** |

| Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |

| 1.24 | 0.85 | 5.28 | 1.10 | N.A. | 1.21 | 1.35 | 1.24 | 1.16 | 4.73 | 6.67 | 0.90 | Nil |
| Nil | Nil | 5.21 | N.A. | Nil | Nil | Nil | Nil | Nil | 1.59 | 1.65 | Nil | Nil |
| Nil | 42.99 | Nil | N.A. | Nil | Nil | Nil | Nil | 106 | Nil | 219 | Nil |
| 4.39 | 2.43 | Nil | 5.74 | N.A. | 2.48 | 0.29 | 2.63 | 8.01 | Nil | Nil | N.A. | Nil |

**Converted into Spindle Brix.**
<table>
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<th>NAME OF MILL</th>
<th>Luabo</th>
<th>Marromeu</th>
<th>Mhlume</th>
<th>Umumbo R.</th>
<th>Triangle</th>
</tr>
</thead>
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<tr>
<td>Closing date reporting</td>
<td>23rd May</td>
<td>28th Nov.</td>
<td>19th Jan.</td>
<td>30th Dec.</td>
<td>23rd Jan.</td>
</tr>
<tr>
<td>TONS (2000 lbs) CANE CRUSHED</td>
<td>446,512</td>
<td>604,001</td>
<td>705,402</td>
<td>693,268</td>
<td>1,103,313</td>
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<td>TONS SUGAR MANUFACTURED</td>
<td>51,496</td>
<td>66,784</td>
<td>81,385</td>
<td>78,012</td>
<td>130,400</td>
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<td>Overall Time Efficiency (%)</td>
<td>96</td>
<td>93</td>
<td>83</td>
<td>94</td>
<td>79</td>
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<tr>
<td>Percentage of White Sugar made</td>
<td>71</td>
<td>58</td>
<td>3</td>
<td>7</td>
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<td>13.71</td>
<td>13.63</td>
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<td>13.36</td>
<td>13.32</td>
<td>14.32</td>
<td>13.59</td>
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<td>Tons Cane per ton Sugar</td>
<td>8.67</td>
<td>9.04</td>
<td>8.67</td>
<td>8.89</td>
<td>8.46</td>
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<td>84.90</td>
<td>87.77</td>
<td>85.51</td>
<td>86.00</td>
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<td>Purity Last Expressed Juice</td>
<td>71.10</td>
<td>76.19</td>
<td>75.51</td>
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<td>76.30</td>
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<td>82.93</td>
<td>85.79</td>
<td>83.73</td>
<td>84.51</td>
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<td>3.85</td>
<td>5.04</td>
<td>5.91</td>
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<td>Imbibition % Fibre</td>
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<td>51.84</td>
<td>51.40</td>
<td>51.50</td>
<td>52.80</td>
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<td>6,220</td>
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<td>BOILING HOUSE PERFORMANCE</td>
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<td>95.14</td>
<td>96.27</td>
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<td>8.90</td>
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<td>7.35</td>
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<td>TOTAL OF ALL LOSSES</td>
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<td>16.18</td>
<td>17.40</td>
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<td>4.57</td>
<td>2.47</td>
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<td>3.42</td>
<td>2.63</td>
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<td>1.80</td>
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<td>GRAVITY PURITY OF FINAL MOLASSES</td>
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<tr>
<td>Apparent Purity</td>
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<td>39.87</td>
<td>39.90</td>
<td>36.00</td>
<td>36.68</td>
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<td>Degrees Brix of Final Molasses</td>
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<td>36.37</td>
<td>38.61</td>
<td>36.00</td>
<td>32.64</td>
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<td>Weight at 85° Brix % Cane</td>
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<td>91.72</td>
<td>88.72</td>
<td>90.70</td>
<td>93.91</td>
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<td>DENSITY OF SYRUP (°BRIX)</td>
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<td>64.50</td>
<td>57.67</td>
<td>59.60</td>
<td>57.18</td>
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<td>CU. FT. MASSECUCITE PER TON BRIX</td>
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<td>A-massecucite</td>
<td>34.34</td>
<td>69.17</td>
<td>20.82</td>
<td>29.03</td>
<td>35.96</td>
</tr>
<tr>
<td>B-massecucite</td>
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<td>14.41</td>
<td>13.43</td>
<td>10.67</td>
<td>8.32</td>
</tr>
<tr>
<td>C-massecucite</td>
<td>12.57</td>
<td>9.73</td>
<td>7.59</td>
<td>10.39</td>
<td>10.96</td>
</tr>
<tr>
<td>TOTAL</td>
<td>66.60</td>
<td>90.97</td>
<td>42.15</td>
<td>50.09</td>
<td>54.96</td>
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<td>CRYSTAL % SU. ROSE IN MASSECUCITE</td>
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<td>A-massecucite</td>
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<td>61.52</td>
<td>60.64</td>
<td>61.1</td>
<td>65.28</td>
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<td>B-massecucite</td>
<td>51.92</td>
<td>63.91</td>
<td>58.16</td>
<td>61.5</td>
<td>64.67</td>
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<td>C-massecucite</td>
<td>53.76</td>
<td>58.89</td>
<td>62.00</td>
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<td>Crystal % C-massecucite</td>
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<td>36.39</td>
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<td>84.90</td>
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<td>84.19</td>
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<td>88.25</td>
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<td>-2.69</td>
<td>+1.9</td>
<td>+3.35</td>
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<td>TABLE 6</td>
<td>AVERAGE MANUFACTURING RETURNS by Monthly Periods (SEASON 1966-1967) for South African Mills</td>
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<td>---------------------------------</td>
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<td>---------------------------------</td>
</tr>
<tr>
<td>END OF MONTHLY PERIOD</td>
<td>TONS CANE CRUSHED</td>
<td>TONS SUGAR MADE AND ESTIMATED</td>
<td>TONS CANE CRUSHED PER HOUR</td>
<td>SUCROSE % CANE</td>
<td>FIBRE % CANE</td>
</tr>
<tr>
<td>TONS CANE CRUSHED</td>
<td>Month</td>
<td>107,235</td>
<td>104,031</td>
<td>203,623</td>
<td>1,808,639</td>
</tr>
<tr>
<td>To-date</td>
<td>107,235</td>
<td>1,077,501</td>
<td>2,136,717</td>
<td>4,294,661</td>
<td>5,411,710</td>
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<tr>
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<td>104,031</td>
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* Refracto Brix converted to Spindle Brix Purities.
# TABLE 7 COMPARATIVE MANUFACTURING DATA of RECENT YEARS (S.A. MILLS)

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**Converted into Spindle Brix.
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<th>Extraction</th>
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<th>Per cent Bagasse</th>
<th>Imbibition per cent</th>
<th>Mixed Juice</th>
<th>Final Molasses Purity</th>
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<th>Boiling House Recovery</th>
<th>Overall Recovery</th>
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Discussion

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

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

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

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

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

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

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

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

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

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