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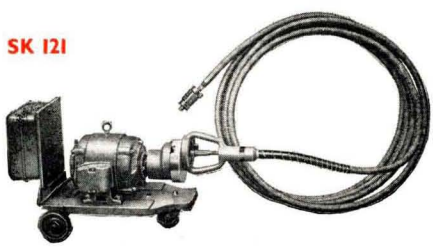

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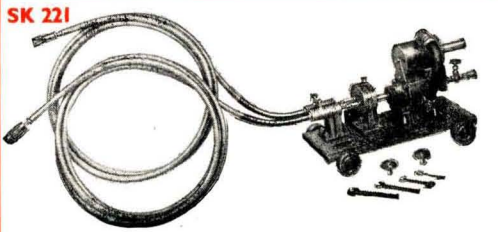

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THE
# INTERNATIONAL SUGAR JOURNAL

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## NOTES AND COMMENTS

**Free market price improvement.**

At a meeting of sugar exporting member countries held under the auspices of the International Sugar Council the following scheme has been adopted:

(*a*) exporting member countries will agree to pursue constructive marketing policites aimed at improving the free market price in the short term;

(*b*) the objective will be to raise the free market price of sugar and, as a first step, exporting member countries will not sell raw sugar at a price below the equivalent of 2·50 U.S. cents per lb avoirdupois raw sugar 96° polarization in bags f.o.b.s. Greater Caribbean basis;

(*c*) sales for forward delivery made at an outright price will be consistent with the price objective of the scheme;

(*d*) the selling price of white sugar will be consistent with the selling price of raw sugar as referred to in (*b*) above;

(*e*) conditions of sales on a deferred pricing basis will as far as practicable specify the final destination of the sugar;

(*f*) the operation of the agreement will be subject to periodical reviews by the Exporters Group;

(*g*) a Marketing Advisory Committee will be set up for the purpose of advising the Group on the implementation of the scheme and on possible further action to promote its objectives in the future;

(*h*) the scheme will be voluntary and without prejudice to the attitude to the countries concerned towards a future International Agreement or their negotiating position and should preferably be entered into by the commercial sector with the least possible involvement of Governments in its operation;

(*i*) The Exporters Group will meet on the 5th April to review the scheme and take such action as might be appropriate. That meeting will be preceded by a meeting of the Marketing Advisory Committee.

The following countries have accepted the scheme: Argentina, Australia, Belgium, Brazil, China, Colombia, Costa Rica, Czechoslovakia, Denmark, Dominican Republic, Ecuador, El Salvador, France, Hungary, India, Jamaica, Malagasy Republic, Mexico, Netherlands, Nicaragua, Peru, Philippines, Poland, South Africa, Trinidad and Tobago, and the U.S.S.R. The scheme was also accepted on behalf of the following other exporting members of the Commonwealth Sugar Agreement: British Honduras, Fiji, Mauritius, Swaziland, and the territories which are members of the British West Indies Sugar Association.

The representative of the Cuban Government has informed the representatives of the countries participating in the scheme that although his country will not participate in the scheme, his Government will recommend the Cuban sugar exporting enterprise to maintain a constructive selling policy aimed at improving the level of prices in the free market. The scheme came into effect on the 4th March 1966.

B. W. Dyer & Company, sugar economists and brokers, comment that the minimum world sugar price of 2·5 cents per pound which was agreed upon was realistically low. Work groups of the International Sugar Council previously had discussed a price range of 4 to 5 cents for world raw sugar as being a desirable objective. Such a high price objective probably would have caused the failure of any international sugar agreement or even the present sugar-exporter cartel.

To be effective, a realistic minimum price must be set below the lowest cost of sugar production in all areas. Moreover, the cost-of-production concept used should be the so-called "variable" cost concept, which is lower than the "average" cost concept. The "variable" cost concept means that any income which exceeds the variable directly assignable to such extra production would be viewed as "profit" contributing toward reducing the fixed overhead costs.

The "floor" price in any agreement must be set low enough to clear the market of the excess production and eliminate the economic incentive to over-produce.

Otherwise, the period of difficulties for sugar producers would merely be extended.

The following "average" production costs were reported: India 8 cents per lb; Dominican Republic 6 to 7 cents per lb; Brazil 5·3 to 5·5 cents; Mexico 4·9 to 5·5 cents; South Africa 5·3 cents; Nicaragua 5 cents; British West Indies 4·9 cents; Guatemala 4·6 cents; El Salvador 4·5 cents; and Peru 3·9 cents per pound. The 2·5 cents set by the sugar-exporter group thus takes realistic cognizance of the "variable" cost concept.

* * *

**U.K. imports and exports, 1965[1].**

The encouraging expansion in the tonnage of British exports of sugar which was a feature of 1963 and 1964 was not maintained last year and at 297,536 tons the total was the lowest since 1947. The major reduction compared with 1964 was in the case of the Netherlands; following a poor domestic crop the Dutch authorities had purchased nearly 140,000 tons of British sugar in 1964, but this need disappeared in the following year and exports of British sugar to Holland fell to 10,958 tons. Exports to Greece, which had also been high in 1964, fell to a more usual level while there was also a marked drop in exports to Saudi Arabia. There was an improvement in the level of exports to Norway and Switzerland, however, while encouragement may be derived from the stepped-up exports to Tunisia and Kuwait.

The combination of lower exports and a very good domestic beet crop in 1964/65 led to a reduction in import requirements, the quantity of raw sugar entering the country falling to 2,092,706 tons. Nevertheless, an increase in the tonnage of raws originating from the Commonwealth brought the share of these countries to about 90%. There was a noticeable expansion in imports of sugar from India, which follows that country's accession to the Commonwealth Sugar Agreement.

Imports of sugar exceeding 98° polarization, except where they form part of the Commonwealth negotiated price quota, are limited under the Board of Trade licensing arrangements to 130,000 tons annually, but foreign whites are not now normally available to the U.K. manufacturer at below the cost of British refined and for the past two years such imports have fallen well below the permitted maximum. The quantity of whites and refined entered last year amounted to 44,811 tons, the lowest tonnage since 1958.

Tables showing the individual import and export figures for 1963–1965 are reproduced elsewhere in this issue.

* * *

**Mauritius sugar production, 1965[2].**

Harvesting of the 1965 crop in Mauritius started on the 23rd June and ended on the 24th December. The 23 mills together crushed 5,890,245 long tons of cane, i.e. about 234,000 tons more than the record figure of 1963. Total sugar output amounted to 654,000 tons which compares with 510,821 tons in 1964 and ranks second after the 1963 crop.

Owing to unseasonable weather during the maturation season, average sugar recovery was only 11·10%, the lowest figure since 1953. On the other hand, average cane yield reached the unprecedented figure of 29·1 tons per acre. As a result yield of sugar per acre amounted to 3·23 tons as against 3·33 tons in 1963.

Exports during 1965 totalled 569,282 tons as against 551,155 tons in 1964; this included 389,860 tons to the U.K. (401,285 tons in 1964), 95,649 tons to Canada (134,881 tons in 1964), 41,180 tons to South Africa (—), 19,643 tons to Malaysia (5000 tons in 1964), 13,600 tons to the U.S.A. (—) and 9350 tons to Hong Kong (—). In 1964 the balance (9989 tons) of exports went to Italy.

* * *

**U.K. beet crop, 1965/66.**

The 1965/66 campaign, which was completed on 11th February, 1966, was a difficult one for both beet growers and factories alike. Very heavy rainfall in September, November and December delayed harvesting whilst severe frosts in November and at Christmas resulted in deterioration of beet quality. Notwithstanding the technical problems thus created, virtually the whole of the crop of 6,705,000 tons was harvested, delivered and processed. This achievement was made possible by outstanding efforts on the part of growers and hauliers and by the factories reaching a new record high slice. Inevitably, owing to the adverse conditions mentioned above, greater factory processing losses were experienced than in 1964/65. The crop was the second highest in the Corporation's history, being exceeded only by the record of 7,215,000 tons in 1960/61 and compares with 6,218,000 tons in 1964/65. However, sugar content in the beet at 15·60% was comparatively low in 1965/66, the figure in 1964/65 having been 17·72%.

* * *

**Increase in U.K. sugar surcharge.**

The Sugar Board surcharge of 3¼d per lb (30s 4d per cwt) was increased to 3½d per lb (32s 8d per cwt) from 22nd February 1966. The Minister of Agriculture, Fisheries and Food, on the advice of the Sugar Board, made the necessary orders under the Sugar Act 1956. The change in surcharge, which resulted in an increase of about 2s 4d per cwt in the ex-refinery price, was made to bring the Sugar Board's trading position more into line with the current level of world prices.

[1] C. Czarnikow Ltd., *Sugar Review*, 1966, (750), 35.
[2] *Mauritius Sugar News Bull.*, 1965, (12).

# SUCROSE % CANE AND DIURNAL TEMPERATURE RANGE

By C. A. JOHNSON, B.Sc.Agric., Chief Agronomist, Hippo Valley Estates, Ltd., Chiredzi, Rhodesia.

HIPPO Valley is situated in the south eastern lowveld of Rhodesia, some 1300 feet above sea level. The climate is hot and dry with average maximum and minimum temperatures of 84·6°F and 58·5°F respectively. Rainfall at an average of 20 inches per annum is confined to the months of November to March. Ground frosts occur in June and July.

The soils are mainly sandy clay loams derived from paragneiss, with local areas of lighter soils showing a forest sandstone influence, and some heavy active clays derived from basaltic lavas.

Both overhead and furrow irrigation are practised. Water is obtained from the Kyle Dam complex by lined canals, and the normal water duty is 6·5 acre feet per annum.

The Estate has 17,000 acres under sugar cane, whilst a further 7000 acres are grown by small farmers on 43 freehold properties. Of the total cane acreage, half is planted to N:Co 310, a good yielding high sucrose variety under local conditions, and the balance to N:Co 376, a heavier yielder with a lower sugar content. With two factories and a combined capacity of 330 tons cane per hour, the normal season will last from April to December.

The average yield for the 1964 season was 62·53 tons cane per acre at a T.C.A.M. of 4·52 tons, and at 12·92% sucrose the nett yield of sugar per acre was 6·192 tons. For this season to the beginning of December the average sucrose % cane was 14·03, and the yield of sugar per acre nearer 7 tons.

Cutting orders are issued on a maturity basis; all fields are sampled at monthly, fortnightly and weekly intervals, for sucrose % cane and fibre, using a "Jeffco" shredder, and for Brix, pol and purity using a standard small mill. Over 1500 samples have been tested this season.

Over the past two years, the sucrose % cane, as recorded by the factory chemical control and by the maturity samples, has shown fairly regular and wide variations from week to week. The fluctuations could not be attributed to any one or a combination of the following factors:

(i) Cane variety harvested
(ii) Age of cane at harvesting
(iii) Plant or ratoon cane
(iv) Interval between harvesting and milling
(v) Variations in the drying-off routine

so attention was turned to a possible climatic factor, and an interesting and strong correlation has been found between the diurnal temperature range one month before harvesting, and sucrose % cane. Figs. 1 and 2 for the seasons 1964 and 1965 show the average weekly sucrose % cane corresponding to the dates indicated, and the average weekly diurnal temperature range for the preceding calendar month.

As the temperature graph is plotted one month in advance, it has been possible to forecast the drops in sucrose % cane accurately, and the factory has been warned on five occasions this season to expect lower purities for periods of up to a week or ten days.

An attempt will be made next season to avoid these fluctuations in sucrose % cane, which not only reflect on the crushing rate but upset the boiling house routine.

With the temperature range recorded one month in advance and the field maturity figures, cutting orders will be adjusted as follows:

For periods where the diurnal range is less than 25°F, cutting will be switched to suitable fields of N:Co 310 of known high purity.

For periods where the diurnal range is greater than 30°F, cutting will be switched to N:Co 376.

At temperature ranges between 25°F and 30°F, cutting of both varieties will continue on a normal maturity basis.

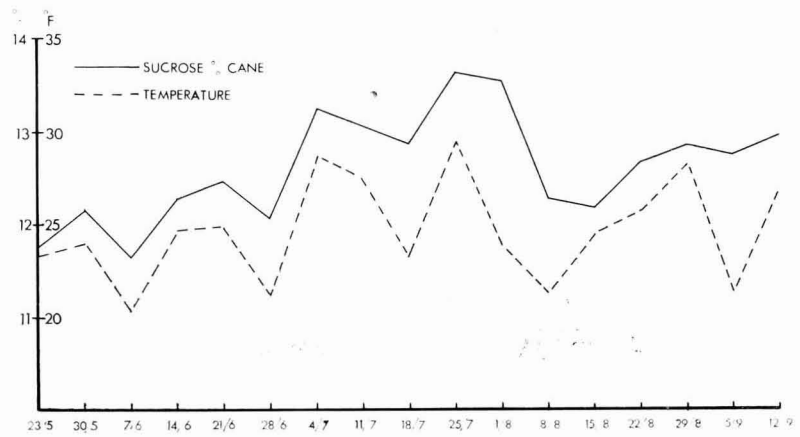


Fig. 1

In this way it is hoped to be able to maintain cane at the gantry with a more constant sugar content, which in turn will be reflected in the smooth running of the factory and a higher overall recovery.

Acknowledgements to my colleague, Mr. M. J. P. KOENIG, Agronomist, Hippo Valley Estates, for crop statistics and weather data.

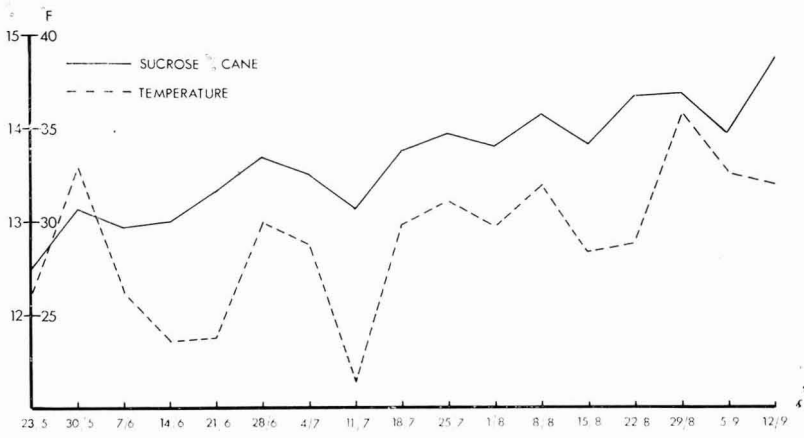


Fig. 2.

# A METHOD FOR DETECTING AND MEASURING ENTRAINMENT

By A. G. CLAIRE
(Bureau of Sugar Experiment Stations, Queensland, Australia)

*Paper presented to the 12th Congress, I.S.S.C.T.*, 1965.

## INTRODUCTION

ENTRAINMENT has been defined[1] as the carrying over of drops of liquid from the evaporator owing to the fact that the vapour velocity is sufficient to overcome the settling rate of the droplets. This definition would exclude material which has entered the vapour as a result of splashing, or by any other means. However the term "entrainment" has been used by BEALE and STEWART[2] to mean the amount of sugar measured as parts per million of vapour, moving in the general direction of the vapour flow.

In any multiple-effect station, the amount of entrainment occurring in any vessel except the last can be readily determined from a sample of condensate taken from the succeeding vessel. The vapours from the last vessel pass to a condenser and are mixed with a large quantity of injection water. This creates certain problems in the measurement of entrainment and these are increased when the injection water is re-circulated through a spray pond or cooling tower. A sample of vapour taken from the vapour pipe to the condenser can therefore be expected to give more reliable information as to the amount of entrainment occurring, and this paper describes a sampling system developed for this purpose, with some typical results.

## SAMPLING EQUIPMENT

The spear used to sample vapour from horizontal vapour pipes is illustrated in Fig. 1. Essentially it is a length of steel tube, of $1\frac{1}{4}$ in outside diameter, fitted with an internal water-tube condenser constructed of $\frac{3}{8}$ in and $\frac{3}{4}$ in brass tube. One end of this steel tube is blanked off and a sampling port, $\frac{3}{4}$ inch in diameter, is located one inch from the blank end, at right angles to the tube. At the other end are three connexions through compression fittings, two for the water lines ($\frac{1}{2}$-inch hose) to the internal condenser and the third for the condensed vapour. Nylon tubing, of $\frac{1}{2}$ inch outside diameter, is used to convey the condensed vapour to the receiving bottle, which in

[1] HONIG: Principles of Sugar Technology, Vol. III. (Elsevier, Amsterdam.) 1963, p. 63.

[2] *Proc. 29th Conf. Queensland Soc. Sugar Cane Tech.*, 1962, 95; *I.S.J.*, 1962, **64**, 301.

turn is connected to a vacuum pump through a water trap. The three connexions are located so as to indicate the direction in which the sampling port at the other end is facing. The port always faces directly into the flow of vapour during sampling operations.

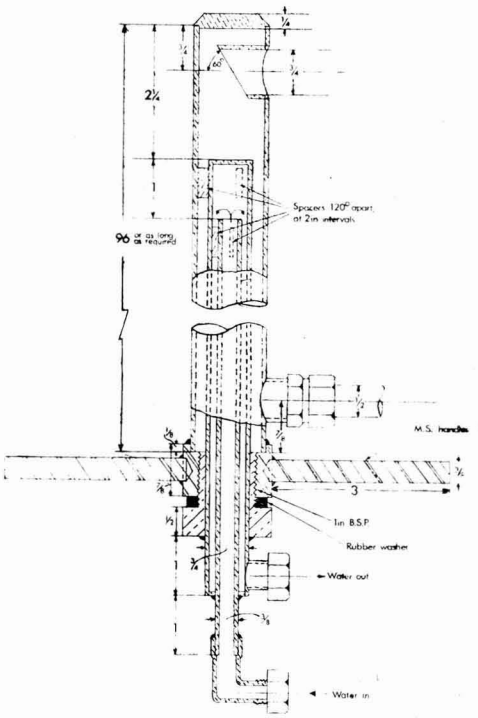


Fig. 1. Dimensions in inches.

In order that the sampling spear may be inserted or withdrawn while the vapour pipe is under vacuum, a special head device (Fig. 2) is fixed to the bottom of the pipe to be sampled. By locating this head on the bottom of the pipe, it is possible to make a traverse diametrically across the pipe in a vertical direction. With the spear in a vertical position, the vapour condensed in it quickly clears the condenser under the influences of gravity and the vacuum pump.

A reciprocating air compressor, of 3 c.f.m. rated capacity and driven by an electric motor, was converted for use as a vacuum pump, in order to provide an independent source of vacuum. This unit produces a vacuum of 29 inches of mercury when discharging into the vacuum pipes of the factory. To prevent the oil in the sump being sucked past the piston rings of the pump, it is necessary to provide a pressure-equalizing line between the discharge line and the sump.

Two Erlenmeyer flasks, each of five litres capacity, are connected in series to the suction side of the pump. The first acts as a water trap and the second as a condensate receiver. Vacuum breakers are provided, as well as an adjustable vent on the suction side of the pump. A graduated measuring cylinder, a funnel and several stoppered plastic bottles are also required, to measure and store the condensates from the various runs.

When the cooling water comes from low-head tanks and when the vapour line to be sampled is 35 to 40 feet above ground level, it is necessary to use a booster pump in the water line to the condenser. This consists of a small centrifugal pump driven by an electric motor. The flow of water is controlled

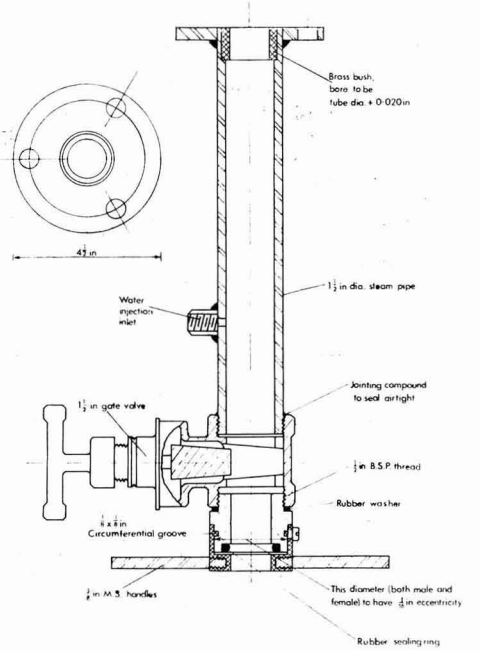


Fig. 2

by a valve on the pump. It is possible to control the amount of vapour sampled by adjusting either the rate of flow of cooling water or the vent on the vacuum pump.

## General

Beale[3] has demonstrated how entrainment caused by splashing can be markedly reduced by the use of baffles at the feed inlet, and by wooden mazes installed in the body of the vessel. Beale and Stewart[2], in their investigations on the efficiency of arresters, or entrainment preventers, stated that as the vapour velocity in the body of an evaporator increases, and with it the entrainment, the efficiency of the arresters increases. From this they postulated that the increase in entrainment with vapour velocity is not nearly

[3] *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 205; *I.S.J.*, 1959, **61**, 336.

as great at the entrance to the condenser as it is in the body of the vessel. Their work on the effect of sampling rate on the quality of the vapour sample taken indicated that the ideal sampling rate is that achieved under iso-kinetic conditions. Under these conditions vapour is drawn into the sampling port of the spear at the same velocity as the vapour moving along the vapour pipe. The tolerance allowable is $\pm$ 20% of the iso-kinetic rate.

Knowing the crushing rate, the ratio of clarified juice to cane, the Brix of clarified juice, the Brix of syrup into and out of the last vessel, and the vacuum in the vessel, the vapour velocity and required rate of sampling may be calculated. An example of this calculations is given in Appendix I.

## Assignment

At one Queensland mill, the evaporator station consisted of five vessels, worked as a quadruple effect, the first two vessels operating in parallel. Whilst the main object of the investigation was to improve the performance of this station, only the data relevant to entrainment will be used in this paper. Routine daily analyses were made for sugar on the condensates of the second, third and fourth calandrias. Because the injection water was recirculated through a cooling tower, the sampling spear was used to sample vapour passing to the condenser, in order to assess the amount of entrainment from the last vessel. The vapour pipe was fitted with three Halpin baffles, so the special head was attached to the bottom of the pipe between the last baffle and the condenser. This was done during the normal week-end mill stop.

## Procedure

It was found expedient to connect the water hoses and the nylon condensate line to the end of the spear whilst it was on the floor of the mill. The end of the condensate line, later to be attached to the vacuum pump system, was closed by means of a short length of rubber tubing closed by pinching a screw clamp. The spear, with attached lines, was then hauled up to a working platform, which was suspended under the vapour pipe for the convenience of the operator.

With the evaporator system under vacuum, the spear was inserted into the synthetic rubber spring seal on the end of the special head. The valve was then opened and the spear pushed through the head into the vapour pipe until it touched the top of the pipe. In this position the sampling port of the spear was approximately one inch from the top of the pipe. The spear was then set so that the sampling port faced directly into the vapour stream and clamped in position. The condensate line was then connected to the vacuum pump system and the cooling water turned on.

Preliminary runs were made to determine the distribution of flow in the vapour line and the rate of sampling with the vacuum pump working at full capacity and maximum flow of cooling water. The vacuum pump was switched on and a sample collected over a five-minute run. The pump was switched off and the amount of condensate was measured and then discarded. This operation was repeated with the sampling port of the spear set at different positions in the vapour stream, i.e. a traverse made along a vertical diameter. In this particular investigation the traverse ended at the centre of the pipe because the last baffle blocked off the lower half of the pipe.

The average of the amounts collected was compared with the amount calculated assuming that iso-kinetic sampling conditions existed. If the determined rate varied more than $\pm$20% from the iso-kinetic rate then the sampling conditions (vacuum or rate of flow of cooling water or both) were altered and further trials made until an acceptable sampling rate was obtained.

## The Sampling Run

Beginning with the sampling port of the spear as near the top of the pipe as possible, samples were taken at intervals of three inches down to the level of the last baffle which was at the centre line of the pipe. Sampling conditions, as determined in the preliminary runs, were kept constant. The spear, condensate line and receiver were flushed out at each new position by withdrawing a sample for five minutes before the sample to be analysed was collected, again over a five-minute period. Each of these latter samples was measured and stored in a stoppered bottle for analysis.

On completion of the sampling run the spear was withdrawn from the vapour pipe, the valve on the special head closed and the sampling system flushed out with water.

**Table I**

**Entrainment in vapour pipe with Halpin baffles**

| *Position of sample port (inches from top of pipe)* | *Measured sampling rate (lb/hr)* | *Ratio sampling rate : samp. rate at 1 in* = R | *Entrainment (p.p.m.)* = E | *Weighted entrainment* R × E |
|---|---|---|---|---|
| 1 | 22·7 | 1·000 | 390 | 390 |
| 4 | 23·0 | 1·013 | 355 | 360 |
| 7 | 23·2 | 1·022 | 298 | 305 |
| 10 | 22·5 | 0·992 | 360 | 357 |
| 13 | 21·4 | 0·944 | 188 | 177 |
| 16 | 18·7 | 0·825 | 190 | 157 |
| 19 | 16·3 | 0·719 | 155 | 111 |
| 23 | 12·8 | 0·564 | 310 | 175 |
| 25 | 12·5 | 0·552 | 275 | 152 |
| 28 | 10·0 | 0·441 | 380 | 168 |
| | Total | 8·072 | | 2352 |

$$\text{Average entrainment} = \frac{2352}{8{\cdot}072} = 290 \text{ p.p.m.}$$

## Analysis

All samples were analysed for sugar using the arseno-molybdate method[4] in conjunction with a spectrophotometer which had been previously calibrated (see Appendix II). Assuming that the sampling rate was directly proportional to the flow rate at each point, the results indicated that there was a reasonably constant flow pattern in the pipe, with a large part of the vapour travelling near the top of the pipe.

[4] Anon: *Bureau of Sugar Expt. Sta. Newsletter*, 1961, (45).

Thus, to obtain the average entrainment for the vapour, it was necessary to determine the weighted average based on the flow rate and entrainment at each point as set out in Table I. This weighted average was 290 p.p.m. and from the heat balance drawn up for the evaporator station the loss of sugar from the last vessel was calculated to be 1980 pounds per week of 120 hours.

## Discussion

The loss of sugar from the last vessel of the evaporator was evaluated by sampling the vapour passing to the condenser and determining the entrainment by analysis, using the arseno-molybdate method. This loss was shown to be less than that from each of the preceding vessels as determined by the analysis of condensates from the appropriate calandrias in conjunction with evaporation rates calculated for each vessel by means of a heat balance. The results, set out in Table II, indicated that action was necessary to reduce the entrainment in all vessels. Subsequently, the efficiency of arresters installed was again checked by sampling the vapour passing to the condenser and the condensates from the calandrias.

**Table II**
**Sugar represented by entrainment**

| *Vessel* | *Entrainment* (*p.p.m.*) | *Evaporation rate* (*pounds per hour*) | *Sugar per week of 120 hours* (*pounds*) |
|---|---|---|---|
| No. 1 | 228 | 85,200 | 2330 |
| No. 2 | 550 | 49,200 | 3250 |
| No. 3 | 720 | 51,400 | 4440 |
| No. 4 | 290 | 56,800 | 1980 |
| | Total = 12,000 lb of sugar = 5·35 tons per week | | |

The sugar from the last vessel is completely lost. That from the other vessels would go back to the milling train and a proportion would probably be recovered.

In another Queensland factory, the vapour line to the effect condenser was not fitted with Halpin baffles. A vertical traverse was carried out, using the sampling spear described, at a point in a horizontal section of this vapour line. It was found that the entrainment and quantity of condensate collected at each point per unit of time were fairly constant. This indicated that turbulent conditions of flow existed inside the vapour pipe and it was thus possible to reduce the number of samples taken.

This method of sampling vapour has also been applied to pans. In each case it was possible to make a vertical traverse across a horizontal section of the vapour pipe, near the condenser. When the flow was found to be reasonably constant across a diameter (this was generally the case), the sample was drawn from the centre of the pipe. Samples were taken at definite intervals during the whole time the pan was in operation. The maximum entrainment measured was 409 p.p.m., which represented a loss of about 500 pounds of sugar per week. However, because of considerable variation in the rate of evaporation, the ideal sampling rate would not have been attained for all the samples taken.


## Summary

A sampling spear containing an integral water tube condenser, together with a special head permits the sampling of vapour from any vessel, or vapour pipe under vacuum, without interruption to the running of the factory. It is necessary to calculate the evaporation rate and the velocity of the vapour at the sampling point so that the sample can be drawn off at approximately the same velocity. Vapour sampling is particularly applicable to the last vessel of a set of effects, as it avoids the problems that arise when entrainment is determined from samples of tail water. If the analysis of the calandria condensate or the condensed vapour sample is carried out by the arseno-molybdate method in conjunction with a previously calibrated spectrophotometer, an accuracy of ± 5 p.p.m. can be expected. If colour standards must be used the accuracy will not be better than ± 10 p.p.m.


## APPENDIX I

### Calculation of Vapour Sampling Rate

Crushing rate = 143 tons cane per hour
Brix of clarified juice = 18·03°
Clarified juice % cane = 102
Brix of feed into last vessel ($b$) = 49·6°
Brix of syrup out of last vessel ($B$) = 70·8°
Diameter of vapour pipe ($D$) = 54 in
Diameter of sampling port ($d$) = $\frac{3}{4}$ in

$$\text{Brix rate} = \frac{18{\cdot}03}{100} \times 143 \times \frac{102}{100}$$
$$= 26{\cdot}2 \text{ tons per hour}$$

$$\text{Syrup rate from last vessel } (S) = \frac{100}{70{\cdot}8} \times 26{\cdot}2$$
$$= 36{\cdot}9 \text{ tons per hour}$$

$$\text{Evaporation rate in last vessel } (E) = \frac{(B - b)}{b} \times S$$
$$= \frac{(70{\cdot}8 - 49{\cdot}6) \times 36{\cdot}9}{49{\cdot}6}$$
$$= 15{\cdot}8 \text{ tons per hour}$$

$$\text{Iso-kinetic sampling rate} = \frac{d^2}{D^2} \times E$$
$$= \frac{(3/4)^2}{54^2} \times 15{\cdot}8 \times 2240 \text{ pounds per hour}$$
$$= 6{\cdot}64 \text{ pounds per hour}$$
$$= 3011 \text{ ml per hour assuming specific gravity} = 1$$
$$= 251 \text{ ml per 5 minutes}$$

Note: Knowing the vacuum in the last vessel, the vapour velocity in the pipe to the condenser can be obtained from the information above. Hugot[5] gives the allowable velocity for vapour as 150–200 feet per second.

## APPENDIX II

*The detection of small quantities of sugar in solution*[5]

Five millilitres of the solution to be tested are mixed with one ml of the arseno-molybdate reagent and the mixture placed in boiling water for 15 minutes. The mixture is then cooled for 10 minutes. The colour

[5] Handbook of Cane Sugar Engineering. (Elsevier, Amsterdam.) 1960, p. 367.

developed may then be evaluated either visually by the use of standard solutions previously prepared or by means of a previously calibrated spectrophotometer. The colour remains stable for several hours. When a spectrophotometer is used to determine the concentration of the solutions it is necessary to adhere strictly to the technique with respect to quantities and boiling time; otherwise errors as large as $\pm$ 20 p.p.m. may occur. Results can be obtained with an accuracy of $\pm$ 5 p.p.m. Often it is necessary to dilute the sample to the extent where the colour developed falls into the range measureable by the spectrophotometer.

*Preparation of Arseno-Molybdate Reagent*[6]

Dissolve 25 g of ammonium molybdate (A.R.) in 450 ml of distilled water, add 21 ml of conc. $H_2SO_4$ (A.R.) and mix well. Then add 3 g of sodium arsenate ($Na_2HAsO_4,7H_2O$) (A.R.) dissolved in 25 ml of distilled water. Mix and heat to 55°C for 25 minutes with constant stirring to prevent local overheating. Store in a stoppered bottle made of dark glass.

# DENSITIES OF IMPURE SUCROSE SOLUTIONS

By G. MANTOVANI and A. INDELLI
(Department of Chemistry, University of Ferrara, Italy.)

SCHNEIDER[1] has recently emphasized the importance of precise physical measurements on sucrose solutions. In fact such measurements furnish important data for the factory operation on the one hand and on the other hand give information on the structure of the sucrose solutions.

The density measurements of SCHNEIDER *et al.*[2] are particularly interesting and we considered it useful, therefore, to extend such measurements to sucrose solutions containing various non-sugars. We have chosen the chlorides of potassium, sodium and calcium because they can be obtained of high purity and because potassium, sodium and calcium salts are normally present in all juices of a sugar factory.

## EXPERIMENTAL

### *Materials*

Potassium and sodium chlorides were crystallized from water, dehydrated by fusion, and their solutions prepared by direct weighing. The $CaCl_2$ employed was a B.D.H. "Analar" product and was kept as a stock solution, the concentration (w/w) of which was determined in three ways: (i) complexometric titration of $Ca^{++}$, (ii) argentometric titration of $Cl^-$ and (iii) conductimetric titration of $Ca^{++}$ using sodium oxalate as titrant. The results of the three determinations agreed within 1% and the average value was used to calculate the concentrations of the final solutions.

The sucrose was a B.D.H. "Analar" product; the water was prepared from ordinary distilled water by ion exchange treatment, using a mixed bed column of resins. Its conductivity was less than $1{\cdot}5 \times 10^{-6}$ $ohm^{-1}$ $cm^{-1}$.

### *Procedure*

The solutions were deaerated in a moderate vacuum for about one hour and then introduced by suction into a modified Sprengel pycnometer[3]. Accurate polarimetric measurements did not show any change in the sucrose concentration due to such treatment. The pycnometer was weighed and placed in a thermostat at 25°C $\pm$ 0·01; after an hour the level of the liquid in the two capillaries was read. All the weights for the preparation of the solutions were corrected to vacuum except for the $CaCl_2$ solutions, where the vacuum correction was of the same magnitude as the uncertainty in the preparation of the solutions. The densities calculated from the weights in air have been corrected to vacuum in all cases.

## RESULTS

Four types of solutions containing 25·223, 50·446, 100·983 and 200·785 g, respectively, of sucrose per 100 g of water and various amounts of salts, were used. Tables I, II and III give the densities and the concentrations of such solutions.

The densities of the salt-free solutions can be compared with the data of SCHNEIDER *et al.*[2] In Fig. 1, the apparent molal volumes of sucrose, $\phi_{sucrose}$, are plotted against the concentration. Some of the smooth data published by SCHNEIDER *et al.*[2] are represented by crosses. The continuous curve has been calculated by the least squares method assuming the $\phi_{sucrose}$ obeys the equation:

$$\phi_{sucrose} = \phi^{\circ}_{sucrose} + AC + BC^2$$

where $C$ is the sucrose concentration (mol/litre) and $A$ and $B$ are empirical coefficients.

From the densities of the solutions the apparent equivalent volume $\phi$ of the various salts has been calculated by considering the pure sucrose solutions as solvents of fixed volume. The relevant equation was:

$$\phi = \frac{P.E.}{d_{\circ}} \left[1 - \frac{1000}{g}\left(1 - \frac{d_{\circ}}{d}\right)\right]$$

where $P.E.$ is the equivalent weight of the salt, $d_{\circ}$ is the density of the pure sucrose solution, $g$ is the salt content expressed as g per 1000 g of sucrose/salt solution and $d$ is the density.

[6] NELSON: *J. Biol. Chem.*, 1944, 375.
[1] *Ind. Sacc. Ital.*, 1964, **57**, 225.; *I.S.J.*, 1965, **67**, 249.
[2] *Zucker Supplement*, 1963, (16), 1-19; (17), 1-19, *I.S.J.*, 1963, **65**, 376; 1964, **66**, 127.
[3] INDELLI: *Ann. Chim.* (Rome), 1963, **53**, 605.

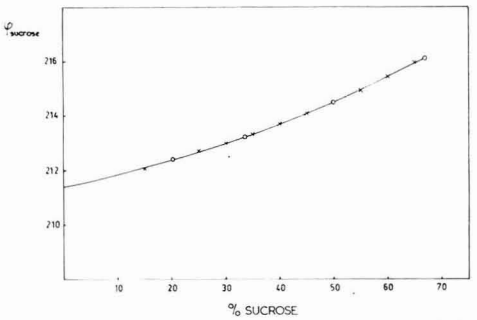


Fig. 1. Apparent molal volumes of sucrose in aqueous solution (o). Comparison with the data of SCHNEIDER (x).

In Figs. 2, 3 and 4, the apparent equivalent volume of KCl, NaCl and $CaCl_2$, respectively, are plotted against the square root of the salt concentration expressed as equivalents per litre. The points fit fairly straight lines; this is a well known phenomenon[4] in water solutions. The lowest straight lines, with no experimental points in Figs. 2, 3 and 4, refer to water solutions and are taken from HARNED and OWEN[4]. Figs. 2, 3 and 4 can be used to interpolate the density of any solution of these salts at any of the four sucrose concentrations as well in pure water. We have calculated the density of solutions at a fixed salt: water ratio. Considering the sucrose-free solutions as solvents, we have calculated the apparent molal volumes of sucrose $\phi_{sucrose}$ for different salt concentrations. $\phi_{sucrose}$ are plotted in Figs. 5, 6 and 7 which can be used to calculate the density of any ternary solution water-sucrose-salt.

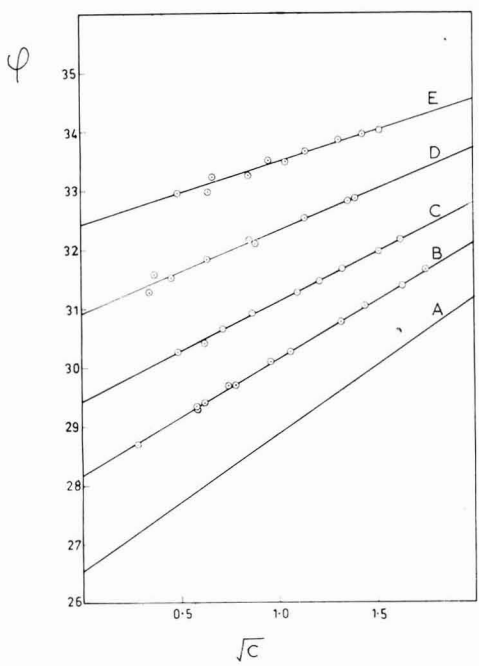


Fig. 2. Apparent equivalent volumes of KCl against $\sqrt{C}$. Solvents: A—pure water, B—22·223 sucrose, C—50·446 sucrose, D—100·893 sucrose, E—201·785 sucrose per 100 g of water.

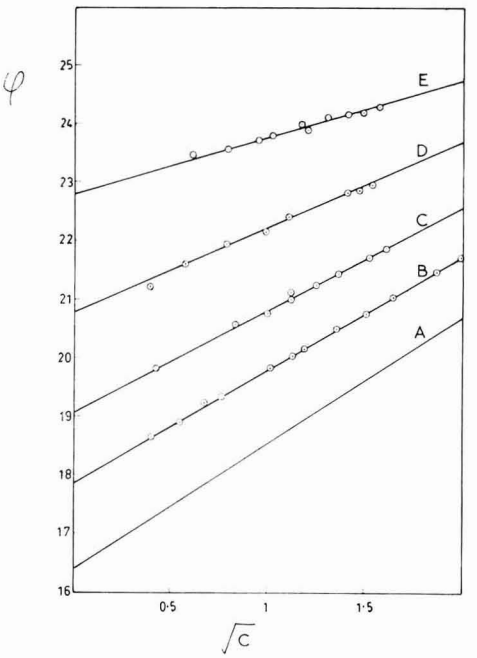


Fig. 3. Apparent equivalent volumes of NaCl against $\sqrt{C}$. A, B, C, D, E as in Fig. 2.

## DISCUSSION

The effect of these three salts on the density of the solutions is definitely specific. This was to be expected because the density of the solutions is a constitutive property. It was rather unexpected, however, that the differences among these three salts are much greater in sucrose solution than in water. This can be seen from Figs. 2, 3 and 4 and even more clearly from the partial molal volume of water, $\bar{V}_{H_2O}$. Table IV reports $\bar{V}_{H_2O}$ for different salt and sucrose concentrations. The calculation and the significance of $\bar{V}_{H_2O}$ are reported in another paper[5]. It should be noticed, however, that these differences are related to the different melassigenic power of the three salts. It is well known in fact that the melassigenic powers range in the order KCl > NaCl > $CaCl_2$[6]. The fact that $\bar{V}_{H_2O}$, in the presence of KCl, is greater than in

[4] The Physical Chemistry of Electrolytic Solutions. (Reinhold, New York.) 1950, p. 253.

[5] INDELLI and MANTOVANI: in press.

[6] SILIN: *Proc. 12th Gen. Assembly C.I.T.S.*, 1963, 253; *I.S.J.*, 1964, **66**, 255–258; ONNA and GOYA: *Rpts.* 1963 *Meeting Hawaiian Sugar Tech.*, 9–16; *I.S.J.*, 1964, **66**, 331.

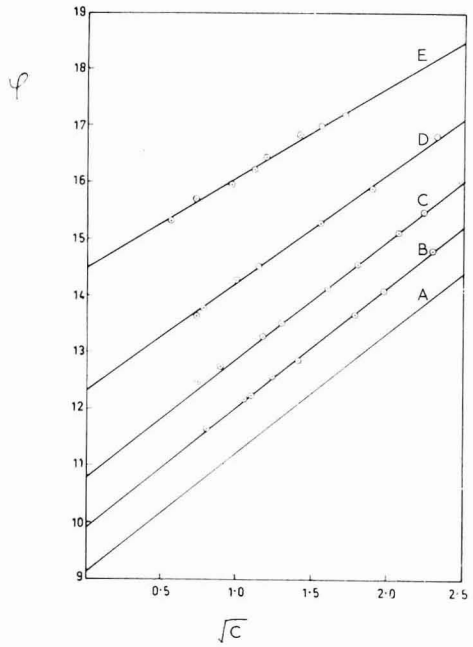


Fig. 4. Apparent equivalent volumes of $CaCl_2$ against $\sqrt{C}$. A, B, C, D, E as in Figs. 2 and 3.

the presence of NaCl or $CaCl_2$ can be interpreted as a greater "expansion" of the solvent which can accommodate more molecules of sucrose in the dissolved state. Another point of view on the same phenomenon is suggested by the considerations of SCHNEIDER[1] on the causes of the change of the volume of sucrose with concentration. The greater partial molal volume of water under such conditions requires a smaller amount of water to dissolve, so that KCl requires a smaller amount of water than NaCl or $CaCl_2$. KCl therefore produces an increased solubility in comparison with NaCl or $CaCl_2$.

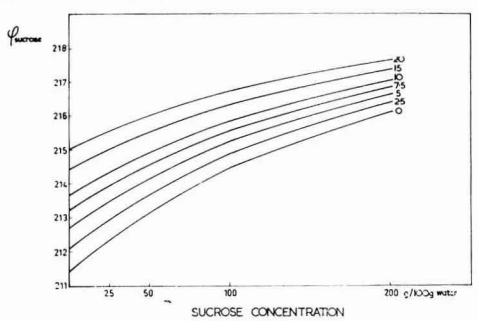


Fig. 5. Apparent equivalent volumes of sucrose, $\phi_{sucrose}$, against the sucrose content, g per 100 g of water, for different KCl concentrations, g per 100 g of sucrose/salt solutions. The seven curves, starting from the top, correspond to: 20, 15 10, 7·5, 5, 2·5 and 0 g of KCl per 100 g of water.

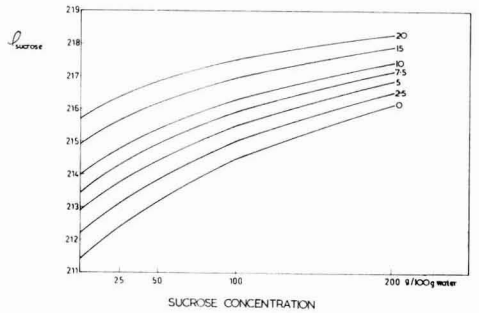


Fig. 6. Apparent equivalent volumes of sucrose, $\phi_{sucrose}$, against the sucrose content, g per 100 g of water, for different NaCl concentrations, g per 100 g of solutions. The seven curves, starting from the top, correspond to: 20, 15, 10, 7·5, 5, 2·5 and 0 g of NaCl per 100 g of water.

These measurements have a direct bearing on the evaluation of the reliability of the densimetric determinations of dry substance. Usually purities are calculated on the bases of such determinations and are used as the fundamental data for judging the qualities of the juices. Therefore we considered it useful to compare the real purities, $Q_R$, with the apparent ones, $Q_A$, calculated, as usual, using the density data of pure sucrose to evaluate the Brix. To minimize possible systematic error we have used our own data for the densities of pure sucrose solutions.

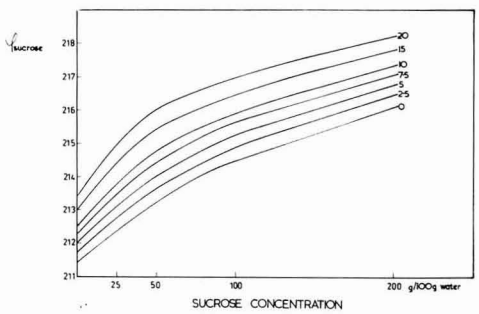


Fig. 7. Apparent equivalent volumes of sucrose, $\phi_{sucrose}$, against the sucrose content, g per 100 g of water, for different $CaCl_2$ concentrations, g per 100 g of solutions. The seven curves, starting from the top, correspond to 20, 15, 10, 7·5, 5, 2·5 and 0 g of $CaCl_2$ per 100 g of water.

The differences $Q_R - Q_A$ are plotted in Fig. 8 against $Q_R$ for the three salts and the four sucrose concentrations. $Q_R - Q_A$ is always positive, as expected, since it is well known that in the presence of electrolytes the densimetric Brix is always remarkable higher than the true dry substance[7]. Moreover $Q_R - Q_A$ depends very little upon the sucrose concentration whereas it depends upon the nature of the salt and the purity. The effect is very large. For instance, for KCl, at a purity of 90, $Q_R - Q_A$ is of the order of 5 and for $CaCl_2$ is more than 9.

[7] MEADE: Cane Sugar Handbook. (Wiley, New York.) 1963, p. 467.

**Table I**

**Densities of solutions containing sucrose and KCl**

| *Sucrose* 25·223 *g per* 100 *g of water* | | *Sucrose* 50·446 *g per* 100 *g of water* | | *Sucrose* 100·893 *g per* 100 *g of water* | | *Sucrose* 201·785 *g per* 100 *g of water* | |
|---|---|---|---|---|---|---|---|
| *KCl g % g of sucrose/salt solution* | *Density* | *KCl g % g of sucrose/salt solution* | *Density* | *KCl g % g of sucrose/salt solution* | *Density* | *KCl g % g of sucrose/salt solution* | *Density* |
| 0 | 1·08004 | 0 | 1·14222 | 0 | 1·22861 | 0 | 1·32537 |
| 0·5699 | 1·08364 | 1·5499 | 1·15179 | 0·7325 | 1·23299 | 1·3525 | 1·33284 |
| 2·3257 | 1·09469 | 2·4904 | 1·15761 | 0·8464 | 1·23362 | 2·3502 | 1·33839 |
| 2·3286 | 1·09470 | 3·2958 | 1·16254 | 1·2689 | 1·23614 | 2·5076 | 1·33911 |
| 2·6517 | 1·09674 | 4·8066 | 1·17187 | 2·4608 | 1·24315 | 4·0192 | 1·34751 |
| 3·9018 | 1·10460 | 7·5945 | 1·18927 | 4·4314 | 1·25475 | 5·0401 | 1·35295 |
| 4·1380 | 1·10612 | 9·1472 | 1·19904 | 4·6550 | 1·25615 | 5·9353 | 1·35797 |
| 6·3092 | 1·11990 | 10·8963 | 1·21010 | 7·5276 | 1·27308 | 7·1417 | 1·36450 |
| 7·5239 | 1·12770 | 13·9355 | 1·22968 | 10·8354 | 1·29289 | 9·3530 | 1·37665 |
| 11·3014 | 1·15223 | 15·8489 | 1·24208 | 11·1274 | 1·29466 | 11·0623 | 1·38617 |
| 13·3792 | 1·16592 | | | | | 12·3753 | 1·39351 |
| 16·7581 | 1·18869 | | | | | | |
| 19·0112 | 1·20402 | | | | | | |

**Table II**

**Densities of solutions containing sucrose and NaCl**

| *Sucrose* 25·223 *g per* 100 *g of water* | | *Sucrose* 50·446 *g per* 100 *g of water* | | *Sucrose* 100·893 *g per* 100 *g of water* | | *Sucrose* 201·785 *g per* 100 *g of water* | |
|---|---|---|---|---|---|---|---|
| *NaCl g % g of sucrose/salt solution* | *Density* | *NaCl g % g of sucrose/salt solution* | *Density* | *NaCl g % g of sucrose/salt solution* | *Density* | *NaCl g % g of sucrose/salt solution* | *Density* |
| 0 | 1·08004 | 0 | 1·14222 | 0 | 1·22861 | 0 | 1·32537 |
| 0·8381 | 1·08624 | 0·8991 | 1·14854 | 0·7170 | 1·23351 | 1·5948 | 1·33533 |
| 1·5767 | 1·09123 | 3·4336 | 1·16616 | 1·5101 | 1·23882 | 2·7055 | 1·34226 |
| 2·3052 | 1·09632 | 4·8736 | 1·17625 | 2·8480 | 1·24775 | 3·8916 | 1·34970 |
| 3·0447 | 1·10158 | 6·1261 | 1·18488 | 4·4884 | 1·25875 | 4·4590 | 1·35311 |
| 5·3093 | 1·11762 | 6·3843 | 1·18682 | 5·6103 | 1·26618 | 5·1631 | 1·35746 |
| 6·5104 | 1·12621 | 7·5339 | 1·19483 | 6·7025 | 1·27348 | 5·8189 | 1·36147 |
| 7·2413 | 1·13144 | 8·8978 | 1·20444 | 8·9324 | 1·28845 | 7·2204 | 1·37016 |
| 9·2718 | 1·14602 | 11·0160 | 1·21950 | 10·5285 | 1·29933 | 8·3787 | 1·37749 |
| 11·3670 | 1·16138 | 12·2657 | 1·22843 | | | 9·2779 | 1·38323 |
| 13·3952 | 1·17630 | | | | | 10·3556 | 1·38998 |
| 16·8839 | 1·20244 | | | | | 10·6593 | 1·39181 |
| 19·0986 | 1·21937 | | | | | | |

**Table III**

**Densities of solutions containing sucrose and $CaCl_2$**

| *Sucrose* 25·223 *g per* 100 *g of water* | | *Sucrose* 50·446 *g per* 100 *g of water* | | *Sucrose* 100·893 *g per* 100 *g of water* | | *Sucrose* 201·785 *g per* 100 *g of water* | |
|---|---|---|---|---|---|---|---|
| $CaCl_2$ *g % g of sucrose/salt solution* | *Density* | $CaCl_2$ *g % g of sucrose/salt solution* | *Density* | $CaCl_2$ *g % g of sucrose/salt solution* | *Density* | $CaCl_2$ *g % g of sucrose/salt solution* | *Density* |
| 0 | 1·08004 | 0 | 1·14222 | 0 | 1·22861 | 0 | 1·32537 |
| 3·1837 | 1·10731 | 2·6123 | 1·16483 | 2·3585 | 1·24919 | 1·2573 | 1·33602 |
| 5·5109 | 1·12744 | 3·6948 | 1·17423 | 2·6421 | 1·25159 | 2·1526 | 1·34344 |
| 5·8183 | 1·13016 | 6·3147 | 1·19715 | 4·3445 | 1·26625 | 3·6959 | 1·35635 |
| 7·3501 | 1·14357 | 7·6189 | 1·20868 | 5·5964 | 1·27710 | 4·9182 | 1·36650 |
| 9·3714 | 1·16166 | 11·3934 | 1·24260 | 10·2700 | 1·31816 | 5·6778 | 1·37270 |
| 14·4810 | 1·20848 | 14·0922 | 1·26727 | 14·5677 | 1·35662 | 7·8306 | 1·39045 |
| 17·4289 | 1·23641 | 18·2007 | 1·30586 | 21·0303 | 1·41541 | 9·5570 | 1·40514 |
| 22·6471 | 1·28759 | 20·8394 | 1·33117 | | | 11·3366 | 1·42024 |

**Table IV**

**Partial molal volumes of water at different contents of salt and sucrose**

| $C_{sucrose}$ *g % g of water* | $C_{KCl}$ *g. equiv./l* | $\bar{V}_{H_2O}$ | $C_{NaCl}$ *g. equiv./l* | $\bar{V}_{H_2O}$ | $C_{CaCl_2}$ *g. equiv./l* | $\bar{V}_{H_2O}$ |
|---|---|---|---|---|---|---|
| 0 | 1 | 18·038 | 1 | 18·040 | 1 | 18·040 |
| | 2 | 18·022 | 2 | 18·024 | 2 | 18·024 |
| | 2·5 | 17·996 | 2·5 | 17·998 | 2·5 | 17·998 |
| 50·446 | 1 | 17·991 | 1 | 17·983 | 1 | 17·988 |
| | 2 | 17·938 | 2 | 17·930 | 2 | 17·928 |
| | 2·5 | 17·921 | 2·5 | 17·911 | 2·5 | 17·906 |
| 201·785 | 1 | 17·762 | 1 | 17·754 | 1 | 17·746 |
| | 2 | 17·742 | 2 | 17·725 | 2 | 17·709 |
| | 2·5 | 17·730 | 2·5 | 17·713 | 2·5 | 17·691 |

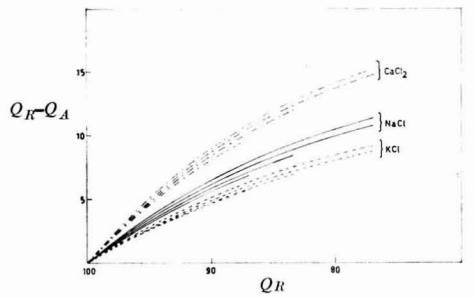


Fig. 8. Differences between the real and the apparent purities, $Q_R - Q_A$ in the presence of KCl - - - -, NaCl———, $CaCl_2$ - · - · - The four curves of each group, starting from the top, correspond to a sucrose content of: 25·223, 50·446, 100·893 and 201·785 g per 100 g of water.

The non-sugars contained in the juices are not, of course, completely comparable with the chlorides of potassium, sodium and calcium[8]. In particular the anions, generally, are not chloride ions. However the cations, having a smaller radius and therefore producing a greater electrostriction, cause the greatest increase in the density of the solutions. On the other hand, a considerable portion (20–50%) of the non-sugars is constituted by ash, where the three cations which we have studied predominate[8,9]. The error introduced by these cations in practice is, beyond doubt, very important.

An analogous investigation on other non-sugars would be certainly interesting. An investigation on the refractometric behaviour of impure sucrose solutions would be still more important. In this case too, as with the density measurements, very high accuracy, superior to the level usually achieved in practice, is required. A programme of research on this topic is under consideration.

SUMMARY

The densities of ternary solutions of sucrose with KCl, NaCl and $CaCl_2$ have been measured at 25°C ± 0·01.

The differences between the three salts are discussed in connexion with their melassigenic power.

The apparent purities of the solutions, calculated from the Brix, are compared with the real ones.

[8] Principles of Sugar Technology, Vol. I. Ed. P. HONIG. (Elsevier, Amsterdam.) 1953, p. 291 *et seq.*

[9] CARRUTHERS *et al.: Paper presented to the 9th Ann. Tech. Conf. British Sugar Corp.*, 1956; *I.S.J.*, 1957, **59**, 106.

# SUGAR CANE AGRICULTURE IN AUSTRALIA

**65th Annual Report of the Director, Bureau of Sugar Experiment Stations, 1965.**

IN his opening remarks the Director points out that during the year under review (1964) the operations of research, extension and advisory duties proceeded on an expanded scale. With increased understanding of nutritional requirements of cane on Queensland cane soils, less emphasis on field fertility trials is now needed. An enlarged soil analysis programme was undertaken in both the old and the new cane areas.

*Manual of Cane Growing*

Reference is made to the revised edition of the *Manual of Cane Growing* prepared by the Bureau and now available, the first edition having appeared in 1963. This new manual is up-to-date, notably in such changing matters as varieties, pest and disease control, irrigation, weedicides and cane nutrition. It consists of 375 pages and is profusely illustrated. The financial arrangements whereby the sugar industry provides almost all of the funds for the Bureau's operations allow for a free distribution of the manual to all cane growers and millers in Queensland. It should prove to be of special value to new cane growers in Queensland who will have in it a work of reference on all matters relating to their crop. Doubtless more experienced growers will also find it of value with its store of up-to-date information relating to Queensland conditions.

*Mechanical Harvesting*

During 1964 mechanical harvesting increased appreciably. Of the total crop 23·8% was machine cut, 64·3% hand cut and mechanically loaded and 11·9% manually cut and loaded. The number of harvesting machines increased from 251 in 1963 to 476 in 1964. Of the latter figure 347 were of the cut-up type. In all 3,403,316 tons of cane were harvested mechanically.

*Deterioration of Cut Cane*

The deterioration of sugar cane during the period between pre-harvest burning and the crushing of the cane is regarded as the most worrying problem in the minds of the industry today. This deterioration, which is accompanied by destruction of some of the sugar in the cane, has been most marked during the past three years and has occurred simultaneously with the increase in the use of cut-up mechanical cane harvesters. It has been found that much of the trouble is due to the organism *Leuconostoc* which, because of its widespread occurrence on the outside of cane stalks and in the soil, is able to enter the cut ends of the cane during harvesting. The fact that it causes greater and more rapid deterioration of cut-up cane is explained by the increase in the number of points of entry and also by the fact that, in the bins of cut-up cane, the cut end remains in a moist condition.

So far attempts to prevent infection by using antibacterial agents at the instant of cutting have not met with much success and there seems little hope of eliminating infection by such means. It is regarded as singularly unfortunate that the rapid development

of mechanical harvesting that has taken place should meet with this serious setback. Failing the discovery of some practical method of preventing infection at harvest time it is felt serious consideration will need to be given to alteration of crushing hours to eliminate or reduce the weekend carryover of cut-cane stocks, which accounts for much of the trouble. The time between burning and crushing might also be reduced. Daily burns on the farms could reduce the period between burning and loading onto transports, but much of the value of the operation would be wasted unless the period between loading and crushing is also cut down considerably.

*Irrigation*

Concern is felt at the developing scarcity of subterranean water in some areas, notably the Burdekin delta area. A succession of years without a major flood in the Burdekin River and the parallel recession of the water level in the underground strata, are believed to account for this. The installation of pumping schemes to alleviate this condition is referred to, but the possibility of a continuance of the present flood-free cycle is viewed with some concern. A disturbing feature is the deterioration of the quality of the water from some of the bores, especially along the coastal fringe, believed to be due to seawater tending to move into the water-bearing strata.

*Cane Nutrition*

Sulphate of ammonia and urea continued to be the major sources of nitrogen but the use of ammonia solutions ("aqua ammonia") increased considerably during the year. The satisfactory results obtained in field trials with "aqua ammonia" were confirmed by growers under general farming conditions during the year. Further replicated trials to compare sulphate of ammonia, "aqua ammonia" and anhydrous ammonia have been set out in some of the northern sugar districts. Among new projects commenced during the year were some aimed at giving information regarding the sulphur, copper and magnesium requirements of cane, as well as a series of trials to test the suitability of calcined phosphatic material from Christmas Island as a source of phosphate on acid soils.

*Cane Breeding*

The selection of drought-resistant varieties for southern and central districts was given greater impetus by two successive droughty seasons. In northern districts, however, where two wet seasons have occurred, this has not applied. There the call is for new varieties less prone to lodge under wet conditions or to show unfavourable sugar development or heavy flowering.

Increase in the plant breeding staff (at Meringa) allowed more investigational work to be undertaken. Several experiments were initiated with the planting of the 1964 seedlings. Single plantings of over 9,500 seedlings were made, while 2900 were bunch-planted. In raising seedlings, filter mud from cane mills has long been used as the organic component in the compost. It has the disadvantage of being variable from year to year and mill to mill. Experiments were carried out using German peat moss as the organic constituent. It proved highly successful and produced strong vigorous seedlings that compared more than favourably with those raised in filter mud compost.

The variety Pindar continued to be the leading variety in the state, producing about 20% of the total crop. Second position was occupied by N:Co 310 and third by Q 57. Among new varieties Q 80 was possibly the most important addition to improved variety lists for 1965. It is expected to replace Trojan in many districts.

*Weed Control*

Investigations on the chemical control of the more troublesome cane field weeds in Queensland were actively continued and results with some of the newer herbicides are given. With nut-grass (*Cyperus rotundus*) pot trials at Mackay showed that the Monsanto chemical C.P.31675 had the greatest potential of the herbicides tested, as soil-incorporated treatments, without causing cane damage. It acted by suppressing germination of tubers. Rates of 2 and 4 lb/acre gave adequate control without retarding cane growth. Field trials also gave good results. Nutgrass was also controlled by "Bromacil" as "Hyvar X" at rates as low as 2 lb/acre, but 4 lb/acre damaged the cane.

With Johnson grass (*Sorghum halepense*) trials in one area showed that "Hyvar X" gave about 80% control when sprayed at rates of 16–24 lb/acre. A treatment of 32 lb/acre was required for 100% control. Para grass (*Brachiaria mutica*) in three areas was well controlled by "Hyvar X" at 15 lb/acre as a spray, a higher rate (20 lb) being needed where access was difficult. With the Giant Sensitive Plant (*Mimosa invisia*) the use of "Picrolam" (as "Tordon 22K"), at rates of 2 oz and above of active ingredient per acre, have a very good kill. Pre-emergence treatment of seed beds with several products gave fair control for 19 weeks. Other weeds discussed include Guinea grass (*Panicum maximum*), stinking passion flower (*Passiflora foetida*) and blue heliotrope.

*Pests and Diseases*

Losses attributed to pests in 1964 amounted to 44,326 tons or only 0·31% of the total tonnage harvested, which was an improvement on that for the previous year, viz. 0·49%. Damage done by insect pests was assessed at 24,026 tons, by rats at 16,180 tons and by other animal and bird pests at 4,120 tons. It is felt that damage from rats cannot be regarded with any degree of complacency. It is hoped the recent appointment of an officer with zoological training to investigate the habits of rodents and other animal pests will bear fruit. Much information has been collected on the habits and breeding of the two troublesome species of rat (*Rattus conatus* and *R. littoralis*). Trials with a new rat poison, "Shoxin", did not appear to offer any advantage over thallium sulphate. In trials involving placement, baits on disturbed soil were taken more freely than those on undisturbed soil.

Accounts are given of the investigationary work carried out on cane grubs or borers, involving some

half dozen species, Rhyparida grubs (*Rhyparida* sp.), soldier fly, funnel ant, wart eye, earth pearls and a number of miscellaneous insect pests.

An account or survey is given of the incidence of cane diseases throughout the state in 1964 and of investigations carried out on chlorotic streak (probably a virus), striate mosaic (probably a virus), leaf scale (*Xanthomonas albilineans*), yellow spot (*Cercospora koepkei*) and red rot (*Glomerella tucumanensis*). Much of the work was concerned with varietal resistance in present-day commercial canes.

F.N.H.

# Indian Sugar Enquiry Commission Report [1]

The Indian Sugar Enquiry Commission set up a year ago[2] has now completed its investigations and has submitted its recommendations to the Government.

It is anticipated that the industry will need to expand considerably if it is to cope with the demand which may be expected to be made upon it. The Commission has forecast that by 1970/71 this will amount to 4·5 million tons, of which 3,760,000 tons will be required for domestic consumption, while by the 1975/76 season home demand will have risen to 5,340,000 tons and overseas markets to one million tons.

This increased output will call for an expansion in existing factory capacities. Some of these have already been licensed; it is recommended that further expansion should be shared equally between new and existing installations. The Commission has examined carefully the question of siting of factories and it is of the opinion that, in considering the expansion of the Indian sugar industry, first priority should be given to units having an installed capacity of less than 1250 tons of cane per day. Many of these small units are located in unfavourable areas, and in these cases it is recommended that they should be encouraged to merge with other units or to move to new sites. Where neither of these alternatives would appear possible it is recommended that the State Governments concerned should take immediate measures to expand the cane growing areas in the vicinity of the factories.

It has been recommended that new units should be confined to the co-operatives where possible. In cases where this may not be considered feasible it is proposed that State Governments should set up their own factories, either directly or in collaboration with private enterprise. It is further recommended that the Government should introduce legislation which would allow them to take over and operate for specific periods factories which they consider to be badly managed.

The Commission considers that the present minimum economic capacity for a factory is 1250 tons of cane per day with provision for expansion up to 2000 tons. It is recommended, however, that this minimum should be reviewed at five year intervals in the light of technological developments.

It is recommended that a buffer stock should be set up which will enable yearly fluctuations in production to be ironed out. This will then, it is hoped, make it possible to maintain prices within 8% of a so-called "pivot price", this to be calculated on the basis of a moving price average over a period of at least three years.

Stocks at the end of the 1964/65 season were estimated at about 609,000 tons; it is recommended that by October 1966, when the 1965/66 season ends, this should be increased by a further 600,000 tons. At that stage it is recommended that controls on production should be lifted. Thereafter it is anticipated that average stocks in existence at the beginning of a new campaign will be of the order of 800,000 tons, but in any case it is proposed to be obligatory that they should amount to not less than 20% of total production during the preceding season. The buffer stock agency will undertake to buy from factories wishing to sell at the low point of the range implicit with the introduction of a pivot price, and will hold itself ready to sell to dealers at the ceiling price.

On the question of cane prices it is proposed that they should be fixed in 1965/66, if possible, at Rs 1.85 per maund (£3 18s 8d per long ton) basis 9·4% sugar recovery, with an increase of 1·5 paise per maund (7½d per long ton) for every 0·1% recovery above this level. The Commission recognised that this may be difficult to implement at this stage, but in any case it has recommended that the price for the 1966/67 season, which was scheduled to be announced in December 1965, should be Rs 1.80 per maund (£3 16s 2d per long ton) at 9% with an increase of 2 paise per maund (10d per long ton) for every 0·1% above that level.

The Commission has specifically stated that its recommendations should be applied in total and not piecemeal.

The urgency of the problems facing India can be readily appreciated. The cost of production compares unfavourably with that in many other cane producing countries and it must be recognised that it is only her acute shortage of foreign currency that takes her into the world market. It is encouraging that the Commission, when recommending what amounts to a doubling of output in ten years, should have envisaged that by far the major proportion of this sugar should be reserved for home consumption. Presumably this will entail the redirection to the sugar industry of a large proportion of the cane supplies presently being used by the gur and khandsari producers so that the total volume of sweeteners reaching the population will not increase in direct proportion to the expansion in the output of sugar. Nevertheless there are well known advantages in producing the purer and less wasteful product and, if implemented, not least among those to benefit from these recommendations will be the Indian consumers.

[1] C. Czarnikow Ltd., *Sugar Review*, 1965, (738), 195–196.
[2] *I.S.J.*, 1965, **67**, 32.


**Some notes on sugar cane planting procedures.** G. D. THOMPSON and C. G. HALSE. *Proc. 38th Congr. S. African Sugar Tech. Assoc.*, 1964, 154–165.—An account is given of experiments to study the effects of various factors on germination of sugar cane setts in 3 different climatic areas, each with a different soil type. Mercurial fungicide treatment improved germination sufficiently to warrant the treatment at all sites in all seasons. Removal of closely adhering trash was not warranted. Setts with 5 eyes should be planted and covered 2–4 inches. Setts from the young part of the stem are to be preferred.

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**Assessing the potential of sugar belt soils to supply nitrogen for plant cane.** R. A. WOOD. *Proc. 38th Congr. S. African Sugar Tech. Assoc.* 1964, 176–179. Results are reported of laboratory incubation studies carried out on the main soil groups, 13 in number, within the Natal sugar belt, in order to determine their potential to mineralize nitrogen after ploughing cut cane. Marked variation was shown, ranging from 200 to 650 lb sulphate of ammonia equivalent, over a 2-week incubation. Magnitude of release was related to soil organic carbon content. Delay in nitrification occurred with the more acid soil types.

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**A preliminary investigation into the behaviour of soluble nitrogen fertilizers on mulched and unmulched soils in coastal Natal.** R. R. MAUD. *Proc. 38th Congr. S. African Sugar Tech. Assoc.*, 1964, 180–189. Four soils, 2 sandy and 2 clayey, from the Natal sugar cane belt, were used. Applications of sulphate of ammonia, urea and nitrate of soda were made at 100 lb N/acre. A rapid loss of applied soluble nitrogenous fertilizer from the surface layer of all soils, mulched and unmulched, was noted. It was most rapid in the sandy soils. This loss may considerably reduce the effectiveness of fertilizer applications.

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**Calibration of soil and leaf analyses for the control of sugar cane fertilization rates in southern Queensland.** R. A. YATES. *Australian J. Agr. Res.*, 1965, **16**, 367–384; through *Biol. Abs.*, 1965, **46**, 7328.—Considerable data are presented from a large series of trials over a number of different soil types to determine the value of leaf and soil analyses for controlling the fertilization of sugar cane. The response to nitrogen fertilizer could not be assessed from leaf analysis data, but the level of mineral nitrogen in incubated topsoil was well correlated with the amount of fertilizer required. Response to P fertilizer could be assessed through soil, leaf or juice phosphate analyses. Response to K fertilizer was only poorly correlated with soil K.

**The sugar content of cell walls and intercellular spaces in sugar cane stems and its relation to sugar transport.** J. S. HAWKER. *Australian J. Biol. Sciences*, 1965, **18**, 959–969.—The concentration of sucrose in the volume external to the vacuoles was found to approach the concentration present in the vacuoles (20%). The view that intercellular sugar transfer in the sugar cane stem occurs mainly by the cell walls (rather than via plasmodesmata) is supported.

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**Comparative trials of sugar beet varieties sown in early autumn in the warm zone.** T. NAGATOMO and T. KAWASHIMA. *Bull. Fac. Agric. Univ. Miyazaki*, 1965, **10**, 307–312; through *Plant Breeding Abs.*, 1965, **35**, 795.—These trials record yield, Brix, vegetative development, flowering behaviour and seed yield for 14 varieties grown in 1962–64, mainly introduced from Europe.

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**Varietal resistance to an inoculum of sugar cane smut from CB 45-3.** W. B. TÓFFANO. *Biologico*, 1965, **31**, 65–66; through *Plant Breeding Abs.*, 1965, **35**, 794. Nine varieties were classed as resistant in a trial of 31 varieties.

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**The protectant effect of "BSM-11" on sugar cane seedpieces.** M. B. LOPEZ, S. G. LOJO and C. R. MORA. *Sugarland*, 1965, **2**, (2), 28–31.—Tests were carried out on about 2 hectares in Tarlac in the Philippines with various concentrations of "BSM-11" and compared with untreated and "Aretan"-treated setts. Germination and tiller counts and also final yield were superior with the "BSM-11" treated setts. Optimum concentration was considered to be 0·4640% by volume. ("BSM-11" is a product of Buckman Laboratories Inc. and contains 10% phenylmercuric acetate and 50% potassium 2,4,6-trichlorophenate as active ingredients).

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**Biological background to cane diseases. II. Constitutional diseases.** G. ROTH and C. WHITEHEAD. *S. African Sugar J.*, 1965, **49**, 469–475.—Details are given of abnormal development of the sugar cane plant, under Natal conditions, caused by lack of soil moisture or by cold, also by deficiency of nitrogen, phosphorus, potassium, iron or manganese and the effects of excess lime.

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**Local ideas for loading and cultivating.** ANON. *S. African Sugar J.*, 1965, **49**, 456–457.—Brief descriptions are given, with photographs, of some new forms of mechanical equipment, viz. modifications to a "Zulu" cane loader, an infield loader and a new

rotary-type cultivator. The latter seemingly ingenious device consists of two large 2-ft-diameter tined discs set at a special angle on the tool-bar of a tractor. The forward motion of the tractor causes the discs to revolve and the tines to uproot the weeds.

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**Control of late germinating weeds in sugar beet.** J. ALKÄMPER. *Zucker*, 1965, **18**, 353–356.—The control of late developing weeds, such as *Galinsoga parviflora*, with herbicides such as "Alipur" and "Simazine", needs to be done with care because of the risk of injury to sugar beet plants thereby causing reduced yields. Well diluted solutions must be used even though this results in only partial control.

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**Production and quality of seven sugar cane varieties in relation to month of planting and harvesting age.** I. P. FERRARIS, R. J. PORTER and T. R. ESCOBER. *Sugar News* (Philippines), 1965, **41**, (5), 260–269.—An account is given of experiments in two different areas with seven commercial varieties of cane in order to determine the best months for planting and harvesting with each variety. Separate recommendations are made for each variety.

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**Herbicides—recommendations for their use in plant cane or burnt ratoons.** ANON. *S. African Sugar J.*, 1965, **49**, 544–551.—Most weed problems in the Natal sugar belt may be successfully tackled with the aid of the four herbicides—2,4-D, "Paraquat", "Diuron" and "Bromacil". Climatic or local conditions may determine which to use. Recommendations regarding other chemical herbicides and specific weeds are given.

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**Studies on the bunch planting and closely spaced planting methods of sugar cane seedlings in Taiwan.** P. Y. JUANG and Y. R. WU. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (37), 1–12.—Bunch planting, with 5 seedlings to a bunch and bunches 40 cm apart, was compared with row planting of single plants 8 cm apart. There was no appreciable difference in stalk length and stalk diameter but it was considered that the row planting or closely spaced system was able to give more stalks and may be the more efficient for the selection of seedlings.

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**Effect on cane yield of shaving autumn planted N:Co 310 after freezing.** H. C. FU, T. P. SOO and Y. H. HSIEH. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (37), 13–19. Experiments after freezing in 1962 and 1963 indicated that there was no benefit from shaving (cutting stalks at ground level). There was no significant difference in subsequent yield of shaved and unshaved cane.

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**Effect of harvest time on the sugar content and yield of N:Co 310.** Y. J. HSIA, T. L. HU, and R. S. CHEN. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (37), 21–42.—Results are given of experiments during 1961–63 on the relationship between the number of millable canes, percentage of dead stalks, yield of cane and sugar, and the available sugar content of the variety N:Co 310 with different soil types and harvesting times. Percentage sugar varied with soil type, climate and lodging.

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**Leaf diagnosis of the sugar cane plant.** T. T. CHAO *et al. Rpt. Taiwan Sugar Expt. Sta.*, 1965, (37), 43–59. Results of fertilizer experiments over a 6–7 year period are given. In general, increase in N of leaf was proportional to the amount of N applied; K had little effect on yield but it went to the leaves; P had little or no effect on yield and no change of P in leaves was observed. Interactions of N, P and K were studied; the more N and P applied the more K was observed in the leaves.

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**The morphology and physiology of *Pythium catenulatum*, sugar cane root rot.** S. C. HSU. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (37), 89–104.—The general biology of the fungus *Pythium catenulatum*, responsible for root rot in Taiwan, along with *P. arrhenomanes*, is discussed. Corn meal agar again proved to be the best culture medium. Optimum temperature for growth was 34°C and the range 12°–39°C.

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**Reproductive potential of the sugar cane grey borer *Eucosma schistaceana*.** Y. S. PAN, S. L. YANG and C. C. CHUANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (37), 105–116.—The functional reproductive characteristics of this major sugar cane pest, also called "heart borer", were studied in order to obtain a better understanding of its reproductive potential.

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**Contribution to the anatomy of the sugar beet leaf.** I. HOLZNER. *Zucker*, 1965, **18**, 428–429.—A study of the distribution of stomata on the upper and lower surfaces of sugar beet leaves is reported.

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**Quality and harvesting of sugar beets.** E. ANDERSEN. *Zucker*, 1965, **18**, 429–433.—Attention is drawn to the amount of trash, stones and improperly topped beets that reaches the sugar factory and the need to reduce this. Incorrect use or setting of mechanical harvesters is often to blame. Results of experiments in harvesting in Denmark are given where less than 1% of the beets were insufficiently topped.

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**Cane varieties (in Mexico).** A. V. PERDOMO. *Bol. Azuc. Mex.*, 1965, (194), 14–17.—This is a comparative study of the behaviour of Mexican and introduced varieties at the "El Carmen" estate.

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**Froghopper in Mexico.** S. F. CÁCERES *et al. Bol. Azuc. Mex.*, 1965, (194), 18–23.—This is the first of a series of four articles on the cane froghopper pest (*Aeneolamia postica*) of Mexico, known locally as "salivazo" or "mosca pinta". In recent years it has caused much damage to the cane crop in some parts of Mexico. In this article details of distribution and of damage caused are given.

**Froghopper in Mexico.** ANON. *Bol. Azuc. Mex.*, 1965, (195), 12–17.—In this, the second of a series of four articles on the sugar cane froghopper pest in Mexico (*Aeneolamia postica*), the classification and general biology of the pest is discussed, besides factors which favour its increase.

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**Q 68 recommended in the Burdekin (area).** I. T. FRESHWATER. *Cane Growers' Quarterly Bull.*, 1965, **29**, 40–41. The versatility of this variety in Queensland is stressed. It is now grown in 19 mill areas and is recommended for sandy soil regions in the Burdekin region, where the present choice of varieties is limited. On the rich Burdekin lands it would be expected to lodge under normal conditions.

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**Merremia—another vine pest.** J. H. BUZACOTT. *Cane Growers' Quarterly Bull.*, 1965, **29**, 42.—A member of the *Convolvulus* family, *Merremia quinquefolia* has assumed pest proportions on a few cane farms in the Cairns district of Queensland in recent years. It can smother cane with dense growth and is believed to have escaped from cultivation. The plant is more difficult to control with herbicides than other vine pests, new growth arising from the rootstock.

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**Q 83 approved for eight mill areas.** O. W. STURGESS. *Cane Growers' Quarterly Bull.*, 1965, **29**, 43.—Details are given of this promising new variety, first raised in 1958. It has good sugar quality maintained throughout the season, even in wet areas, and is reasonably resistant to lodging and to disease.

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**Guinea grass control.** L. S. CHAPMAN. *Cane Growers' Quarterly Bull.*, 1965, **29**, 44–47.—The importance of Guinea grass (*Panicum maximum*) as a cane field weed has increased in Queensland with mechanical harvesting. Stools of Guinea grass are harvested along with the cane and add to the extraneous matter content. Suggestions for control, viz. regular slashing, discing, fencing an area so that stock can graze the Guinea grass and the use of suitable chemical weed-killers, are discussed.

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**Leaf scald at Mackay.** C. G. HUGHES. *Cane Growers' Quarterly Bull.*, 1965, **29**, 48–49.—Outbreaks of leaf scald disease (*Xanthomonas albilineans*) in recent years in Queensland are described. The disease is often difficult to eradicate or control because of its habit of remaining dormant for long periods in outwardly healthy crops. Active steps for control are in operation.

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**More about frost damage.** N. MCD. SMITH. *Cane Growers' Quarterly Bull.*, 1965, **29**, 50–52.—At one time cold or frost could render a cane crop a total loss in Queensland; not so today with the cultivation of more cold resistant varieties, such as N:Co 310. Frost resistance in other varieties is discussed.

**Diseases of new lands.** B. T. EGAN. *Cane Growers' Quarterly Bull.*, 1965, **29**, 57.—The belief held by some Queensland cane farmers, that cane on new lands is virtually disease-free, is shown to be fallacious, particularly where leaf diseases spread by air-borne spores are concerned. Special emphasis is given to red stripe, brown rot and droopy top (a copper deficiency disease).

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**Coot damage.** R. B. MOLLER. *Cane Growers' Quarterly Bull.*, 1965, **29**, 58.—Some severe damage in a variety collection in Queensland by coots or red-bills is referred to. The softer stemmed noble canes suffered most, all the stalks of some varieties being destroyed By using stalks in which a few grains of strychnine had been inserted the pest was controlled.

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**Mulgrave cowpea.** J. H. BUZACOTT. *Cane Growers' Quarterly Bull.*, 1965, **29**, 60.—This new cowpea, "Mulgrave", bred in 1958 (at Meringa, Queensland) and selected for commercial release, is described. It has large foliage and a capacity for good early cover, also good resistance to stem rot.

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**Copper deficiency in the Bundaberg area.** J. F. USHER. *Cane Growers' Quarterly Bull.*, 1965, **29**, 61–62.—The sugar cane malady "droopy top", caused by copper deficiency, is fully described. It affects cane mainly on light sandy soils. Droopiness of the leaves and an unusually flexible stalk are characteristic.

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**Can sour cane losses be prevented?** B. T. EGAN. *Cane Growers' Quarterly Bull.*, 1965, **29**, 68.—Investigations with chemicals have not so far shown much promise in controlling *Leuconostoc* infection. Recommendations to reduce c.c.s. losses remain the same, viz. cut freshly burnt cane with well-adjusted, sharp chopper blades, and wash down the inside of the machine regularly.

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**Wart eye: an agronomic approach to its control.** R. FERRARIS. *Cane Growers' Quarterly Bull.*, 1965, **29**, 69.—This malady of cane, which occurs in northern Queensland, manifests itself in a lacerated condition of the buds on setts after planting and prevents subsequent growth. Trials on depth of planting indicate that shallow planting and good tilth reduce the incidence of the malady.

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**Fiji disease at Rocky Point.** D. R. L. STEINDL. *Cane Growers' Quarterly Bull.*, 1965, **29**, 71.—Increased outbreaks of Fiji disease (a virus) in the Rocky Point area and the susceptibility of the varieties grown, notably Q 71, are referred to. New regulations relating to control have had to be introduced.

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**Response of a sugar cane nematode population to the addition of nematocides in irrigation water.** J. ROMAN and J. BADILLO. *J. Agric.* (Univ. Puerto Rico), 1965, **49**, 325–330.—Two nematocides, "Nemagon" and "Fumazone", at rates of ½ and 1 gal per acre, were

applied, two applications being given, one at planting time and the other 5 months later. The nematode population was found to be reduced after application but gradually increased thereafter. There was a trend towards increased yields from the treated plots but the differences were not significant.

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**Nematode-transmitted viruses of sugar beet in East Anglia, 1963 and 1964.** G. D. HEATHCOTE. *Plant Pathology*, 1965, **14**, 154–157.—Further information on the causes of stunting of sugar beet on light soils known as "Docking disorder", believed to be due to more than one cause or organism, is recorded. Of 135 samples of stunted beet collected in 1963 and 1964 tobacco rattle virus was found in 16 and tomato black ring virus in 14. Little of the stunting caused by the "Docking disorder" can be attributed to virus infection.

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**Effect of fertilizers on sugar content of beet.** E. N. ALEKSEEVA. *Agrokhimiya*, (6), 36–52; through *Soils and Fertilizers*, 1965, **28**, 616.—The fertilizer with the largest and most constant effect on sugar concentration is N. It usually decreases sugar concentration but increases root and sugar yield. P usually increases sugar content and yield slightly. K, especially at high rates, increases sugar concentration but has less effect on yield than P and N. High yields of roots, with a high sugar concentration, are most often obtained by applying N-P-K or dung plus mineral fertilizers.

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**Herbicidal weed control in sugar cane.** J. R. ORSENIGO. *Rpt. Fla. Agric. Expt. Sta.*, 1964, 255; through *Weed Abs.*, 1965, **14**, 263.—On dry weed-free organic soil "Chloramben", "Fenac", "Trifluralin" and CDAA applied at ratooning suppressed annual grasses and broad-leaf weeds until the crop closed in and resulted in higher yields of cane than any of the other treatments tested.

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**Competition between irrigated sugar beets and annual weeds.** J. H. DAWSON. *Weeds*, 1965, **13**, (3), 245–249; through *Biol. Abs.*, 1965, **46**, 8104.—Weed competition reduced yields up to 94%; weeds emerging soon after planting reduced yields the most, but little yield-reducing competition took place until 12 weeks after planting the beets. Full season weed control resulted when beets were hand-weeded for 10 to 12 weeks after planting. Weeds that emerged later were controlled by crop competition.

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**Sugar cane germ plasm. V. Mauritius varieties.** ANON. *Sugar Cane Varieties Quarterly Newsletter* (Coimbatore), 1965, **2**, (3), 3–8.—A historical outline is given of the development of sugar cane varieties in Mauritius, also descriptions of modern commercial varieties on the island. So far these have not done well under Indian conditions.

**Facts about Co 785.** ANON. *Sugar Cane Varieties Quarterly Newsletter* (Coimbatore), 1965, **2**, (3), 9–10. A description is given of this variety (a cross between Co 443 and Co 453) which has made a mark for good performance under flooded and waterlogged conditions.

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**Highest sugar cane yields.** ANON. *Sugar Cane Varieties Quarterly Newsletter* (Coimbatore), 1965, **2**, (3), 11–14.—Details are given of how a competition winner (a physician in Andhra Pradesh) cultivated sugar cane to give record yields of 297·6 and 298·5 metric tons of cane per hectare for 14-month and 12-month crops. Large quantities of fertilizer and animal manure were given as well as frequent irrigation and fortnightly spraying against borers. Heavy supports to prevent lodging were erected. Some canes reached 30 feet and weighed 4·5 kg each. The varieties used were Co 997 for the shorter, and Co 419 for the longer-term crop.

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**Co canes abroad.** ANON. *Sugar Cane Varieties Quarterly Newsletter* (Coimbatore), 1965, **2**, (3), 15. A list is given of some two dozen cane growing countries and the varieties of Co canes which each has in cultivation.

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**Bolting in early-sown sugar beet.** L. A. WILLEY. *British Sugar Beet Rev.*, 1965, **34**, 75–76.—From spring sowings at 18 centres in 1965 the average number of bolters (plants in flower) was 3·2%, compared with 4% in 1965 and 7·3% in 1963. At two centres the average was 10% or more. The variety Camhilt showed the greatest resistance to bolting and remained the best choice for the earliest showings. Sharpes Klein E is an alternative choice.

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**Nematodes associated with "Docking disorders" of sugar beet.** A. G. WHITEHEAD. *British Sugar Beet Rev.*, 1965, **34**, 77–84, 92.—This malady, first reported at Docking in Norfolk in 1948 on alkaline sandy soils, causes severe stunting. There may be more than one cause for it, including nematodes (*Trichodorus*). Reasons for suspecting the needle nematode (*Longidorus attenuatus*), and suggestions for control, are given.

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**Green manuring for sugar beet.** G. V. DYKE. *British Sugar Beet Rev.*, 1965, **34**, 94–98.—Recent experiments on light sandy soils, where barley is followed by sugar beet, have shown that if the barley is undersown with a green manure (trefoil or ryegrass) increased yields of sugar beet result, even when fertilizer is generously applied. Such green manuring may have a useful place on some farms.

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**"Double Torpedo" rat bait.** ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1965, **12**, (8 & 9), 4.—The effectiveness of this rat poison is described. It is made up of one part thallium sulphate, 1·5 parts sugar and

23·5 parts of corn meal by weight. The mixture is made into thumb-sized balls and coated with vanilla-extract-flavoured paraffin wax. Rats are attracted by the aroma and eat the baits freely, no pre-baiting being necessary. Distribution is at the rate of 200–400 balls per hectare, depending on severity of infestation.

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**BHC, a profitable soil insecticide.** ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1965, **12,** (8 & 9), 5.—The effectiveness of benzene hexachloride against a wide range of soil sugar cane pests in the Philippines, the worst of which is white grub, is emphasized. Recent trials (with BHC 26W) stressed the importance of application at the right time. Marked increase in yield resulted. A rate of 8 lb/hectare at planting time and another 8 lb after off-barring (in the plough line) in the ratoon may be tried. BHC and lime should never be applied together or at a close interval.

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**N.S.W. virus disease control.** ANON. *Producers' Review*, 1965, **55,** (10), 21.—This is a popular account of the present position in regard to sugar cane virus diseases in New South Wales, viz.: Fiji disease, mosaic, and ratoon stunting disease. The recent increase in Fiji disease is referred to and the need for constant vigilance and adequate control measures emphasized.

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**The problem of insects and rats.** ANON. *Producers' Review*, 1965, **55,** (10), 23.—Reference is made to the advances achieved in controlling the major insect pests in Australian cane fields, thanks to modern insecticides. Less progress has been made against rats, largely because of the difficulty of adequately distributing poison baits, especially in lodged cane.

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**Assessing frost damage.** ANON. *Producers' Review*, 1965, **55,** (10), 29.—The nature of frost damage to cane, whether affecting stalk, growing point, eyes or leaves, is described. Reference is made to germination tests with setts from frosted cane in order to determine the degree of damage necessary to prevent eyes from germinating. Notes on how to assess frost damage (by splitting the stalk longitudinally) are given.

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**Weed problems in Australian sugar cane areas.** ANON. *Producers' Review*, 1965, **55,** (10), 89.—This is a summary of an address given by the Director of Sugar Experiment Stations at a reception to mark the introduction of a new herbicide "Pesco 18-15". The high cost of many modern herbicides is condoned. The three worst weeds in Australian cane fields are considered to be nut grass (*Cyperus rotundus*), Guinea grass (*Panicum maxicum*) and blue-top (*Ageratum*).

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**Some methods of cane cultivation and a review of harvesting methods.** R. O. PETERSEN. *Sugar J.* (La.), 1965, **27,** (9), 20–23.—See *I.S.J.*, 1964, **66,** 292.

**Controlling sugar cane mosaic.** I. L. FORBES and R. J. STEIB. *Sugar J.* (La.), 1964, **27,** (6), 51–52. The history of mosaic in Louisiana and the damage it causes are briefly dealt with, as is the possibility of its having been confused with ratoon stunting disease in earlier days. Reference is made to the possiblity of new strains attacking cane varieties previously regarded as resistant.

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**Record yields of sugar cane in Florida.** B. A. BOURNE. *Sugar J.* (La.), 1964, **27,** (7), 37–40.—A historical account is given of the first successful cane breeding experiments under glass. Examples are given of very high yields of cane recorded in Florida (near Lake Okeechobee) which approximated to 100 tons cane per acre, the variety being Cl.41-223. This variety now represents about 90% of the cane acreage in commercial production in Florida.

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**Sugar cane—new king of the Everglades.** J. R. ORSENIGO and J. H. COUSEY. *Sugar J.* (La.), 1964, **27,** (7), 69–70.—The remarkably rapid development of sugar cane cultivation in the rich organic or muck soils of the Everglades near Lake Okeechobee, which has taken place since 1960, is described.

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**Harvesting of sugar cane in Tucumán.** W. E. CROSS. *Sugar J.* (La.), 1965, **27,** (8), 11–16.—The need to harvest cane selectively is emphasized, i.e. to harvest each field when it attains the optimum degree of ripeness. The various causes of delay in getting cut cane to the factory are discussed as well as the urgent need to produce new varieties in Tucumán that are better suited to mechanical harvesting.

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**Evaluation of the cane leaf desiccant "Gramoxone".** J. C. P. CHEN and P. P. D. LIU. *Sugar J.* (La.), 1965, **27,** (8), 22–23, 32.—Results are given of aerial application trials (dosage of $2\frac{3}{4}$–3 litres in 10–15 gal water per hectare). It was concluded that in addition to leaf desiccation the cane stem may be affected physiologically, resulting in lower purity of juice especially in the upper part of the cane stalk. The length of time between application and burning was considered to be important.

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**Mechanization in the Argentine.** W. J. LANDRY. *Sugar J.* (La.), 1965, **27,** (8), 24–25.—Until 1960 all Tucumán cane was hand harvested, but mechanization has been introduced subsequently. Two large estates harvest half their crop mechanically and plan early full mechanization. Conditions are not unlike those of Louisiana and frosts may occur.

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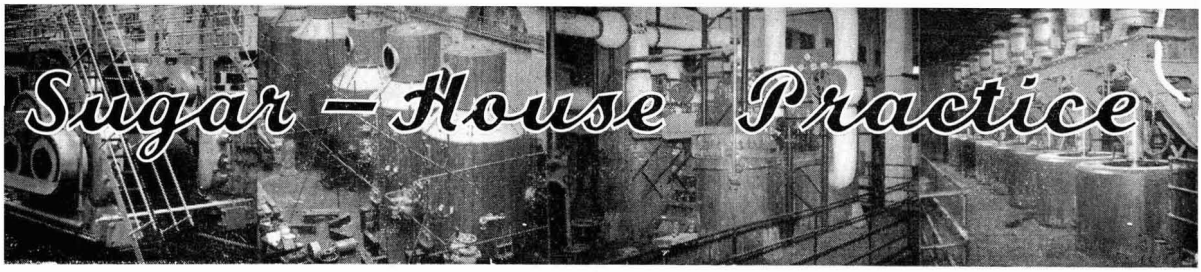
**Virus diseases and sugar cane.** G. ROTH and C. WHITEHEAD. *S. African Sugar J.*, 1965, **49,** 675–683. This is the third of a series of articles on sugar cane diseases in South Africa. Mosaic, ratoon stunting disease and streak are dealt with in turn, with photographs.




**Continuous diffusion for the sugar cane industry.** J. DÍAZ-COMPAIN. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—Pilot plant trials of the author's cane diffuser design have provided high extractions with low maceration. A full-size unit was built in Pakistan in 1964 and is under trial. The design includes a series of trapezoidal cells having no tops or bottoms and connected by chains. The chains are driven so that the cells (each of 24–36 cu.ft. capacity for a 2000–3000 tons/day factory) pass first along an upper tank, out of this, around a side wheel and then into and along a second, lower tank, leaving this to rise around a wheel at the other end and so to the first tank. Maceration applied at one end of the upper tank percolates through each cell as it moves along and is collected below and pumped to an overhead spray above a cell nearer the head of the diffuser. The exhausted bagasse is discharged at one end and the empty cell then filled with fresh cane chips. The open ends of the cells ensure that maceration can flow in either direction, depending on which tank the cell has entered.

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**Gulbaran diffuser for sugar beets and sugar cane.** E. GULBARAN. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—Laboratory experiments have been made on extraction of sugar from beet slices and from powdered sugar cane using water percolation at about 80°C and intermittent subjection to a vacuum of ½ atm. The technique permitted complete extraction of sucrose in 25 min and is the basis for a patented diffuser design[1].

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**Extraction of cane in the DDS diffuser.** H. WENG and H. BRÜNICHE-OLSEN. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—The nature of sugar cane tissue is such that it does not lend itself to diffusion as applied in sugar extraction from beet slices. Instead a lixiviation process can be used whereby crushed cane is squeezed and then released, to absorb water or a less concentrated juice, followed by a further squeeze, absorption, squeeze, etc. The DDS beet diffuser has been modified to produce this repeated squeezing and absorption, and has been used for cane sugar extraction at Tanganyika Planting Co.[2] The equipment is described in detail, and an account given of its results; 97% total extraction can be achieved with a production of 95% mixed juice on cane, one three-roller mill being sufficient for cane preparation. The mixed juice purity from a diffusion process achieving 97% extraction will be as high as that from a mill achieving only 92% extraction. The short retention time eliminates bacterial hazard, while the exhausted bagasse can be brought to 50–53% dry matter with a single three-roller mill, or 53–55% with two. Insertion of a diffuser in a tandem can increase its capacity by 30%. By addition of lime to the diffuser the juice pH is increased, which permits use of mild steel for diffuser construction.

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**Application of steam turbines to the cane sugar industry.** S. VAN DER LINDEN. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—Thermodynamic considerations are presented with must be taken into account and be properly planned by the final user and by the turbine manufacturer so that the equipment will perform under conditions allowing maximum efficiency and economy in power generation. Design criteria which should serve mill engineers in selection of reliable, robust and efficient turbines are discussed, and a survey is made of applications for turbines for various duties in sugar mills. The installation of the chosen turbine so as to ensure proper operation and team supply is then discussed.

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**Modern equipment application to the raw sugar factory thermal cycle.** F. B. MARTIN. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—The pre-1963 steam generating plant at Oahu Sugar Co. comprised eleven water-tube boilers averaging over 40 years old. Power generating capacity was only 6000 kW and electricity had to be bought from the public utility at high and increasing cost. Boiler plant labour, maintenance and repair costs were high, while boiler efficiency was low, steam conditions erratic and fly-ash was a major community problem. Studies were made to select steam conditions for determining modernization requirements, and a detailed account is given of the plant installed. This includes a bagasse-oil fired Combustion Engineering boiler rated at 250–290,000 lb/hr at 875 p.s.i. and 760°FTT, a 12,500 kW General Electric turbine and a 15,625 kVA General Electric generator. Operating results are given with details of present and future savings. The design and performance of an electro-hydraulic turbine control system are described.

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**Latest developments regarding bulk storing of sugar and bagasse.** N. WEIBULL. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—In raw sugar silos at refineries in temperate climates, developments include the use of thermal insulation to avoid migration of water towards the cold walls, use of retractable scraper

[1] U.S.P. 3,135,631; *I.S.J.*, 1964, **66**, 335.
[2] *I.S.J.*, 1964, **66**, 187–189.

or scroll conveyors for recovery of the sugar (these can reclaim 150 tons/hr), installation of accurate automatic hopper scales with tare compensation, automatic sampling of sugar from conveyor belts, and use of steel belt conveyors. In refined sugar silos thermal insulation is applied to silo floors as well as walls, while circulation of the air is carried out using heaters to adjust the air temperature as required. Humidifiers are used to maintain a relative humidity such that dust is not easily detached from the sugar with consequent risk of explosion. In addition, generation of static electricity by sugar sliding down a crater formed when sugar is reclaimed, is limited by stopping the lower feed table when the crater gets too deep, and stopping the scroll conveyor when the crater is filled with sugar. White sugar scroll conveyor bearings are now supplied with compressed air to keep out sugar dust which contaminates the bearing grease. Bagasse storage in silos is suggested as a possibility for investigation.

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**Sugar cane washing at Central Roig and Central Cortada in Puerto Rico.** A CABRER, F. A. THILLET and W. CLINCHARD. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—By the time the proportion of mechanically-harvested cane rises to 30–35% of that crushed, the dirt and trash content makes mill operation difficult and unsatisfactory so that some way of removing it becomes necessary. Factors involved in the design of a washing station—the only practical method at present—are discussed; the equipment should be simple, sturdy and functional and the volume of water, cane mat thickness, bundle size, drag chain velocity, kicker design and positioning and used wash water collection and disposal must all be considered in order to ensure proper operation of the unit. Centrals Roig and Cortada have used washers since 1960 and 1955, respectively, and experience gained has provided a basis for any future installation. The importance is emphasized of having complete materials on hand before erection, in view of slow and uncertain deliveries. Washing of cane results in some pol loss; however, the value of this loss is more than outweighed by the elimination of difficulties in milling and processing due to the mud and trash.

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**The new D-C clarifier buffers and prevents acidity and inversion.** J. DÍAZ-COMPAIN. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—A clarifier design is described in which a vertical series of conical trays is located within one tank. Each of the trays has at its centre a dependent cylindrical portion and halfway down the cylinder is an annular disc. The central aperture of the disc is provided with a small cylindrical flange which surrounds a vertical central hollow shaft running from almost the top to the bottom of the tank and provided with a motor and gearing so that it can be rotated, and a bearing at its lower end to ensure rigidity. The shaft has vertical walls within it which act as partitions between sections, numbering one for each tray. A fixed cylinder attached to the top of the tank fits closely inside the top of the shaft and is connected to the juice feed so that feed is evenly supplied to each shaft section. Slots are provided in the shaft, one for each shaft section just below the annular disc. Below these slots the shaft section is blanked off, and a second slot is provided just above the next lower annular disc. The conical bottom of the tank has its own cylindrical section and annular disc, forming a mud boot. Juice entering each compartment separates into a clear portion, which is withdrawn through a peripheral pipe or trough at the highest level of the compartment. Mud settles on the tray and is drawn by scraper arms, attached to the rotating shaft, into the mud boot formed by the upper half of the cylinder above the annular disc. A further scraper directs the mud through the slot into the shaft and down to a mud receiver below the tank. Each compartment is fed and clear juice and mud removed separately; this ensures very short residence and minimum inversion losses, as indicated by data from an installation in Pakistan, which, moreover, permitted a 30% capacity increase.

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**Cane milling research and development in South Africa, 1961-64.** E. J. BUCHANAN, K. DOUWES DEKKER and A. VAN HENGEL. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—The Mutual Milling Control Project in Natal has provided a sound and practical basis on which to adjust variables associated with milling so as to achieve optimum results. Performance data were obtained in detail from a number of tandems comprising a variety of installations, and conclusions were drawn from their analysis: (a) when milling performance is gauged by specific performance figures, e.g. lost absolute juice % fibre, the influence of cane quality is of minor significance; (b) tandems equipped with shredders have improved overall performance, a fact thought to be due to feed of more consistent bulk density to the first mill; (c) first mill performance is important, particularly with short tandems; (d) high pressures are necessary in first mills but low speeds are not, because of the relatively porous nature of the cane mat; because final bagasse is less porous, the last mill requires low speeds more than high pressures for efficient milling; (e) mill settings have been calculated by a formula which is simplified by assuming that the apparent density of bagasse in the discharge openings of first and last mills is 110 lb per cu.ft. of escribed volume; by means of top roller lift integrators this figure has proved to be close enough to the true value to confirm its applicability; (f) gravity chutes have contributed to increased feed rates without increased losses, although settings are important; feeder rollers have not been found to improve milling unless their use is coupled with pressure and low speeds, although they do eliminate mill chokes; (g) high imbibition rates (725% on fibre) cause slip and do not contribute to good extraction except in the case of very inefficient milling, and are not recommended. The investigation has promoted

an increase in local milling performance and the saving in losses has more than compensated for the cost of research and modifications to tandems to achieve this result.

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**Application of statistical quality control to sugar cane manufacture.** J. E. FORLIN. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—"Statistical quality control" is a method of charting inspection data so that visual indication is given of the quality of the product as it is being manufactured, thereby enabling corrective action to be taken as soon as things go wrong with the production process. The technique allows unavoidable variations due to chance and those due to assignable causes to be distinguished. The system was applied for a trial period in 1963, charts being constructed for % trash in cut cane delivered to the factory and for lengths of cane stumps left in the field. By this means the trash was reduced from 5·0 to 14·5% and cane stumps from 3·0 to 1·74 inches long. The technique has since become a standard routine process.

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**Principles of plant maintenance with particular reference to its use in sugar factories.** C. J. LAAN, W. G. HOLLOCK and D. C. PERREIRA. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—The planned preventive maintenance of plant is described and an account given of its advantages and growing necessity in the face of increasing mechanization and automatic control in sugar factories. A detailed account is given of the system adopted at Bookers Sugar Estates Ltd. since 1960, which involves the use of key sheets, planning charts, work orders and costing sheets. The system has resulted in a "cost-consciousness" in all the factories, better knowledge of the effective life of the plant, reduction in the frequency of breakdowns and shortening of the week-end maintenance period.

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**The Segura natural high-speed evaporator with increased juice velocity and accelerated condensate drainage.** H. T. A. DE KRIJGER. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—In this evaporator design the contents of the calandria—condensate and vapour—are withdrawn together and passed through a separator from which the vapour is withdrawn for bleeding. In this way steam velocity at the bottom of the calandria is increased and heat transfer made more uniform over the length of the tube. In addition, condensate forming on the steam side of the tube will be entrained, so reducing the thickness of the water layer and its resistance to heat transfer. A series of curved baffles surround the calandria and divide the space above the top tube sheet into segments connected to separate compartments of the annular downtake surrounding the calandria. Juice passes up through the tubes into one segment and is guided by the baffle so that it passes down the outside of the calandria and under the tubes discharging into the next segment. Juice is withdrawn from below the calandria in one compartment and added at another; its rapid flow through the tubes improves heat transfer and also reduces scale formation, with added benefit.

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**Some Louisiana sugar mill pumping problems.** A. W. BETZ. *Sugar J.* (La.), 1965, **27,** (11), 37.—Some information is given on various types of pumps supplied by Warren Pumps Inc. to Louisiana sugar factories for raw juice handling.

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**Ingenio Azucarero de Tababuela (Ecuador).** R. FRANÇOIS. *Sugar J.* (La.), 1965, **27,** (11), 42–43.—Details and illustrations are given of this small factory constructed by Soc. Fives Lille-Cail for the crushing of 700–750 metric tons of cane per day, expandable to 900–1000 tons. Equipment includes a tandem of four 23 × 44 inch mills driven in pairs by two 300 h.p. steam turbines (space is provided for a fifth mill), three vacuum pans and two 48 × 24 inch 1200 r.p.m. semi-automatic centrifugals for *A* and *B* sugars and two 42 × 24 inch 1800 r.p.m. units for *C* sugar.

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**Leighton factory.** I. E. LEGENDRE. *Sugar J.* (La.), 1965, **27,** (11), 57.—A list is given of the additional equipment installed in this Louisiana factory to raise its capacity to 5000 t.c.d. and ultimately to 6000 t.c.d.

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**New concept for the design of (a) vacuum pan.** B. B. PAUL. *Sugar J.* (La.), 1965, **27,** (12), 23–26.—The design of an experimental floating calandria vacuum pan is described. The central steam pipe passes through the top tube sheet and extends to the bottom tube sheet. The pipe has a serrated lower end and is provided with slits in the part below the top tube plate, so as to facilitate radial steam flow and improve steam distribution across the calandria. The incondensable gas removal system is also claimed to provide positive vapour circulation from the centre of the calandria to its outer edge. The peripheral downtake is divided into 20 equal chambers into which syrup is added to ensure even feeding. Some performance data are given for a 1500 sq.ft. pan of 35 tons effective capacity. Boiling time was 2 hr compared with 2–3 hr in a 31-ton conventional pan of 1200 sq.ft. h.s., using 1–3 p.s.i.g. steam as against 6–7 p.s.i.g. Average massecuite Brix was 94·75° compared with 93·50° in the conventional pan, mother liquor purity was lower and the crystal sugar:sugar in massecuite ratio was higher. The massecuite colour was lighter and crystal uniformity was improved.

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**Gatke moulded fabric bearings on sugar cane journals and auxiliary equipment.** A. W. NORMAN and N. RADLOFF. *Sugar J.* (La.), 1965, **28,** (1), 35–38.—The advantages of Gatke Corporation fabric bearing liners used in cane mill journals are discussed.

# BEET FACTORY NOTES

**Decolorization of sugar juices and sugar products by the bed column method.** H. ZAORSKA. *Ind. Alim. Agric.*, 1965, **82**, 741–747.—Decolorization of sugar liquors with active carbon in agitator and counter-current bed columns was examined[1]. Flow resistance increased greatly with column height, reducing flow rates; consequently less active carbon was needed when used in two columns than when used in a single column to achieve the same decolorization. The combined carbon-resin method developed at the Dept. of Sugar and Food Technology, Lodz Institute of Technology[2], was compared with treatment by active carbon or decolorization resin alone. The sugar obtained from the treated liquor was comparable to that obtained with bone char or resin treatment, while the method does not have the disadvantage of waste water production as a result of resin regeneration.

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**Drying of beet pulp.** M. ROCHE. *Ind. Alim. Agric.*, 1965, **82**, 775–784.—In a survey (with 11 references to the literature) of beet pulp drying and storage, the author discusses the factors limiting the pressure used to extract the moisture, the types of dryers and presses used to produce various shapes, storage conditions (particularly R.H.) and the reactions that can occur in stored pulp (microbial actions leading to temperature rise and such reactions as oxidation and Maillard reactions). Despite the fact that molasses is hygroscopic, it is considered the molasses-pulp mixtures are no more difficult to store than pulp alone.

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**Water economies of sugar factories. III.** F. KASTNER. *Listy Cukr.*, 1965, **81**, 209–214.—Methods used to cool hot waste waters are described and the more important parameters are calculated. The most suitable form of cooling element is considered to be the cooling tower. The data are intended to help technologists improve their factory water economies.

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**Waste water elimination in sugar with particular reference to Bavarian conditions.** K. OFFHAUS. *Zucker*, 1965, **18**, 539–545.—Possible means of reducing waste water quantities in sugar factories are discussed on the basis of experience at five sugar factories in Bavaria with a total daily slice of 25,000 tons of beet. Flume-wash water and press-water are recycled. The condenser water load has been reduced to a $BOD_5$ of 15 mg/litre by modernizing various stations, particularly the pan station. Three methods of disposing of carbonatation mud are described. Lagooning has certain disadvantages, particularly the large amount of land needed, and a compact multi-stage clarification plant is considered necessary, although at present none exists.

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**Effect of formalin on undetermined sugar losses in diffusion.** L. S. TVERDOKHLEBOV. *Sakhar. Prom.*, 1965, **39**, 648–650.—Data from a number of factories have shown that formalin added to diffusers reduces undetermined losses. A curve of undetermined losses drawn from the data for the period 1960–1964 and covering the range approx. 0·62–0·45% is almost an exact mirror image of the curve of formalin addition (0 to approx. 0·015% on beet). Statistical analysis showed that the optimum amount of formalin is 0·010% on beet. Little, if any, improvement is achieved by increasing to 0·015%. Certain bacteria have proved immune to quantities below 0·010%.

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**Examination of filter cloths.** I. F. ZELIKMAN and V. A. KOLESNIKOV. *Sakhar. Prom.*, 1965, **39**, 651–655. Syrup filtration tests with a Proksh leaf filter showed that of four different types of filter cloth (two "Terylene"-type cloths, a caprone and a cotton fabric) the cotton fabric had the highest swelling capacity (expressed as the time up to constant throughput) and hence greatest throughput loss: 80–90 min and 35% compared with 15–20 min and 5–6% respectively for the other three cloths. The permeability of the caprone cloth was 40% higher and that of the two "Terylene"-type cloths 20% and 30% higher than that of the cotton cloth. The turbidity of the 60°Bx syrup filtered through the cotton and two "Terylene"-type cloths was almost identical and was far lower than with the caprone cloth, which photomicrographs showed to have the greatest number of open pores and almost no nap. Determination of the porosity of a clean cloth and of the amount of mud trapped by the cloth showed that the caprone cloth had least initial porosity and trapped least mud, while one of the "Terylene"-type cloths had less initial porosity than the cotton cloth but trapped more mud.

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**Results of investigation of equipment handling beets on their way to the factory.** YU. G. GONCHAROV, V. A. MAKSYUTOV and E. V. LOMAKO. *Sakhar. Prom.*, 1965, **39**, 656–659.—At Novo-Kuban', investigations have revealed a number of operational defects in the beet-handling equipment between pile and factory. One of the major disadvantages of the Pavlyuk-Sokolov stone catcher and the disc-type water separator was the large quantity of whole beet discarded. Other equipment discussed includes the beet gate at the flume entrance, a triangular trash catcher, beet tail separator and the screw conveyors. Tabulated data show that generally the greatest losses occurred in the flume-wash water; these were considerably higher than losses occurring at the sloping steel "spring-board" onto which the beets are thrown by the tail separator in order to separate impurities (based on differences in trajectories between the beets and impurities governed by weight and volume); the loss at the trash catcher was smaller than at the stone catcher, although the combined losses from these were still lower than at the "spring-board". Losses were lower when the beets were first cleaned manually.

[1] *See also* ZAORSKA: *I.S.J.*, 1966, **68**, **85**.
[2] *I.S.J.*, 1964, **66**, 262.

**Storage and use of (beet) pulp at sugar factories in Krasnodar Territory.** V. A. SEREBRINSKII. *Sakhar. Prom.*, 1965, **39**, 659–662.—The question of preventing losses in the nutritional value of beet pulp intended for cattle fodder is discussed. While drying and briquetting of that proportion of the pulp not used in the fresh state reduces storage losses and raises storage capacity, investigation has shown that the majority of the factories in Krasnodar Territory have no briquetting plant, briquette storage facilities or pneumatic conveyors for dried pulp.

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**Use of ESU-2 electronic signalling level indicators for viscous electroconducting sugar factory products.** B. E. BELEN'KII and ZH. D. ZIMAN. *Sakhar. Prom.*, 1965, **39**, 664–665.—An account is given of tests on an ESU-2 level indicator fitted with a steel electrode. With green, wash and affination syrup, the signal stopped ½–1 sec after the level had dropped below the electrode. Operation was independent of the extent of immersion of the primary element and build-up of the electrode had no effect on performance. Maximum efficiency was obtained by connecting two 2000 pF capacitors in series to the electrode.

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**Improving the performance of beet elevators.** A. P. PARKHOD'KO. *Sakhar. Prom.*, 1965, **39**, 688–690. Details are given of modifications to a standard Soviet beet elevator. These are designed to improve durability, facilitate repairs and reduce the amount of water accompanying the beets entering the elevator.

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**Performance of a modernized five-tray clarifier.** V. M. PERTSEL', B. I. KATS and A. S. OSITYANSKII. *Sakhar. Prom.*, 1965, **39**, 691–692.—Among the advantages of a modified PMZ five-tray clarifier, in which the top and 4th from the top juice withdrawal pipes were provided with parabolic throats across the pipe sections (one on each side of the clarifier) of dimensions corresponding to juice flow, were increased throughput, and high mud density and juice purity. Operation was made easier and juice residence was reduced.

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**Effect of components of the pectin complex on 1st carbonatation juice filtration.** S. A. BOGDANOV. *Sbornik Pishch. Prom.*, 1965, (1), 27–31.—When, in laboratory tests, araban and Ca, Mg pectate were added, respectively, to a 15% sugar solution which was purified by standard carbonatation after addition of 2·1% CaO by weight, both raised the settling rate while the filtration rate remained unaltered. Laboratory beet diffusion was carried out at 70, 80 and 90°C and the colloids and invert determined quantitatively after standard carbonatation as above. It was found that the invert, pectin, dextran and araban contents increased with diffusion temperature, while the albumin and levan contents decreased. The pectin, araban and dextran together constituted approx. 91% of the total colloid content (by weight). Increase in the invert content was ascribed to inversion of sucrose by the Ca,Mg pectate and to partial destruction of pectin at high carbonatation temperatures, as well as to high diffusion temperatures. From the results it is concluded that filtration difficulties must be due to the invert and dextran, and to various hydrolysis and condensation products of pectin and araban.

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**The effect of certain factors on the settling rate of 1st carbonatation juice.** M. KH. LIKHITSKII, I. M. LITVAK and L. P. REVA. *Sbornik Pishch. Prom.*, 1965, (1), 32–37.—Addition of 7% raw juice (by volume) to 1st carbonatation juice gassed to various alkalinities in the range 0·06–0·14% CaO increased the settling rate while the filtration rate was only slightly impaired. The optimum 1st carbonatation alkalinity was found to be 0·12–0·14% CaO. The mechanics of Ca ion adsorption on $CaCO_3$ particles and aggregation with the pectin-albumin complex are discussed. The beneficial effect of the raw juice was increased by raising the temperature during settling from 60°C, at which some turbidity was noticed in the supernatant, to 80°C, at which temperature the juice was absolutely clear and sparkling. While recycling 100% unfiltered 1st carbonatation juice to pre-liming gave higher 1st carbonatation settling and filtration rates, preliminary addition of 7% raw juice to the unfiltered 1st carbonatation juice gave yet further improvement, while the lime salts and colour contents and purity of the 2nd carbonatation juice remained almost unchanged.

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**Examination of circulation in evaporators at low pressure and vacuum.** N. YU. TOBILEVICH, I. I. SAGAN', S. I. TKACHENKO and V. S. PAVLENKO. *Sbornik Pishch. Prom.*, 1965, (1), 131–137.—Formulae are developed for processing data obtained in experiments with a vertical single-tube evaporator. The tube circuit contained two exchangeable boiling tubes and an external downtake and was provided with sampling cocks for condensate. Flow rate, pressure drop through the tubes and boiling tube wall temperature were measured at a secondary steam pressure of 1 atm and 30,000–120,000 kcal/sq.m./hr heat flow. The effective head and tube resistances were determined from the pressure losses and from these and various flow factors the mean steam content determined. This is related to the mean "consumption steam" and a graph drawn from the test data and including values obtained by other authors. It is shown that the results agree satisfactorily with those obtained by SHER but not those obtained by DÜNGLER under identical conditions.

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**The problem of scale in sugar factory evaporators.** G. MANTOVANI. *Ind. Sacc. Ital.*, 1965, **58**, 233–241. The formation, composition and removal of evaporator scale in sugar factories are reviewed, with 56 references to the literature.

# LABORATORY METHODS AND CHEMICAL REPORTS

**Coloured components in evaporator syrup.** C. C. TU and J. H. PAYNE. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—The isolation of coloured compounds from evaporator syrup by preparative electrophoresis and ion exchange chromatography is described, and their visible and u.v. absorption characteristics recorded. One (yellow) fraction has an absorption maximum at 281·5 mμ which corresponds to that found by SINGH *et al.*[1] for thermal degradation products of reducing sugars. Most of the coloured compounds were in other fractions, two brown and one other reddish brown. The two brown fractions had no u.v. absorption peak and remain unidentified, while the reddish-brown fraction contained 3·9% nitrogen and had peaks at 240, 278 and 360 mμ.

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**The nature of the insoluble matter in the commercial raw sugar crystal.** C. C. TU. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—Light scattering studies have shown that the insoluble particles in the sugar crystal are essentially spherical and have an average diameter of 0·9 microns. Included is a significant fraction of particles having a uniform diameter of 0·3–0·4 microns. The insoluble material has been fractionated into groups and is shown to contain lipids and principally low M.W. substances along with higher M.W. nitrogen- and methoxyl-containing compounds.

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**The amino acids of sugar cane.** D. H. PARISH. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—The free amino acids occurring in leaf laminae and cane juice have been studied; the amino acids picture of leaf laminae is complex but alanine is shown to account for half of the total, while arginine has been shown to be depressed by nitrogenous fertilization. Pipecolic acid, methionine and tryptophane occur in juice as does a substance resembling 4-hydroxypipecolic acid; the presence of arginine is confirmed.

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**Determination of sucrose in the impure products of the cane sugar manufacturing process by the action of boron salts.** J. LÓPEZ HERNÁNDEZ. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—Further laboratory and factory data are recorded which confirm the applicability of the author's method for polarimetric determination of sucrose in the presence of glucose and fructose by addition of borax.

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**Glucose ratio for maturity testing of sugar cane.** G. R. ROUSSELET. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965.—The glucose ratio in cane juice is considered to be the best criterion of cane maturity since it is independent of the cane quality. Details are given of the procedures followed at the author's factory for measurement of glucose ratio; Brix is measured by hydrometer and reducing sugars by the original Fehling method, improved by Soxhlet[2]. Examples of such analyses show the fall in glucose ratio with maturing of the cane. Harvesting of factory-owned cane, as guided by determinations of glucose ratio, always gave better results than farmers' cane, harvested without such guidance.

* * *

**A simple and practical method to evaluate the exhaustibility of final molasses.** G. R. SERBÍA and J. BALSA. *Paper presented to the 12th Congr. I.S.S.C.T.*, 1965. The Hawaiian equation for expected final molasses is based on sucrose and refractometric dry substance. A collection of Hawaiian data was examined and conversion data obtained with Puerto Rican molasses, used to convert the R.D.S. figures to hydrometer Brix. The data produced average and minimum regression lines for the Hawaiian molasses which were subjected to boiling-down tests, and the average line corresponded to an equation $Y = 55{\cdot}3 + 0{\cdot}46\,(X - 15)$ where Y = indicated total sugars % Brix and X = reducing sugars % Brix. For factory purpose this can be simplified to $Y = 55 + \frac{(X - 15).}{2}$ Comparison of the expected purity given by this equation with that given by the full Hawaiian formula ($Y = 38{\cdot}55 - 61{\cdot}9\,X + 49{\cdot}9\,X^2$) where Y = purity (sucrose/R.D.S.) and X = reducing substances/specific conductance ratio at 28°R.D.S. gave correlation coefficients of 0·86 and 0·88 for 1963 and 1964 crop data. The simplified equation is therefore considered to give a good criterion for exhaustibility.

* * *

**Direct analysis of cane.** A. BRUMEN. *Sugar J.* (La.), 1965, **28**, (3), 43–45.—At Central Aguirre a cane sampling device was installed at the No. 3 mill. This consisted of a 4-ft scroll conveyor placed at the top of the cane conveyor and parallel to the shaft of the knife set. Cane falls through a gap and is carried by the scroll to a chute, then into a closed container. Comparison of analytical data from the average of 12 continuous samplings with routine analyses and calculated results showed a fairly constant relationship between Brix and pol in both cases, while the moisture data were so close that the differences could be disregarded. Purity differences were also small. However, the differences between the Brix values were surprisingly great; this is ascribed to the fact that the sample was not representative. Further tests suggested that the sampling device was located in the wrong place. After it had been re-positioned, analyses indicated that samples would be more representative and more tests are to be carried out.

[1] *J. Amer. Chem. Soc.*, 1948, **70**, 517.
[2] BATES *et al.*: *Nat. Bureau Standards Circ.*, 1942, (C440), 165-170r.


## UNITED KINGDOM

**Polyurethane derived from polyether polyols.** PITTSBURGH PLATE GLASS CO., of Pittsburgh, Pa., U.S.A. **957,946.** 18th July 1960; 13th May 1964.—A polyurethane or prepolymer is prepared by interaction [in the presence of a blowing agent (a carbon halide or water) to produce a foam] of an organic isocyanate containing two or more isocyanate groups (toluene diisocyanate) with a polyetherified sucrose which has been prepared by reaction (in an aqueous medium) of sucrose with [at least 10 (10–25) moles/mole of] propylene and/or ethylene oxide. The reaction may be in the presence of a catalyst.

* * *

**Polyether polyols.** PITTSBURGH PLATE GLASS CO., of Pittsburgh, Pa., U.S.A. **957,947.** 18th July 1960; 13th May 1964.—A polyether polyol is prepared by reacting an aqueous (5–90% w/w) solution of sucrose with at least 3 (at least 10) moles/mole of propylene oxide and, optionally, sufficient of another $C_2$–$C_4$ alkylene oxide (ethylene oxide) to bring the total used to 10–25 moles per mole of sucrose. The propylene oxide and subsequently the ethylene oxide are introduced into the sucrose solution at a pressure not over 200 p.s.i. and at 70–270°F in the presence of an oxyalkylation catalyst, e.g. NaOH.

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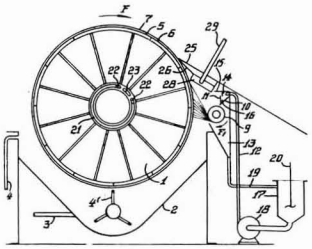
**Beet or cane diffuser.** A/S. DE DANSKE SUKKERFABRIKKER, of Copenhagen, Denmark. **968,936.** 21st June 1962; 9th September 1964.—An inclined trough diffuser is provided with two pairs of screw conveyors, one pair mounted above the other at centres less than the screw diameter apart. The trough wall follows approximately the outer contour of the four screws. The trough may be filled so that both pairs of screws convey the material along the trough against a counterflow of water. With a smaller supply of material the conveying is performed by the lower screws, the upper pair running partly or completely idle. This permits a much wider variation in throughput of the diffuser compared with that possible by varying the speed of a single pair of screws.

* * *

**Rotary filters.** ECREMEUSES MELOTTE S.A., of Remicourt, Belgium. **969,492.** 6th December 1960; 9th September 1964.—The filter comprises a hollow drum 1 rotating in the direction of arrow *F*, the lower part being submerged in trough 2 to which muddy sugar juice is supplied through pipe 3. The filter cloth 5 on the outer surface of the drum, which is divided internally into a number, e.g. twelve, of sectors, is placed between two sieves or nettings (preferably of rustless wire) 6 and 7, the inner netting being made up of as many pieces as there are sectors, while the outer netting is in one piece. Filter-aid, e.g. shredded cellulose, is continuously sprayed as a thin film onto the drum surface from cylinder 9.




During rotation the majority of the consecutive sectors, say ten or eleven, are maintained under reduced pressure, while the others are subjected to a positive internal pressure. This is achieved by means of vacuum-creating device 21 which is provided with two non-communicating orifices, one of which 22 is connected to a vacuum source while the other 23 is connected to a source of gas (air or steam) under pressure. When the sectors are under pressure the filter-cake is detached from the cloth at the same time as the initial filter-aid film. These are removed from the drum outer surface by air or steam projected onto it from an air-knife 25, which serves instead of the usual scraper and is located at least 0·5 mm from the drum, and inclined at a natural sliding angle for the cake. Thus, the cake and filter-aid are removed by an internal and an external gas stream.

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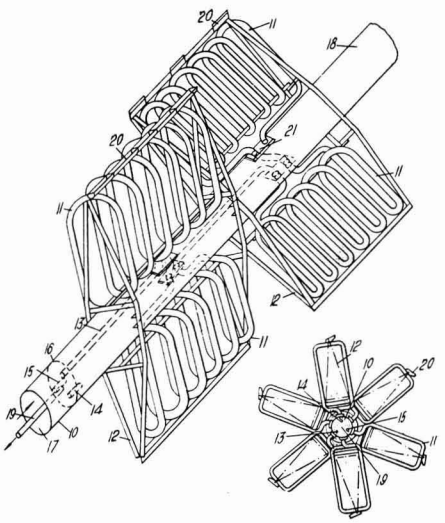
**Beet topper.** VYZKUMNY USTAV ZEMEDELSKYCH STROJU, of Chodov, Czechoslovakia. **969,543.** 19th December 1961; 9th September 1964.

* * *

**Purification of sugar solutions.** SUGAR CHEMICAL CO. ETBT., of Vaduz, Liechtenstein. **970,287.** 14th March 1963; 16th September 1964.—The impure sugar solution is treated with an anion exchanger containing carbonate or bicarbonate ions and is then divided into two portions; one portion is treated with a cation exchanger containing ammonium ions and the two portions are remixed, heated and boiled to expel ammonium carbonate, providing a purified solution substantially free of ammonium salts and free acids. The pH of this purified solution is measured and used to control the ratio between the two portions of the anion exchanger-treated solution.

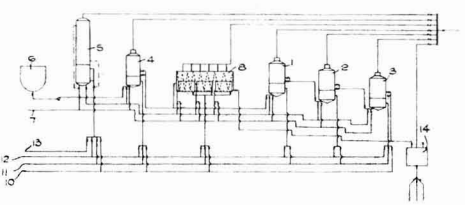
**Tubular mixing device for sugar production (crystallizer cooling element).** ZAVODY VITEZNEHO UNORA, NARODNI PODNIK, of Hradec Kralove, Czechoslovakia. **970,122.** 25th February 1961; 16th September 1964. Several pairs of helical tubular sections 11 are mounted on a hollow rotating shaft 10 and supported by arms 12. Each pair of elements is supplied with cooling water from one of the three main pipes 13, 14 and 15, open to filling chamber 17. The ends of the helical elements open into discharge chamber 18 which communicates with discharge pipe 19 running through the centre of shaft 10 and the filling chamber 17. A partition 16 extending across the cavity of shaft 10



separates filling chamber 17 from discharge chamber 18. In contact with partition 16 is a plate which makes a sliding fit over pipe 19 and has an arcuate slot so that as the shaft rotates the slot is brought successively into register with the open ends of tubes 13, 14 and 15 and cooling water is admitted to one set of helical tubes at a time. The massecuite is fed into the trough through feed chambers located along the side of the crystallizer. Provision is made for steam heating of the massecuite through a jacket. The massecuite temperature is automatically controlled through capillary valves with feelers which come into contact with the mass and open or close the valves automatically to stop or allow water feed.

* * *

**Continuous sugar boiling.** BRITISH SUGAR CORPORATION LTD., A. J. DYKE and R. M. J. WITHERS. **970,654.** 24th July 1961; 23rd September 1964.—Sugar boiling is effected continuously in a number of stages connected in series, in which the quality of the massecuite is controlled by varying the amount of vapour supplied to, the pressure existing in, and the amount of thickened juice added in each stage so that the degree of saturation of the liquor flowing from each stage to the subsequent stage is constant, and in which the conditions obtaining in each stage are chosen so as to provide overall crystal growth. This is achieved in a series of vessels which include four floating calandria pans 1–4, a larger pan 5 used as a pre-thickener, a magma mixer 6 and a scroll pan 8. Grain formation takes place in pan 4 which is supplied with thick juice at 74°Bx and 90·6 purity and magma at 85°Bx. This may be made from



a suspension of ground sugar crystals in isopropyl alcohol or may be formed spontaneously in a special pan by flash evaporation of "thickened" juice to a supersaturation of 1·30 at 65°C. Second vapour is used in pan 4 to produce a massecuite of 86·9°Bx and 90·6 purity. This passes either to scroll pan 8 or to pans 1–3 where it is boiled in series, with addition of "thickened" juice of about 81°Bx and 1·1 supersaturation produced in pre-thickener 5 by evaporation of thick juice with third vapour. Pan 1 is operated at 68·5°C and pans 2 and 3 at 64°C. Massecuite from the final vessel may be discharged either through a batch vacuum transfer chamber 14 and by gravity to a sealed trough over the centrifugals, or through a massecuite pump. Provision is made for control of the various boiling parameters.

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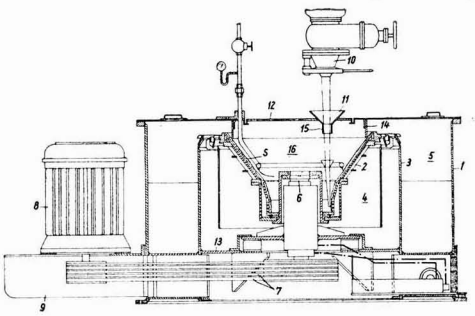
**A process for operating continuous centrifugals and sugar centrifugals for use in such process.** BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT A.G., of Braunschweig, Germany. **971,234.** 28th September 1962; 30th September 1964.—Optimum output of a conical continuous centrifugal is achieved by heating the massecuite layer to 52–80°C (65–75°C), at least in the region adjacent to the top edge of the centrifugal basket, and as far as possible over its entire height. Steam or hot air is admitted to the molasses compartment and regulated to any required temperature (60–110°C) by a mixing valve and a control valve, steam or hot air passing from one side of the mixing valve and cold air from the other side. Alternatively, the material may be heated by friction or dielectrically, whereby the centrifugal basket 2 or its screen act as an electrode, a counter-electrode being located inside the basket. To prevent air flowing through the material near the top of the basket, a deflector ring 14 is inserted in the gap between basket 2 and sugar compartment 5. Funnel 11 is also provided with a similar baffle in the form of an extended outlet

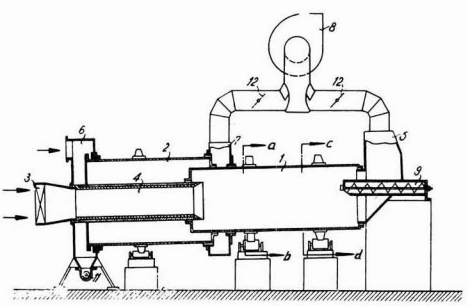
15. These baffles prevent formation of cold zones by circulation of air inside the casing, particularly



between the inside of the basket, sugar compartment 5 and molasses compartment 4.

* * *

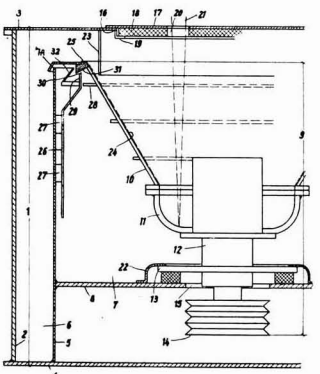
**Machine for drying and cooling white sugar in counter current.** BÜTTNER-WERKE A.G., of Krefeld-Uerdingen, Germany. **971,829.** 11th October 1962; 7th October 1964.—Sugar is fed by a screw conveyor 9 into drying drum 1 which is provided with vanes. The dried sugar then passes into cooling drum 2, which also has lifting vanes, and is discharged by screw conveyor 11. The drying air is heated by heater 3 from which a hot air supply pipe 4 extends to drying



drum 1 centrally through cooling drum 2. Exhaust drying air is removed, by suction fan 8, through housing 5. Cooling air is supplied through inlet housing 6 at the sugar discharge end of cooling drum 2 and is discharged through outlet 7 at the sugar feed end of drum 2. Throttle valves 12 in the air exhaust pipes are so adjusted that the same pressure is maintained in drums 1 and 2 at the sugar transfer point, so eliminating air flow and preventing drying air from flowing into the cooling drum and cooling air flowing into the drying drum.

* * *

**Continuous centrifugal.** BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT A.G., of Brunschweig, Germany. **972,479.** 20th July 1962; 14th October 1964.—Air flow through the molasses compartment of a conical centrifugal is eliminated so as to prevent molasses particles being entrained into the sugar compartment and avoid over-cooling of the molasses. To this end, the recess or cut-out portion 15 in the false bottom 8 of the molasses compartment 7 through which passes the vertical drive shaft is closed by a hood 22, and the inspection port 16 in the cover plate 3 is closed by a grille 17 and a packing 18 sealed in an angle ring 19. Only a small opening 20 is provided in grille 17 for feeding of material to be centrifuged 21 into head 11. A trap ring 23 projecting down from



cover plate 3 into the basket protects the basket screen 24, while a sealing ring 25 at the upper edge of the conical basket projects over partition wall 5 so that the molasses compartment 7 is closed from above. An air baffle 26 in compartment 7 is attached to wall 5 by a spacing ring 27. This, in conjunction with upper ring 28 on the basket 10, deflects the air into the molasses compartment. Circulation of air is promoted by flat horizontal annular plate inserts which extend from the conical basket wall into the molasses compartment.

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**Cane harvester.** MASSEY-FERGUSON (AUSTRALIA) LTD., of Sunshine, Va., Australia. **972,578.** 9th February 1961; 14th October 1964.

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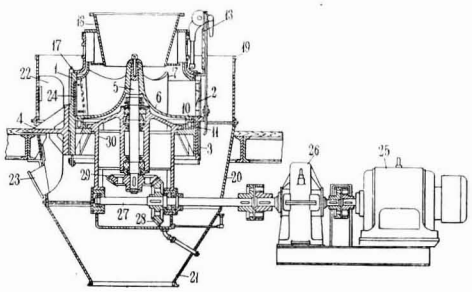
**Beet harvester.** A. E. BROOKES, of Suckley, Worcs. **973,032.** 3rd July 1962; 21st October 1964.

* * *

**Producing L-glutamic acid.** AJINOMOTO CO. INC. and SANRAKU OCEAN CO. INC., of Tokyo, Japan. **973,376.** 4th October 1962; 28th October 1964.—A micro-organism capable of producing L-glutamic acid, e.g. *Brevibacterium saccharoliticum*, *B. divaricatum*, *B. roseum*, *B. immariophillium*, or *B. lactofermentum*, is cultivated in the presence of beet or cane molasses, beet or cane raw sugar or beet or cane thin juice, and in the presence of (0·01–1% w/v of) a (non-ionic) surface-active agent.

**A centrifugal sugar beet cutter.** KIEVSKY MASHINOSTROITELNY ZAVOD "BOLSHEVIK", of Kiev, U.S.S.R. **978,887.** 12th April 1961; 23rd December 1964. Inside vertical drum 1 is a rotary impeller with a bell-shaped outer face 6 and three curved blades 7 with cutting tips which have an optimum velocity of 6–9 m/sec. The tips may be adjusted radially to vary the clearance between them and the knives 2 in the drum. The impeller has an upper band and a lower band 10, the latter carrying scrapers 11 to remove marc which has passed through the space between drum 1 and lower band 10. To remove and replace a knife 2 during operation, without stopping the machine, a



rack winch 13 is operated to raise a shutter 3 which in turn forces up the knife, the shutter then taking the place of the knife. After replacement, knife alignment is adjusted through a screw device fixed to the top of drum 1. Free discharge of cossettes through knives 2 is ensured by enclosing drum 1 in a housing made up of three sections, one cylindrical 19 and two conical, 20 and 21. Uncut beet and foreign matter are ejected from drum 1 by centrifugal force through an outlet 23 in pocket 22 provided in the housing of drum 1.

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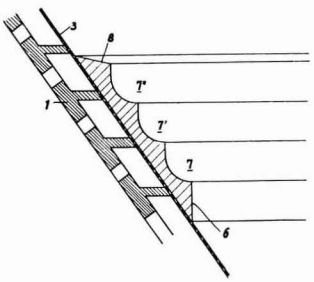
**Apparatus for automatically monitoring the filling of a centrifugal.** SIEMENS-SCHUCKERTWERKE A.G., of Berlin, Germany. **979,534.** 1st October 1962; 6th January 1965.—The control apparatus comprises a relay to which are selectively connected three different resistances and to which is fed a signal which is a function of the centrifugal speed. The motor brings the centrifugal to the chosen initial speed and filling starts at the rate governed by the value of the first resistance, while the motor is disconnected. The speed falls to a level at which the relay cuts out the first resistance and replaces it by the second. Filling continues at the lower rate appropriate to the value of the second resistance, until the speed falls to the third value when the third resistance is brought into the circuit, cutting off the supply. The resistances are variable so that variations in feed density and viscosity can be compensated.

* * *

**Continuous centrifugals for sugar.** BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT A.G., of Braunschweig, Germany. **979,601.** 5th July 1962; 6th January 1965. Massecuite in the conical basket 1 of a vertical shaft centrifugal flows in a thin layer over the screen 3 of the basket from the acceleration pot until it reaches a stirring ring at about the level corresponding to the region of greatest discharge of wash liquid from the centrifugal. The sugar layer cannot pass smoothly beyond the ring because of the presence of a projecting, steeply-rising partition or baffle plate 6, which breaks



up the sugar layer and forces it to spread into troughs 7, 7′ and 7″ arranged in cascade order. The wash liquid directed into these troughs helps stir the crystals and removes the molasses film. The sugar crystals are then deflected by a baffle plate 8 to the part of the screen 3 above the stirring rim and the last of the molasses film is then removed.

* * *

**Producing L-glutamine by fermentation.** KYOWA HAKKO KOGYO CO. LTD., of Tokyo, Japan. **981,132.** 3rd August 1962; 20th January 1965.—L-Glutamine is produced by aerobic culturing at pH 5·5–8·5 and 24–37°C (28–33°C) a glutamic acid-producing micro-organism (*Micrococcus glutamicus* ATCC No. 14751 or 14752) in a nutrient medium comprising a source of assimilable carbon (glucose, sucrose or molasses, etc.), a source of assimilable nitrogen (urea) and a source of inorganic salts. The nitrogen source may be added partly after the initial propagation of the micro-organism, and provides at least 5 parts by weight of assimilable nitrogen per 100 parts of assimilable carbon in the medium.

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**Sugar derivatives (glycol ethers).** FARBENFABRIKEN BAYER A.G., of 22c Leverkusen-Bayerwerk, Germany. **982,078.** 16th August 1961; 3rd February 1965. The derivatives, useful as wetting agents, plasticizers, etc., are of the general formula $Z\,[-(CH_2-CHR-O-)_mX]_n$, where $Z$ is the radical of a di- or tri-saccharide, $R$ is an alkyl or hydrogen atom, $m$ is a number from 1 to 5, $X$ is the residue of a fatty acid containing at least 10 carbon atoms, and $n$ is a number from 1 to 8 when $Z$ is the radical of a disaccharide and from 1–12 when $Z$ is the radical of a trisaccharide. They are prepared by reacting the glycol ether $Z\,[-(CH_2-CHR-O-)_mH]_n$, e.g. sucrose octapropylene glycol ether, with a fatty acid of an alkanol in the presence of an alkaline catalyst (KOH, $K_2CO_3$ or $NaOCH_3$) at 75–160°C, in a solvent (dimethylformamide, toluene, xylene, or chlorobenzene).

# TRADE NOTICES

*Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.*

**"Toncan" iron.** Republic Steel Corp., 1441 Republic Building, Cleveland, Ohio, U.S.A.

Produced exclusively by Republic Steel Corp., "Toncan" copper-molybdenum iron has a higher corrosion resistance than ordinary steel and is being used by St. Mary Iron Works, Franklin, La., U.S.A., in the manufacture of sugar factory evaporators and vacuum pans. "Toncan" contains a minimum of 0·40% copper (i.e. double the amount in conventional copper-bearing steels), 0·05% molybdenum and a maximum of 0·25% of the five elements, carbon, manganese, phosphorus, sulphur and silicon. The chemical and structural uniformity of the iron minimizes electrolytic corrosion and no unusual fabricating difficulties have been encountered. "Toncan" can be bent, punched, stamped, drawn, etc., with practically no adverse effect on its rust resistance.

* * *

**Control valves for solids.** Flow Regulators Ltd., 101 Sandford Rd., Moseley, Birmingham 13.

A new range of low-cost valves has been produced for handling free-flowing solids, slurries, gases and air. The "Flowmaster" control valve consists basically of a multi-leaved iris steel shutter closing on a tube of fabric or rubber to give an adjustment of orifice from full bore to complete closure by the operation of a simple hand-lever through an arc of slightly less than 90°. The infinitely variable circular aperture is always concentric with the outside diameter of the valve and the bore remains unobstructed. The valves are available in a wide range of sizes with a variety of flexible sleeve materials, are easily and quickly fitted to any duct or hopper and require no maintenance. While the standard "Flowmaster" valve is operated by hand-lever or pneumatic cylinder, it can easily be adapted for remote manual operation.

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**New pressure-type dust collector.** Mikropul Ltd., Towerfield Industrial Estate, Shoeburyness, Essex.

Details are released of the "Mikro-Pulsaire" dust collector, already proven in a number of industries, but now available in cylindrical form. The use of a "round housing" permits the filter to be used for high-vacuum and high-pressure operation, with a rating of up to 220 in w.g. (approx 7½ p.s.i.g.), and increases the fabric area and the amount of air filterable through the unit per sq.ft. of floor space occupied. A further advantage lies in the absence of corners which could trap excess material. The filter has no moving parts and is fitted with solenoids prewired to the junction box, while the design is based on a wide range of standard parts. A recovery efficiency of almost 100% is claimed by the manufacturers.

## PUBLICATIONS RECEIVED

**INDUSTRIAL BLOWERS.** Sir George Godfrey & Partners (Industrial) Ltd., Hanworth, Middx.

A leaflet and data sheets are available giving details of the new L-800 and X-420 series double-sealed industrial blowers. The gland-type double seal ensures oil-free air. The bi-rotational blowers can be supplied for top or bottom drive, with or without integral step-up gearboxes, and are available in aluminium alloy or cast iron. The X-420 series is suitable for 3-in bore pipelines handling 100–270 c.f.m., while the L-800 is suitable for 4-in pipelines handling 180–470 c.f.m Both types can operate continuously against back pressures of up to 15 p.s.i. with overall flows of up to 500 c f.m. for the X-420 and 900 c.f.m. for the L-800. Details are given in separate leaflets of standard equipment designed for use with the blowers.

* * *

**OSCILLATING CONVEYORS.** Link-Belt Co., Prudential Plaza, Chicago, Ill., 60601 U.S.A.

Book 2944 is a new 32-page publication giving details of eight types of oscillating conveyors manufactured in three basic designs—"Flexmount", "Coilmount" and "Torqmount". The book also introduces the new energy-booster starter, which reduces the size of motor to the running load requirements in very heavy-duty applications requiring extremely high horsepowers. When the motor, which may be just large enough to overcome friction during natural frequency oscillation, reaches stalling point, the energy-booster starter automatically reverses motor polarity and releases inertial forces in the opposite direction, thus bringing the conveyor up to its operating stroke speed and its natural frequency.

* * *

**BROOKS INSTRUMENTS.** Brooks Instrument N.V., Groeneveldselaan 6, Veenendaal, Holland.

Bulletin SP-110 describes the various types of Brooks flow measuring instruments as well as gas flow calibrators and dynamic weight/time calibrators.

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**DBL DOUBLE-SUCTION CENTRIFUGAL PUMPS.** Warren Pumps Inc., Warren, Mass., U.S.A.

A revised bulletin, No. 242-2011, describes the Warren 3600 r.p.m. DBL double-suction centrifugal pump which is available in four sizes up to 500 g.p.m. and total heads up to 260 ft.

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**SP90 ATOMIC ABSORPTION SPECTROPHOTOMETER.** Unicam Instruments Ltd., York Street, Cambridge.

A brochure has been published giving details of this flame spectrophotometer, which uses pre-focused hollow cathode lamps and has a range of analytical applications where K, Na, Zn, Pb, Mg, Ca, Fe, Co, Mn etc. are to be determined.

* * *

**Sugar silo at Bardney.**—John Laing Construction Ltd., who have already built two 8000-ton silos at this British Sugar Corporation factory, have started construction of a third silo, this time of 10,000 tons capacity. Due for completion in August, it will be 131 ft high and have an i.d. of 66 ft. The pre-stressed, post-tensioned concrete walls, 9 inches thick, will be raised by using sliding framework and a new type of hydraulic jack which has been found to require less maintenance than previous designs. Up to 40 of these jacks will enable an average rate of climb of 14 ft/day to be attained. The silo's sugar floor will be 3 ft thick and will be supported by 2-ft diameter columns rising from a 1-ft thick reinforced concrete raft foundation, supported by 60-ft long bored piles, of which 20 will have diameters of 42 inches and 28 will have diameters of 30 inches. The piles are to be installed by McKinney Foundations Ltd. The silo will be connected to the existing silos by a steel-framed gantry on top of the silo roof, of similar construction.

# United Kingdom Sugar Imports and Exports[1]

| IMPORTS | (long tons) | | |
|---|---|---|---|
| | 1965 | 1964 | 1963 |
| REFINED AND WHITE SUGAR | | | |
| Argentina | — | 981 | — |
| Belgium | 46 | 40 | 2,556 |
| Brazil | 246 | — | — |
| British Guiana | — | 2,143 | 1,915 |
| Canada | 2 | 1,602 | 3,406 |
| Cuba | 2 | 497 | 14,122 |
| Czechoslovakia | 24,269 | 8,647 | 32,868 |
| Denmark | 1 | 11,977 | 6,742 |
| France | 5,148 | 3,098 | 8,640 |
| Germany, East | 1,895 | 3,525 | 21,407 |
| Germany, West | 1 | 3,237 | 3,603 |
| Ireland | 8,339 | 16,587 | 17,086 |
| Netherlands | — | 900 | 2,352 |
| Norway | — | — | 593 |
| Poland | 1,408 | 571 | 4,611 |
| Sweden | — | — | 989 |
| Uganda | — | 499 | 1,000 |
| U.S.S.R. | 1,624 | — | 17,450 |
| West Indies* | 1,798 | 2,057 | 1,938 |
| Other Countries | 32 | 40 | 378 |
| | 44,811 | 56,401 | 141,656 |
| RAWS—CANE AND BEET | | | |
| Australia | 403,002 | 458,760 | 416,194 |
| British Guiana | 119,689 | 96,196 | 137,476 |
| British Honduras | 23,958 | 19,823 | 20,614 |
| Fiji | 168,207 | 143,500 | 145,047 |
| India | 74,120 | 10,270 | 29,468 |
| Mauritius | 406,405 | 421,890 | 446,345 |
| Rhodesia | 34,439 | 20,540 | 14,964 |
| Swaziland | 86,290 | 37,725 | † |
| West Indies* | 563,107 | 525,190 | 620,823 |
| Argentina | — | 15,601 | — |
| Belgium | — | 5,911 | — |
| Brazil | 52,558 | 20,493 | 15,314 |
| Cuba | 90,038 | 90,151 | 180,323 |
| Czechoslovakia | 183 | — | 4,312 |
| Dominican Republic | 10,328 | 52,411 | 19,776 |
| Ecuador | — | 5,430 | — |
| France | 24,246 | 3,494 | — |
| Germany, East | — | — | 1,058 |
| Germany, West | — | 727 | 33,188‡ |
| Guatemala | — | 9,429 | 1,545 |
| Indonesia | — | 40,211 | 10,300 |
| Mexico | — | 20,295 | — |
| Netherlands | — | — | 2,020 |
| Peru | — | 57,572 | 18,912 |
| Poland | 16,196 | 37,602 | 34,864 |
| Puerto Rico | — | — | 1,311 |
| South Africa | 19,938 | 95,373 | 186,556 |
| Surinam | — | — | 980 |
| Taiwan | — | 10,354 | — |
| Turkey | — | 10,192 | — |
| U.S.S.R. | — | — | 26,941 |
| Other Countries | 2 | 2 | 251 |
| | 2,092,706 | 2,209,142 | 2,368,582 |

| EXPORTS | (long tons) | | |
|---|---|---|---|
| | 1965 | 1964 | 1963 |
| Bulgaria | 9,340 | — | — |
| Burma | 149 | 228 | 70 |
| Cameroons | 358 | 211 | 120 |
| Chile | 5,861 | 1,457 | 1,526 |
| France | 96 | 93 | 384 |
| French Pacific | 3,443 | 2 | 703 |
| Germany, West | 1,491 | 1,240 | 61,323 |
| Greece | 5,119 | 32,218 | 6,617 |
| Iceland | 1,428 | 465 | 418 |
| Iran | 975 | 9,475 | 98 |

| EXPORTS—*continued* | (long tons) | | |
|---|---|---|---|
| | 1965 | 1964 | 1963 |
| Iraq | — | 4,946 | 9,841 |
| Ireland | 6,178 | 2,695 | 452 |
| Israel | 276 | 182 | 77 |
| Italy | 30 | 10,268 | 13,392 |
| Japan | 3 | 375 | 725 |
| Korea, South | 492 | 505 | — |
| Kuwait | 24,104 | 5,913 | 234 |
| Lebanon | 2,417 | 2,509 | 4,865 |
| Liberia | 906 | 1,217 | 611 |
| Libya | 784 | 420 | 2,033 |
| Muscat & Oman | 42 | 576 | 22 |
| Netherlands | 10,958 | 139,151 | 36,410 |
| Norway | 53,844 | 31,148 | 69,288 |
| Rwanda & Burundi | 156 | 100 | — |
| Saudi Arabia | 4,894 | 44,367 | 20,764 |
| Spain | 4 | 6,812 | 11,050 |
| Spanish W. Africa | 217 | 59 | 123 |
| Sudan | — | — | 19,758 |
| Sweden | 1,965 | 18,341 | 8,830 |
| Switzerland | 42,005 | 34,818 | 52,499 |
| Togo | 284 | 25 | — |
| Tunisia | 20,564 | 2,952 | 3,138 |
| U.A.R. | 152 | 103 | 17 |
| U.S.A. | 4,326 | 189 | 4 |
| Other Countries | 250 | 704 | 253 |
| TOTAL FOREIGN | 203,111 | 353,764 | 325,645 |
| Aden | 966 | 1,828 | 109 |
| Bahamas/Turks & Caicos Is. | 981 | 665 | 565 |
| Bahrain & Trucial States | 15,840 | 8,316 | 335 |
| Bermuda | 539 | 506 | 403 |
| British Guiana | 104 | 310 | 46 |
| British Honduras | 580 | 418 | 431 |
| Canada | 538 | 59 | 15 |
| Ceylon | 1,944 | 1,223 | 971 |
| Cyprus | 10,359 | 7,434 | 4,541 |
| Gambia | 458 | 220 | 376 |
| Ghana | 556 | 8,178 | 5,302 |
| Gibraltar | 1,443 | 833 | 1,098 |
| Isles in Indian Seas | 543 | 92 | 208 |
| Kenya | 2,123 | 263 | 7,890 |
| Malaysia/Singapore | 18,831 | 18,183 | 17,967 |
| Malta | 1,002 | 1,327 | 1,301 |
| Nigeria | 25,016 | 23,520 | 20,885 |
| Pakistan | 62 | 40 | 16 |
| Sierra Leone | 10,228 | 9,393 | 7,205 |
| Tanzania | 82 | 1 | 6,002 |
| West Indies* | 1,972 | 408 | 396 |
| Zambia | 45 | — | — |
| Other Countries | 213 | 151 | 255 |
| TOTAL COMMONWEALTH | 94,425 | 83,368 | 76,317 |
| GRAND TOTAL | 297,536 | 437,132 | 401,962 |

**Paraguay sugar production, 1965.**—Sugar production in Paraguay in 1965 reached 35,040 metric tons, as against 48,267 tons in 1964[2]. This production will, however, be sufficient to cover domestic requirements which are estimated at 35,000 tons.

[1] C. Czarnikow Ltd., *Sugar Review*, 1966, (750), 37.
[2] *Agence France-Presse*, 22nd January 1966.
* Comprising Barbados, Jamaica, Leeward Islands, Trinidad and Tobago and Windward Islands.
† Import figure for 1963 is included in that of South Africa.
‡ Including sugar originating in Cuba and the Dominican Republic and entering the U.K for in-transit refining.

# BREVITIES

**New York Sugar Trade Laboratory Inc. 1965 Report.**—Incoming samples of raw sugar totalled 16,692 during the year, nearly as many as the past 10-year average of 17,061. Thirty-five sugar producing areas supplied the 1965 samples, the major sources being the Philippine Islands, Puerto Rico, Florida, Dominican Republic, Mexico, Peru, Brazil and Australia. Receipts in samples of molasses continued to be high; 1351 samples were analysed during the year, the 10-year average being 1258. A very limited amount of research was carried out; two articles appeared in the *International Sugar Journal* and one paper was presented before the Division of Carbohydrate Chemistry of the American Chemical Society. The Cane Molasses Research Project was started on 16th August 1965 with the arrival of Dr. S. K. D. AGARWAL of the National Sugar Institute, Kanpur, India. The principal efforts of the project have been the preparation of model browning polymers and the attempted preparation of a crystalline glycosidic glycine to use in a study of the mode of formation of these polymers.

* * *

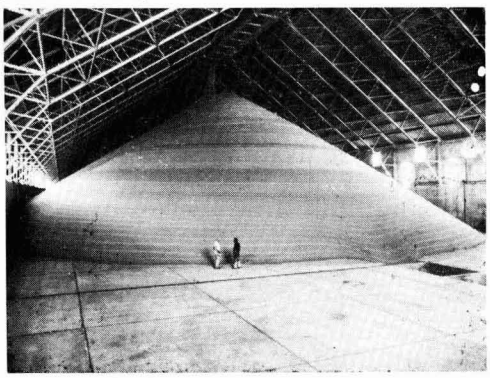
**U.S. sugar import authorization.**—On the 10th February the U.S. Dept. of Agriculture announced an increase of 50,000 tons in the first quarter limitation on sugar imports for 1966. On the 14th February the Department increased the limitation by an additional 50,000 tons, making a total of 800,000 short tons, raw value, which might be imported during January—March 1966[1]. These measures were intended to check price increases of refined sugar; however, at the end of February, the Department removed all restrictions in imports of raw sugar during the quarter. Imports would be authorized as applications from overseas suppliers became eligible for consideration under the sugar import regulations[2].

## Stock Exchange Quotations

| London Stocks (*at 17th March*, 1966) | CLOSING MIDDLE s d |
|---|---|
| Anglo-Ceylon (5s) | 5/– |
| Antigua Sugar Factory (£1) | 10/– |
| Booker Bros. (10s) | 21/1½ |
| British Sugar Corp. Ltd. (£1) | 24/9 |
| Caroni Ord. (2s) | 1/11¼ |
| Caroni 6% Cum. Pref. (£1) | 16/– |
| Demerara Co. (Holdings) Ltd. | 3/– |
| Distillers Co. Ltd. (10s units) | 20/6 |
| Gledhow Chaka's Kraal (R1) | 17/– |
| Hulett & Sons (R1) | 17/9 |
| Jamaica Sugar Estates Ltd. (5s units) | 3/3 |
| Leach's Argentine (10s units) | 10/9 |
| Manbré & Garton Ltd. (10s) | 32/9 |
| Reynolds Bros. (R1) | 20/– |
| St. Kitts (London) Ltd. (£1) | 15/6 |
| Sena Sugar Estates Ltd. (5s) | 9/1½ |
| Tate & Lyle Ltd. (£1) | 30/6 |
| Trinidad Sugar (5s stock units) | 2/6 |
| West Indies Sugar Co. Ltd. (£1) | 9/6 |

| New York Stocks (*at 16th March*, 1966) | CLOSING MIDDLE $ |
|---|---|
| American Crystal ($5) | 19⅛ |
| Amer. Sugar Ref. Co. ($12.50) | 31¾ |
| Central Aguirre ($5) | 33 |
| Great Western Sugar Co. | 37⅝ |
| North American Sugar ($10) | 14¼ |
| South P.R. Sugar Co. | 28½ |
| United Fruit Co. | 28 |

**Queensland sugar terminal expansion.**—Storage space at Australia's largest bulk sugar terminal at Mackay in Queensland is being increased. A third $A2,500,000 sugar shed which will house 140,000 tons of sugar is being built at the terminal. This will mean that three sheds will have a total storage capacity of 420,000 tons. The height of the new Mackay shed will be 87 feet and width 150 feet. It will have an area of 3½ acres. The three bulk sheds will be worth $A9,400,000. The construction of Australia's first bulk sugar terminal at Mackay Harbour in 1957 revolutionized raw sugar distribution. Considerable advances have been made since at the terminal in the speed of sugar handling. Originally the equipment was designed to load into bulk ships 650 tons an hour. The highest rate achieved to date is 900 tons an hour. The flow of sugar into the ship's hold, speeding up the transfer of sugar from one conveyor belt to another and speeding up of conveyor belts through the use of stronger motors have all helped the rate of raw sugar handling. The shipment of cargoes of up to 20,000 tons is possible at Mackay.



Queensland's raw sugar used to be handled in bags. When raw sugar was bagged, a 10,000 ton ship took three weeks to load—now it takes less than a day. Large quantities of raw sugar can be stored ready for immediate shipment. This year Queensland's six bulk raw sugar installations will have capacity to store about 1,500,000 tons of raw sugar. The photograph shows a 70 ft high mound of raw sugar in one of the existing sheds at the Mackay terminal. The different shadings are caused by variations in the colour from different mills. Men working at the terminal can tell by the colour which mill the product came from. The sugar is fed into the store from a belt conveyor in the roof and taken by hoppers in the floor to an outgoing conveyor system.

* * *

**Sugar Industry Technologists, Inc. 1966 Meeting.**—The 1966 Meeting of S.I.T. will be held at the New York Hilton Hotel, New York City, on 1st–3rd May 1966. This will be the Silver Anniversary of Sugar Industry Technologists. Sunday, 1st May will be devoted to meetings of the Board of Directors and the several Committees. Technical sessions will begin at 9 a.m. on the 2nd May, and papers will be presented by members and friends from Australia, England, Canada, India, and the United States. One of the highlights will be a full afternoon Seminar in Instrumentation to be presented by qualified experts in this field. E. D. GILLETTE, Vice President of Refined Syrups and Sugars Inc., will be Chairman for this part of the programme. On the same evening the Annual Reception and Banquet will be held. Honorary Awards for achievement in sugar technology will be presented, and the authors of the best technical paper given in 1965 will receive handsome "Meade Award" plaques. Further information on the meeting can be obtained from CURTIS L. TAGGART, Executive Secretary, Sugar Industry Technologists Inc., P.O. Box 47, Medford, Mass., 02155 U.S.A.

[1] *Lamborn*, 1966, **44**, 25.
[2] *Public Ledger*, 26th February 1966.