# DROP IN PURITY BETWEEN MASSECUITE AND MOLASSES

By A. D. ELYSEE and L. E. TURNER

The main objective in sugar pan boiling is to achieve the highest yield of crystals from massecuite and correlatively the lowest drop in purity of the mother liquor boiled.

In all sugar factories routine analysis of massecuites and molasses is considered essential for the control of pan boiling. The usual data reported daily from the Laboratory comprise Brix and purity of massecuites boiled, and Brix and purity of molasses separated at the centrifugals, indicating an overall drop in purity.

From this information the Process Manager can visualise the general trend of results, to plan proportions and massecuite cycles.

In factories where pans are not fully equipped with instruments and automatic control, doubts may arise as to whether irregular work may be due to neglect when pan operation is left entirely to the human element, and to inadequate and inefficient plant. It has been ascertained in practice that irregularities may occur at the centrifugal station, consequently undesirable results could not with any degree of certainty be specifically attributed to bad work at the pan, over-feeding of crystallisers or irregular work at the centrifugals.

The authors of this paper have collaborated during the past three years to determine definitely the drop of purity achieved in the pans and further reduction of purity whilst massecuites are cooled before curing. Initially, a few weekly tests were done which revealed such a wide variation of results that it was decided to have the mother liquor of every B. and C. massecuite analysed at striking. This duplication of analysis of pan products increased considerably the routine work of the laboratory. A large chart, Figs. 1 and 2, was placed at the pan station and the drop in purity of mother liquor from every B. and C. massecuite was plotted daily, indicating to all pan boilers the results of their respective massecuites boiled. This information was found most valuable, as subsequently pan work was stabilised.

Careful observations of variations of the work led to investigations of efficiency of vacuum pumps, condenser water supply, steam supply, temperatures of boilings, boiling time, quantity and quality of grain, early establishment of metastable supersaturation in every boiling, highest concentration of Brix possible without causing loss of time in striking, and even the steaming of pan and also feeding of massecuites cooling in crystallisers. At the curing station: routine check of speed of centrifugals, quantity of steam and water used, check of possible perforated screens, proper separation of molasses and sugar washings.

Amatikulu Factory has not deviated from a near four massecuite pan cycle during the last three years, viz:

Virgin massecuite and "A" massecuite, 82 purity syrup grain. Two to three hours cooling time.

"B" Massecuite, footing with "C" sugar magma, 4 hours boiling and 20–24 hours, cooling time.

"C" Massecuites, syrup blended grain, six hours boiling and 36–40 hours, cooling time.

All graining is done with a predetermined quantity of slurry.

Five pans are in operation—

| | |
|---|---|
| Nos. 1, 3 and 5 | 700 cu. ft., calandria 1,450 H.S., Ht. 7.25 ft. above tube plate. |
| No. 2 | 850 cu. ft., calandria 1,450 H.S., Ht. 8.1 ft. above tube plate. |
| No. 4 | 1,400 cu. ft., calandria 1,800 H.S., Ht. 9.5 ft. above tube plate. |

"A" Massecuites, single cured in twenty-three 30″ water driven centrifugals, 1,200 r.p.m.

"B" Massecuites, cured in eight 42″ belt driven machines, 1,000 r.p.m.

"C" Massecuites, cured in six 36″ belt driven machines, 900—1,000 r.p.m.

From the above description of the plant it may be concluded that this equipment is not of approved modern standards.

This factory in the past has experienced an overall drop in purity of 27° for "B" massecuites and 21° drop for "C" massecuites.

The monthly data tabulated for the three years do not indicate the maximum and minimum drops, nevertheless the averages leave much to be desired. It may be mentioned that the throughput of this factory has been increased 20 per cent in recent years with no additional factory plant.

It is generally accepted that during the last two seasons great difficulty was experienced in the industry in maintaining a satisfactory standard of sucrose recovery and boiling house performance. Consensus of opinion is that the composition of non-sugars in cane juices is not consistent, influences of climatic conditions have been noted to change the

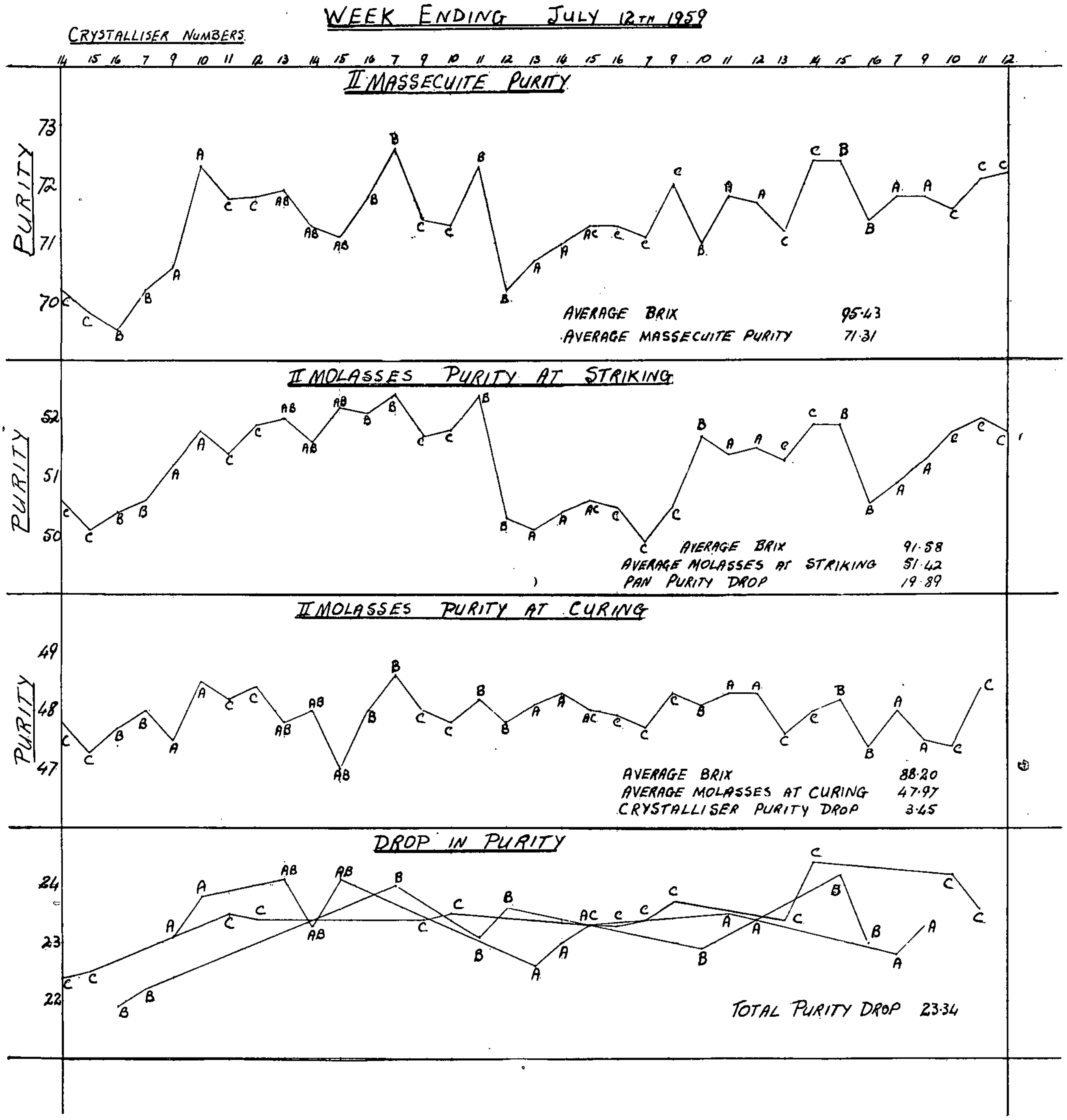
WEEK ENDING JULY 12TH 1959
CRYSTALLISER NUMBERS
II MASSECUITE PURITY
PURITY
AVERAGE BRIX 95·43
AVERAGE MASSECUITE PURITY 71·31
II MOLASSES PURITY AT STRIKING
AVERAGE BRIX 91·58
AVERAGE MOLASSES AT STRIKING 51·42
PAN PURITY DROP 19·89
II MOLASSES PURITY AT CURING
AVERAGE BRIX 88·20
AVERAGE MOLASSES AT CURING 47·97
CRYSTALLISER PURITY DROP 3·45
DROP IN PURITY
TOTAL PURITY DROP 23·34

Fig. 1

nature of factory products although the quotient of purity may only indicate very slight variations.

The decreasing overall drop of purity and the corresponding decrease in sugar yields indicated by the tabulated figures during the last two years leaves no doubt that there is room for improvement.

In conclusion it may be stated that revealing this practical information on pan boiling, it would be enlightening to all process personnel if similar work was done, particularly where modern pans, crystallisers and centrifugals are in use under different conditions. From practical data and further research, a definite standard of Pan work may be set and maintained to the benefit of the Sugar Industry.

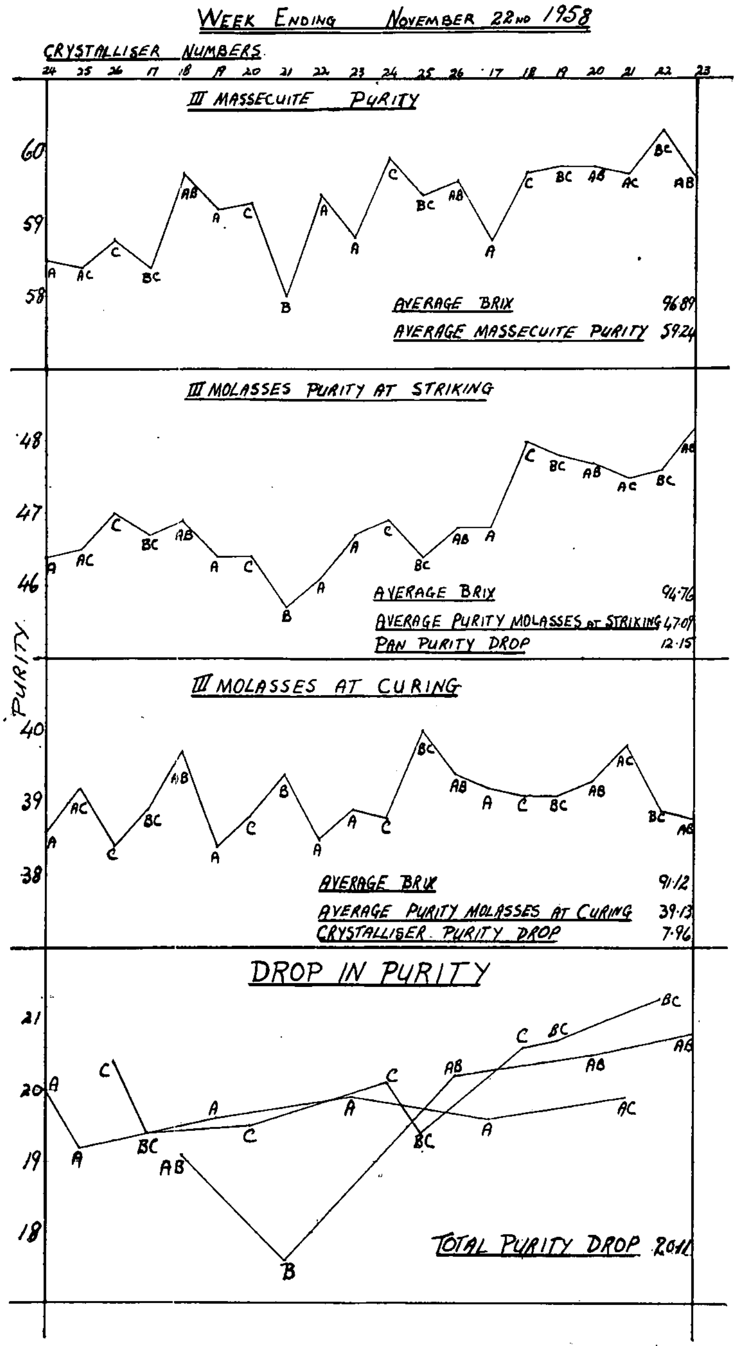


Fig. 2

# SEASON 1957/58

## II MASSECUITE

| MONTH | Massecuites Averages Brix | Massecuites Averages Purity | II Molasses at Striking Brix | II Molasses at Striking Purity | II Molasses at Curing Brix | II Molasses at Curing Purity | Pan Purity Drop | Cryst. Purity Drop | Total Purity Drop |
|---|---|---|---|---|---|---|---|---|---|
| April ... ... | 94.98 | 70.00 | 90.98 | 45.25 | 85.81 | 44.11 | 24.75 | 1.14 | 25.89 |
| May ... ... | 94.82 | 71.35 | — | 47.48 | 85.80 | 45.36 | 23.87 | 2.12 | 25.99 |
| June ... ... | 95.08 | 71.43 | — | 48.33 | 85.90 | 46.45 | 23.10 | 1.88 | 24.98 |
| July ... ... | 95 08 | 71.42 | — | 49.50 | 85.48 | 47.28 | 21.92 | 2.22 | 24.14 |
| August ... | 95.28 | 71.95 | — | 50.59 | 86.66 | 48.07 | 21.36 | 2.52 | 23.88 |
| September ... | 95.40 | 71.56 | — | 50.75 | 88.38 | 48.06 | 20.81 | 2.69 | 23.50 |
| October ... | 95.18 | 72.31 | — | 51.60 | 88.42 | 48.23 | 20.71 | 3.37 | 24.08 |
| November ... | 95.81 | 71.22 | — | 50.95 | 88.30 | 48.03 | 20.27 | 2.92 | 23.19 |
| December ... | 95.23 | 70.46 | — | 49.89 | 87.70 | 46.82 | 20.57 | 3.07 | 23.64 |
| Season Average ... | 95.11 | 71.30 | — | 49.37 | 87.10 | 46.93 | 21.93 | 2.44 | 24.37 |

## III MASSECUITE

| MONTH | Massecuites Averages Brix | Massecuites Averages Purity | III Molasses at Striking Brix | III Molasses at Striking Purity | III Molasses at Curing Brix | III Molasses at Curing Purity | Pan Purity Drop | Cryst. Purity Drop | Total Purity Drop |
|---|---|---|---|---|---|---|---|---|---|
| April ... ... | 96.18 | 57.56 | 93.59 | 42.93 | 88.01 | 36.40 | 14.63 | 6.53 | 21.16 |
| May ... ... | 96.42 | 58.92 | — | 42.86 | 88.02 | 35.83 | 16.06 | 7.03 | 23.09 |
| June ... ... | 96.72 | 59.24 | — | 43.28 | 88.60 | 37.17 | 15.96 | 6.11 | 22.07 |
| July ... ... | 96.68 | 59.21 | — | 43.77 | 88.70 | 38.01 | 15.44 | 5.76 | 21.20 |
| August ... | 97.14 | 58.90 | — | 44.15 | 89.18 | 38.44 | 14.75 | 5.71 | 20.46 |
| September ... | 97.28 | 58.47 | — | 44.98 | 89.50 | 38.92 | 13.49 | 6.06 | 19.55 |
| October ... | 96.86 | 60.20 | — | 47.19 | 89.32 | 39.97 | 13.01 | 7.22 | 20.23 |
| November ... | 96.88 | 58.04 | — | 47.66 | 90.00 | 38.62 | 10.38 | 9.04 | 19.42 |
| December ... | 96.93 | 57.97 | — | 46.45 | 90.10 | 38.63 | 11.52 | 7.82 | 19.34 |
| Season Average ... | 96.79 | 58.72 | — | 44.81 | 89.00 | 38.00 | 13.91 | 6.81 | 20.72 |

TONS CANE PER HOUR **102.58** TONS SUGAR PER HOUR **11.65** TONS SUGAR MADE **61,470**

| | Cubic feet Massecuite Cured | Per cent of Total | Lbs. Sugar per cu. ft. Massecuite | Cubic feet Massecuite per ton Sugar | Pol. of Sugar | Safety Factor | Sp. Gr. Grain Size | Boiling House Recovery | Boiling House Performance | Purity Syrup | Purity Exhausted Molasses | Overall Purity Drop |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| "A" Massecuite ... ... | 1,823,647 | 56.61 } | 45.61 | 43.85 | 98.80 | .25 | .53 | 91.22 | 99.28 | 85.9 | 38.9 | 46.99 |
| "B" Massecuite ... ... | 872,183 | 27.07 } | | | | | | | | | | |
| "C" Massecuite ... ... | 525,789 | 16.32 | — | — | — | | | | | | | |

# SEASON 1958/59

## II MASSECUITE

| MONTH | Massecuites Averages Brix | Massecuites Averages Purity | II Molasses at Striking Brix | II Molasses at Striking Purity | II Molasses at Curing Brix | II Molasses at Curing Purity | Pan Purity Drop | Cryst. Purity Drop | Total Purity Drop |
|---|---|---|---|---|---|---|---|---|---|
| May ... ... | 94.78 | 69.51 | 91.14 | 49.68 | 87.10 | 46.98 | 19.83 | 2.70 | 22.53 |
| June ... ... | 95.06 | 69.76 | 90.87 | 49.77 | 87.32 | 46.16 | 19.99 | 3.61 | 23.60 |
| July ... ... | 95.04 | 70 81 | 90.88 | 51.10 | 87.94 | 47.09 | 19.71 | 4.01 | 23.72 |
| August ... | 95.35 | 70.78 | 91.15 | 50.99 | 88.04 | 47.28 | 19.79 | 3.71 | 23.50 |
| September ... | 95.45 | 70.75 | 91.36 | 51.02 | 87.96 | 47.02 | 19.73 | 4.00 | 23.73 |
| October ... | 95.29 | 71.00 | 91.37 | 51.46 | 88.28 | 47.67 | 19.54 | 3.79 | 23.33 |
| November ... | 95.35 | 70.86 | 91.58 | 51.58 | 88.28 | 47.57 | 19.28 | 4.01 | 23.29 |
| December ... | 95.40 | 70.61 | 91.62 | 51.55 | 88.30 | 47.33 | 19.06 | 4.22 | 23.28 |
| January 59... | 95.20 | 70.78 | 91.44 | 51.38 | 88.23 | 47.43 | 19.40 | 3.95 | 23.35 |
| February ... | 95.18 | 70.60 | 91.54 | 51.04 | 88.22 | 47.43 | 19.56 | 3.61 | 23.17 |
| Season Average ... | 95.25 | 70.64 | 91.29 | 51.08 | 88.04 | 47.22 | 19.56 | 3.86 | 23.42 |

## III MASSECUITE

| MONTH | Massecuites Averages Brix | Massecuites Averages Purity | III Molasses at Striking Brix | III Molasses at Striking Purity | III Molasses at Curing Brix | III Molasses at Curing Purity | Pan Purity Drop | Cryst. Purity Drop | Total Purity Drop |
|---|---|---|---|---|---|---|---|---|---|
| May ... ... | 96.19 | 58.74 | 94.18 | 46.46 | 89.04 | 37.80 | 12.28 | 8.66 | 20.94 |
| June ... ... | 96.38 | 58.80 | 94.46 | 47.45 | 89.00 | 38.06 | 11.35 | 9.39 | 20.74 |
| July ... ... | 96.73 | 59.15 | 94.62 | 48.17 | 89.17 | 38.24 | 10.98 | 9.93 | 20.91 |
| August ... | 97.26 | 58.82 | 94.70 | 47.10 | 89.93 | 38.40 | 11.72 | 8.70 | 20.42 |
| September ... | 97.17 | 58.70 | 94.88 | 46.40 | 90.16 | 38.41 | 12.30 | 7.99 | 20.29 |
| October ... | 96.85 | 59.54 | 94.72 | 47.51 | 90.48 | 39.16 | 12.03 | 8.35 | 20.38 |
| November ... | 97.01 | 58.94 | 94.82 | 47.04 | 90.78 | 39.07 | 11.90 | 7.97 | 19.87 |
| December ... | 97.26 | 58.16 | 95.14 | 46.92 | 90.52 | 38.86 | 11.24 | 8.06 | 19.30 |
| January ... | 96.90 | 58.90 | 94.79 | 46.87 | 89.41 | 38.47 | 12.03 | 8.40 | 20.43 |
| February ... | 96.64 | 59.27 | 94.92 | 46.88 | 90.84 | 38.96 | 12.39 | 7.92 | 20.31 |
| Season Average ... | 96.90 | 58.89 | 94.75 | 47.10 | 89.94 | 38.57 | 11.79 | 8.53 | 20.32 |

TONS CANE PER HOUR **103.09** TONS SUGAR PER HOUR **11.41** TOTAL TONS SUGAR MADE **70,741**

| | Cubic feet Massecuite Cured | Per cent of Total | Lbs. Sugar per cu. ft. Massecuite | Cubic feet Massecuite per ton Sugar | Pol. of Sugar | Safety Factor | Sp. Gr. Grain Size | Boiling House Recovery | Boiling House Performance | Purity Syrup | Purity Exhausted Molasses | Overall Purity Drop |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| "A" Massecuite ... ... | 2,035,632 | 52.75 } | 44.97 | 44.47 | 98.85 | .23 | .52 | 89.82 | 98.09 | 85.2 | 39.19 | 46.01 |
| "B" Massecuite ... ... | 1,110,139 | 28.76 } | | | | | | | | | | |
| "C" Massecuite ... ... | 713,589 | 18.49 | — | — | — | | | | | | | |

# SEASON 1959/60

## II MASSECUITE

## III MASSECUITE

| MONTH | Massecuites Averages | | II Molasses at Striking | | II Molasses at Curing | | Pan Purity Drop | Cryst. Purity Drop | Total Purity Drop |
|---|---|---|---|---|---|---|---|---|---|
| | Brix | Purity | Brix | Purity | Brix | Purity | | | |
| April ... ... | 95.13 | 69.94 | 91.37 | 48.85 | 87.46 | 46.65 | 21.09 | 2.20 | 23.29 |
| May ... ... | 95.50 | 71.33 | 91.18 | 51.04 | 87.73 | 47.25 | 20.29 | 3.79 | 24.08 |
| June ... ... | 95.63 | 71.32 | 91.58 | 51.27 | 8[illegible].19 | 47.77 | 20.05 | 3.50 | 23.55 |
| July ... ... | 95.32 | 71.34 | 91.69 | 51.58 | 88.21 | 48.16 | 19.76 | 3.42 | 23.18 |
| August ... | 95.30 | 70.76 | 91.52 | 51.14 | 88.51 | 47.88 | 19.62 | 3.26 | 22.88 |
| September ... | 95.11 | 71.88 | 91.56 | 52.02 | 87.91 | 48.40 | 19.86 | 3.62 | 23.48 |
| October ... | 95.28 | 71.06 | 91.63 | 51.51 | 87.71 | 48.43 | 19.55 | 3.08 | 22.63 |
| November ... | 95.42 | 69.52 | 91.72 | 50.16 | 87.90 | 47.80 | 19.36 | 2.36 | 21.72 |
| December ... | 95.72 | 68.74 | 91.73 | 49.51 | 88.00 | 47.36 | 19.23 | 2.15 | 21.38 |
| Season Average ... | 95.40 | 70.74 | 91.55 | 50.98 | 88.00 | 47.81 | 19.76 | 3.17 | 22.93 |

| MONTH | Massecuites Averages | | III Molasses at Striking | | III Molasses at Curing | | Pan Purity Drop | Cryst. Purity Drop | Total Purity Drop |
|---|---|---|---|---|---|---|---|---|---|
| | Brix | Purity | Brix | Purity | Brix | Purity | | | |
| April ... ... | 96.54 | 58.10 | 94.33 | 46.20 | 88.91 | 37.76 | 11.90 | 8.44 | 20.34 |
| May ... ... | 97.22 | 59.18 | 94.90 | 45.78 | 88.98 | 38.80 | 13.40 | 6.98 | 20.38 |
| June ... ... | 97.57 | 59.22 | 95.53 | 47.75 | 90.26 | 39.98 | 11.47 | 7.77 | 19.24 |
| July ... ... | 97.45 | 59.40 | 95.45 | 47.15 | 90.07 | 40.49 | 12.25 | 6.66 | 18.91 |
| August ... | 97.23 | 58.78 | 94.36 | 37.34 | 90.18 | 40.14 | 11.44 | 7.20 | 18.64 |
| September ... | 96.84 | 59.32 | 94.91 | 47.67 | 89.88 | 40.73 | 11.65 | 6.94 | 18.59 |
| October ... | 96.91 | 59.16 | 94.74 | 47.93 | 89.58 | 42.88 | 11.23 | 5.05 | 16.28 |
| November ... | 97.19 | 57.68 | 94.83 | 46.31 | 89.96 | 40.74 | 11.37 | 5.57 | 16.94 |
| December ... | 96.88 | 57.84 | 94.57 | 46.54 | 89.83 | 40.28 | 11.30 | 6.26 | 17.56 |
| Season Average ... | 97.14 | 58.82 | 94.90 | 47.05 | 89.87 | 40.30 | 11.77 | 6.75 | 18.52 |

TONS CANE PER HOUR **101.79**  TONS SUGAR PER HOUR **11.64**  TOTAL TONS SUGAR MADE **57,149**

| | Cubic feet Massecuite Cured | Per cent of Total | Lbs. Sugar per cu. ft. Massecuite | Cubic feet Massecuite per ton Sugar | Pol. of Sugar | Safety Factor | Sp. Gr. Grain Size | Boiling House Recovery | Boiling House Performance | Purity Syrup | Purity Exhausted Molasses | Overall Purity Drop |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| "A" Massecuite ... ... | 1,677,009 | 54.08 | 44.95 | 44.49 | 98.79 | .22 | .47 | 88.87 | 96.89 | 85.4 | 40.65 | 44.75 |
| "B" Massecuite ... ... | 865,579 | 27.91 | | | | | | | | | | |
| "C" Massecuite ... ... | 558,656 | 18.01 | — | — | — | | | | | | | |

**The President** said that regarding the graining of A massecuite he asked why molasses was not used for graining? Was this due to the small number of centrifugals they had? He wanted to know what cycle time six 36" machines would give them with the throughput they handled at present.

**Mr. Turner** said they had not tried molasses graining because their pan capacity was very low and graining on molasses took a long time. Owing to the limited capacity of C centrifugals a large grain had to be boiled. Twelve water-driven machines had to be used as well for about 20 per cent of the available time, and the cycle was about 15 to 20 minutes. This is a very short cycle for an old-fashioned machine.

**Mr. Johnston** remarking on Chart 1 pointed to the very low drops shown in certain cases between purity of massecuite and molasses. He wanted to know what this could be attributed to.

**Mr. Elysee** pointed out that it was not a question of a drop of 12° or 24° Nutsch purity. As far as the variation in a particular individual's work was concerned, they had ample steam and water and vacuum, and it was merely the operation of the pan boiler that counted. All the work was not good and that is why he would like to see other factories try out these tests. It might be that their plant was not of sufficient size or modern design at Amatikulu. Further work of this nature would indicate what capacity was required and what drops in purity could be expected. In season 1957, the recovery was 91.22. In the case of second massecuite the drop in purity was 21.9 and only 2.4 in the crystallizer. In May of every year they had the highest drops. This might indicate that the nature of the product was not the same throughout the season. Throughput had not changed and the purity of syrup was more or less the same over the past three seasons. Throughput had been the same, equipment had been the same, but the results have deteriorated particularly during this last year. Some of the other mills which had achieved good results in the past had not been able to repeat them this past season, so he thought he was justified in claiming that the products were not of the same nature as before.

**Dr. Douwes-Dekker** stated that the paper was useful because it gave more data than was usually obtained in the monthly data. The authors were to be congratulated on having determined all these Nutsch purities. He thought more factories should carry out these tests to guide them in their boiling and cooling process. He had carried out a large scale investigation in Java to find out how the various factories operated their C-pans, crystallizers and centrifugals. It appeared that hardly two factories were working in the same way. Some achieved a much greater drop in purity in the pan than others, the latter doing their utmost to obtain the required exhaustion in the crystallizers. Factories with a generous pan capacity usually got the highest drop in the pans, and when a generous crystallizer volume was available, the factory often did not seem to bother to reach maximum exhaustion in the pan. In the case of one factory complete exhaustion was obtained in the pan. Purity of molasses after centrifuging was no different from that obtained from Nutsch test when the pan was struck, and the molasses was satisfactorily exhausted when spun off.

**Mr. Turner** said that when it was decided to make exhaustive study of B and C massecuites figures, these tests were immediately given to the pan boilers—finally in the form of a graph. The pan-boilers apparently took great interest in the graph for they soon corrected any errors they spotted in them.

**Mr. Beesley** said that Mr. Elysee had asked for figures from other factories. In this respect he could say that under average conditions, Illovo expected to get 29° apparent purity crystallizer Nutsch from 58° purity massecuite. He said that Illovo boiled C massecuites very slowly and tight all the way. It took three to four hours from starting a pan to having the grain ready for feed and then 10½ hours before striking the pan.

**Mr. Elysee** said that whereas previously the drop had been 29° degrees at Amatikulu they had not obtained anything like this recently. This probably explained the poor results in recent years.

**Mr. Beesley** pointed out that the grain size of C sugars at Illovo was 0.28 mm. long.

**Mr. Turner** said that this was a most important point, where time and centrifugal capacity was suitable, to form grain of that size was very desirable.

**The Chairman** asked Mr. Beesley how long at Illovo could they spin third massecuites.

**Mr. Beesley** replied that they cured 100 cubic feet of C massecuite per hour in a start to stop cycle of about 22 minutes. The machines were 40" x 30" baskets running at about 1400 rev. per minute. They were going to be speeded up to 1700 revs. this year.

**Mr. Dedekind** asked if they could get any circulation in the pans at Amatikulu when there was over nine feet of massecuite above the tube plate.

**Mr. Elysee** said that the discharge gutter from a pan did not have a steep slope so the massecuites could not be concentrated to a higher Brix. On boiling to get a 99° Brix massecuite, molasses was introduced to reduce the brix to 97° Brix for discharge. However when the massecuite was discharged it was followed by the molasses indicating that there was no circulation in the pan.

**Mr. Dedekind** enquired if any mechanical stirring device had been considered.

**Mr. Turner** said not, not as yet, but he hoped to investigate the possibility.

**Mr. Ducasse** said there he had a similar height of massecuite above the tube plate. It took nine hours at Renishaw to boil a pan so he thought perhaps at Amatikulu they were boiling too fast. He enquired the amount of footing used in the pan. At times even seventeen hours had been taken to boil a 3rd massecuite.

**Mr. Turner** said that boiling time was limited by capacity. As far as footing was concerned, his opinion was that one should not use more than 35 or 40 per cent of the capacity of the pan.

**Mr. Davies** felt that with the old type of pan when boiling a second or third massecuite you finished with a "jelly" on the top. At Felixton they had comparatively new pans with only about 5′ 6″ of massecuite above the tube plate when full. He considered that after about 3′ above the tube plate circulation ceased. Pan research in America had suggested the same thing.

**Mr. Rault** said that one could not always go by drops in purity. This depended also on the purity level of the massecuite, a high purity first massecuite giving a better yield with a small drop between massecuite and molasses, than a third massecuite. He endorsed the remark that equipment was generally inadequate with its 20° to 23° drop in purity and through the increased throughput of recent years, many factories were no longer balanced. He enquired from Mr. Beesley if any increase in recovery had materialised in his factory as a result of the successful reduction of molasses purity to a further stage than other factories. He said that in spite of Amatikulu getting lower drops, recovery figures were still comparatively fair at that mill.

**Mr. Beesley** said that one had to look at the non-sucrose in mixed juice—some of which went out of the factory in filter cake, but most of which went out in final molasses. Hence as he was convinced that destruction of sucrose into non-sucrose in a raw-house was negligible, one inevitably must get higher recoveries from lower molasses purities. However, he suspected Mr. Rault was having a quiet "dig" at him about the low recovery at Illovo in 1959-60 and in this respect he could say: The clarification plant at Illovo was under-capacity and resulted in mud going over in clear juice at times, this gave increased losses in final molasses and probably increased the refinery losses due to poor filtrability, etc. Further it was very difficult to wash the filter cake to a low pol, and even if this was achieved, the filtrate returns dropped in purity, which in turn probably affected the final molasses. Finally, it must not be forgotten that Illovo's Boiling House Recovery included the Refinery.

Referring to an earlier remark about circulation, he pointed out that the C massecuite pan at Illovo was a floating calandria type, with the feed straight into the side of the pan above the calandria, hence the feed went straight to the top of the massecuite and did not help circulation at all. In fact he had noticed that during the last 100 to 150 cu. ft. of each strike, there was a layer of froth resting on the seemingly still massecuite. However the strike took feed quite normally and judging by the conductivity (if left on while striking) the strikes were always homogeneous throughout. Conversely he said that some pans he had observed showed a marked increase in conductivity as the last of the massecuite passed the electrodes, which definitely indicated poor circulation and a slack layer on top.

**Mr. Davies** said that the advantage at Illovo was that it took a long time to build up their pan.

**Mr. Rabe** enquired about the effectiveness of louvres in the pan.

**Mr. Johnston** said that at Maidstone they had installed louvres and he thought that to work correctly they should be installed in a pan with a rather shallow base. They would be more effective in a pan with proper circulation.

**Mr. Boyes** said that the louvres installed did not shew any great improvement. He had studied performance from the point of view of evaporation at different levels in the pan. At the low levels (up to 3 feet above the calandria) there appeared to be a slightly better rate of evaporation. He pointed our however that the steam coil originally in the pan spoken of by Mr. Johnstone had been removed, thereby reducing the effective heating surface by about 45 square feet.

**Mr. Phipson** asked if anybody had used perforated steel steam coils in the pan to encourage circulation. This had been tried at Empangeni with great advantage.

**Mr. Rault** said he had seen this in beet factories in American and had noted its marked success in increasing circulation. This system was installed in Natal Estates but it was abused. In other words, the pan boilers had used this to assist the massecuite to be discharged from the pan.

**Mr. Beesley** said that to his mind there was no substitute for slow boiling to get good exhaustion and even with excellent circulation, the strikes should be boiled slowly. However, he did point out, that assistance to circulation was sometimes very necessary and mentioned the first C massecuite pan he worked on, in Australia. It was a tall narrow coil pan and was fitted with four $\frac{1}{4}$″ steam inlets through the bottom cone. The pan just would not boil unless the steam inlets were slightly open.

**Mr. Rabe** said that a 3″ perforated steam pipe was introduced into a pan with poor circulation. Sugar however eventually got into this pipe and it choked up.

**Mr. Thumann** said in regard to massecuite above the tube plate the performance of the pan could not be stepped up when there was a high level of massecuite above the tube plate. There would be no boiling in the top portion of the pan. It would appear that the pan with a nine foot height above the tube plate had been altered since it was first installed.

**Mr. Turner** said that the pan in question was a fairly new one designed to boil 1,000 cu. ft., but when sucrose was high it had to be pushed up to 1,400 ft.

**Mr. Johnston** said that the efficiency of a pan could be much impaired by neglecting the cleaning of pans from week to week and the efficiency was thereby impaired.

**Mr. Davies** said when he gave information of his pan capacity to a factory manager from East Africa he was told that his capacity was ample, but he should put in steam traps rather than "U" tubes for discharging the condensate from the calandria.

**Mr. Thumann** said that it was obvious that evaporation was fastest when the pan was first started, and maybe the "U" tubes did not have the capacity to take away the condensate from the calandria in the initial stages.

**Mr. Phipson** said that Gesta steam traps had been installed on all the pans at Z.S.M. and they had found them most satisfactory.