THE International Sugar Journal

JULY 1975

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P2

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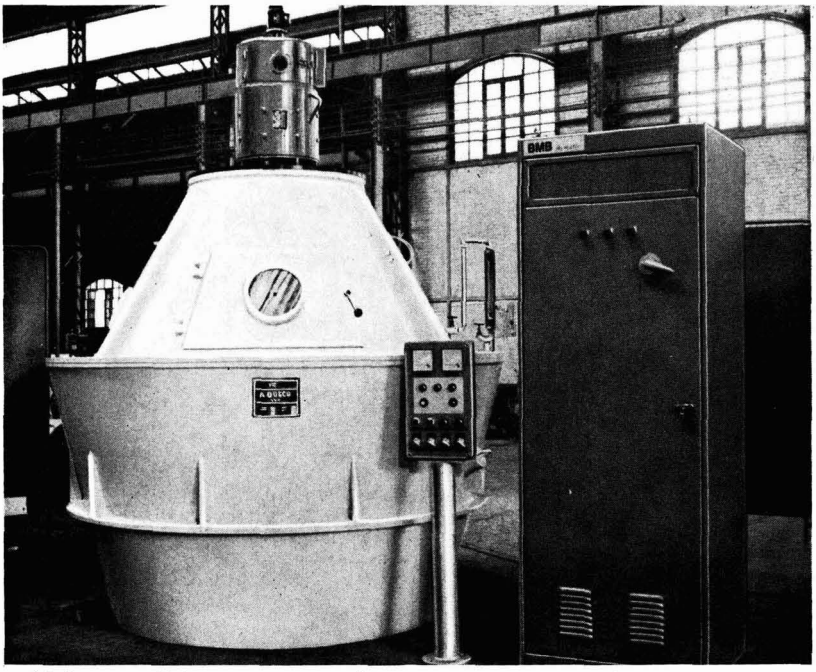

...this machine guarantees:

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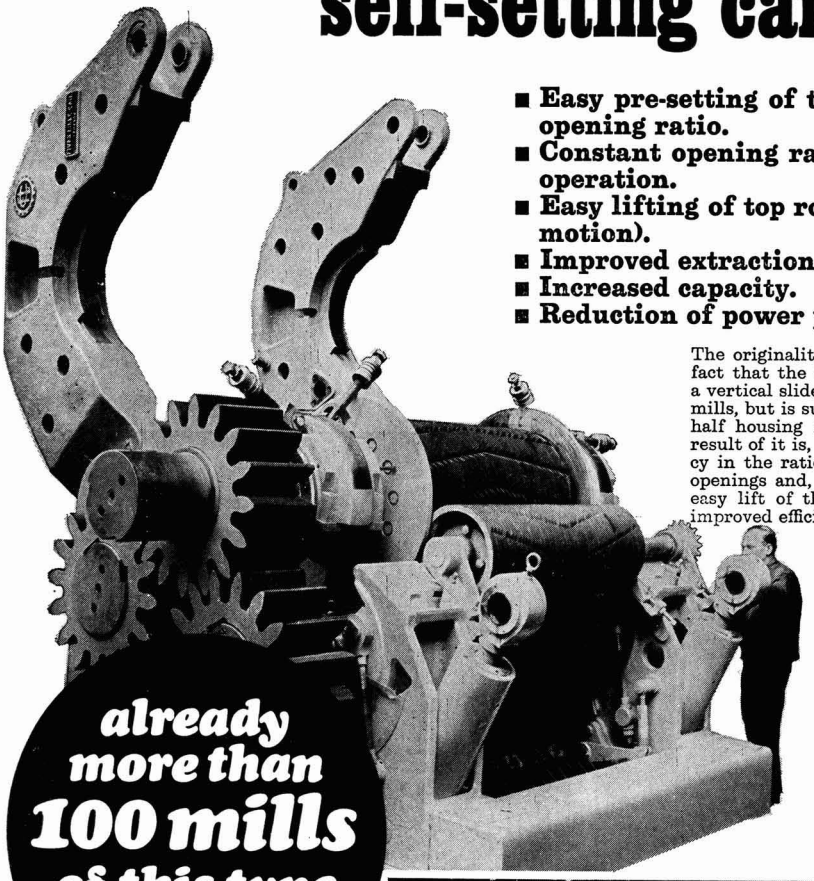

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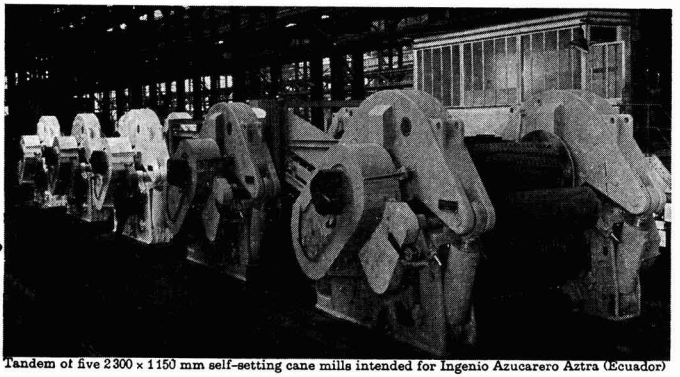

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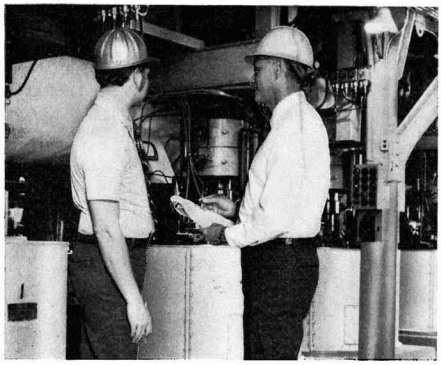
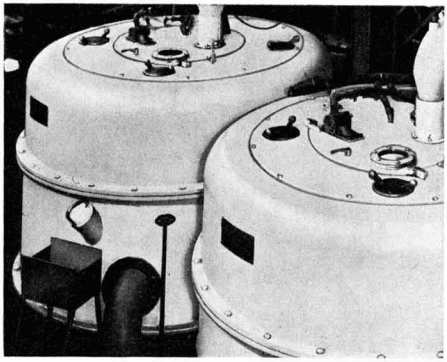
think R.O.I.

(return on investment)



George Conrad, Western States Sugar Technologist, says, "Maximum productivity results when you operate your centrifugal at top efficiency." George regularly visits Western States installations world-wide to develop centrifugal operating know-how and to communicate this to our customers.



Maximum productivity, minimum downtime and long life are three main ingredients contributing to high R.O.I. . . . you get all three with Western States. That's because they are built to take the "hard knocks" inherent in making sugar.

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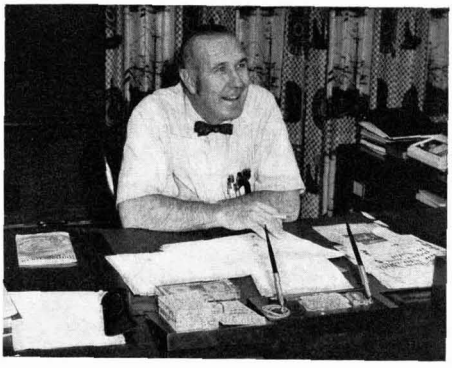

Robert Jones, President, says, "we need capital equipment to manufacture our centrifugals. When we specify machine tools, we think R.O.I. . . . it pays off handsomely for us and that's why we insist that it be built into every Western States centrifugal."

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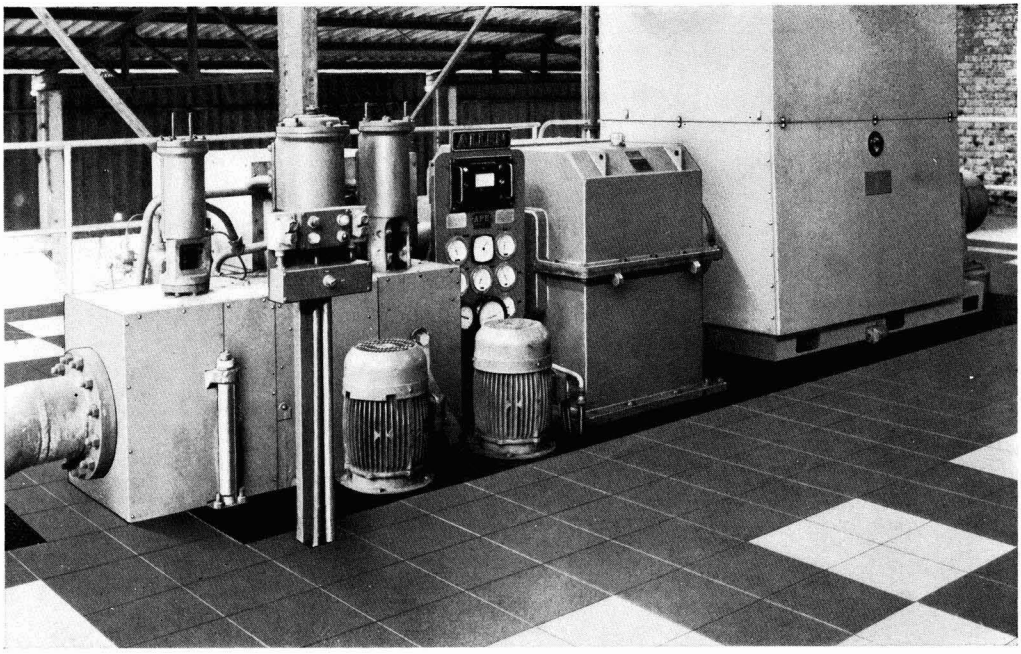
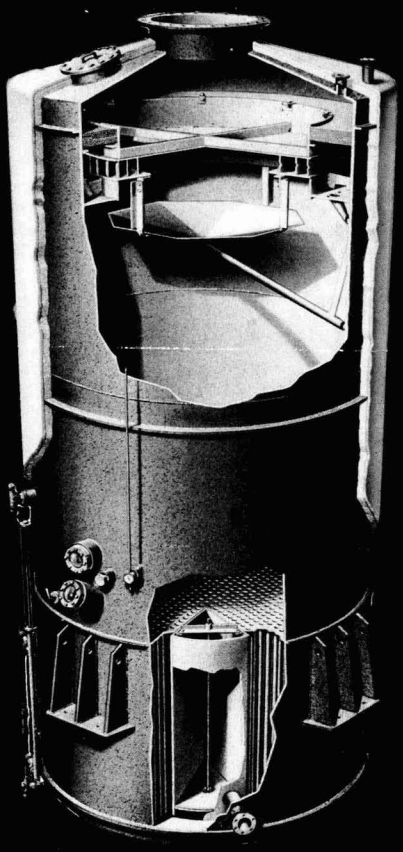


When you think of sugar machinery...



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July 1975

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SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Effets thermiques sur le sucre cristallisé. F. K. MAK, F. H. C. KELLY et K. GUNASEELAN. *p.* 195–197

On décrit des études au cours desquelles a été déterminé l'effet de la température sur la qualité de conservation du sucre blanc dans un environnement de température uniformément élevée (comme à Singapour). Des quantités de sucre cristallisé et pulvérisé sont conservés en bouteilles de verre et conservés à l'étuve à 50°C et 70°C durant deux mois. On retire des échantillons à certains intervalles et on mesure l'absorption à 420 nm. Les mesures de coloration et les études des surfaces des cristaux au microscope électronique sont discutées, tout comme l'effet du rayonnement ultraviolet sur la coloration (qu'on trouve être négligeable à temperature ambiante). Les auteurs suggèrent que la coloration est due à la fois à la réaction de Maillard et à la dégradation thermique.

* * *

Aspects technologiques et financiers de l'extension de la production mondiale de sucre. G. S. BISHOP. *p.* 198–201

La situation sucrière dans le monde et les prévisions d'accroissement de la production de sucre sont discutées, tandis qu'on examine les problèmes liés à l'établissement de nouvelles sucreries et plantations de canne. Les aspects techniques et financiers de ces problèmes sont considérés de façon assez détaillée.

* * *

Une appréciation des méthodes d'estimation de la maturité. R. JULIEN. *p.* 201–205

Comme méthodes d'estimation de la maturité de la canne on envisage la détermination du Brix de la canne sur champ et au laboratoire, le quotient glucosique, la teneur en eau des internoeuds de la canne et de la tige de la feuille ainsi que les rapports des Brix. On obtient la plus grande corrélation entre la polarisation % canne et les mesures du Brix au laboratoire tout au long de la saison. Les résultats révèlent clairement que le Brix au laboratoire est l'indication la plus fiable de la teneur en sucre de la canne, tandis que la mesure du Brix sur champ est une méthode fiable en début de- et à mi-saison.

* * *

Sugar Industry Technologists Inc. 34e assemblée annuelle 1975. *p.* 205

On présente le rapport de la 34e assemblée annuelle de la SIT qui a eu lieu du 5 au 7 mai à Savannah, Géorgie, U.S.A.

Der Einfluss der Temperatur auf Kristallzucker. F. K. MAK, F. H. C. KELLY und K. GUNASEELAN. *S.* 195–197

Die Verfasser berichten über Versuche, bei denen der Einfluss der Temperatur auf die Lagerfähigkeit von Weisszucker in einer Umgebung gleichmässig hoher Temperatur—wie in Singapore—studiert wurde. Mengen von Kristallzucker und feingemahlenem Zucker wurden in Glasflaschen bis zu zwei Monaten in Trockenschränken bei 50 und 70°C aufbewahrt. In Abständen wurden davon Proben entnommen, deren Extinktion dann bei 420 nm gemessen wurde. Die Farbmessungen und Untersuchungen der Kristallflächen mit Hilfe eines Elektronenmikroskops werden diskutiert, so z.B. der Einfluss von UV-Strahlen auf die Farbe (der bei Zimmertemperatur als vernachlässigbar klein ermittelt wurde). Die Verfasser nehmen an, dass die Farbe sowohl durch die Maillard-Reaktion als auch durch thermische Zersetzung hervorgerufen wird.

* * *

Technologische und finanzielle Aspekte der Entwicklung der Weltzuckererzeugung. G. S. BISHOP. *S.* 198–201

Der Verfasser diskutiert die Lage auf dem Weltzuckermarkt und die Aussichten für eine Steigerung der Zuckererzeugung und untersucht die Probleme, die sich bei der Errichtung neuer Rohrzuckerfabriken und der Schaffung neuer Anbaugebiete ergeben. Sowohl die technischen als auch die finanziellen Aspekte dieser Probleme werden eingehender behandelt.

* * *

Beurteilung der für Reifeuntersuchungen benutzten Methoden. R. JULIEN. *S.* 201–205

Die Bestimmung des Trockensubstanzgehaltes des Zuckerrohrs auf dem Felde und im Laboratorium, des Glucoseanteils, des Feuchtigkeitsgehaltes der Zuckerrohrinternodien und des Blattansatzes sowie des Verhältnisses der Trockensubstanzwerte wurden hinsichtlich ihrer Eignung als Methoden zur Untersuchung des Reifezustandes beurteilt. Die beste Korrelation ergab sich zwischen dem polarimetrisch bestimmten Zuckergehalt des Rohrs und den im Laboratorium während der Vegetationsperiode gefundenen Trockensubstanzwerten. Die Ergebnisse zeigten deutlich, dass der im Laboratorium bestimmte Trockensubstanzgehalt die verlässlichste Unterlage für den Saccharosegehalt des Zuckerrohrs darstellte, während die Trockensubstanzbestimmung auf dem Felde als zuverlässige Methode in den ersten und den mittleren Abschnitten der Vegetationsperiode bezeichnet werden konnte.

* * *

34. Jahresversammlung 1975 der Sugar Industry Technologists Inc. *S.* 205

Es wird über die 34. Jahresversammlung der Sugar Industry Technologists Inc. berichtet, die vom 5. bis zum 7. Mai 1975 in Savannah/Georgia (USA) abgehalten wurde.

Efectos térmicos sobre azúcar cristalino. F. K. MAK, F. H. C. KELLY y K. GUNASEELAN. *Pág.* 195–197

Se describen estudio del efecto de temperatura sobre la calidad para almacenaje de azúcar blanco en un ambiente de temperatura uniformamente alta (como en Singapur). Cantidates de azúcar cristalino y pulverizado se almacenaban en frascos de vidrio y se mantenaban en hornos a 50° y 70°C durante períodos de hasta dos meses. En intervales los autores tomaron muestras y medieron sus absorbancias a 420 nm. Se discuten las medidas de color y estudios por microscopio electrónico de los superficies de los cristales, tanto como el efecto de irradiación ultra-violeta sobre color (demostrado como insignificante a la temperatura del ambiente normal). Los autores sugieron que formación de color resulta de la reacción Maillard y de degradación térmica también.

* * *

Aspectos tecnológicos y financieros del desarrollo de producción mundial de azúcar. G. S. BISHOP. *Pág.* 198–201

La situatión mundial en respecto al azúcar y perspectivas para crecimiento de producción se discuten y las problemas que surgen en la establecemiento de nuevas industrias azucareras y plantaciones de caña se examinan. Se menudean los aspectos tecnológicas y financieros de estas problemas.

* * *

Un evaluación de métodos para estimación de madurez. R. JULIEN. *Pág.* 201–205

Determinatión del Brix de caña en el campo y en el laboratorio, del cociente de la glucosa, el contenido de agua en los entrenudos y yemas y los cocientes de Brix se evaluaron como métodos para estimar la madurez de caña. La más alta correlación se obtuvo entre pol % caña y valores del Brix determinado en el laboratorio durante la zafra. Las resultas demostraron que el Brix determinado en el laboratorio fue la indicación la más segura del contenido de sacarosa en la caña, pero que el Brix determinado en el campo fue un indicador seguro para la parte temprana y en media-zafra.

* * *

Sugar Industry Technologists Inc., 34a Sesión Anual, 1975. *Pág.* 205

Se presenta una memoria del 34a Sesión Anual de SIT que se celebraba el 5–7 de mayo en Savannah, Georgia, E.U.A.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXVII JULY 1975 No. 919

Notes & Comments

International Sugar Organization

During early May various working parties of the ISO were meeting to study problems connected with prices and stocks and to help provide a basis for submission to a future international conference to establish a new International Sugar Agreement. The Council of the Organization met in London on the 15th May to consider the work of the groups and it was announced afterwards that it had been agreed in principle to extend the present Agreement for one year beyond its current end-1975 expiry date. The method of implementing the decision has been left to the Executive Committee.

* * *

Europe beet crop

The cold rainy weather of the spring hindered sowing of the 1975 beet crop and by mid-April, for instance, only a quarter of the UK crop had been sown as against the usual three-quarters. Warm dry weather came to Europe at the end of the month and by mid-May almost all the crop was sown in most countries. Fears have been expressed that the late sowings will mean a reduced beet sugar production through inadequate time for development of the plants.

F. O. Licht K.G. recently made a survey[1] to discover the relationship between planting date and sugar yields per hectare, using the well-documented figures of France. A table is presented below showing the information for the past ten years.

	% *of total area sown by*		*Sugar yield, metric tons/ hectare*
	31st March	*15th April*	
1975	1·52	3·87	
1974	12·13	92·65	5·97
1973	82·84	95·91 (18th)	6·78
1972	75·03	84·66	7·35
1971	38·10	91·00	8·37
1970	3·17	9·01	7·45
1969	19·49	74·84	7·66
1968	38·70	87·70	6·77
1967	47·70	80·60	6·35
1966	11·30	57·90	7·16
1965	6·13	72·00	6·74

Although the figures for sowings in 1975 are smaller than the other years, it is evident that, in spite of late sowings in 1966 and especially 1970, yields were good. Again, while the extent of sowing by mid-April was quite high in 1967 and 1968 the yields were not as high as in years such as 1966, 1969 or 1970 when sowing was delayed. Of course there were additional factors which applied in 1974 to give a very low yield in spite of early sowing.

On balance, nevertheless, it seems preferable to sow as early as possible but also that the late sowing this year does not necessarily presage a low crop for next campaign.

* * *

World raw sugar price

Erosion of world sugar prices continued during the past two months, the London Daily Price reaching £156 in early June but recovering to £162 at the time of writing. The fall has not been due to any major cause but demand has been poor and several producers have had sugar to offer. Freight rates have also fallen during the period. With lower prices, the consumer resistance which has been so noticeable over the past six months may be expected to diminish, but this has not yet become apparent. With the summer, increased usage for soft drinks may increase refined sugar offtake in Europe and North America, and statistical information will be watched closely to discern signs of a recovery.

Looking to the future, E. D. & F. Man write[2]: "However, there is envisaged a period ahead in which there is likely to be a small surplus of supply over demand and, on the theory that the price at which beet sugar can be produced should be the par price for sugar, we should not expect the values to fall much more. Probably the American Government will take some action to protect their domestic sugar production if the world price falls below those production costs. The expectation of this might cause Americans to consider buying sugar at these levels because they might think the opportunity to bring it in more cheaply will not exist. This could be a steadying point for the market. It could also possibly bring some world buying for re-stocking purposes."

* * *

Western Hemisphere sugar talks[3]

Twenty-one Western Hemisphere sugar-producing countries met in Puerto Plata (Dominican Republic) on 25th-28th April to discuss joint action to hold up market prices. No formal agenda was published for the 4-day conference, but sources said that its main task was to analyse the market and decide whether to bolster it now that the movement which drove up prices last year had lost momentum. Divisions among major producers were apparent as expected before the talks; Cuba and Mexico would like to see a sugar stockpile created to be used to support

[1] *International Sugar Rpt.*, 1975, **107**, (14), 1–3.
[2] *The Sugar Situation*, 30th May 1975.
[3] *Public Ledger*, 26th April 1975.

market prices, but Brazil and the Dominican Republic have expressed little enthusiasm for intervention. Some producers, like Brazil, argue that the world shortage which caused last year's price rises will continue for several years to come; but the Mexicans and others point to the short-lived booms in other commodities such as copper, and fear prices could move lower without intervention. The countries represented at the conference, apart from the four already mentioned, were Argentina, Barbados, Bolivia, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, and Venezuela.

* * *

UK refined sugar price

In a written reply to a question in Parliament on the 13th May, the UK Minister of Agriculture, Fisheries and Food said: "Since last November, the three United Kingdom sugar refining companies (Tate & Lyle Ltd., Manbré Sugars Ltd. and the British Sugar Corporation Ltd.) have voluntarily operated a price equalization scheme in such a way that the price of raw sugar imported from the Commonwealth, which forms the greater part of our total supplies, is offset by the lower prices of our own beet sugar and of sugar imported from the world market under the EEC subsidy arrangements. Commonwealth sugar is now being supplied under the agreement between the ACP countries and the Community, which forms part of the Lomé Convention. The Community has guaranteed a basic price for this sugar. But, as I told the House in a statement on 21st November, the EEC Council of Ministers accepted that a higher price could be given to the buyers. I announced on 3rd February that the Government had accordingly guaranteed a price of £260 per ton for ACP sugar shipped to the United Kingdom in 1975, and this has been taken into account in setting the level of the equalized price.

"Sugar from other sources is available to the United Kingdom market at prices below the present equalized price for forward delivery, particularly from October onwards when supplies from this year's beet crops will become available. Recognizing that many buyers need to contract for their supplies well in advance and that the United Kingdom refiners must be in a position to sell their sugar competitively with other supplies to the United Kingdom market, the Government has decided to introduce a system of forward quotations of the equalized price which will initially relate to deliveries of United Kingdom refined sugar in October, November and December. Consideration is also being given to the most effective means of maintaining the competitiveness of this sugar in the period up to October".

On the 22nd May it was announced that, as from the following day, the system of forward quotations would, so far as industrial sugars are concerned, be extended to deliveries in July, August and September. The forward prices for refined sugar in bulk or in 1 cwt/50 kg bags would be £240 per long ton for July–September while for October onwards they will be £199 per long ton for such sugar, rising to £214 per ton for sales in parcels of 14 × 2 lb. The price up to July was £281.80 per ton.

High-fructose corn syrup in the US

It is estimated that high-fructose corn syrup, a liquid mixture similar to invert sugar and with a sweetening power similar to sucrose syrup, could replace 20% of the US industrial sugar market by 1977, equivalent to about 1·75 million short tons. This estimate[1] is based on industry projections of production levels by three firms—Standard Brands Inc., A. E. Staley Mfg. Co. and Amstar Corporation—who are selling on an allocation basis and are all expanding capacity.

Mr. JOHN MOUNT, Vice-President of Purchasing for Coca-Cola USA, said that usage of high-fructose corn syrup by the soft drink industry is limited only by its availability and he expects almost 1 million tons to be on stream by mid-to-late 1977. High fructose corn syrup is produced by isomerization of part of the glucose in corn syrup and was first introduced in mid-1973. It began to take over part of the US sugar market—mainly general line canners, soft drink producers and the baking and confectionery industries—when sugar prices soared in 1974.

Production for 1975 is estimated at between 700,000 and 900,000 tons dry equivalent to sucrose (all HFC figures will be on this basis) and, after first phase expansion and new entries, capacity should exceed 1·75 million tons in mid-1977.

* * *

Booker McConnell Ltd. 1974 report

Bookers Sugar Estates made 291,000 tons of sugar in 1974 compared with 219,000 in 1973. The yield of sugar per acre was better at 2·7 tons than in 1973 but was still below average because of residual damage caused by the heavy rains of 1973. However, harvesting and growing conditions in 1974 were good and should result in a further improvement in yield in 1975. Some 2300 acres of new land were planted to cane during 1974 for harvesting in 1975.

The Nigerian Sugar Co. Ltd. made a profit of £3·5 million up to October 1974, compared with £1·4 million in 1972/73, largely because of the expansion in production from 27,000 to 35,000 tons. A further increase in production to 50,000 tons is planned by 1980.

Mumias Sugar Co. Ltd. in Kenya made a net profit of £875,000 in 1974, its first full year of operation; production is being expanded, a target of 75,000 tons of sugar being set for the 1977 crop. Chemelil Sugar Co. has improved its performance markedly.

Bookers Agricultural and Technical Services Ltd. is a flourishing business, offering services ranging from feasibility studies and surveys to full management responsibility, including the trraining and development of local staff. While the focus is on the cane sugar industry (the company is undertaking preliminary work for the development of another major sugar project near Mumias in Kenya), it is also involved in beet sugar projects, often in collaboration with the British Sugar Corporation.

Fletcher and Stewart Ltd. started the year with a record order book for major deliveries, including complete sugar factories, to a number of countries; SPP Group also did very well, supplying irrigation equipment and pumps for a number of applications.

[1] *Reuter's Sugar Rpt.*, 16th April 1975.

Thermal effects on crystal sugar

By F. K. MAK*, F. H. C. KELLY* and K. GUNASEELAN

(Chemistry Department, Singapore University)

Introduction

THIS paper reports on a study of the thermal effect on the keeping quality of sugar in an environment of uniformly high temperature as obtained in Singapore.

It has always been standard practice in many industries to use the visual appearance of white sugar as one of the ways to assess its acceptability. Our study therefore focuses attention on the change of colour of white refined and raw sugar, colour being an extremely important factor in determining the quality of sugars. Under normal storage conditions, the visual appearance of white sugars alters with time; the yellowness increases as is confirmed by light absorption measurements of solutions of the sugar.

The measurement of colour of dry white sugar as well as solutions of white sugar are significant for quality evaluation and control purposes. Solution colours are of particular importance where the white sugar is dissolved prior to use in industrial food processes whilst the white appearance of granulated sugar is of significance where it is used or compared in the dry form. Solution colour measurements are generally more precise because the colour is accentuated in solution, and transmittance measurements are more readily made than reflectance measurements.

It is well known that raw sugar colour increases linearly with storage time[1,2] as a result of colour development from the Maillard reaction or thermal degradation products.

In the Maillard reaction the reducing sugars (e.g. dextrose and levulose) react with the amino-acid present to form melanoidins which are dark colour substances, whilst during thermal degradation the sugar generates caramelized products which are also highly coloured.

Many workers, including ZERBAN[3], MEADE[4], FOWLER & KOPFLER[5], believed that the path of colour development in raw sugar was the Maillard reaction between the reducing sugars and amino-acids which are present in raw crystals as a surface film. However, RAMAIAH & NEMADE[6] attributed the colour in plantation white sugar to caramelization of the hexoses catalysed by ash components, chiefly carbonates and bicarbonates concentrated in the crystal. Sulphitation sugars were also found by them to be less susceptible to deterioration than carbonatation sugars. On the other hand TU *et al.*[7] attributed the colour in raw sugar to both caramelization and melanoidin products, whilst FLEMING *et al.*[8] were in agreement, also finding that the products of the thermal degradation of dextrose and levulose closely resembled colour isolated from raw sugar.

We have considered both colour generating reactions to occur simultaneously although their relative contribution to the sugar colour depends largely on the nature and amount of impurities present, as well as the ambient conditions of storage. It has been shown by SAMANIEGO & SOLAIMAN[2] that with heating of raw sugars to 100–150°C or under comparable thermal conditions, colour formation is solely caused by caramelization as this would be the predominant reaction.

So far one other colour-forming reaction has not been considered—that between polyphenols present initially in the juice and iron from factory equipment. Although the polyphenols are present in only very minute quantities, they do not appear to be removed by conventional clarification methods, whilst their properties as colour precursors have been increasingly demonstrated. We believe that this reaction, although not fully elucidated, will prove to be of major concern to both the raw sugar manufacturer and refiner.

HIBBERT *et al.*[9] considered the visual appearance of white sugar to be dependent on the nature of the surface—e.g. whether it is a shiny or matte surface. Also, finer crystals show higher reflectance than coarser sizes to both the eyes and photoelectric devices, whilst colouring matter has more pronounced effect on the reflectance of coarser crystals. The presence of colloidal matter also gives a grey "cast" to the reflectance, but the solution instrument corrects for the presence of colloidal matter, thus accentuating the difference between the two colour values.

VANE[10] studied the effect of using a sucrose solution as a reference as compared with water but found that absorbance measured at 420 nm has a higher value for water than the sucrose solution. In a Tate & Lyle report[11] the absorbance of filtered sucrose solutions at 420 nm and 900 nm was also found to be lower than that of pure water as a reference. This phenomenon, known as negative turbidity, was explained as a refractive index effect at 420 nm and by bands in the spectrum of water in the range 600–1000 nm.

Experimental

Fine granulated white sugar crystals were screened to obtain a sample of 350 microns. Two other pulverized samples of 350 and 150 microns were also prepared by comminuting the granulated crystals in a rolling ball mill, whilst a fourth sample was chosen with random distribution from a raw sugar.

The sugar samples were stored in glass bottles and kept in ovens at 50° and 70°C for up to two months.

Colour measurement of the solid phase by reflectance was achieved by withdrawing portions of the test samples at intervals and determining the adsorbance of the reflected beam at 420 nm using a Beckman DU spectrophotometer, with reference to a magnesium oxide standard white diffusing surface.

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[1] HONIG: "Principles of Sugar Technology". Vol. 1. (Elsevier, Amsterdam). 1953, pp. 214–225.

[2] SAMANIEGO & SOLAIMAN: *Proc. 15th Congr. ISSCT*, 1974, 1412–1425.

[3] ZERBAN: *Tech. Rpt. Sugar Res. Found. Inc.*, 1947, (2).

[4] MEADE: "Cane Sugar Handbook", 9th Edn. (Wiley, London). 1963, pp. 303–304.

[5] FOWLER & KOPFLER: *Proc. 9th Cuban Sugar Tech. Assoc.*, 1935, 210.

[6] RAMAIAH & NEMADE: *Proc. 13th Congr. ISSCT*, 1968, 385–394.

[7] TU, OKAMOTO & ONNA: *Hawaiian Planters' Record*, 1960, **56**, 169–181.

[8] FLEMING, PARKER & WILLIAMS: *Proc. 13th Congr. ISSCT*, 1968, 1781–1800.

Solution colour of white refined sugar was determined using solutions of 60% w/w of sugar in distilled water, whilst for raw sugar solutions of 5% w/w were used.

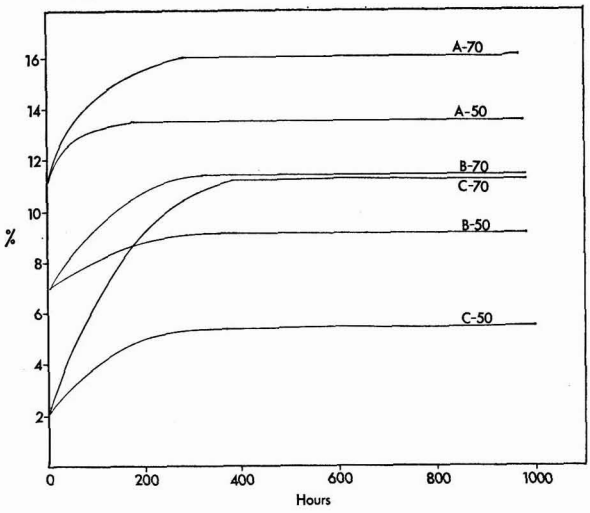

Fig. 1. Solid colour absorbance with storage time
A-50: 350 microns crystal sample, 50°C
A-70: 350 microns crystal sample, 70°C
B-50: 350 microns pulverized sample, 50°C
B-70: 350 microns pulverized sample, 70°C
C-50: 150 microns pulverized sample, 50°C
C-70: 150 microns pulverized sample, 70°C

Absorbance measurements were obtained at 420 nm using a Unicam SP600 spectrophotometer.

Results

Fig. 1 summarizes solid colour measurements at 50° and 70°C, showing thermal deterioration of the refined sugar to increase at the higher temperature. The crystal sample shows the highest absorbance compared with the pulverized samples, a difference we believe to be related to the presence of dextrose and levulose on the crystal surface in the dried residual syrup layer left after centrifuging and sensitive to thermal degradation. The comminuted particles from the ball milling expose a very large new surface from the interior of the sucrose crystals substantially over-riding the effects of the original surface.

Electron micrographs in Fig. 2 clearly illustrate the physical difference in surface features between the crystal and pulverized samples.

The finer comminuted particles of 150 microns are also largely free of a surface film of reducing sugars, showing consequently higher reflectance.

Fig. 3 shows that application of UV irradiation at room temperature (22–28°C) has negligible effect on

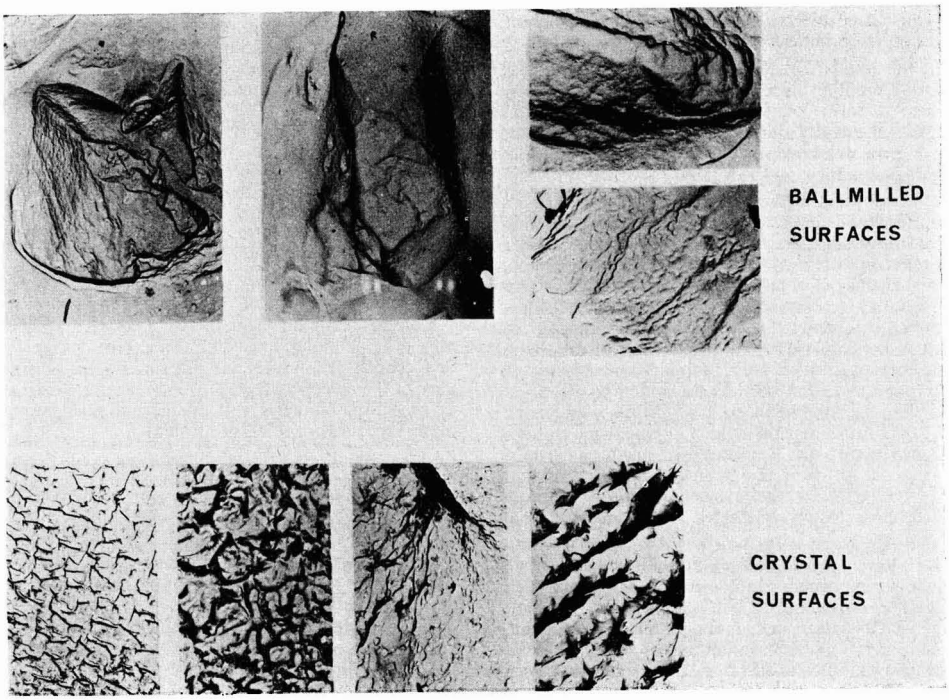

Fig. 2. Electron micrographs of sucrose surfaces

increasing the colour of samples. UV irradiation has been shown by MURPHY[12] to be capable of killing all heat-resistant bacteria which survive treatment with such compounds as formaldehyde, chlorine and alcohol. Thus it appears satisfactory to utilize the bacterial effect of UV irradiation without causing thermal degradation in the sugar. It is also worth noting that the keeping quality of sugar is independent of temperature in the range of 10-30°C[13].

Both Figs. 1 and 3 show colour content appearing to remain constant in all samples after an initial two weeks, which period was associated with rapid colour development. The rate of colour increase was higher at 70° than 50°C. Comparing the colour increases at "equilibrium" absorbance for the crystals and the pulverized samples of 350 and 150 microns, at 50°C these were respectively 2%, 2·2% and 3·4%; at 70°C, 4·3%, 4·4% and 9·5%. The results obtained in the 150 microns sample appear to be related to heat transfer sensitivity of a larger specific surface.

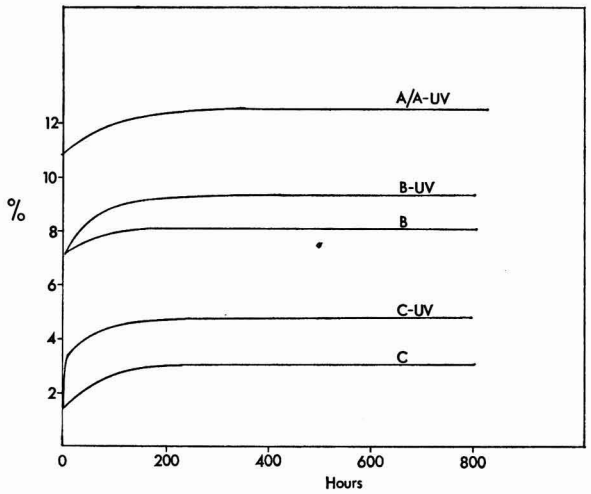

Fig. 3. Effect of UV irradiation on solid colour absorbance with storage time

The colour measured by reflectance does not appear to alter with time but is nevertheless shown to increase indefinitely with measurements in the solution phase. Fig. 4 shows solutions of raw and refined crystals giving the highest rate of colour formation at 50° and 70°C. On the other hand the pulverized samples showed less increase within the 400 hours of observation. Colour measurement by solution phase transmission is therefore more sensitive than reflectance measurement of the solid phase.

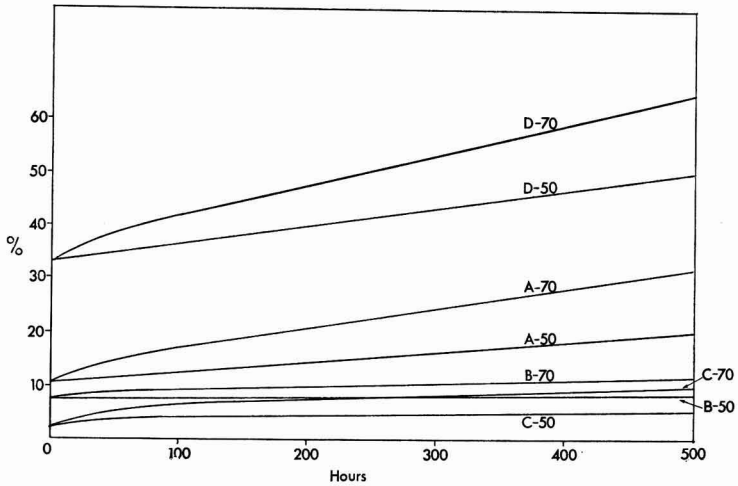

Fig. 4. Solution colour absorbance with storage time
D-50: Raw sugar, 50°C
D-70: Raw sugar, 70°C

We are of the opinion that colour is generated by both Maillard reaction and thermal degradation. However, we agree with DUBOURG & DEVILLERS[14] that when all the amino-acids in the sugar have been consumed by the Maillard reaction, the contribution to the colour then comes mainly from caramelization.

In this series of experiments we did not adjust the solution pH to 7 before measurement since it was not practicable to do so in the case of the solid phase reflectance measurements. In this respect we believe we obtained a satisfactory comparison of behaviour. Whereas it is known that pH in the range 4–11 has little effect on the colour of melanoidins it does have an effect on caramelization products[15]. We view our results as the net effect of these two factors.

BREVITIES

Kenya sugar expansion[16].—The Kenya Government has set up a Sugar Belt Cooperative Union in Nyanza district of the Western Province. A total of 9200 hectares of new land is to be planted to cane initially and a new sugar factory is to be erected, while the capacities and cane supplies of the Miwani, Muhuroni and Chemelil factories are to be expanded.

[9] HIBBERT, PHILLIPSON & WILSON: *I.S.J.*, 1970, **72**, 227–231.
[10] VANE: *ibid.*, 1972, **74**, 35–36.
[11] ANON: *Ann. Rpt. Tate & Lyle Ltd., Research Centre* 1969, p. 23.
[12] MURPHY: *I.S.J.*, 1965, **67**, 82.
[13] SPENGLER & BÖTTGER: *ibid.*, 1931, **33**, 77.
[14] DUBOURG & DEVILLERS: *Sucr. Franç.*, 1950, **101**, 163–165.
[15] PERSSON: *Socker*, 1959, **15**, 5.
[16] *Zeitsch. Zuckerind.*, 1975, **100**, 159.

Technological and financial aspects of world sugar production development

By G. S. BISHOP, C.B., O.B.E., Booker McConnel Ltd., London
(Address to the International Sugar Colloquium, London, March 1975)

THE United Nations World Food Conference in Rome in November made clear to the world that it now faces the most acute world food crisis since 1945. I believe that sugar could be a key commodity in helping to find a solution. Dr. FREDERICK STARE, the Chairman of the Department of Nutrition of Harvard University, has argued that one acre of fertile land can produce 7 million calories if planted in sugar as compared to 2·3 million calories in potatoes or 1·1 million calories in wheat.

At a time when many developing countries are changing from a subsistence economy to a cash economy, sugar is one of the first foods that people want to buy. Furthermore, in such countries sugar is one of the most important crops for economic development because of the employment it gives, because it introduces such a wide variety of new skills to the local people and because it can be the first introduction of farmers to a cash economy. It provides a sound base for rural development—as opposed to urban development. It also secures a significant foreign exchange saving as well as offering scope for the development of secondary and tertiary industry.

What are the world's future requirements of sugar? Estimates of sugar requirements over the next decade were produced for the Rome Conference. These estimates depend basically on two factors:—

First, the rate of increase in the world's population and second, the rate of improvement in national income per head of population.

It is easier in the medium term to be more certain of the estimate of population increase than of the rate of growth of national income. However, taking middle-of-the-road assumptions about both population and national income, the United Nations estimate is that in 10 years' time world sugar requirements will be about 107 million tons compared with 70 million tons at the beginning of this decade and 78 million tons in 1973.

This is a growth rate of about 3% and is roughly in line with the increase in recent years. But due caution must be exercised in extrapolating these figures. So much depends on price. Price exercises its powerful effect on both demand and supply and its importance is often overlooked in discussions of world needs. The market is concerned with demand and supply *at a price* and not with needs measured on theoretical dietary standards regardless of price. If the price of sugar moves high or in relation to other foods, consumption will be reduced and the use of substitutes encouraged. On the supply side of the equation a high price will call forth extra production whereas a low price will check production.

What are the prospects for production on the required scale? 46 million tons of the existing world production of 78 million tons comes from cane sugar. In the world terms the main emphasis in the years ahead for obtaining the extra sugar we need should come from cane rather than beet. The essential requirements for sugar production are sunshine, soil and water. Sunshine is of key significance in the biological creation of sugar. This is something that the tropics provide in abundance, and with energy fast becoming one of the major constraints on economic acitivity cane sugar has one great advantage. It can be processed even to the white sugar stage without the use of oil fuel or any other fossilized fuel. It is an ecologically satisfying product in that the energy requirement of factories can be supplied by bagasse—the waste material of cane once the sugar has been extracted. At a time when world fuel costs are fast increasing this could help to tip the scale in favour of cane.

Cane sugar will benefit from the fact that the tropical countries have greater unused resources of both land and labour. This will help to offset the tremendous advantage which beet enjoys, being produced in industrialized countries where the infrastructure and many other essential facilities are already provided by the State. Largely because of this, together with the flexible ability of farmers to respond speedily to new incentives which encourage the production of beet as opposed to other crops, the most immediate increase in production should come from the beet sugar producers. However, the alternative use to which the land can be put in these industrialized temperate countries may be a significantly limiting factor to the expansion of beet. The most serious effect on the world food shortage has been felt on grain. Grain prices have quadrupled. This sharp rise has given a relative advantage to both grassland and feed crops in Europe in order to sustain the livestock industry. This will affect the rate of expansion of beet. And apart from these economic factors there is an increasing tendency for environmental issues to hold up the expansion of industrial facilities in rural areas. I understand that the British Sugar Corporation, for instance, has encountered difficulties from the planning authorities with some of their proposals for expanding the capacity of their factories.

One of the problems of expanding world sugar production is the greatly increased cost of bring new estates into operation:

First, the cost of building a new sugar factory has risen sharply—I estimate by three times over the last seven years. Finance charges on such a cost in these days of high interest charges are a further complication.

Second, the cost of clearing new land and laying it out for the production of sugar cane—an operation which calls for costly mechanical equipment and significant fuel expenditure—has also increased greatly, particularly if land has to be irrigated by a furrow system. The extra capital cost of producing sugar by sprinkler irrigation could be of the order of up to £50 per ton of capacity and could be very significantly more in some areas especially if the infrastructure costs like dams or ancillary waterways are taken into account. Sprinkler irrigation also requires heavy recurrent costs for maintenance, fuel, spare parts and so on.

Third, the costs of all the necessary inputs, whether they be labour, fertilizers or weedicides, have also increased. Some of these factors are common to all

countries—fertilizers and weedicides depend on the international market. The rate of increase in labour costs, however, varies from country to country. In some traditional areas of production, such as the Caribbean, as alternative work opportunities emerge it has proved difficult to maintain the required labour supply because of social influence or competing job opportunities.

The combined effect of these factors means that whereas a decade ago it was estimated that a new sugar operation would call for an investment of £200 per ton of capacity, the current estimate of the prime cost of a 100,000-ton unit is £400–£500 or more per ton of capacity, depending on the need for irrigation and the length of the crop. At today's interest rates the debt charge alone would be equivalent to about £50 per ton of capacity if the finance is borrowed at commercial interest rates.

So what are the most economical ways of increasing production?

First, the obvious step is to try to secure the biggest possible extra increment of production with lowest capital outlay. This means improving the performance of existing units both in agriculture and in processing plants. Agriculturally, it calls for a better yield per acre from land which is already in cultivation. The prime steps are better cane varieties, better drainage and irrigation efficiencies, fertilizer, disease and pests and better standards of agricultural management. It is also necessary to pursue more research into the most economical methods of mechanization. A useful quick increase in production could be obtained if experienced agriculturalists were able to advise some of the less progressive sugar industries in many countries of Asia, Africa and South America. In some countries special work is necessary to overcome the social factors which restrict the productivity of small cane producers.

In the longer term a very important need is to improve existing techniques of plant breeding. Beet has the advantage of being grown in developed countries with the full resources of agricultural research work behind them. Cane production in a variety of mostly less developed countries could still profit from improved research.

We should apply to cane the techniques which were used under the leadership of first the Ford and Rockefeller Foundation and now the World Bank with such great success in developing the new high-yielding varieties of wheat, maize and rice. For these crops specialized research stations were set up in Mexico and the Philippines where teams of first rate scientists have been working together. The concept of organizing multi-disciplinary teams of outstanding agronomists, entomologists, pathologists and others has been successful.

I believe one of the most important technological contributions to the expansion of sugar production would be a more concerted international approach to sugar cane breeding. We ought to consider setting up some international organization which could secure the most rapid and efficient exploitation of the total sugar cane germ plasm with existing breeding stations also playing their part. Sugar cane breeding has been extremely successful in many countries over the past 50 years but programmes have not been co-ordinated and the genetic base of the crop has by no means been fully exploited. This is particularly important especially if the expansion of sugar cane is to be taken to its ecological limits. This is an area in which all the commercial interests represented here could help to build up the technology of the developing countries.

In many countries, however, especially the developing ones, it is not so much a question of waiting for new fundamental research but rather the simple question of applying existing knowledge of the art of growing sugar cane. A typical example is the routine heat treatment of planting material to combat ratoon stunting disease. In some countries, this disease reduces yields by 20%. It would be very greatly reduced by using nursery material produced from heat treated planting material. The cost is trifling.

My guess is that the quick, short-term measures could lead to the production of about an extra 2 million tons of sugar within the capital cost range of £50–£100 per ton of capacity. In this I allow also for the extra sugar which could be produced by the more efficient operation of sugar factories, and the installation of more modern processing plant which will increase the recovery of the available sugar in cane.

Second, the next most economical additional production could be obtained by the marginal extension of existing operations; by taking in new land adjacent to existing cultivated land, for instance, or by increasing the capacity of an existing factory, through "de-bottlenecking" and the addition of unit equipment where necessary. I also include in this category remedial works, like improved drainage or improved irrigation or better transport systems to avoid sugar losses en-route to the factory. Such measures have the merit of increasing production without all the extra capital expenditure for new infrastructure. When roads have to be made, or when complete new factories or new dams for irrigation have to be built, the capital cost per ton of the extra capacity is enormous. Extension of existing facilities avoids the need for new basic infrastructure. There are schemes of the type which would cost probably £100–£200 per ton of capacity and which could be effective in say five years.

Finally, there is the heroic task of establishing in a new area a complete new sugar estate. It is necessary to take time to determine data on soils, hydrology and climate so as to be sure that economical yields of sugar can be obtained. Also there are inevitably delays in locating and obtaining finance for the project itself apart from the related infrastructure. Not only does the decision process involve the local Government but also often bilateral and multilateral aid agencies. These are some of the reasons why new production always comes into operation much more slowly than expected. In today's conditions, when the order books of the firms making sugar machinery are so full, it would take a further two to three years to bring a new estate into production. Very few brand-new sugar estates could come into operation with a lead time of less than five years. There are too many instances in the world of factories being erected speedily in areas in which it has been difficult, if not impossible, to grow cane economically.

Important to the economics of the operation is the period of the harvest. With factory costs high, the cost per ton of an installation which can only be used for a few months of the year is that much greater than a factory which can be operated for 10 months

in the year. This is one of the conditions which is important in the competition between cane and beet sugar. A heavy investment in a beet sugar factory which can only operate for a campaign of 90 days is more costly than a cane factory which in the right countries can operate for a minimum crop length of 6 months and preferably as long as 10 months as is the case in Kenya, Colombia and Peru.

The essential factors are capital and management; the developing countries have the unused resources to make a great contribution to meeting the world's sugar needs. They have the soil, the weather—the sunshine and the rain—and they have the unused labour. What is needed now are the two essential ingredients—the capital and the management.

The capital requirements are gigantic. When the World Bank Group looked at the sugar situation a few years ago they "guesstimated" that the additional capital for the required expansion would be over US$ 3000 million. It would be more than double that figure now. Private capital is unlikely to take the risks of big investments in sugar in virgin land in developing countries because of the extent to which governments can interfere in controlling the factors on which the return of the investment will depend such as the price of sugar for the domestic market, the imposition of export levies or influencing the labour costs. Hence much of the capital will have to come from institutions like the World Bank. It is important that they should be ready to play their part in financing the expansion of sugar production and I hope that many of you here today will be ready to bring your influence to bear to encourage the international institutions in this respect.

There is the notorious instability of the world sugar market which will have to be faced by investors in sugar. In Guyana, within the lifetime of a field of cane planted in 1967, the net return to the country, after freight and other charges, has varied from £648 to £6·50 per ton—a ratio of 1 to 100. With swings in price of that violence it is important for Governments and sugar industries to begin work now to prepare for the negotiation of a new International Sugar Agreement to try to create more stable conditions to encourage the expansion of sugar production. There is a real community of interest for producers and consumers. The chance of creating a new stabilization scheme has been increased by Britain's membership of the Common Market and by the UK Prime Minister's recent personal initiative on commodity agreements. Even with these conditions, however, it is clear that outside capital on the scale required, especially for investment in developing countries, can only come from an international source—from the World Bank organization, from the Arab development funds or from aid programmes.

Now that the need for increased investment in sugar has been recognized internationally, I feel the real bottleneck for the development of sugar production overseas will be the scarcity of experienced management. I think that skilled managerial manpower above all, but technological and scientific manpower in addition, is one of the scarcest resources which is limiting the progress of developed countries. More money can be lost quickly on badly devised and badly managed large-scale agricultural projects than in almost any other sphere of economic acitivity.

It is of no avail to have the capital unless good management is available. In all my experience in recent years I have never yet found a good agricultural project for which the money could not be obtained provided experienced management was available. However, the world is relying increasingly on people who have gained their practical experience in the past but replacements for them are not being trained.

As new sugar estates are planned we will find countries competing for experienced general managers, factory managers, field managers and scientists. Every country wants people with experience but many countries restrict the number of expatriates so that men with the right qualifications can no longer gain the practical experience of actual operations on a sugar estate. The sugar industry of the world was a highly international industry with people switching their career from continent to continent. This mobility was a great factor in encouraging the adoption of international standards. If we are to get an extra 30 million tons more sugar we will have to pay more careful attention to the training and development of the right people for this purpose.

The long-term future in many developing countries will depend on the training of their own nationals for such a new industry. It calls for great skill to create and manage a new sugar estate and at the same time to bring together staff for the senior appointments of the future. Somehow, we have got to find the right mechanism for collaboration on management training between the world institutions, the Governments of developing countries, the development agencies and the big international sugar firms.

Here is a way in which Governments and the sugar industry can collaborate in a pioneering step and I hope that this Colloquium will encourage established sugar industries—both beet and cane—to be ready to play a responsible role in helping developing countries to set up sugar industries and to train their own people.

May I, as Vice Chairman of the Industry Cooperative Programme, make an appeal for the industry's co-operation on one of the key resolutions adopted by the World Food Conference. This is the resolution which relates to global information and an "early warning system" on food and agriculture. While they made a particular request that there should be co-operation particularly with the International Wheat Council, it seems vital that the experienced commercial co-operation of the international sugar trade should be harnessed to national and international efforts to strengthen the information system on sugar.

Now that the second earth satellite has been launched there has been a great step forward in using remote sensing techniques for agriculture. With two earth satellites in orbit they have the capability of supplying photographs, once in every nine days, of any area in the world. A lot of work is being done internationally to devise means of using this material to forecast not only acreage under crop but to produce yield estimates. Alas, the photographs cannot distinguish buyers from sellers!

But I hope that ways and means can be found for the sugar industry to bring its commercial expertise to bear in helping national Governments and international institutions to make the best use of new techniques to improve the food warning system.

The trade contribution will be vital because their experienced judgement is the key to effective interpretation of what the statistics mean. That is why we have all benefited so much from the understanding that Dr. VITON of FAO has been able to establish with the sugar industry and sugar traders around the world.

One thing is clear and that is that, if the world food crisis is to be overcome successfully, Governments will have to draw on the experience, the judgements, and management skills of the international business. The heartening feature of the sugar industry is its willingness to co-operate and to work together. I have spent over 20 years in Government service and now 14 years in the City. I have had much contact with many industries. Nowhere have I encountered such a spirit of co-operation than exists in the world's sugar industry. The success of this Colloquium is a tribute to that spirit.

An evaluation of methods used for maturity testing

By R. JULIEN

(Mauritius Sugar Industry Research Institute, Réduit, Mauritius)

Paper presented to the 15th Congress ISSCT, 1974

Introduction

VARIOUS methods have been used to determine the degree of maturity of a cane field in order to rationalize harvest and obtain maximum yield. Pre-harvest sampling followed by determination of Brix and pol was adopted by WOLTERS[1]. However, this method was found to be time-consuming, and a more rapid one based on the determination of Brix using a juice sampler, "Gempol" knife, and a hand refractometer was developed[2]. Shortly afterwards the use of Brix ratios as indices of maturity was recommended[3]. More recently, WADDELL[4] described a method of maturity testing based on the difference between Brix at points $\frac{3}{4}$ and $\frac{1}{4}$ along the stalk.

Moisture content of the spindle, leaf sheath and internodes have been used as indices of maturity. HUMBERT, ZAMORA & FRAZER[5] showed that, when the moisture content of the 8–10th internodes reached 70%, the cane was ready for harvest. The critical value appears somewhat higher for moisture content of the young leaf sheaths, being about 74%[6].

The determination of glucose ratio suggested by ROUSSELET[7] has the disadvantage of requiring two sets of analyses.

To the best of the author's knowledge, the methods outlined above have not yet been compared under similar experimental conditions for any variety. It was therefore decided to evaluate them using four of our commercial varieties, and results are reported in this paper.

MATERIAL AND METHODS

Evaluation of methods (1972 *experiments*)

Four experiments were conducted, one on each of the following varieties: S 17, M 13/56, M 442/51 and M 351/57. Randomized block designs with four replicates were adopted in all experiments. Harvest and sampling on different dates were regarded as treatments. There were six such treatments in the experiment on variety M 442/51 and 10 in the others. Two lines of 7 m were used as a plot in the experiments on varieties S 17 and M 351/57, and four lines in the other experiments. The following data were recorded in each experimental plot:

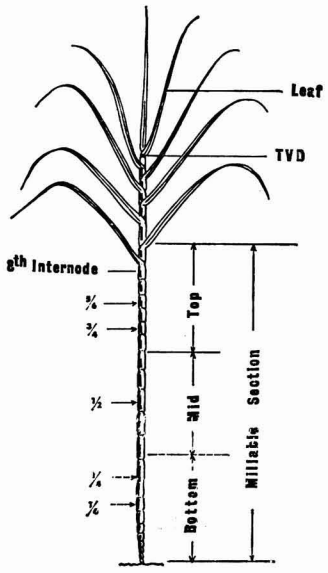

Fig. 1. Leaf and internode numbering, points at which Brix readings taken and sectioning of cane

Refractometric Brix (*field method*): Brix readings were taken at 3 points (1/6, $\frac{1}{2}$, 5/6) along the stalk in all varieties; additional readings at points $\frac{1}{4}$ and $\frac{3}{4}$ were recorded in variety M 442/51 (Fig. 1).

[1] *Hawaiian Planters' Record*, 1931, **35**, 411–418.
[2] LEVERT, VAN DER WOUDE & VAN DILLEWIJN: Abstr. in *Facts about Sugar*, 1934, **29**, 167, 243.
[3] LENNOX: *Hawaiian Planters' Record*, 1935, **39**, 13–18.
[4] *Australian Sugar Year Book*, 1967, p. 197.
[5] *Proc. 12th Congr. ISSCT*, 1967, 446–452.
[6] CLEMENTS, SHIGURA & AKAMINE: *Hawaii Agric. Expt. Sta. Rpt.*, 1946, **48**, 120–124.
[7] *Proc. 12th Congr. ISSCT*, 1967, 715–721.

To obtain a Brix reading at a given point along the stalk, a juice puncher was used and the juice collected from 5 canes of the same stool; this was thoroughly mixed and the Brix was measured by a hand refractometer. This procedure was repeated twice or three times on randomly selected stools in a given plot.

Moisture content: The spindle (unfurled leaves) and the internodes 8, 9 and 10 were sampled for moisture content (Fig. 1). Varieties S 17 and M 351/57 had flowered heavily; consequently moisture assay of the spindle was carried out only on varieties M 442/51 and M 13/56. In each plot two samples were taken, the internodes or spindles of five canes from the same stool representing a sample. The 15 internodes obtained for each sample were sub-sampled and reduced to six (two 8th, two 9th and two 10th). Moisture determination was carried out on this sub-sample.

Pol % cane, fibre % cane, reducing sugars and refractometric Brix (laboratory): A sample was prepared for each plot by bulking 6 sub-samples, each consisting of five canes belonging to the same stool. Each cane of this sample was cut into three equal parts designated top, mid and bottom (Fig. 1). Similar sections were grouped together, then weighed and analysed separately. The following determinations were made on these samples:

Pol % cane (DE ST. ANTOINE[8])
Fibre % cane (DE ST. ANTOINE & DE FROBERVILLE[9])
Reducing sugars (ANON[10])
Refractometric Brix (ANON[10])

Derived variates: The following derived variates were computed from the primary data:

(1) Brix ratios:
  (a) field — 5/6 ÷ 1/6
  (b) laboratory — top ÷ bottom
(2) Glucose ratio: reducing sugars % cane ÷ pol % cane.

Statistical analysis: Regression analysis and correlation coefficients between mean pol % cane (proportional mean of top, mid and bottom sections) and the various indices were calculated.

Field sampling (1973 *experiments*)

Fields of approximately 2 ha were selected for the experiments and the following varieties were studied: M 442/51, M 13/56, M 93/48 and M 351/57.

Experimental design: Each field was divided into four blocks and, in each block, three random sampling sites were chosen for each sampling date. The number of sampling dates ranged from 7 to 10, the first sample being taken in July/August and the last in November/December. The intervals between two sampling dates ranged from 10 to 14 days. On each sampling date and at each sampling site, field Brix at points 5/6, 1/6 and ½ was measured in two adjoining stools as already described. The canes were harvested and samples of top, middle and bottom sections were prepared for each site. Laboratory Brix, pol % cane and fresh weight were measured for each sample. In the experiment on variety M 93/48, a composite sample comprising 1/3 each of top, middle and bottom sections of cane was prepared and, therefore, a single pol % cane and laboratory Brix reading was obtained for each site.

Statistical analysis: Correlation coefficients between proportional mean pol % cane and the various Brix readings were calculated. Analysis of variance was carried out for each sampling date; within site variance was considered as plant variance while soil variance was derived as described in Table I[11].

Table I. Analysis of variance

Source	*df*	*Parameters estimated by mean square (MS)*
Blocks	3	$\sigma p^2+2\sigma s^2+6\sigma B^2$
Within blocks (sites)	8	$\sigma p^2+2\sigma s^2$
Total	11	
Within sites (plant)	12	σp^2
Plant variance ..	$= p^2$	
Soil variance.....	$= s^2 = \frac{\text{Site MS} - \text{Plant MS}}{2}$	
Block variance	$= B^2 = \frac{\text{Block MS} - \text{Site MS}}{6}$	

An estimate of number of sites required for a 2 ha block for a range of standard errors (SE) was computed using the following formulae[11].

$$\text{For field Brix: } (SE)^2 = \frac{\text{Soil variance}}{n} + \frac{\text{Plant variance}}{an}$$

where a = no. of readings/site, n = no. of sites.

$$\text{For laboratory Brix: } (SE)^2 = \frac{\text{within site variance}^*}{n}$$

RESULTS

Evaluation of methods

The results were generally similar in all experiments; hence, details will be given only for varieties S 17 and M 351/57 and any differences between these and the other varieties will be pointed out.

Pol % cane: The two components of sugar yield are pol % cane and fresh weight yield. No significant differences in fresh weight yield could be detected between the different sampling dates for any of the varieties; therefore the evolution of pol % cane is closely related to that of sugar yield.

The patterns of evolution of pol % cane in the top, middle and bottom sections of variety M 351/57 were similar; they all reached an optimum value at about mid-October. The marked difference between the optimum pol % cane of the top section and the lower two is of interest and was found in all the varieties.

Refractometric Brix

Field method: The evolution of field Brix at points 1/6, ½ and 5/6 showed an increasing trend with time, reaching optimum values at about the same time as the mean pol % cane. Highest correlation coefficients between field Brix and pol % cane were found early in the harvest season and they gradually decreased at later dates and for the last part of the harvest season correlations were generally not significant (Table II).

Laboratory method: The results of determinations of laboratory Brix were essentially similar to those of field Brix; correlations with pol % cane were, how-

[8] *Rpt. Mauritius Sugar Ind. Research Inst.*, 1969, **17**, 120–121.
[9] *ibid.*, 1964, **12**, 142–150.
[10] "Official methods of control and analysis of Mauritius sugar factories". (Société de Technologie Agricole et Sucrière de Maurice, Port Louis), 1970.
[11] SNEDECOR: "Statistical methods". (The Iowa State College Press, Ames, Iowa). 1956.
* Block components of variance have not been included as block effects were generally not significant.

Table II. Correlation coefficients between mean pol % cane and field Brix at points 5/6, 1/2 and 1/6 for early, middle and late parts of harvest season in varieties S 17 and M 351/57

Point	*Variety*	*July-August*	*September–mid-October*	*Late October November*
5/6	S 17	0·562*	0·584*	0·240
	M 351/57	0·815‡	0·753†	0·448
1/2	S 17	0·680†	0·635*	0·213
	M 351/57	0·922‡	0·541	0·605*
1/6	S 17	0·646*	0·818†	0·181
	M 351/57	0·918‡	0·470	0·384

* Significant at P 0·05. † Significant at P 0·01.
‡ Significant at P 0·001.

ever, higher with this method and significant correlations were obtained even late in the season (Table III).

Table III. Correlation coefficients between mean pol % cane and laboratory Brix of top, middle and bottom sections for the early, middle and late parts of the harvest season in varieties S 17 and M 351/57

Section	*Variety*	*July-August*	*September mid-October*	*Late October–November*
Top	S 17	0·932‡	0·865‡	0·770†
	M 351/57	0·926‡	0·735†	0·581*
Middle	S 17	0·937‡	0·834‡	0·695*
	M 351/57	0·940‡	0·938‡	0·847‡
Bottom	S 17	0·880‡	0·749†	0·794†
	M 351/57	0·946‡	0·875‡	0·816†

* Significant at P 0·05 † Significant at P 0·01
‡ Significant at P 0·001

Brix ratios: Field and laboratory Brix ratios were generally more variable than the primary variates, and correlation coefficients with pol % cane were not significant (Table IV).

Table IV. Correlation coefficients between mean pol % cane and glucose ratio, moisture of internode and field Brix ratio 5/6 : 1/6 for early, middle and later harvests in varieties S 17 and M 351/57

Index	*Variety*	*July-August*	*September– mid-October*	*Late October –November*
Glucose ratio	S 17	—0·539*	—0·515	—0·308
	M 351/57	—0·958‡	—0·776†	0·822†
Moisture of internode	S 17	—0·857‡	—0·527	—0·103
	M 351/57	—0·840‡	—0·451	—0·419
Field Brix 5/6 ÷ 1/6	S 17	0·092	0·198	0·234
	M 351/57	0·032	0·240	0·220

* Significant at P 0·05 † Significant at P 0·01
‡ Significant at P 0·001

Moisture content: The moisture content of the internodes generally showed a decreasing trend with increase in pol % cane, becoming stable around 70 to 72%. However, during the final phases of ripening, this character exhibited great variability from week to week in most varieties. This effect is shown by the low correlation coefficients obtained late in the season (Table IV). Moisture content of the spindle could be measured only in the low flowering varieties (M 13/56, M 442/51); the trend in variety M 442/51 was similar to that of moisture content of the internodes, while in variety M 13/56 this parameter was highly variable. Their usefulness as maturity indices therefore appear to be restricted.

Glucose ratio: Glucose ratio showed a marked diminishing trend as sucrose content increased. Correlation coefficients between pol % cane and glucose ratio were high for M 351/57 but generally low and not significant for variety S 17 (Table IV). It was also more variable than Brix (field and laboratory) although it may still be considered as an acceptable method for detecting optimum sucrose content for some varieties.

Field sampling

Correlation coefficients: The results for varieties M 13/56 and M 351/57 followed the same pattern as those of the 1972 experiments. However, in variety M 93/48 correlation coefficients between field Brix and pol % cane were higher later in the season (Table V).

Variance: Soil and plant variance for field Brix varied with sampling date and variety. Variation with sampling date appeared to be random and no clear trend was detected in any of the varieties. Variety M 442/51 had the highest soil and plant variances while soil variance was lowest in variety M 93/48. Locality also had an effect on variance, this being shown by comparing the two experiments on variety M 13/56 (Table VI).

Table VI. Mean soil and plant variance for field Brix at points 5/6, 1/2 and 1/6

		Variety				
Field Brix	*Variance of:*	M 13/56 (*a*)*	M 13/56 (*b*)*	M 442/56	M 351/57	M 93/48
5/6	Soil	0·769	0·480	0·880	2·64	0·419
	Plant	0·520	0·777	0·740	1·51	0·644
1/2	Soil	0·840	0·280	1·100	1·97	0·292
	Plant	0·359	0·370	0·880	0·86	0·488
1/6	Soil	0·617	0·296	0·550	1·71	0·291
	Plant	0·506	0·320	1·400	0·46	0·400

* These refer to two different sites.

In most varieties, variance was highest at point 5/6 and lowest at point 1/6; this could be expected as the top section of the cane was still immature in most varieties.

Sampling: Three stages have been used in the sampling technique studied: blocks, within blocks (sites) and within sites (plant for field Brix). Block effects were generally not significant and blocking may therefore be considered as not necessary unless fields show marked gradients or any other characteristic which may justify this. The optimum number of readings per site appears to be 2; and increasing it to 3 had only small effects on the variance and consequently on the number of samples required (Table VII).

Table VII. Effect of number of field Brix readings per site on number of sites per 2 ha for a standard error of 0·4

	No. of	*Variety*				
Section	*readings/site*	M13/56 (*a*)*	M13/56 (*b*)*	M442/51	M351/57	M93/48
5/6	1	8	8	10	26	7
	2	6	5	8	21	5
	3	6	5	7	18	4

* These refer to two different sites.

Table V. Correlation coefficients between mean pol % cane and Brix

Variety	*Brix*	*Section*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
M 13/56	Field	5/6	0·843	0·738	0·828	0·619	0·237	0·010
	Lab	Top	0·885	0·836	0·797	0·901	0·846	0·791
M 351/57	Field	5/6		0·787	0·685	0·648	0·384	
	Lab	Top		0·812	0·862	0·454	0·282	
M 442/51	Field	5/6		0·440	0·363	0·453	0·685	0·091
	Lab	Top		0·523	0·260	0·342	0·598	0·168
M 93/48	Field	5/6	0·400	0·560	0·572	0·643	0·851	

The intensity of sampling will therefore depend mainly on the number of sites, which is related to intrinsic variation (soil) in the field and to the precision required.

Discussion

In order to assess the relative merits of the different methods of maturity testing, the following factors must be considered and integrated:

(i) The relative efficiency of the methods in detecting optimum sucrose content in the cane stalk.

(ii) The time, labour and cost of material involved in carrying out the test.

(iii) The number of samples required for each method.

The relative efficiency of the methods

The results showed clearly that laboratory Brix was the most reliable method for following the evolution of sucrose content and for detecting its optimum value in all varieties. Although somewhat more variable than laboratory Brix, field Brix was a reliable method particularly for the early and middle part of the harvest season. On the other hand, Brix ratios showed fluctuations from date to date and appeared to be generally less reliable. In varieties where both the moisture content of the internodes and spindle were measured, the former appears to be more reliable, although detection of optimum sucrose level was not very clear. Glucose ratio was generally better correlated with pol % cane than moisture content of the internodes but less so than Brix. The ranking of the different methods for predicting pol % cane is therefore as follows: laboratory Brix; field Brix (except late in the harvest season); glucose ratio and moisture content (for some varieties) and Brix ratios (not recommended).

The time, labour, and cost of material involved in carrying out the tests

An estimate of labour and time was obtained by dividing the work involved for each method into steps which were evaluated independently. Field Brix which is the easiest to determine was taken as 1 and the ratios of the other methods to field Brix are as shown in Table VIII.

Table VIII. Relative time and labour involved in carrying out one test

Field Brix	1
Brix ratio	2
Moisture content	4
Laboratory Brix	6
Pol % cane	8
Glucose ratio	16

The cost of equipment shows considerable variation, e.g. the ratio of the cost of equipment for the determination of glucose ratio (highest) to that for field Brix (lowest) is 25 to 1. However, as on many of the sugar estates facilities for conducting routine cane analysis already exist, the factor of cost of equipment in the choice of a method will be important only for the planters who do not have such facilities, and in their case the field Brix method would be the most economical.

The number of samples

The number of samples required for the different methods was generally similar in the 1972 experiments; hence, sampling techniques were studied only for Brix in the 1973 experiments.

The evolution of Brix in a given field can be followed only if differences between two sampling dates can be detected. These differences will depend on the interval between the sampling dates and the rate of increase of the character measured. An interval of about two weeks between two sampling dates has been used in this investigation and may be considered practical. Rates of increase of Brix were generally highest in the top section and lowest in the bottom section. Thus, for the top section it is necessary to detect differences of 0·4 to 0·9 as compared with 0·2 to 0·5 in the mid-section. Hence standard errors required to detect these differences range from 0·2 to 0·4 for the top section and from 0·1 to 0·2 for the mid section. The number of samples required for a range of SE from 0·1 to 0·3 are shown in Table IX for variety M 13/56; the trend being similar in the other varieties. Field Brix 5/6 and laboratory Brix of the top section required the smallest number of samples as the SE was greater on account of a higher rate of increase of these indices in this section. As the cost involved in performing a determination of laboratory Brix is about six times that of field Brix, the latter is recommended.

Table IX. Number of samples of Brix per 2 ha for SE of 0·1 to 0·3 in variety M 13/56 and rate of increase of Brix per 2 weeks

		SE			*Mean increase*
		0·1	0·2	0·3	*in Bx/ 2 weeks*
Field Brix	5/6	103	26	11	0·4
	1/2	102	25	11	0·3
Laboratory Brix	Top	121	30	11	0·7
	Mid	99	25	11	0·3

Conclusions

On the basis of accuracy of prediction of sucrose content and considering the time, labour and cost involved, the best maturity testing index appears to be field Brix at point 5/6. Its evolution in time gives a good estimate of the evolution of pol % cane and a field could be considered ripe and ready for harvest when Brix at point 5/6 reaches its maximum value. Two Brix readings per site were found to be sufficient, but it is not possible at this stage to give an estimate of the number of sites required per hectare because of observed variations due to locality and variety. The method will have to be tried on a large number of fields and the effects of variety and locality on intensity of sampling determined.

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Summary

The following methods of maturity testing were evaluated: field and laboratory Brix, glucose ratio, moisture content of internodes and spindle and Brix ratios. Highest correlation coefficients were obtained between pol % cane and laboratory Brix throughout the harvest season. Correlations between pol % cane and field Brix were significant only for the early and middle part of the harvest season, and those between pol % cane and field Brix ratios were not significant. The best methods of detecting maturity in a field

appear to be: evolution of field and laboratory Brix in time. Field sampling techniques were studied for these methods.

In a three-stage sampling, a field was divided into four blocks within which three sites were selected and at each site three readings of field and laboratory Brix were recorded. Differences between blocks were generally not significant while two readings per site was found to be the optimum. The number of sites per block varied with variety, locality and character measured. The best index was found to be the evolution of field Brix recorded at the top of the cane (5/6 height of stalks). Laboratory Brix required fewer samples than field Brix but had to be rejected on account of higher cost.

Sugar Industry Technologists Inc.

34th Annual Meeting, 1975

A RECORD number of almost 300 people, including 80 wives, attended the 1975 meeting of the SIT, held at the De Soto Hilton Hotel in Savannah, Georgia, during the 5th–7th May. Representatives of sugar refining companies from Belgium, Canada, Chile, Malaysia, the UK and Venezuela as well as the largest contingent from within the USA gathered during the 4th May, meeting at an evening "mixer" held in the hotel.

On the following morning, they were welcomed by Mr. WARREN REED, Immediate Past-President, while a number of announcements concerning the meetings were made by M. GEORGE FAWCETT who was in charge of local arrangements. The President, Mr. STEPHEN STACHENKO, addressed the meeting which then heard the first paper, describing flocculation technology in sugar manufacture, by Dr. M. C. BENNETT of Tate & Lyle Enterprises Ltd. Some applications of an "Enzymax" glucose analyser were described by Dr. JOHN R. SULLIVAN of SuCrest Corporation.

The third paper, on an evaluation of an automatic sugar polarimeter, by C. C. CHOU and K. R. HANSON of Amstar Corporation, was presented by Dr. CHOU, after which Dr. J. C. P. CHEN of Southdown Sugars Inc. described work on measurement of the transluminescence of solid sugar and its relation to colour in solution. The business meeting, under the direction of SIT Executive Secretary W. A. BEMIS and President S. STACHENKO, then approved the accession of a number of corporate members and election of the directors proposed by the Executive Committee.

At an official luncheon, Mr. B. A. OXNARD, Jr., of Farr, Man & Co. Inc., delivered an informative speech on raw sugar marketing in a changing environment, in which he discussed the reasons for the dramatic changes in world raw sugar prices in recent years and considered possibilities for the future.

In the afternoon a series of four presentations were made on the present and future trends in use and cost of a number of decolorizing agents, namely bone char (by A. I. MACDONALD of British Charcoals and Macdonalds Ltd.), granular carbon (by F. M. WILLIAMS, H. E. MOORE and W. G. SCHULIGER of Calgon Corporation Carbon Division), filter aids (by GORDON SMITH of Johns-Manville Products Corporation) and "Talofloc"/"Taloflote" (by JOHN RUNDELL of Tate & Lyle Enterprises Ltd.).

In the evening, the Master of Ceremonies for the Annual Banquet was Mr. R. F. GILES, of Savannah Foods & Industries Inc., while Mr. STACHENKO welcomed those present. Mr. FAWCETT presented the George & Eleanor Meade Award to the author of the best paper presented at the 33rd Meeting in 1974, namely Mr. R. S. PATTERSON of C & H Sugar Company, whose paper was entitled "Equipment cleaning procedures". The presentation of the SIT Achievement Award in Sugar Technology was made by Mr. STACHENKO to Dr. FRANK G. CARPENTER, formerly of the Bone Char Research Project and now of its successor, the Cane Sugar Refining Research Project in New Orleans. The evening concluded with the transfer of the President's gavel from Mr. STACHENKO to Mr. FAWCETT, President for 1976.

On the morning of Tuesday 6th May, Mr. M. BRAECKMAN of Raffinerie Tirlemontoise S.A. described the structure and operation of his company's white sugar silos, while P. H. PETRI (Godchaux-Henderson Sugar Co.) described work on a continuous pan for boiling of intermediate-grade remelt sugar. Two further papers were presented, on the new filtration station at St. Lawrence Sugar Division of Sucronel Ltd., by G. R. MCCONNELL, and on the melt house computer installation at C & H Sugar Co. by A. C. MAYLOTT and J. W. DE CELIS, the latter presenting it.

After lunch, the symposium was continued with contributions on filter cloth by FRANK MITTELBERGER of American Plant Equipment Co., materials of construction by W. O. YOUNG of Stearns-Roger Inc., and packaging materials by P. STRAIN, R. BOLLING and E. H. MASON, of Union Camp Corporation.

Members of the SIT were able to visit the Savannah sugar refinery the next day for a guided tour while they and wives joining them were entertained at a large barbecue provided with southern hospitality by the Savannah company. The ladies had been entertained by a ladies' programme during the meetings organized by Mrs. MARTHA FAWCETT, and had been able to tour some of the historic homes and locations in the city, and speciality shops near the river, and were taken on a boat ride to the Yacht Club for lunch on the 6th May.

Mr. BEMIS, who has been Executive Secretary for a considerable number of years, has decided to retire and his place is to be taken by Mr. GEORGE W. MULLER, Jr., who will be organizing the 1976 meeting which is to take place in Toronto, Canada.

Sugar cane agriculture

Studies on isoenzymes of sugar cane. I. Peroxidase and esterase isoenzymes in major Taiwan sugar cane varieties and their parents. Y. T. LIU, S. S. CHEN, S. LEE and H. C. LEE. *Rpt. Taiwan Sugar Research Inst.*, 1973, (62), 63–81.—Analysis of peroxidase and esterase isoenzymes by disc electrophoresis was carried out on 11 Taiwan cane varieties and their parents. The patterns for each variety are reproduced and the enzymes classified into a number of groups. Identification of a particular variety from its enzyme pattern is demonstrated. (See also LIU *et al.*: *I.S.J.*, 1975, **77**, 143.)

* * *

Technological characteristics of 15 varieties of sugar cane. Preliminary results for plant cane. E. R. DE OLIVEIRA, C. CRUCCIANI, A. I. BASSINELLO and D. BARBIN. *Brasil Açuc.*, 1974, **84**, 34–43.—Comparative tests are reported on the juice characteristics (Brix, pol, reducing sugars, etc.) and juice % cane contents of 15 CB and IAC varieties, and assessments made of their relative yields and technological merit.

* * *

Residual effects of three consecutive years of fertilization and trash mulching on soil fertility and the yield of the fourth ratoon crop. T. P. PAO. *Taiwan Sugar*, 1974, **21**, 70–73.—Trash mulching and application of N, P and K at 300, 150 and 150 kg per hectare, respectively, gave the highest cane yields of three different N-P-K rates with and without trash mulching, although results for the two cane varieties involved were not as good in clay soil as in sandy soil.

* * *

Artificial ripening of sugar cane with chemicals. P. C. YANG and T. P. PAO. *Taiwan Sugar*, 1974, **21**, 74–80. Field studies with "Cycocel", "Polaris", "Racuza" and "Ethrel" ripeners applied to two mid-season, high-yielding cane varieties are reported. Responses depended on variety and age of cane, but all increased sugar content up to 56 days after application, with sometimes noticeable fluctuations during the period between 7 and 56 days after treatment. While no adverse effects on the cane were discovered, only the cane treated with "Ethrel" exhibited more shoots in the ratoon crop than did the untreated controls, while cane treated with the other ripeners had fewer.

* * *

Influence of 2-chloroethyl trimethylammonium chloride on spindle extension and ribonucleic acid concentration in relation to cold treatment of sugar cane. C. C. LO. *Taiwan Sugar*, 1974, **21**, 81–83.—Young cane plants of F 160 variety first treated with 2-chloroethyl trimethylammonium chloride (CCC), a growth regulator, were (i) exposed to a temperature of 3°C for 2 days and then to room temperature, or (ii) stood at room temperature throughout the test period. Untreated controls were subjected to temperature conditions (i) or (ii). There was no growth of the spindle during the "hardening" period at 3°C, but subsequent growth rate averaged 2·10 cm in the case of the CCC-treated cane and 1·88 cm in the case of the untreated cane, while in the case of the cane in (ii), the growth rates averaged 0·98 cm and 0·91 cm for the CCC-treated and untreated cane, respectively. This indicated that temperature has a greater effect on growth under low temperature conditions than did chemical treatment which, however, had the greater effect on the concentration of ribonucleic acid, one of the metabolic constituents of cane closely associated with cold tolerance.

* * *

Differential incidence of the sheath mite, *Aceria sacchari*, in promising sugar cane varieties. S. SITHANANTHAM, R. DURAI and S. MUTHUSAMY. *Indian Sugar*, 1974, **23**, 955–957.—Results are given of experiments to determine *A. sacchari* incidence among twelve promising Coimbatore cane varieties. Two varieties were found to be completely resistant to the pest, while three were highly susceptible. It is suggested that slight resistance in certain varieties is due to Co 798 or Co 605 as one of the parents.

* * *

Varietal response of sugar cane to flooding tolerance. O. SINGH and O. S. SINGH. *Indian Sugar*, 1974, **23**, 963–965.—Greenhouse experiments were conducted over two years on four cane varieties to assess their behaviour under flood conditions. Tabulated results indicate that three performed better and had higher sugar contents than under normal irrigation, while the fourth did not improve much on its behaviour under normal irrigation conditions.

* * *

Drought resistance in sugar cane (a review). V. S. MANE. *Indian Sugar*, 1974, **23**, 973–974.—The literature on the effects of drought on cane is briefly reviewed.

* * *

The sterile male technique for the control of the white top borer pest of sugar cane (*Scirpophaga nivella* F.). S. HATMOSOEWARNO. *Berita Lembaga Pendidikan Perkebunan* (Indonesia), 1973, **5**, (3/4), 32–44.—Advantages of the use of the sterile-male technique (with sterilization brought about by irradiation) in controlling *S. nivella* are discussed.

* * *

Sprinkler irrigation in Swaziland. R. P. HUMBERT. *World Farming*, 1974, **16**, (8), 18, 30.—About half of the total of 16,746 ha under cane in Swaziland is sprinkler-irrigated. More than 1300 ha receive water from a permanent solid-set irrigation system; at Tambankulu Estates, where 810 ha are irrigated by this method, cane yields as high as 235 tons.ha^{-1} have been obtained at a cane age of 13 months. Once a full canopy has developed, 27 mm of water is applied every 3 days during the active growth stage, and the

red latosol soils release much of their available water at low moisture tensions (less than 1 atm) to give excellent root systems developing to depths of well over 1 m. Illustrations demonstrate the effects of the irrigation and show how easily the irrigation risers are coupled to the underground system. Class A pans are used for irrigation scheduling. The author also briefly discusses drip irrigation, but considers that under ideal conditions it has no advantage over the solid-set sprinkler system; installation and maintenance costs are regarded as the governing factors in the choice of systems, both systems using only 50–75% of the water used by flood or furrow irrigation.

* * *

Agronomic characteristics of 15 varieties of sugar cane. Preliminary results for ratoons. A. I. BASSINELLO, C. CRUCCIANI, E. R. DE OLIVEIRA and D. BARBIN. *Brasil Açuc.*, 1974, **84**, 131–137.—The 15 varieties studied for plant cane[1] have yielded results for a first ratoon crop and comparative data are tabulated and discussed in respect of tons of cane per ha, stalks per linear metre and weight of cane per stalk.

* * *

Nematode pests. R. H. G. HARRIS. *S. African Sugar J.*, 1974, **58**, 425–427.—It is pointed out that nematodes cause greater damage in sandy soils such as occur on the coastal strip along the length of the Natal sugar belt and in the lowveld areas of the eastern Transvaal, so that any control is bound to have a beneficial effect on the South African sugar industry. Various methods of control discussed include crop rotation, fallowing, disturbance of the soil, physical methods (using heat, electricity, irradiation or ultrasonics), biological control, breeding resistant cane varieties, mulching and chemical control. Advantages and disadvantages are discussed, and great importance is attached to successes achieved with "Temik 10 G" nematicide.

* * *

Subsoiling and heat treatment. L. L. LAUDEN. *Sugar Bull.*, 1974, **52**, (22), 6, 27.—A subsoiler developed by R. RICAUD of the Louisiana State University Agronomy Dept. has proved beneficial in breaking the soil and shattering the compacted area in the zone of root penetration, thus allowing cane to withstand drought and grow better. Because of the problems associated with compaction, many growers in Louisiana have expressed interest in making a subsoiler to the same design, and are invited to apply to the relevant office for a copy of the plans. Tests conducted earlier by the designer showed that up to 3·5 extra tons of cane could be obtained per acre. The use of heat treatment of certain cane varieties which are highly susceptible to ratoon stunting disease is essential, although treatment of all varieties is advocated. The question of whether to use hot air or hot water is briefly discussed—while hot air has generally been used in Louisiana, the author feels that there is justification for considering the use of hot water on the basis of the experience of those who do use it, one of the main reasons for its preference being reduced labour requirements.

* * *

Sugar cane variety recommendations for Louisiana for 1974. ANON. *Sugar Bull.*, 1974, **52**, (22), 19–20. The recommendations given are based primarily on test plot trials carried out under the supervision of the state authorities and USDA experiment stations. The characteristics of the varieties, of which L 62–96, CP 61–37 and CP 65–357 are the major ones recommended, are given, and planting advice for the different cane-growing areas of Louisiana is also provided. Emphasis is placed on the need for control of mosaic and RSD.

* * *

Some varietal characteristics of the more important commercial varieties. ANON. *Sugar Bull.*, 1974, **52**, (22), 21–22.—The advantages and disadvantages are given for L 62–96, CP 61–37, CP 65–357, L 65–69, L 60–25, CP 48–103, CP 52-68 and N:Co 310. A census of the varieties planted in 1974 in Louisiana shows the changes that have come about in the period 1972–74. The major changes include the increase in the amount of L 62–96 planted and the sharp fall in the planting of L 60–25 and CP 52–68 cane; L 60–25, although an early-maturing variety of high sugar content, is susceptible to mosaic and injury by "Dalapon", highly susceptible to borers and also prone to lodging and brittleness, while CP 52–68 is not recommended because of its susceptibility to mosaic, despite a number of advantages. L 62–96 has consistently outyielded CP 52–68, is erect and well adapted to mechanical harvesting, and has a high sugar and low fibre content, although it is also susceptible to RSD and moderately susceptible to mosaic and borers.

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Controlling Johnson grass seedlings and annual weeds in sugar cane planted in Louisiana in summer and autumn, 1974. ANON. *Sugar Bull.*, 1974, **52**, (22), 23–24.—Advice on chemical weed control is divided into two sections: weed control in planted cane on medium-to-heavy soils in most areas of Louisiana, and control of annual weeds in planted cane on light soils in certain areas of the cane belt. Nine herbicides are mentioned.

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Leaf scald on sugar cane—a new disease in Andhra Pradesh. Y. SATYANARAYANA. *Indian Sugar*, 1974, **24**, 23–26.—The symptoms of the disease, observed for the first time in Andhra Pradesh in 1972, are described and details given of the isolation and characteristics of the pathogen, *Xanthomonas albilineans*. A table is presented showing the incidence of the disease in the progeny from the various crosses at the research station at Anakapalle where the outbreak first occurred.

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Green manuring for sugar cane. R. N. SEETHARAMAN, K. SRIRANGAN and E. K. NATARAJAN. *Indian Sugar*, 1974, **24**, 29–30.—The advantages of green manuring are briefly discussed and the various green manure crops grown in India and elsewhere indicated.

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Studies on the carry-over effects of pre-monsoon soil moisture regimes on sugar cane. O. SINGH, O. S. SINGH and J. P. GUPTA. *Indian Sugar*, 1974, **24**, 31–34. Split-plot experiments with four replications were carried out during two years with three varieties of cane which was irrigated when the available soil moisture at a depth of 5–20 cm was 85%, 45% and 5% during the pre-monsoon period, corrections being made for any rainfall. Results indicated variations in

[1] CRUCCIANI *et al.*: *I.S.J.*, 1975, **77**, 176.

tillering, growth, yield and juice quality with differences in the soil moisture regimes under the effects of the irrigations, varietal differences also being apparent.

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Cooperation, phytopathology and sugar cane. H. BARAT. *Agron. Trop.*, 1974, **29**, 739–741.—Precautions to take in the introduction of foreign cane varieties into a country are briefly discussed with mention of quarantine stations in various countries; the quarantine station at Nogent-sur-Marne in France has been concerned solely with sugar cane since 1960 and has a capacity for 72 varieties which are primarily intended for the French West Indies. Up to 1971 the station drew its cane from Muguga (Kenya), Beltsville (USA) and Ibadan (Nigeria) quarantine stations, but since then it has drawn cane direct from a number of cane breeding countries such as South Africa and Barbados. A virology laboratory at Versailles has collaborated in the work of testing for ratoon stunting disease using elephant grass, and testing for mosaic using TX 412 sorghum is also envisaged. Short lists are given of varieties under investigation at Nogent-sur-Marne and of countries to which canes were sent after quarantine in 1972 and 1973.

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Date-time relationship of ratooning and fertilization on the yield of sugar cane. M. T. ILAGA. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 49–66.—Results of experiments are discussed in which cane and sugar yields and overall profits were greater in plant cane harvested at a cane age of 9 months as opposed to 10½ and 12 months. The ratoons from early-harvested cane also gave better results than did the ratoons from later-harvested cane; a further factor affecting yield was the time of fertilization, which gave highest yield when carried out two weeks after ratooning compared with five weeks after ratooning and delaying fertilization until the onset of rain (which generally gave the lowest yield of all three dates).

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Harvesting—methods, problems and the economics of various methods. M. T. ROBENIOL and M. T. ILAGA. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 67–72. See *I.S.J.*, 1975, **77**, 174.

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Cane ripening effect of "Polaris 1". P. H. PORQUEZ, F. Y. PANOL and J. N. GIBE. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 73–77.—Aerial application of "Polaris" at 5·3 kg in 18 gal of water per ha, 4 and 6 weeks before the scheduled harvesting date, increased sugar yield per ha and amount of sugar per ton of cane, the earlier application giving better results than the later application. During the 6-week period of the experiment rainfall was 10–12 inches below the 22-year average for the same period and area.

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Phosphorus and zinc interactions in the mineral nutrition of sugar cane in a Lipa load soil at Canlubang, Laguna. R. UL-QAYYUM and N. C. FERNANDEZ. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 78–90. Phosphorus was applied at three levels and zinc at four levels in a factorial combination in which it was found that cane growth and yield were higher than in the untreated controls, although juice pol and Brix were reduced by P application except at the highest level, at which the results were still only about the same as in the untreated control. Maximum yield was obtained with 20 kg Zn and 320 kg P per ha, while maximum length of millable cane was obtained with 5 kg Zn and 320 kg P per ha.

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Micronutrient studies at Canlubang mill district. I. E. L. ROSARIO, E. B. PUYAOAN and R. A. CRUZ. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 91–100. Laboratory experiments to determine the effect of various ratios of P to Zn on plant growth in sand culture are discussed. Preliminary results indicated that a P:Zn ratio of 4·4:1 approached the ideal for root development and tillering capacity. Increase in the ratio beyond this reduced root growth and adversely affected tillering, while the cane dry solids weight was also reduced; a ratio of 2·2:1 also had a detrimental effect on cane performance, but it is not known whether this was due to a shortage of P or to Zn toxicity. Alteration in the levels of P and Zn had no consistent effect on the nutrient content of different parts of the plant except in the case of iron, the amount of which increased in the roots with increase in the P:Zn ratio. Above a ratio of 4·4:1 the iron accumulation in the roots caused a reduction in root growth. Field trials are also reported, in which Zn and P requirements varied with soil.

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Computerized fertilizer recommendations for the Victorias mill district. E. M. TIANCO and C. N. ELEVADO. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 101–107.—Details are given of the computerized system at the Victorias Milling Co. Inc. which gives growers fertilizer recommendations based on analyses of soil samples which they have submitted. The soil laboratory can handle 40 soil samples in three days, using only two analyses, while computation of the data, preparation of the fertilizer recommendations and making out the report is completed by the computer in less than five minutes.

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Irrigation and improved cultural methods—key to increased sugar yield. M. T. ILAGA. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 116–138.—Aspects of overhead irrigation discussed include the benefits to the cane, agronomic factors which increase irrigation effectiveness, development of an irrigation programme, irrigation scheduling, and costs.

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The Philsugin sugar cane breeding project. ANON. *Proc. 21st Conv. Philippines Sugar Tech.*, 1973, 139–165.—A review is presented of the Philippine Sugar Institute cane breeding programme, with details of the individual stages, data on the number of selections and lists of varieties grown commercially and recommended for commercial planting (with their agronomic characteristics).

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A study on the mode of nitrogen fertilizer application in sugar cane. R. L. TRIPATHI and S. P. JAISWAL. *Indian Sugar*, 1974, **24**, 101–103.—While application of all the nitrogen in one single dose at the time of planting gave slightly lower percentage germination (53·5%) than did (i) application to the soil of half the dose at planting followed by spraying with 25% in May and 25% in June (56·4%), (ii) absence of N (55·6%), and (iii) half the N applied at planting foll-

owed by 25% in May and 25% in June (all soil applied) (55·2%), it gave the greatest yield per ha and the greatest net profit. A warning is given that application of gamma-BHC at planting time accelerates cane growth in the early phase and so alters N requirements, which should therefore be re-examined under such circumstances.

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Role of systemic fungicides in the control of sugar cane smut. S. MUTHUSAMY and S. SITHANANTHAM. *Indian Sugar*, 1974, **24**, 105–106.—The effects of six fungicides on smut-infected cane were determined. Best results (81·8% decrease in infection compared with the untreated control) were obtained with 0·5% "Agallol", followed by 0·1% "Demosan" (58·3% reduction). An increase in infection (31·1% compared with the control) was recorded after treatment with 0·1% "Vitavax".

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Loss in yield of cane and juice quality due to grassy shoot disease. G. R. SINGH. *Indian Sugar*, 1974, **24**, 109–112.—The adverse effect of grassy shoot was determined with Co 421 and Co 658 cane. The reduction in cane and sugar yields was greater at 90·5% and 91·3%, respectively, for Co 421 than for Co 658 (82·2% and 83·5% reduction, respectively). The disease affected germination of Co 421 cane but not of Co 568.

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Looking into the possibilities of fertilizer and soil conservation. R. A. CRUZ. *Sugar News* (Philippines), 1974, **50**, 224–226.—The advantages of incorporating cane trash in the soil (either by chopping it and ploughing it in, or by piling it between the furrows and allowing it to decompose) are discussed and references made to experiences outside the Philippines.

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Testing standard tractors on hillsides. ANON. *S. African Sugar J.*, 1974, **58**, 483–485.—Tests conducted in South Africa with 2-wheel drive tractors and implements on slopes between 10° and 17° are briefly reported and recommendations summarized.

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Pre-release of a new variety: N 52/219. ANON. *S. African Sugar J.*, 1974, **58**, 506.—The agronomic characteristics, disease reactions, yield and adaptability of N 52/219 cane variety, bred from N:Co 399 × NM 214, are given and its performance compared with that of N:Co 376.

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Identification of the cause of red stripe disease of sorghum in New South Wales (Australia) and its relationship to mosaic viruses in maize and sugar cane. L. J. PENROSE. *Plant Disease Reporter*, 1974, **58**, 832–836.—Investigations have shown that isolates of the viruses responsible for red stripe in sorghum and mosaic in maize were similar in host range, reaction to purification and particle length, as well as being serologically related. The virus was identified as the Johnson grass-infesting strain of cane mosaic virus SCMV-J. The virus isolated from mosaic-infected cane failed to infect Johnson grass, but in some other hosts caused symptoms similar to those caused by the sorghum and maize isolates. Particles of the cane isolate were shorter than those of the other two isolates and reacted differently to the purification method. The cane isolate was not found to be serologically related to the other two isolates.

Mineral nutrition of sugar cane in Brazil. J. O. FILHO and S. RUGAI. *Brasil Açuc.*, 1974, **84**, 210–219.—A review is presented of fertilizer studies carried out in Brazil and the need emphasized for further trials to be made using the new cane varieties now in use.

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Technological characteristics of 15 varieties of sugar cane. Preliminary results for ratoons. E. R. DE OLIVEIRA, C. CRUCCIANI, A. I. BASSINELLO and D. BARBIN. *Brasil Açuc.*, 1974, **84**, 220–229.—Tabulated data are presented for the juice yield and characteristics for the first ratoon crop of the 15 Brazilian varieties studied earlier as plant cane[1].

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Mineral composition of rotary filter cake. N. A. DA GLÓRIA, A. O. JACINTHO, J. M. M. GROSSI and R. F. SANTOS. *Brasil Açuc.*, 1974, **84**, 235–242.—264 samples of filter cake from a single factory were collected and made up into 22 composite samples which were then analysed for oxydizable carbon, Ca, Mg, K, N, SO_4, Cu, Mn, Zn, Mo, Co and water content. Other analyses included organic and inorganic phosphorus, silica and organic matter % dry cake, and it is concluded that the principal macronutrient present was N in mainly protein form. Of the phosphorus present, about 30% was in organic form. Iron was the most common micronutrient, followed by Mn, Zn, Cu and Mo.

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Flowering control with "Diquat". P. H. MOORE. *Hawaiian Planters' Record*, 1974, **58**, 323–329.—Tests with two heavy-flowering varieties of cane at different sites in Hawaii are reported, in which ¼ lb of "Diquat" in 7 gal of water per acre was applied and the results compared with untreated controls. Aerial application at a time found to be optimum for the region reduced flowering by more than 90%, while application 1 week before or after the optimum date halved the effectiveness of the treatment. Since the optimum dates were 3 weeks apart for the two varieties tested and differed from reported dates for other varieties, individual testing for the response of any one variety to "Diquat" is necessary.

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Ripening of sugar cane with chemicals. ANON. *Sugar y Azúcar*, 1974, **69**, (10), 19–21.—Control of cane ripening is discussed and results achieved with "Polaris" chemical ripener are reported generally.

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Irrigation—new developments in Hawaii. R. J. LEFFINGWELL. *Sugar y Azúcar*, 1974, **69**, (10), 23–28. Drip and sub-surface irrigation techniques in Hawaii are discussed with the aid of illustrations.

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High-speed photography of sugar cane harvesting. A new technique for evaluating equipment and its effect on cane. J. E. CLAYTON. *Sugar y Azúcar*, 1974, **69**, (10), 29–31.—The use of high-speed photography to study contact between cane and the rotating components of harvesters, cleaners, etc. is discussed and use of the technique in Florida to establish optimum means of harvesting is explained.

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[1] DE OLIVEIRA *et al.*: *I.S.J.*, 1975, **77**, 206.

Sugar beet agriculture

Assimilate translocation and sugar accumulation in the sugar beet. A. L. KURSANOV. *Zeitsch. Zuckerind.*, 1974, **99**, 478–487.—The findings of a number of authors (52 references are given to the literature) are summarized to give a general picture of the processes of sugar accumulation in the beet, starting with translocation of assimilation products from the photosynthesizing chloroplasts in the leaf blade and ending with accumulation of sugar in the vacuoles of the root storage cells.

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Effect of nitrogen on the quality of beet roots from a technological point of view. J. S. MEHTA, J. K. P. AGARWAL, R. SRIVASTAVA and S. SHARAN. *Indian Sugar*, 1974, **23**, 959–961.—Preliminary studies on the effects of nitrogen on beet morphology and processing properties are reported, showing the tendency for quality to fall in both varieties under examination as the rate of nitrogen application was increased from 60 to 240 kg.ha^{-1}.

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Nitrogen fertilizer experiments to be established in Magic Valley sugar beet fields in 1975. L. KERBS. *Sugarbeet*, 1974, (76), 12–13.—Reference is made to a series of experiments planned for 1975 to determine the effects of N application on a number of beet farms in the Magic Valley area of Utah, USA. A brief mention is made of an experiment conducted in 1973 on one farm in the area, where 0, 50, 150 or 250 lb of N per acre was applied before spring ploughing. The top 2 ft of soil revealed 101 lb of nitrate N per acre left over from the previous year when beans had been grown. Results of the study showed that root yields increased to a maximum at about 250 lb available soil N per acre, after which it fell with increase in soil N; the beet sugar content fell with each increase in soil N, while maximum sugar yield per acre occurred at about 150 lb of soil N per acre.

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Relationship between sugar content and nitrogen fertilization. II. ANON. *Sugarbeet*, 1974, (76), 17–18. On the basis of field tests in which soil residual nitrate N was determined, the beet yields on individual farms noted and other factors considered, including soil type, a recommendation of 10–12 lb of N per ton of beets per acre was made in order to obtain maximum sugar yield. Tabulated data demonstrate the trends in various beet factors with increasing N application. It is pointed out that even with increase in the nitrate content of beet brei, the root yield per acre changed only very slightly.

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Fertilization and chemical composition of sugar beet. T. MAZUR, J. KOC and Z. WRÓBEL. *Gaz. Cukr.*, 1974, **82**, 186–189.—Investigation of the effects of N-P-K, applied with farmyard manure, on the chemical composition of beet roots and leaves as expressed by the albumin, N, P and K contents, showed that in fact mineral fertilizers had less effect than did climatic and soil conditions, and influenced the chemical composition of the leaves more than of the root. It was found, from average results for 1971–1973 in which varying proportions and quantities of N, P and K were added (with beet grown in soil treated only with manure as control), that N application had a greater effect on the N content of the beet than did P application on the P content and K application on the K content.

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The importance of the early stage of development of the sugar beet for its subsequent growth and yield. C. WINNER. *Zucker*, 1974, **27**, 517–527.—While the development of the beet in its early stages is of paramount importance for its final yield, there are many factors which can have a detrimental effect on the young beet, and these have been examined, including soil and climatic conditions as well as soil-inhabiting root parasites such as fungi and nematodes. While, under ideal conditions, the planting of seedlings will give better yields than will seed, under adverse conditions the theoretical yield from seedlings can be considerably reduced; with poor weather conditions the vegetation period may be extended, and if seedlings have been planted, the size and number of leaves will be excessive. Particularly important for young beet is a starting fertilizer application, although a number of questions arise concerning this, e.g. dosage and proximity to seed or plant, the answers to which can only be given for a specific soil.

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Enzymes involved in the post-harvest degradation of sucrose in *Beta vulgaris* L. root tissue. R. WYSE. *Plant Physiol.*, 1974, **53**, 507–508; through *S.I.A.*, 1974, **36**, Abs. 74-1058.—Sugar beets were stored at 2° or 21°C for 30 days, or at 5°C for 110 or 160 days, and the reducing sugar contents and enzyme activities measured. The reducing sugar content of beets stored at 2°C did not change, but that of beets stored at 21°C for 30 days or 5°C for 160 days approximately doubled; in the latter case, the increase was particularly rapid during the final 50 days. Acid invertase activity increased very considerably during storage, especially at the higher temperatures; neutral invertase and sucrose synthetase activities decreased during storage. Acid α-glucosidase activity was detected in fresh beets.

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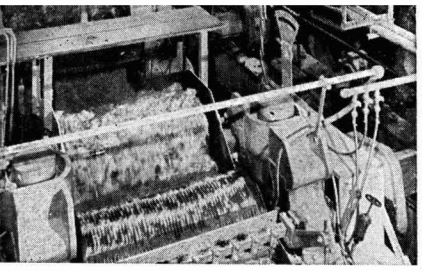
The soil test. R. KOLWAITE. *Sugar Beet J.*, 1974, **38**, (1), 8–9.—The value of soil testing to determine fertilizer requirements is discussed, and nutrient equilibrium and exchangeability in the soil briefly explained. The question of judicious application of fertilizers is considered particularly important in view of current shortages.



Cane sugar manufacture

The effect of field soil on sugar cane clarification. W. H. KAMPEN. *Sugar y Azúcar*, 1974, **69,** (8), 18–22. The detrimental effect of soil, introduced into the factory with cane, on clarification was investigated in the case of three cane varieties grown in Louisiana. The effects of varying amounts of soil were determined individually for each variety, the three basic types of soil occurring in Louisiana being represented (sand, silt and clay). The effects of the soils on sugar losses in molasses and filter cake were also determined, showing that a factory crushing 3000 t.c.d. could lose about 2800 lb of sugar per day if 1% (w/v) sandy soil were present in juice, over 5500 lb if 1% silty soil were present, and over 10,000 lb if 1% clay were present. A relationship between field soil and insoluble solids in juice was established, and details are given of the procedure for determining field soil in juice.

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Inversion control in mill juice. M. H. SILVA. *Sugar y Azúcar*, 1974, **69,** (8), 25–27.—Experiments at Mayaguez sugar factory in Colombia concerned the use of Hodag "Sanitrol" to combat inversion in cane milling. From the positive results obtained, a saving of $144,000 is calculated for a 300-day season when 720,000 tons of cane is crushed, allowing for 12 g of "Sanitrol" used per ton of cane, and assuming a price of $1.20 per lb for the sugar recovered.

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Waste control in the sugar industry. ANON. *Indian Sugar*, 1974, **23,** 975–980; 1974, **24,** 35–41.—Ways in which waste can be reduced in a cane sugar factory are indicated. The article covers all materials entering the factory, including cane, water, fuel, chemicals, etc. and examines the processes and machinery used, improvements which could reduce sugar losses as well as raise the efficiency of manpower and such items as bagasse fuel utilization.

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Water requirements for a sugar factory. L. G. DE SOUZA and U. DE A. LIMA. *Brasil Açuc.*, 1974, **84,** 140–152.—Measurements and calculations have been used to determine the water consumption of a small sugar factory producing 12,000 metric tons of sugar per crop; it is set at around 850 m^3 per hour, although variations occur as a consequence of using different equipment and processes within the factory. Treatment and re-use of waste water offers scope for the reduction in fresh water requirements.

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Integration of sugar factory operations with a cattle feedlot. J. FARMER. *Sugar y Azúcar*, 1974, **69,** (9), 30–37.—Integration of cane sugar factory and cattle feedlot operation provides for utilization of all that part of the cane growing above ground, reduces the problem of waste disposal, facilitates harvesting and cane cleaning, and reduces factory and cattle feeding costs, while location of a feedlot near the factory would minimize handling and storage of fodder prepared from cane tops and leaves mixed with molasses. The various aspects of factory processing which would benefit from the scheme are examined in turn and the economics considered. The article is primarily based on conditions in Hawaii.

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Bagasse, diffusion, rendement. P. NEUVILLE. *Ind. Alim. Agric.*, 1974, **91,** 857–861.—See *I.S.J.*, 1970, **72,** 164–167.

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TSC's Kaohsiung harbour terminal. H. Y. CHEN. *Taiwan Sugar*, 1974, **21,** 106–113.—Details and illustrations are given of the Kaohsiung bulk terminal for sugar and grain. The sugar storage facilities include a 50,000-ton capacity bulk sugar warehouse and two 10,000-ton capacity bagged sugar warehouses. Future expansion will include construction of a further bulk sugar warehouse of 20,000 tons capacity. The terminal started operations in early 1974.

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The development of a continuous process in a cane sugar factory. S. L. SANG, Y. C. YEN, C. H. CHEN and C. S. WU. *Taiwan Sugar*, 1974, **21,** 114–119. Results are given of pilot-scale experiments with a continuous carbonatation system involving treatment of 6·5–9·0 tons of mixed juice per hour. No difference in carbonatation juice filtrability, filtered juice colour and mud settling rate were found between the conventional batch system and the continuous scheme.

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An experiment report on the stainless steel tube type filter. Y. L. CHEN. *Taiwan Sugar*, 1974, **21,** 125–130. Tests with a stainless steel candle filter, in which the porous element is surrounded by filter fabric, are reported and construction and operation of the filter, made by the Taiwan Sugar Corporation, described. Results showed that the filter gave better quality 1st carbonatation juice than did a filter-press. Suggested means of improving the filter are listed.

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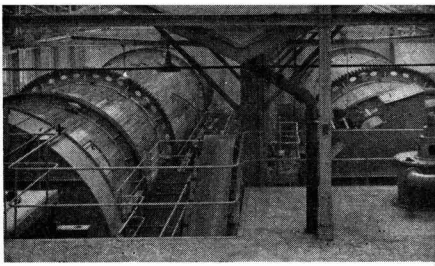
Experiment on cane dry cleaning in the 1973/74 crop. K. T. FANG. *Taiwan Sugar*, 1974, **21,** 136–139. Experiments are described in which a grid drum type of trash separator was used to handle a maximum of 120 tons of cane per hour. The cane was allowed to fall from the top end of an elevator into the drum, down which it passed on its way to a conveyor. Trash fell onto a conveyor beneath the drum, which rotated at 5 rpm and had an upward slope (towards the cane feed) which was optimum at 7–9°. Trash content was reduced from an average of 6·06% to 3·86% in one set of tests and from 7·01 to 3·21% in another. In all cases, more than 60% of the trash removed consisted of sand and mud.

Beet sugar manufacture



A float level indicator for juice in evaporators. A. I. KHOMENKO and B. I. KRAMARENKO. *Sakhar. Prom.*, 1974, (7), 38–39.—A description is given of a simple float-type indicator which has proved reliable when incorporated in an evaporator and which is recommended for use with various liquids under pressure.

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Automatic device for technical control of the filtration rate of suspensions. S. M. ZAGRODZKI. *Zeitsch. Zuckerind.*, 1974, **99**, 421–423.—The automatic apparatus described comprises a vertical tube divided into an upper and lower chamber of special profile with vertical and sloping faces so that a filter screen separates the two compartments. Suspension is fed into the upper chamber and passes, with increase in regulated pressure, through the filter screen into the lower chamber where it eventually flows between two electrodes located just before the discharge port. The impulse transmitted by the electrodes actuates a recorder, the pen of which charts a straight line which is the resultant of the flow rate in horizontal and in vertical directions. As soon as the filtrate level in the lower chamber reaches a further electrode located towards the top, the recorder stops and the pen returns to its null position. At the same time the pressure valve is closed and a feed valve opened to admit water for rinsing of the filter screen. Water and mud valves are closed after the rinsing operation is complete, the suspension feed valve opened, and the automatic cycle restarted.

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Experiences with a vibratory (beet) leaf catcher. A. MILOVANOVIC and B. DEVECERSKI. *Zeitsch. Zuckerind.*, 1974, **99**, 423–425.—Details are given of the Venot-Pic vibratory leaf catcher as installed at "Dimitrije Tucović" sugar factory in Yugoslavia. Use of the equipment has permitted a 26% reduction in beet slicer knife consumption and improved beet cossette quality (compared with the previous campaign without the leaf catcher) through removal of some 8 tons of extraneous matter (soil, grass, leaves and beet pieces) in one campaign.

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Control of the non-sugar:water ratio in low-grade massecuite. L. TÓTH. *Cukoripar*, 1974, **27**, 184–188. With the aim of achieving maximum molasses exhaustion, the crystallization rate in boiling should be maintained by gradually decreasing the massecuite temperature at constant supersaturation; however, with decrease in temperature, massecuite viscosity increases, necessitating addition of water. Nevertheless, there is an optimum non-sugar:water ratio (2·6–2·9) corresponding to an optimum crystallization rate, so that excessive water addition is undesirable. The author presents two nomograms which can be applied to pan boiling and massecuite cooling, respectively, for establishment of optimum Brix and non-sugar:water ratios, whereby the boiling time and steam consumption are reduced and molasses exhaustion brought to a maximum.

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The quality of feed water for the diffusion process. N. V. KULINICH, V. G. YARMILKO, L. D. BOBROVNIK and P. G. ZAGORODNYI. *Sakhar. Prom.*, 1974, (8), 17–20.—The question of the most suitable form of water to use for beet diffusion and the effect of treatment (to adjust its pH to that of the juice in the beet cells) on losses and non-sugar extraction are discussed with reference to results obtained by various authors. Promising results have been obtained by experimental electrodialysis of ammoniacal water, whereby most of the ammonia has been removed and an optimum pH achieved.

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The effect of natural alkalinity on pH of carbonatation juice and syrup. V. Z. SEMENENKO, R. G. ZHIZHINA and A. R. SAPRONOV. *Sakhar. Prom.*, 1974, (8), 21–25. Tests to establish the effect of carbonatation juice and sulphitation syrup natural alkalinity on pH and its temperature coefficient showed that at a high natural alkalinity, pH change was less governed by temperature and SO_2 concentration than it was at low natural alkalinity. Moreover, juices with high natural alkalinity yielded syrups which were more heat-stable and suffered less colour formation and lower sugar losses than juices of low natural alkalinity.

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Inter-vessel sulphitation. YU. D. GOLOVNYAK, YU. V. ANIKEEV, V. Z. SEMENENKO and L. D. BOBROVNIK. *Sakhar. Prom.*, 1974, (8), 25–29.—Reference is made to investigations at two Soviet sugar factories where juice from the 3rd effect of a quadruple-effect evaporator (with vapour cell) was mixed with remelt liquor and subjected to intermediate sulphitation and filtration before feeding to the 4th effect. The pH of 3rd and 4th effect juices was 8·4 and 7·6 on average during tests at one factory and 8·5 and 7·4 at the other, while colour contents were 15·2°St and 16·2°St at one factory and 28·2°St and 33·5°St at the other. Optimum conditions were those giving a juice pH (at 20°C) of 8·3–8·5 and a Brix of 53–55°.

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A unit for continuous determination of maximum electric conductance (of sugar solutions). V. I. TUZHILKIN, A. I. LAPKIN and V. A. KHOMYAKOV. *Sakhar. Prom.*, 1964, (8), 34–36.—A specially designed unit has been tested at Timashev factory for automatic continuous determination of maximum conductance χ_M, linearly related to purity. The unit, which is briefly described, embodies automatic temperature and concentration control.

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Evaluation of the technological value of sugar beet from the purity of pressed juice. S. ZAGRODZKI. *Gaz. Cukr.*, 1974, **82**, 166–171.—Tests, results of which are

given in the form of graphs, indicated that sugar yield from beet can be predicted, for normal processing, from the purity of pressed juice and from the beet sugar content, although allowance must still be made for molasses purity and the amount of sugar remaining in exhausted cossettes.

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Multi-sectioned radial settler for flume water treatment. B. MAZUR. *Gaz. Cukr.*, 1974, **82**, 172–174.—A 10-compartment settler 36 m in diameter and 5·75 m high of special configuration and with a central structure for discharge of muds (which are removed from the compartments by a suction system) is designed for a 1 hour residence period and is claimed to have up to 95% purification efficiency. Details and diagrams are given of the settler.

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Browning control in beet sugar production. J. F. T. OLDFIELD. *Chem. and Ind.*, 1974, 720–721.—The effect of SO_2 in reducing colour formation in beet thick juice is examined and the question of optimum dosage discussed. It is pointed out that while SO_2 reduces colour formation caused by direct alkaline degradation of reducing sugars, part of its action is directed towards preventing the colour-forming degradation of amino-acid deoxyfructoses (formed by reaction between amino-acids and glucose followed by an Amadori rearrangement of the N-glucosyl amino-acids).

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Processing problems with beet of extreme quality as a result of heat and drought in 1973. E. MALITS. *Zucker*, 1974, **27**, 465–469.—Because of very dry conditions and relatively high day and night temperatures during the 1973 beet growing season, the processing quality of the beet was poor and presented problems at Siegendorf sugar factory in Austria. Particular mention is made of a 4-minute interval which took place between adjustment of juice pH to the optimum of 10·8 for flocculation in preliming and the actual occurrence of flocculation. By allowing for this and adjusting the pH at the end of preliming to 12, considerable improvements were obtained in the mud properties and juice colour, but without any benefit to the general purification efficiency. Marked fluctuations in thick juice pol and purity were observed, and the hourly throughput was increased or reduced according to the levels of the two factors. Further complications arose when stale and frosted beet were delivered to the factory towards the end of the campaign; the average dextran content was almost 0·6 g per 100 g dry solids, and this necessitated the use of filter aid to obtain satisfactory juice filtration. The question of irrigation under such adverse growing conditions as mentioned above and the factors governing optimum irrigation are discussed. It was found in some cases that irrigation under these conditions had a detrimental effect on the beet which consequently had a poorer processing quality than did unirrigated beet.

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The use of gas turbines in the sugar industry. N. MARIGNETTI and G. MANTOVANI. *Zucker*, 1974, **27**, 470–474.—The economic and technological advantages of gas turbines for simultaneous power generation and heating of boiler plant for steam generation (with exhaust gas) are considered for beet and cane sugar factories and for a refinery. In each case examined, a heat flow diagram is presented and appropriate data tabulated. While the schemes are applicable to new factories, a scheme for an existing factory is briefly described which incorporates both a steam turbine and a gas turbine for power production.

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Development of and results of tests on a SM-1,5 spray-type beet washer for washing of beet before storage in piles. E. T. KOVAL' *et al. Sakhar. Prom.*, 1974, (9), 12–15.—Details are given of a Soviet-designed spray-type washer of 1500 tons per day beet throughput developed for pre-storage washing of beet. Tests over a few days showed that at a residence time of 14–19 seconds, the beet lost 79–94% of their dirt compared with only 16·4–26·6% in a trough-type washer, while sugar losses were 0·006–0·008% on weight of beet, compared with about 0·40% in the other washer. Over 95% of the beet trash was removed by the spray-type washer. Total water usage was 67–68% on weight of beet (of which 20% absolute was fresh water).

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Results of factory tests on increasing the hot defecation period. I. P. FEDOROVA, V. P. KUZ'MENKO, V. A. KOLESNIKOV and V. A. MAKSYUTOV. *Sakhar. Prom.*, 1974, (9), 15–18.—Tests at Malorossiiskaya factory in which 4–5 minute (conventional) hot liming was compared with 11–12 minute hot liming demonstrated the advantages of the extended period over the standard scheme when juice had an abnormally high reducing matter and amide content which, with a short liming period, caused a low pH with attendant difficulties and increased losses in subsequent process stations. The prolonged liming reduced molasses sugar and increased white sugar yield and quality.

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Results of experimental investigations into methods of treating beet sugar factory wash water. A. P. PARKHOMETS and A. I. SOROKIN. *Sakhar. Prom.*, 1974, (9), 23–27.—Experiments on wash water treatment are described, from which it is concluded that optimum treatment involves addition of lime as coagulant to give a pH of 9·6–9·8, followed by quiescent settling, after which the water is aerated for 15–20 minutes and finally filtered through quartz sand.

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Electro-flotation treatment of flume-wash water. I. M. FEDOTKIN, N. A. ARKHIPOVICH and V. A. LAGODA. *Sakhar. Prom.*, 1974, (9), 27–30.—Laboratory experiments on electro-flotation of flume-wash water are described in which the water was fed into a vertical glass column at the bottom of which were installed an annular cathode and anode connected to a transformer through a rectifier. Addition of $FeCl_3$ considerably reduced the time required to effect almost complete removal of suspension, while increase in current density had little effect on treatment above a certain level. The effects of other factors were also established.

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Improvement in the design and automation of FiLS filters. V. T. RUD', YU. F. TYSUKALO, N. B. IL'CHENKO and V. M. PERTSEL'. *Sakhar. Prom.*, 1974, (9), 38–43. A description is given of the latest modifications to the FiLS vertical pressure leaf filter, including 50% enlargement of the filtration surface by relatively simple changes to the configuration of the filter body. Details are also given of the automatic control scheme for a battery of six such filters used for carbonatation juice treatment.

Automatic control of a stone catcher. N. F. BONDARENKO. *Sakhar. Prom.*, 1974, (9), 44–46.—Details are given of a scheme for remote control of the speed of rotation of a Pavlyuk-Sokolov drum-type stone catcher.

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New methods for combating scale formation in an evaporator. A. S. IVANOV and D. R. SAPRONOV. *Sakhar. Prom.*, 1974, (9), 48–51.—Laboratory and factory tests showed that treatment of evaporator tubes with a 5% aqueous solution of "Trilon B" (a sodium salt of ethylene diamine tetraacetic acid) led to formation of a layer of magnetite on the tube surface which reduced both scaling and corrosion. The corrosion resistance of various types and grades of steel was also determined.

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Tests on a plate-type heat exchanger. V. N. GOROKH, A. A. KNYAZEV, A. S. TIMOSHENKO, B. F. US and V. N. FILONENKO. *Sakhar. Prom.*, 1974, (9), 51–56. Tests on a De-Laval R-15 plate-type heat exchanger of 75 m^2 heat exchange surface (150 plates) are reported. Results are given for heating of water, raw and 1st carbonatation juice and thick juice and for cooling of thick juice (for purposes of storage).

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Examination of the performance of a vacuum pan calandria. L. M. KLIMENKO, I. M. FEDOTKIN, A. S. DYCHENKO, P. A. KHOTYNENKO and V. D. NOVOSELETSKII. *Sakhar. Prom.*, 1974, (9), 56–58.—Investigations showed that removal of incondensable gases from a VATs-600 floating calandria pan also removed heating vapour and that the only way to remove the gases without vapour loss was precise control of the vent opening as a function of change in the vapour condensation temperature (in turn a function of the concentration of incondensable gases in the vapour space).

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Continuous treatment with "Trilon B" of feed water for medium-pressure boilers having highly scaled baffled tubes. P. T. DUNAEV, A. K. IL'IN and Z. F. BASHMAKOVA. *Sakhar. Prom.*, 1974, (9), 59–61. Successful prevention of scale formation has been obtained with continuous addition of a weak solution of "Trilon B" and ammonia to boiler feed water.

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Effect of sugar beet topping on its processing properties. M. Z. KHELEMSKII, N. T. POEDINOK, A. KH. STARUSHENKO, D. G. GOMANYUK and T. A. KURBET. *Sakhar. Prom.*, 1974, (9), 61–64.—While beet with the whole crown removed had better processing properties (as indicated by raw and carbonatation juice quality and molasses and sugar yields) than did beet from which only the very top of the crown had been removed, the beet topped to the lower level did not store as well as the other beet, so that low topping is recommended only in the case of beet going directly to processing.

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Sugar factory (waste) water treatment. Study on the volume and quality of waste water. L. HERSSENS. *Sucr. Belge*, 1974, **93**, 353–357.—A simplified formula can be used, it is shown, to calculate the total weight Q (in metric tons) of waste water emanating from a sugar factory in a campaign; it takes the form $Q = \alpha B$, where B is the amount of beet processed (metric tons) and α is a constant defining the ratio of the weight of water in liquid form to the weight of beet from which it originates. The value of α, which is governed by a number of factors (of which the most important are the processing scheme used by the factory, the extent of pulp pressing and the vapour conditions in boiling and in the last evaporator effect), is almost always between 0·20 and 0·35. The nature and quality of waste water from the various sources in a sugar factory are discussed and suggestions given on how to reduce the quantity and BOD_5.

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How to act on cations to improve the sugar yield in beet processing. K. W. R. SCHOENROCK, C. L. HSIEH and P. RICHEY. *Sucr. Belge*, 1974, **93**, 359–365. While addition of ionic sodium to beet juice, as NaOH or Na_2CO_3, has become the practice in some factories in order to reduce the quantity of calcium ions while restoring the required alkalinity, it was found at Nampa sugar factory in the USA that sugar yield fell as the amount of sodium carbonate added was increased. To overcome this problem, magnesium oxide is advocated instead of sodium carbonate in 2nd carbonatation, and is featured in a process for which a patent application has been submitted. Details are given of tests at the Mini-Cassia and Nampa factories in which MgO was added to 1st carbonatation juice gassed with CO_2 to "over-carbonatation" conditions. Comparison with the use of sodium carbonate showed that the new process gave a lower molasses sugar content, while evaporator scale formation was reduced.

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Evaluation of the efficiency of diffusers in the beet sugar industry on the basis of transfer units. G. V. GENIE. *Zeitsch. Zuckerind.*, 1974, **99**, 473–477.—The principle of sugar extraction in counter-current diffusers is discussed and a generalization of SMET's theory derived for stage-less diffusers. A transfer unit model is developed for evaluation of beet diffuser efficiency using a method parallel to the theoretical plate method for evaluating distillation column efficiency. The number of transfer units in a diffuser is that number of perfect counter-current batch diffusions which would be required to give the same juice extraction from the same beet raw material at identical losses. A formula is presented for calculation of the transfer unit number.

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The micro-mechanism of (beet) diffusion. E. SLAVÍČEK. *Listy Cukr.*, 1974, **90**, 182–184.—From differential equations, the sugar concentration field in cossettes was calculated and expressed as lines of constant concentration for various cossette shapes (although a hexagonal-section cossette was selected for the calculations since it came closest to the form of the diffusion field). Results of the calculations showed that the ratio of mass transfer coefficient to the mean sugar concentration in the cossette remained constant throughout diffusion.

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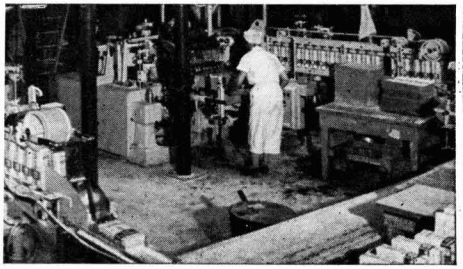
New method for sugar juice purification. S. ZAGRODZKI. *Ind. Alim. Agric.*, 1974, **91**, 875–878.—Results obtained with the pre-carbonatation scheme described earlier[1] are discussed and a number of modifications to the original scheme indicated. Comparison with conventional carbonatation showed that the new method gave a juice of higher purity rise and lower colour content as well as providing better filtration and settling.

[1] ZAGRODZKI: *I.S.J.*, 1973, **75**, 139–140.



Sugar refining

Melt phosflotation *vs.* melt carbo-sulphitation for the manufacture of refined sugar. A. C. CHATTERJEE and C. SHYAMSUNDAR. *Sugar News* (India), 1973, **5**, (7), 5–10, 13.—See *I.S.J.*, 1975, **77**, 25.

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Centralized control of bulk sugar handling. ANON. *Instrumentation* (Philadelphia), 1971, **24**, (1), 16–19; through *S.I.A.*, 1974, **36**, Abs. 74–815.—The control system for sugar handling designed and built by Honeywell for the National Sugar Refining Co. refinery is briefly described. The loading of sugar into, conditioning of sugar in, and discharging of sugar from nine 90-ton bins are controlled; a sugar dust reclamation system is included. Interlocks which prevent the mixing of different grades of sugar are included in the system. Sensing probes which monitor the filling and conditioning are present at different levels in the bins.

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New automatic defecation-decolorization station using the "Talofloc" process. J. T. RUNDELL, C. V. RICH and A. E. NORCOTT. *Sugar J.*, 1974, **37**, (1), 18–25. See *I.S.J.*, 1975, **77**, 155.

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Acid treatment of AV-16GS decolorizing resin. G. A. CHIKIN, L. A. REZNIKOVA, T. A. SINYAVSKAYA and V. V. ZHELEZNYAKOV. *Sakhar. Prom.*, 1974, (7), 25–26. Reference is made to fouling of AV-16GS anion exchange resin in OH^- form by calcium and iron ions when white sugar solutions containing considerable amounts of these particular ions are treated. Tests have shown that periodic treatment of the resin with HCl removes sufficient of the mineral impurities to permit an increase in the decolorizing efficiency.

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Test on production of higher quality sugar from raw sugar. B. K. RYAZANOV *et al. Sakhar. Prom.*, 1974, (8), 31–33.—Details are given of the refining scheme used at Pavlov sugar factory in 1973 for treatment of some 27,000 tons of cane raw sugar.

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Comparative evaluation of the physico-chemical properties of active carbons in decolorization of sugar factory products. G. P. PUSTOKHOD, YA. O. KRAVETS and YU. D. GOLOVNYAK. *Sakhar. Prom.*, 1974, (9), 18–21. Laboratory tests were conducted on various brands of active carbons (in granular, crushed and powdered form) used to decolorize a standard liquor of 60°Bx, pH 7·0 and a colour content of 5·0°St. Of the granular type, the best was Pittsburgh "CAL", followed by Norit DRK-1 and various Soviet carbons made from peat, while two Soviet carbons in crushed form also gave 80% decolorization. In the case of powdered carbons, best results were given by A5/8S (of British origin) and 23361 (of French origin) but, although better than "Supra-Norit-33" used as standard, they are unsuitable for use in the sugar industry because of the acidity of the water extract. Hence, a Yugoslavian carbon, "Suchar SCZ", and a Soviet carbon of peat origin are recommended in this group of carbons.

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Liquid sugar manufacture for industrial processing. A. A. SOLLOGUB and M. B. YARMOLINSKII. *Sakhar. Prom.*, 1974, (9), 21–23.—Despite the greater costs of transporting liquid sugar by rail in the USSR compared with granulated sugar (calculated for distances up to 1000 km), the authors are of the opinion that liquid sugar has sufficient advantages, both for the refinery or factory and for the user, that they recommend greater liquid sugar production (at present only one refinery in the Soviet Union produces it). In any case, it is pointed out that the calculated rail costs do not allow for the lower costs resulting from a reduction in labour normally required for transport operations. On the other hand, it is considered advisable to concentrate on short hauls, since the difference in costs between liquid and granulated sugar transportation increases with distance.

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Conditioning and storage of refined sugar in bulk at Puerto Rican American Sugar Refinery Inc. O. DE ARAGON and M. CRUZ V. *Paper presented at 16th General Meeting, Amer. Soc. Sugar Beet Tech.*, 1970. Information is given on the two Weibull white sugar silos, of 20,000 and 40,000 tons capacity, at Mercedita refinery and graphs are presented showing the moisture and colour contents of ingoing and outgoing sugar.

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BSP carbon regeneration systems. L. A. LOMBANA. *Paper presented at 16th General Meeting, Amer. Soc. Sugar Beet Tech.*, 1970.—Full details are given of BSP Corporation carbon regeneration systems, including conveying of the carbon slurry, de-watering before the carbon is fed to a regeneration furnace, equipment for handling the hot waste gases and instrumentation and controls.

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Aiea refinery has automated melt system. R. G. KINZLER. *Cubelet Press*, 1974, **39**, (6), 4–5.—Information is given on automatic control of affination, melting, liming and addition of filter aid at Aiea refinery in Hawaii.

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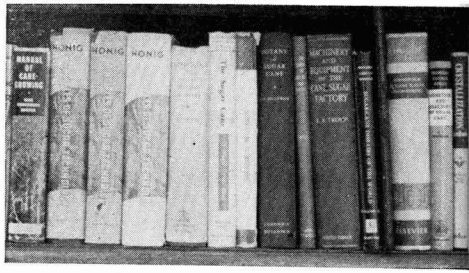
Improving the utilization of lines for packaging refined sugar. G. K. TUNTIYA and B. M. SHISEL'. *Sakhar. Prom.*, 1974, (11), 29–35.—Details are given of the amount of refined sugar packaged by various types of automatic lines in the Soviet Union, the types of sugar handled, distribution of the lines by republic and other information concerned with illustrating the present situation and how greater use must be made of the equipment.

New books



Tate & Lyle Group Research & Development annual report 1974. 28 pp; 21 × 30 cm. (Group Research & Development, Philip Lyle Memorial Research Laboratory, PO Box 68, Reading, Berks., RG6 2BX England.) 1974.

The 1974 report highlights the work being conducted on the creation of new products from the agricultural commodities handled by companies within the Tate & Lyle Group. The ultimate aim is to upgrade the value of sugars, starches, fats or proteins, while an integral part of the programme is the search for new and economical means of increasing the yields of the crops which serve as the primary source of the commodities. Past work on chemical ripening of cane is now beginning to have an impact in the world, and considerable interest is being shown in the use of carbohydrates and agricultural wastes as substrates in fermentation processes, while the use of carbohydrates and fats as reactants to yield products normally synthesized from petrochemicals is also being evaluated. Work on production of a biodegradable detergent from sugar and fat and on fermentation of sugars to produce microbial polysaccharides has progressed favourably and worldwide patents have been filed. Research has also been carried out on production and refining of sugar by less capital-intensive means. The various lines of research are amply illustrated in the report and the work being conducted in each department is clearly outlined.

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The South African sugar year book 1973-1974. 196 pp; 21 × 28 cm. (The South African Sugar Journal, PO Box 1209, Durban, South Africa.) 1975.

The 44th edition of the South African sugar year book devotes space to the 15th Congress of the ISSCT held in Durban in June 1974, but in addition it is packed with much that is of interest to the sugar man wishing to be acquainted with developments in the South African sugar industry. Apart from reports from the various sugar organizations, there are a number of articles, including "Seven types of diffusers operating in South Africa" by J. P. FITZGERALD and J. P. LAMUSSE, and "Men and machines in agriculture" by A. G. DE BEER. Abstracts are presented of papers read at the 48th Congress of the South African Sugar Technologists' Association in 1974, and the annual report of the Sugar Milling Research Institute, covering research and development work, is reproduced. After the annual review of the 1973–74 milling season by J. P. LAMUSSE (with tables of data for all the sugar factories), there is a survey of the structure of the South African sugar industry followed by details of sugar industry organizations and information on South African sugar enterprises. The final section of the book from p. 129 to the end gives details of sugar companies and their factories in South African and neighbouring countries. The clear type used plus the coated paper makes for very good legibility. As said above, this is a very interesting publication and a worthwhile acquisition for those interested in South African sugar.

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Philippine sugar handbook, 1974 edition. Ed. C. ANUNCIACION. 120 pp; 23 × 30·5 cm. (The Sugar News Press Inc., PO Box 514, 316 Doña Salud Building, Dasmariñas, Manila, Philippines.) 1974. Price: $10.00.

Unusually, the table of contents for this book appears on page 79 and the reader would do well to mark this page if he is to refer to the wealth of articles and information contained in it. In addition to articles by the President of the Philippine Sugar Association and an account of its work since its formation in 1922, data are presented on the financial affairs of the country's milling companies and articles on the Honiron sugar machinery company, the Sugar Industry Foundation Inc., as well as studies on the Philippines after the end of the Laurel-Langley Trade Agreement with the USA, sugar cane research in the Philippines, the activities of the Philippines Sugar Institute, etc. A table shows the development of the rated capacities of the country's sugar factories during the period from the 1963/64 crop to that of 1972/73, while other statistics include sugar consumption and monthly export figures, sugar, molasses and alcohol production, etc. For anyone concerned with the Philippines sugar industry this new compendium will be a most useful source of information.

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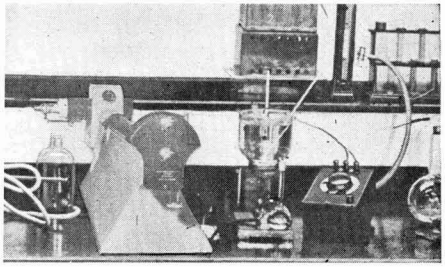
Production of sugar cane under saline desert conditions in Iran. K. A. SUND and H. F. CLEMENTS. 64 pp; 15 × 23 cm. (Hawaii Agricultural Experiment Station, College of Tropical Agriculture, University of Hawaii, 2500 Dole St., Honolulu, Hawaii, 96822 USA.) 1974.

This book, Research Bulletin 160, is a detailed study of the work involved and major problems encountered in setting up the Haft Tappeh cane sugar project in Khuzestan, Iran. Dr. SUND, plant physiologist with Hawaiian Agronomics Co. (International), who were the main contractors responsible for the project, was Director of Research of the project during the period 1963–70, while Dr. CLEMENTS was also actively concerned with the agricultural aspects of the project from its inception, and introduced his system of crop logging at Haft Tappeh. Every important aspect of cane agriculture relative to the scheme is discussed, and some yield data are given for a number of cane varieties, demonstrating the effects of the drainage programme inplemented. The study is clearly set out, and will undoubtedly be of great value to anyone wishing to introduce a cane growing scheme under conditions similar to those at Haft Tappeh, particularly where soil salinity poses a problem.



Laboratory methods & Chemical reports

The amino-acids content in sugar beet. I. Methodical investigations. W. HAMPEL, M. RÖHR, K. LINTNER and N. KUBADINOW. *Zucker*, 1974, **27**, 418–423. For quantitative determination of amino-acids in beet, an aqueous extract was prepared with addition of a 0·1N lithium citrate buffering solution of pH 1·5 followed by ultrafiltration to remove high molecular nitrogenous compounds. Treatment with basic lead acetate followed by filtration did not remove as much of these compounds as did the above method, while ultracentrifuging after addition of the lithium citrate was not quite as good as the ultrafiltration method. Separation of the amino-acids was achieved by passing the solution through a column of cation exchange resin at prescribed temperatures and eluting with 0·3N lithium citrate solution of pH 2·8 or 1·2N lithium citrate of pH 4·1. Quantitative determination of the individual amino-acids was carried out with a Beckman "Unichrom" analyser, using ninhydrin as reagent. For most amino-acids, the colour intensity was measured at 570 nm, while for proline and glutamine 440 nm was used. Full details are given of the results.

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Filtering quality of raw sugar: influence of "ageing" during storage. J. P. MURRAY and F. M. RUNGGAS. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 256–262.—The effect of prolonged storage on raw sugar filtrability was studied in tests in which samples of export quality raw sugar from five sugar factories were stored under conditions approximating to those at the bulk sugar terminal in Durban, South Africa. A low-purity sample coated with molasses was also included. No "ageing" effect was found in the case of the five high-purity samples, whereas the low-purity sample suffered a slight drop in filtrability. This reduction was, however, insignificant compared with the potential fall which a small increase in the sugar starch content could cause. It is thus concluded that the presence of impurities during manufacture has a greater detrimental effect on filtrability than does bulk storage.

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Automatic saccharimeters. C. FOREST. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 309–315.—The way in which an automatic saccharimeter works and the role of the various components are explained.

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Cane quality determination in South Africa. M. A. BROKENSHA. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 316–324.—Details are given of the method of direct cane sampling and analysis used in South African sugar factories in place of the Java Ratio used previously. Total pol in cane is obtained by determining mixed juice and bagasse pol as part of a separate mill balance procedure, since the direct analysis method is affected to a greater extent by moisture loss, through evaporation, from cane which has been weighed but subsequently delayed in the mill yard.

The method used by the Cane Planters and Millers Arbitration and Control Board for cane payment in Mauritius. I. D. NAWOOR. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 325–330.—In Mauritius, there are 21 factories receiving cane from a specified area, the limits of which are set by the Board. For analysis purposes, the Board has established a system of cane land regionalization which takes into account such factors as climate, topography, etc. At each factory a member of the Board staff is responsible for determining primary juice Brix and pol and cane fibre content in samples. The article presents the formulae used for calculation of cane fibre and sugar content, mixed juice purity and sugar yield on cane. Compilation of the results by the Board is explained with the aid of tabulated data.

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Determination of cane quality for purposes of payment to the producers in Réunion. H. HOARAU. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 331–343.—Since 1968, direct cane analysis using a hydraulic press has been employed. Details are given of the procedures and formulae used for cane evaluation. While direct analysis suffers from the inability to allow for losses between cane arrival in the mill yard and extraction of the juice by the mills, it is suggested that the only way to overcome this problem would be to employ mixed juice and bagasse analysis parallel with direct cane analysis, as used in other countries.

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Determination of the optimum flocculation point in preliming and first carbonatation. F. A. BACZEK and V. M. JESIC. *Zucker*, 1974, **27**, 475–476.—A brief report is given on the procedure devised by the authors for determination of optimum preliming and 1st carbonatation alkalinity and pH (at which the greatest amount of colloidal material is precipitated). For preliming, 1 litre of raw juice at 65°C is stirred, some drops of 10% milk-of-lime slurry added to bring the pH to 11·8, and the juice stood for 1 minute; samples are then pipetted into reagent bottles and stood for 30 minutes to allow the colloids to settle, after which a 15 cm^3 sample of clear juice is used for spectrophotometric measurement at 560 nm. For 1st carbonatation, raw juice is limed with up to 1·8% CaO on beet, followed by gassing with CO_2 in a Benning apparatus to the required pH. After 1 minute, samples are pipetted into reagent bottles into which 0·5 $mg.kg^{-1}$ of flocculation aid is added to remove the fine carbonate particles and thus reduce turbidity. After 15 minutes' settling, the transmittancy of 15 cm^3 samples is determined spectrophotometrically at 560 nm. It is strongly recommended to determine the optimum pH frequently because of marked fluctuations within the pH range 10·6–11·6. (By the methods described, the authors have found 11·2 to be the optimum pH of prelimed juice and 11·27 for 1st carbonatation juice.)

The amino-acids content in sugar beet. II. Analytical results. W. HAMPEL, M. RÖHR, K. LINTNER and N. KUBADINOW. *Zucker*, 1974, **27**, 477–483.—Column chromatography was used to determine the contents of individual amino-acids in samples from two beet varieties, and full details are given in tables. While the amount of nitrogenous fertilizer applied and use of overhead irrigation had no effect on the proportions of the individual amino-acids in the total amino-acid content during the September-November growth period, during which the proportions remained almost constant, the total amino-acid content increased with increased N application. Most of the total amino-acid content (84%) was represented by glutamine, γ-amino butyric acid, asparagine, alanine, aspartic acid, serine, glutamic acid and glycine; glutamine was responsible for 53% of the total amino-acids, while asparagine accounted for 7%. Comparison of the chromatographic values with those given by the "blue number" method showed that the latter method systematically gave values which were about 4% too low.

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Determination of sugar losses from degradation during heating of highly concentrated beet sugar factory products. L. I. TREBIN and D. E. SINAT-RADCHENKO. *Sakhar. Prom.*, 1974, (9), 46–48.—From investigations of the behaviour of sugar solutions of 50–90% dry solids when heated at constant temperature in the range 50–120°C, the decomposition rate constant K was determined as a function of pH, temperature, heating time and purity. From the equations derived, a nomogram has been constructed for use in rapid sugar loss determination.

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Colorimetric method for the estimation of sucrose in jaggery samples. C. P. VINAYAK, B. SINGH and S. P. SETH. *Indian J. Agric. Sci.*, 1973, **43**, 343–345; through *S.I.A.*, 1974, **36**, Abs. 74-1146.—A colorimetric method for the determination of sucrose was compared with standard inversion methods. A solution of the sample is treated with ammoniacal $AgNO_3$ solution and heated to oxidize any reducing sugars present. Acid ammonium vanadate solution is then added which oxidizes the sucrose, vanadyl ions being obtained in direct proportion to the concentration of the latter; the intensity of the colour formed is measured at 660 nm. The results obtained using this method were not significantly different from those obtained by Fehling's solution or polarimetric methods. Sucrose recovery studies gave an average value of 98·3%.

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The need for an integrated standardization of the different chemical control apparatus, equipment and other control factors used in our Philippine sugar industry. L. L. SAN JOSE. *Sugar News* (Philippines), 1974, **50**, 130–143.—The author puts forward a plan for standardization of chemical control methods and equipment and suggests the setting up of six technical committees to supervise the finalization and implementation of the standards.

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Investigation of sucrose crystal growth and dissolution. V. M. KHARIN and A. L. ZHARKOV. *Izv. Vuzov, Pishch. Tekh.*, 1974, (4), 121–123.—A unit is described in which a solution of known concentration is poured into a vertical glass tube and held at constant temperature while a single sucrose crystal is dropped into it and allowed to fall until it reaches a glass slide with a calibrated lattice. As soon as the crystal touches the slide the time is recorded and a photograph taken. The glass tube is then turned upside down, so that the crystal resumes its free fall, but in the opposite direction. When it reaches the original top of the tube the process is repeated for a required number of times. Results confirmed the validity of an earlier formula for calculation of the mass transfer coefficient during growth or dissolution of single crystals based on Stokes' law concerning particle fall in a solution. At temperature $t \geqslant 60$°C crystal growth or dissolution takes place in the diffusion region, while at $t < 60$°C intermediate (mixed) crystallization kinetics apply. The limiting role of the surface (crystallo-chemical) reaction gains in importance with fall in temperature and concentration.

* * *

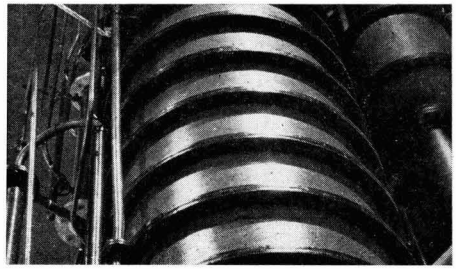
The nucleic acid content in sugar beet and products of beet sugar manufacture. N. V. REMESLO and G. P. VOLOSHANENKO. *Izv. Vuzov, Pishch. Tekh.*, 1974, (4), 153–154.—The contents of nucleic acids and purines in the beet crown, root and tail and in beet juice, syrup and molasses were determined spectrophotometrically by a method which is described. Results are tabulated, showing that carbonatation considerably reduced the proportions of both nucleic acids and purines (expressed as a weight percentage of dry solids and of total non-sugars) in beet juice, while the proportions in molasses were even smaller. The beet root contained most of the nucleic acids and purines, followed by the crown and finally the tail.

* * *

Solubility of calcium sulphite in sugar solutions. L. D. BOBROVNIK and L. P. KOTEL'NIKOVA. *Izv. Vuzov, Pishch. Tekh.*, 1974, (4), 155–156.—The solubility of $CaSO_3$ in sugar solutions of 10–60% concentration was determined at temperatures in the range 50–95°C and pH 7·1 and 9·0. Tabulated values show the fall in solubility with rise in pH (associated with reduction in hydrolysis of the salt in the more alkaline region). The solubility of calcium carbonate was also determined in water and 15% and 60% sucrose solution at pH 9·0 and 80°C. The findings showed that $CaSO_3$ was more soluble in the 15% solution than was $CaCO_3$, while the position was reversed in the 60% solution; the results thus confirmed the validity of the argument for the sequence carbonatation—sulphitation in the treatment of remelt liquor and for carrying out defecto-sulphitation at a temperature of about 80°C, at which solubility was found to be lowest at pH 7·1 in the solutions of higher concentration.

* * *

Sucrose determination and a sugar balance. P. DEVILLERS, C. CORNET and R. DETAVERNIER. *Ind. Alim. Agric.*, 1974, **91**, 833–839.—A gas-liquid chromatographic method for determination of sucrose is described, in which silylation is by N,O-bis-(trimethylsilyl) trifluoroacetamide. Details are given of the chromatograph used and of the procedure for determining sucrose and other sugars in beet juices and molasses. Accuracy averaged 0·7–1·0%. Sugar balances drawn up from beet sugar contents as determined by polarization and by chromatography showed that the latter method is more accurate and could replace, or be used to check values given by, polarization.



By-products

Beet betaine and its use. R. BRETSCHNEIDER, J. ČOPÍKOVÁ and P. KADLEC. *Listy Cukr.*, 1974, **90,** 155–163. The properties and uses of betaine are examined and methods of determining it are reviewed. A table is presented showing betaine hydrochloride, betaine-N and total N contents in molasses at 13 Czechoslovakian sugar factories. A proposed scheme for betaine isolation from molasses by electrodialysis followed by ion exchange is described.

* * *

Feasibility of bagasse cellulose obtained by nitric digestion as acetate-grade pulp. C. J. TRIANA and Y. A. KOSTROV. *Sobre los derivados de la caña de azúcar*, 1974, **8,** (1), 14–18.—Pilot plant trials have been made on the production of cellulose pulps by the nitric digestion of bagasse and conversion to cellulose acetate. The product was not suitable and did not compare with a commercial sulphite pulp cellulose acetate from the USA; nevertheless, the initial trials were useful in identifying the aspects on which attention should be concentrated so as to give improved and acceptable quality.

* * *

Influence of the cane variety factor on the manufacture of hard fibre board by the wet-dry method. E. BATLLE C., N. RUÍZ M., A. LÓPEZ A., M. CARBONELL R. and O. SUÁREZ S. *Sobre los derivados de la caña de azúcar*, 1974, **8,** (1), 27–36.—Significant differences in modulus of rupture and elasticity were detected in fibre board obtained from different varieties, that from B 42231 showing the lowest values. The differences appear to be related to fibre length and thickness coefficient rather than to chemical composition. The highest pulp yields were found with three named varieties and the high yields may be related to the behaviour of such bagasse pulps in the refining stage.

* * *

Mathematical kinetic study of the neutral sulphite process applied to bagasse. R. BAMBANASTE M. *Sobre los derivados de la caña de azúcar*, 1974, **8,** (1), 51–74. A study of the kinetics of this process is reported for conditions of 140–160°C, and 1–15 mg.cm^{-3} concentration of sodium sulphite, using sodium bicarbonate buffer in a ratio of 1:2 against the sulphite, and a mean initial pH of 8·5. Application of the model derived to design of a tubular continuous digester is described; its use to determine velocity of delignification, etc. indicates that bagasse is a satisfactory material for production of chemico-mechanical high-yield pulp.

* * *

Trays of special design for alcohol distilleries. R. ALEMÁN G. *Centro Rev. Cient. Univ. Central Las Villas, Serie: Azúcar*, 1973, **1,** (1), 73–83.—Trays constructed of expanded metal were compared in pilot plant studies with corresponding trays of perforated metal, used in a stripping column for alcohol distillation. The expanded metal performed as well as the perforated metal and better in some respects (turbulence, operation at lower pressure, deposition of dirt, etc.) and further trials on a larger scale are to be made.

* * *

Beet pulp for the dairy cow. M. E. CASTLE. *British Sugar Beet Rev.*, 1974, **42,** 146–151.—Recent experimental work has confirmed earlier findings[1] that beet pulp and barley can replace each other on a weight-for-weight basis in dairy cattle rations, and that beet pulp has the advantage of acting as a palatable energy source and as a base for a balanced concentrate when supplemented with minerals, vitamins and urea, while maintaining milk yields and composition at the same levels as with barley.

* * *

Investigation of the quality of beet leaf silage in 1973-1974. A. DE VUYST, R. ARNOULD, M. MARTENS and P. H. VERSTRAETE. *Publ. Trimest. Inst. Belge Amél. Betterave*, 1974, 73–84.—The feed value of beet leaf silage has been investigated. Results, given in some detail, confirm earlier findings[2] that, provided the leaves are "harvested" by suitable means (either a beet topper or a "defoliator") and stored properly, they provide a good nitrogenous fodder for both fattening stock and dairy cattle.

* * *

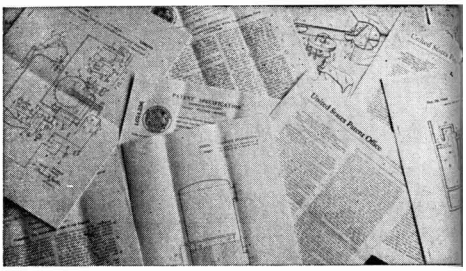
On the possibility of using rice straw, bagasse and reed pulps in the manufacture of some grades of paper. A. E. M. AHMED, P. OBROCEA, S. PETROVAN and C. SIMIONESCU. *Cellulose Chem. Technol.*, 1973, **7,** (1), 135–150; through *S.I.A.*, 1974, **36,** Abs. 74–1109. The properties of paper manufactured from bleached spruce sulphate, bagasse sulphate, rice straw soda and reed soda pulp mixtures were measured. The main variables studied were the composition of the mixture and the degree of beating of the pulps. The breaking length of paper containing a moderate proportion, e.g. 42%, of annual plant pulp was greater than that of paper made entirely from spruce pulp, especially at a low degree of beating, e.g. 30°SR. Folding endurance, burst strength, tear resistance and porosity all tended to improve with increasing spruce pulp content; moderate proportions of other pulps did not have seriously harmful effects.

* * *

Pulp and paper in developing countries. UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION. *Rpt. Expert Group Meeting*, 1971, 67 pp; through *S.I.A.*, 1974, **36,** Abs. 74–1110.—The possibilities of producing newsprint, other grades of paper and dissolving pulp from bagasse or other indigenous plant materials in developing countries are discussed; technical and economic factors involved are outlined.

[1] CASTLE: *I.S.J.*, 1974, **76,** 62.
[2] DE VUYST *et al.*: *ibid.*, 1972, **74,** 49.

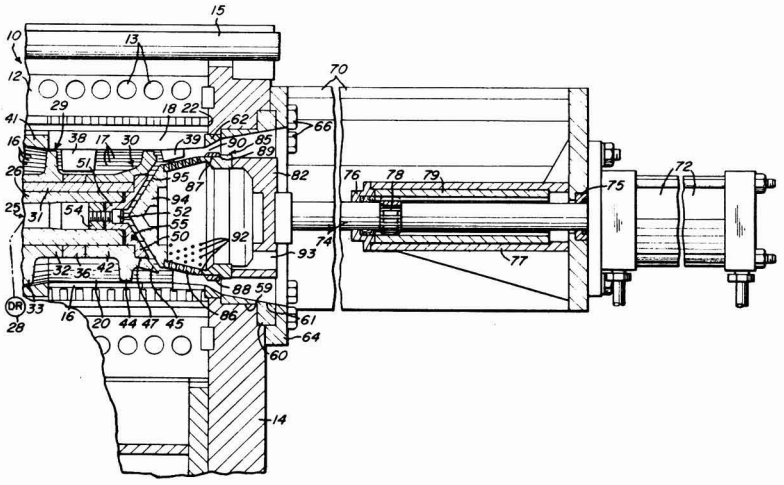
Patents



UNITED STATES

Mechanical screw press. A. W. FRENCH and F. J. STARRETT, of Piqua, Ohio, USA, *assrs.* THE FRENCH OIL MILL MACHINERY CO. **3,766,848.** 13th July 1971; 23rd October 1973.

At the discharge end of the bagasse press, the final discharge worm 30 is held onto the hollow shaft 26 by an end-plate 50 locked by bolt 52 into a threaded hole in the plug 54 which is welded into the shaft. A final lug or breaker bar 39 is provided to prevent rotation of the pressed bagasse during discharge which is through the annular gap 90 formed between the hardened discharge rings 60, 62 on the stationary housing and the conical surfaces of the piston held by hydraulic pressure transmitted through shaft 74.



The liquid expressed during the discharge passes through perforations 92 into the interior of the piston and drains through port 93. The fact that the piston and housing rings 60, 62 are all stationary means that sand present in the bagasse does not cause the wear which arises when one is stationary and the other rotates. Since the discharging bagasse has a self-centring action on the shaft there is no need for a bearing, and wear on the screen bars 16 of the cage 10 is also reduced at the discharge end by a bushing 41 which surrounds the flight 33 of worm 29.

* * *

Increasing recoverable sugar from sugar cane. P. L. POULOS, of Winnetka, Ill., USA, *assr.* VELSICOL CHEMICAL CORP. **3,767,377.** 2nd November 1970; 23rd October 1973.—Sugar cane is treated (2–4 weeks before harvest) with at least 0·25 lb/acre (at least 0·5 lb/acre) (0·5–1·5 lb/acre) of an alkyl (C_1–C_{10}, methyl, decyl) ester of 2-methoxy-3,6-dichlorobenzoic acid.

* * *

Increasing yield of sucrose. H. SUZUKI, H. YOSHIDA, Y. OZAWA, A. KAMIBAYASHI, M. SATO, A. MORI and M. ENDO, *assrs.* AGENCY OF INDUSTRIAL SCIENCE & TECHNOLOGY and HOKKAIDO CO. LTD., of Tokyo, Japan. **3,767,526.** 6th December 1971; 23rd October 1973.—Beet molasses is treated (at 20–60°Bx, 45–55°C and pH 5–5·2) with α-galactosidase, which hydrolyses its raffinose content to galactose and sucrose, and then deionized with ion exchange resins. Alternatively the deionization may precede the hydrolysis. The treated molasses is returned to the beet juice purification stage.

* * *

Beet harvester cleaning rolls. R. W. HOOK, of Des Moines, Iowa, USA, *assr.* DEERE & CO. **3,771,651.** 26th December 1972; 13th November 1973.

* * *

Cane harvester topper. K. RODRIGUE, of Thibodaux, La., USA, *assr.* CANE MACHINERY & ENGINEERING CO. INC. **3,772,864.** 5th March 1973; 20th November 1973.

* * *

Centrifugal basket bottom valve mechanism. T. R. LAVEN, of Hamilton, Ohio, USA, *assr.* THE WESTERN STATES MACHINE CO. **3,773,253.** 25th May 1972; 20th November 1973.

The bottom of the centrifugal basket is closed by a number of leaves (here shown as four) which pivot about pins 26 which fasten them to hinge plates 30 mounted on radial arms 7. The leaves have curved outer and inner edges 21, 22 corresponding to the

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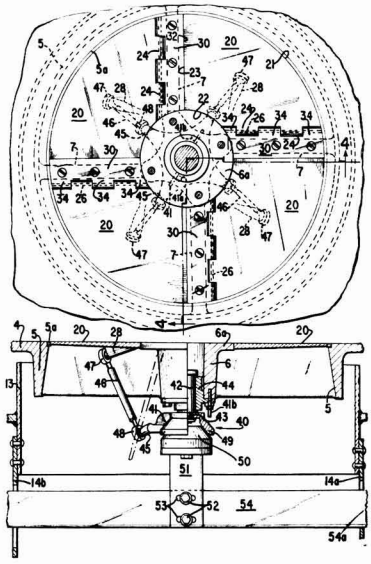
outer bearing ring 5a and flange 6a of the inner hub 6, while the straight edge 23 closes against the hinge plate 30 of the adjacent leaf. While the basket is turning at high speed in a clockwise direction, relative to the upper drawing, centrifugal force and pressure of air on the lower faces tend to bring the leaves to their closed position.



Mounted on the shaft below the basket is a spider 40 carried by a bearing 43 such that it is able to move through a limited angle but normally rotates with the shaft at one or other limit of its relative movement. When the basket turns clockwise the arms 45, which carry rigid links 46, connected through universal joints 47 and 48, cause the arms 28 beneath the leaves 20 to move so as to hold the latter in the closed position. When the basket rotates slowly in the reverse direction for ploughing out of the sugar, the spider moves to its other limit and its arms open the leaves.

* * *

Brown sugar. M. BATTIN and B. M. STEIN, *assrs.* GREAT WESTERN SUGAR CO., of Denver, Colo., USA. **3,779,809.** 20th August 1971; 18th December 1973. To improve flow characteristics of brown sugar (and also increase accuracy of weighing) it is (mixed with sugar syrup and water and) frozen to between —50° and —10°C (—20°C) (in a nitrogen atmosphere), becoming brittle and hard. The frozen sugar is ground to give a product of about 65-mesh and bulk density about 41 lb.ft^{-3}. The freezing may be by passage through a freezing zone when in a $\frac{1}{2}$-inch layer on a perforated support. The quantity of syrup and water are chosen to give the required colour and moisture content of the final product.

* * *

Bagasse press. J. FARMER, of Honolulu, Hawaii, U.S.A, *assr.* WARD FOODS INC. **3,780,645.** 2nd August 1972; 25th December 1973.—A multiple screw press (See UK Patent 1,244,047[1]) is provided with barrels which are perforated substantially throughout their length for expression of the juice and the pressure built up within the barrels by the rotary screws is relatively low except near the plug-regulated outlet orifices. This permits the barrels to be of light-weight construction and minimizes the power required. The press is also able to handle bagasse of high moisture content.

* * *

Refined sugar production from cane juice. Y. NISHIJIMA and K. ADACHI, of Osaka, Japan, *assr.* HITACHI SHIPBUILDING & ENGINEERING CO. LTD. **3,781,174.** 13th October 1971; 25th December 1973.—Cane juice is purified by a continuous carbonatation process and then decolorized, e.g. with granular active carbon. It may then be concentrated in a multiple-effect evaporator before or after additional purification by passage through cation and anion exchange resins followed by ion exchange membrane dialysis or *vice-versa*. The concentrated purified syrup is then crystallized to give refined sugar.

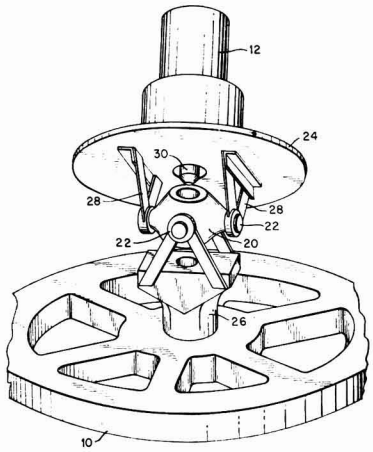
* * *

Beet juice purification. P. L. H. DEVILLERS and M. LOILIER, *assrs.* SYNDICAT NATIONAL DES FABRICANTS DE SUCRE DE FRANCE, of Paris, France. **3,785,863.** 23rd August 1971; 15th January 1974.—Diffusion juice is (cooled and) passed through a strong H^+ cation exchanger, neutralized with lime (>3 g CaO per litre), (reheated and) filtered and the filtrate passed successively through a second strong cation exchanger and a weak anion exchanger. The first cation exchanger is eluted with an alkali (NH_4OH solution) (the eluate being used to regenerate the anion exchanger) and then regenerated with a strong acid (HNO_3). The juice from the anion exchanger is treated by a lime/phosphoric acid purification process and then passed through a mixed-bed of weak cation exchange and strong anion exchange resins.

* * *

Centrifugal. R. RETALI, of St.-Cloud, France, *assr.* FIVES LILLE-CAIL. **3,789,623.** 4th May 1972; 5th February 1974.

The end of the drive shaft 12 of a batch centrifugal is connected to the rotary basket 10 by means of a universal joint in the form of a cross-piece 20 held in trunnions 22 supported by laminated leaves 28 from the plate 24. The crosspiece is provided with two further trunnions 22 linked to the hub 26 of basket 10.



[1] *I.S.J.*, 1972, 74, 283.

The vibration transmitted to the cross-piece may be damped, e.g. by rubber blocks or by linked hydraulic dampers mounted between the trunnions 22 and their supporting frames. In order to be able to lock the assembly as a unit, the cross-piece is bored and a socket provided in hub 26 so that axially-movable shaft 30 within the hollow shaft 12 may be extended downwards through the crosspiece and into the socket. Alternatively the shaft may extend upwards from the basket hub 26 and into the socket in shaft 12.

* * *

Beet thinner electronic control. R. C. EBERHART, of Manhattan, Kansas, USA, *assr.* ALLIED FARM EQUIPMENT INC. **3,776,316.** 5th January 1972; 4th December 1973.

* * *

Cane harvester trash separator. R. A. STIFF and K. L. RUBACK, of Bundaberg, Queensland, Australia, *assrs.* MASSEY-FERGUSON (AUSTRALIA) LTD. **3,788,048.** 30th June 1971; 29th January 1974.

* * *

Cane harvester. L. G. FOWLER, of Belle Glade, Fla., USA, *assr.* SUGAR CANE GROWERS COOPERATIVE OF FLORIDA. **3,791,114.** 18th May 1972; 12th February 1974.

* * *

Beet harvester. R. D. ZAUN and R. W. HOOK, of Des Moines, Iowa, USA, *assrs.* DEERE & CO. **3,791,451.** 17th December 1971; 12th February 1974.

* * *

Recovery of waste brine regenerant (from sugar decolorizing resin treatment). R. KUNIN and W. FRIES, *assrs.* ROHM & HAAS CO., of Philadelphia, Pa, USA. **3,791,866.** 7th August 1972; 12th February 1974. The spent salt solution, used to regenerate porous anion exchange resins previously exhausted by adsorption of colouring matter from sugar liquors, is treated with an oxidizing agent (H_2O_2, NaOCl or $CaOCl_2$ solution) whereby the organic colorants are substantially destroyed and the brine thus rendered suitable for regenerating further exhausted resin.

* * *

Citric acid (and levulose) production. K. ISHII, Y. NAJAKIMA and T. IWAKURA, of Tokyo, Japan, *assrs.* MITSUI SUGAR CO. LTD. **3,793,146.** 15th November 1971; 19th February 1974.—$CaCl_2$ is added to a mixture of dextrose and levulose whereby levulose is precipitated as an addition compound. The precipitate is separated to leave a waste impure dextrose solution which is inoculated with *Candida oleaphilia* and incubated to produce citric acid in high concentration and high yield, after which it is recovered from the broth.

* * *

Synthesis of sucrose fatty acid esters. F. YAMAGISHI, F. ENDO, H. OOI and Y. KOZUKA, of Kyoto, Japan, *assrs.* DAI-ICHI KOGYO SEIYAKU CO. LTD. **3,792,041.** 23rd October 1970; 12th February 1974.—A solution is made of sucrose in an aqueous solution of a K, Na or Ca salt of a C_8–C_{22} fatty acid (40% soap on weight of sucrose plus ester). To this is added (0·1–10% on weight of sucrose of) an alkaline catalyst (K, Na or Li hydroxide, carbonate, bicarbonate, methoxide, ethoxide or propoxide) and (25%–1900%on weight of sucrose of) an ester formed between a C_3–C_{22} fatty acid and MeOH, EtOH, PrOH, BuOH, ethylene glycol, propylene glycol, butylene glycerol, sorbitol, or pentaerythritol, with increasing temperature and reducing pressure conditions such as to avoid hydrolysis of the ester but giving a substantially completely dehydrated homogeneous melt. (A minor amount of ester is added and) The melt is subjected to transesterification at a temperature of 110–175°C (under reduced pressure, at 0–60 mm Hg).

* * *

Diffusion tower. W. DIETZEL and S. MATUSCH, of Braunschweig, Germany, *assrs.* BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT. **3,794,521.** 10th January 1972; 26th February 1974.—See UK Patent 1,323,651[1].

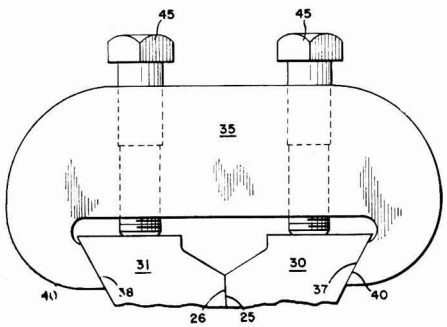
* * *

Animal fodder from cane. R. B. MILLER and C. K. LAURIE, *assrs.* CANADIAN CANE EQUIPMENT LTD., of Montreal, Quebec, Canada. **3,796,809.** 11th December 1970; 12th March 1974.—Pith is separated from cane by splitting the latter and scraping the pith from the interior of the rind. The pith may be dried at 25–125°C and fed to livestock or sufficient of a *Lactobacillus* or *Acetobacter* micro-organism added to the pith to reduce its pH to below 4 after 7 days ensilage. Animal fodder is produced by combining the pith with (20–40% of) chopped cane tops {plus 1–5% of urea [and 1–90% (40–80%) of soybean, clover or alfalfa meal and 1–20% of a mineral mix (containing Ca, P, Na and/or I) plus (1–40% of) fish meal and/or blood meal]}.

* * *

Screw press. R. M. STURM, of Sidney, Ohio, USA, *assr.* THE FRENCH OIL MILL MACHINERY CO. **3,797,383.** 24th April 1972; 19th March 1974.

The cage of a screw press is usually in two halves pivoting about a joint axis at the bottom and with flanges bolted together at the top; for dismantling, this requires much time and effort in unfastening the bolts. The cage described is provided with two halves 30, 31, the outer surfaces 37 and 38 of the upper flanges forming a dovetail section.



When the two halves are closed together as shown, with inner surfaces 25 and 26 abutting, a single flange 35 is slid along the length of the cage so that its inward facing surfaces 40 engage with the surfaces 37 and 38. Clamp screws 45 are then tightened against the upper surfaces of the cage halves, a small amount of force causing the halves 30 and 31 to be securely clamped together. When dismantling is required the screws 45 are easily loosened and the flange 35 withdrawn quickly.

[1] *I.S.J.*, 1974, **76**, 126.

Brazil sugar exports 1974[1]

	1974	1973	1972
	(metric tons, raw value)		
Afghanistan	0	10,317	0
Algeria	279,321	78,706	77,859
Bangladesh	0	48,290	35,955
Bolivia	0	0	42,400
Chile	51,880	54,818	26,098
China	0	367,598	410,609
Cyprus	1,085	2,129	0
Egypt	63,130	0	49,022
Finland	0	47,081	47,759
France	76,470	25,476	48,441
Germany, East	0	0	46,853
Greece	10,848	7,312	0
Hungary	19,456	0	0
India	0	12,095	0
Indonesia	0	68,462	0
Iran	62,298	190,099	11,550
Iraq	247,241	221,566	49,508
Israel	19,451	2,405	0
Ivory Coast	0	1,073	0
Japan	234,994	129,015	112,283
Jordan	0	11,480	13,412
Korea, South	0	10,250	0
Lebanon	32,055	42,598	11,000
Libya	11,390	0	0
Malaysia	0	7,650	0
Morocco	49,584	105,430	55,404
Pakistan	0	21,960	178,916
Poland	0	0	12,600
Portugal	11,000	58,250	9,971
Qatar	5,966	0	0
Senegal	40,126	0	14,450
Singapore	0	16,152	31,852
Somalia	0	0	8,480
Sri Lanka	0	111,591	80,553
Sudan	0	104,280	26,768
Surinam	0	1,597	1,064
Syria	70,217	53,628	32,825
Tunisia	47,911	28,160	62,736
Turkey	11,282	0	0
UK	135,982	90,839	18,847
Uruguay	12,740	11,545	42,000
USA	699,928	445,584	621,241
USSR	0	438,154	325,289
Venezuela	12,144	36,900	0
Vietnam, South	0	73,382	94,327
Yemen	5,098	0	0
Yugoslavia	0	39,434	34,075
Zaïre	0	0	3,353
Other countries	90,662	0	25
	2,302,262	2,975,306	2,637,525

The late Geoffrey Fairrie.—We regret to report the recent death of GEOFFREY FAIRRIE, a fifth-generation member of a sugar family which began its refining business in Greenock, Scotland, in 1797. He joined the family firm in 1909, under the tuition of his father, JAMES FAIRRIE, and was responsible for the introduction of a number of innovations, especially the Hersey cube press which he saw in the USA during a tour after the first World War in which he served in the Tank Corps. In 1925 he wrote his book "Sugar" which became a widely-used textbook of the period. In 1929 Fairrie & Co. Ltd. were bought by Tate & Lyle Ltd., of which he became a Director in 1931. He continued his interest in development and was concerned with the acquisition of the Huskisson berths for reception of sugar for the Love Lane refinery in Liverpool where he was also concerned in the rebuilding. He played a prominent part in the development of the transport side of the Tate & Lyle Group. In 1951 he wrote another interesting book on "The Sugar Refining Families of Great Britain". He retired in 1958.

* * *

New Indonesian sugar factory[2].—A new sugar factory is to be erected near Bodjonegoro in East Java.

* * *

Bagasse paper in Argentina[3].—An Anglo-Italian consortium is to build a plant in Argentina for production of newsprint from bagasse. The plant will have a capacity of one million tons per year, of which 70% will be exported.

Canada sugar imports[4]

	1974	1973
Raw sugar	(metric tons, raw value)	
Australia	357,754	364,541
Belize	0	6,096
Colombia	0	12,395
Cuba	99,721	44,439
Dominican Republic	5,161	0
Fiji	14,334	45,110
Guatemala	4,939	0
Jamaica	10,203	0
Mauritius	157,584	179,595
Nicaragua	8,345	0
South Africa	166,969	294,922
Swaziland[5]	28,722	15,673
USA	27	1
	853,759	962,772
Refined sugar		
China	20	24
Holland	2	3
Hong Kong	15	5
Mexico	49	0
Norway	0	40
Puerto Rico	313	0
Taiwan	3	1
USA	45,459	438
UK	40	103
	45,901	614

Tanzania sugar exports 1974[6].—Exports of sugar from Tanzania reached 190,111 metric tons, raw value, in 1974 as against 157,521 tons in 1973. As before, the largest amount went to the UK which took 99,644 tons (81,159 tons in 1973), while exports to the USA were increased to 37,965 tons in 1974 from 27,625 tons previously. Canada received 30,367 tons as against 34,318 tons in 1973 while exports to Zambia were up from 14,419 tons in 1973 to 16,156 tons. A new destination was Israel, which took 5707 tons, the remaining 272 tons going to other countries.

* * *

Japan beet sugar campaign, 1974/75[7].—The beet crop for 1974/75 was very much reduced from the previous campaign, at 1,878,771 metric tons as against 2,948,466 tons in 1973/74. This was due partly to a fall in the yield per hectare but mostly to the reduced area (47,483 ha *vs.* 61,683 ha). The sugar content was higher at 13·71% compared with 12·48%, giving a sugar outturn of 257,554 metric tons, white value, as against 368,023 tons in 1973/74.

* * *

Italian sugar factory closure[8].—The Chieti sugar factory, which processed only 12,500 tons of beet to 1430 tons of white sugar during the 1974 campaign, is not to operate in the 1975 campaign.

* * *

Louisiana sugar crop, 1974/75[9].—Cane sugar production in Louisiana from the 1974/75 crop reached 539,163 metric tons, raw value, compared with 506,080 tons in 1973/74, representing an increase of 6·54%.

* * *

Turkey sugar production, 1974/75[10].—The 1974/75 beet sugar campaign ended on the 5th March, with the production by the 17 sugar factories of 766,978 metric tons of white sugar from 5,620,450 tons of beet.

* * *

Bulgaria sugar industry modernization[11].—With Polish aid and equipment, the sugar factories at Lom and Plovdiv are to be modernized, while a new factory is to be built in the district of Pleven.

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[1] *I.S.O. Stat. Bull.*, 1975, **34**, (3), 23.
[2] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (8), 14.
[3] *Amerop Noticias*, 1975, (16), 16.
[4] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (10), vii–viii.
[5] C. Czarnikow Ltd., *Sugar Review*, 1975, (1232), 87.
[6] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (10), ix.
[7] C. Czarnikow Ltd., *Sugar Review*, 1975, (1222), 47.
[8] *Zeitsch. Zuckerind.*, 1975, **100**, 158.
[9] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (9), 10.
[10] *Zeitsch. Zuckerind.*, 1975, **100**, 158.
[11] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (10), 7.

Argentina sugar exports[1]

	1974	1973	1972
	(metric tons, raw value)		
Algeria	45,279	23,637	0
Bangladesh	0	11,870	0
Chile	65,454	57,694	0
Egypt	34,365	10,419	0
Finland	4,241	0	0
France	31,248	13,296	0
Greece	984	0	0
Indonesia	0	28,981	0
Iran	63,652	48,760	0
Iraq	21,742	33,879	0
Ireland	0	0	4,607
Korea, North	0	10,379	0
Libya	32,609	0	0
Holland	894	0	0
Morocco	27,406	33,566	23,221
Portugal	0	0	9,619
Spain	49,878	0	0
Sri Lanka	10,760	26,305	26,167
Syria	16,538	0	0
Tunisia	17,939	11,504	0
UK	79,333	40,731	0
Uruguay	8,000	19,160	0
USA	100,018	74,795	77,830
USSR	0	0	16,015
Venezuela	12,119	5,163	0
Vietnam, South	0	30,725	9,675
Yugoslavia	11,154	0	0
Zaïre	10,156	0	0
	643,769	470,445	167,134

New sugar factory for Liberia[2].—Erection of a sugar factory is to start this year in Maryland County. The investment of $15,000,000 will be partly met by a credit from China.

* * *

The late J. G. Davies.—It is with great regret that we report the death on 29th May of JOHN GARDINER DAVIES at the age of 70. At the time of his death he was Consultant Sugar Technologist to Fletcher and Stewart Ltd., of Derby, whom he joined in 1961. He was educated at St. Dunstan's College, London, and later studied at the Imperial College of Tropical Agriculture in Trinidad where he specialized in Sugar Chemistry and Technology, and where he subsequently became Senior Lecturer responsible for the Department of Sugar Technology. From 1944 to 1961 he held senior technical and managerial posts in the sugar industries of both Jamaica and Brazil. He was the author of one of the industry's standard reference books and co-author of and contributor to many other standard reference works and papers on sugar technology. He was a prominent member of the International Society of Sugar Cane Technologists and an honorary member of the Jamaican Sugar Technologists' Association. JACK DAVIES was a man dedicated to his profession and his experience and sound advice was highly valued by his countless friends throughout the sugar industry of the world. He will be sadly missed by all who knew and worked with him.

* * *

Sugar bagging station in China[3].—Chinese technicians, aided by an Australian sugar industry team, have reassembled and commissioned a sugar bagging station from Australia at the southern Chinese port of Whampoa. The station is a step in China's development of a capacity to import large quantities of bulk raw sugar and bag it on arrival for storage and internal distribution. Government sources in Australia had said that China's internal distribution problems have been among factors holding up signing of a contract—already agreed in principle—for Australia to supply China with three million tons of raws over five years.

* * *

Pakistan sugar shortage[4].—Owing to a shortfall in sugar cane production, the estimated sugar production in Palistan for 1975 is set at approximately 465,000 tons which, with carry-over stocks of 35,000 tons, provides a total availability of 500,000 tons or 50,000 tons less than anticipated demand. Production in 1974 was 580,000 tons. It is thought that the price of cane for next season will be increased from Rs. 5.40 to Rs. 7 per maund (77 lb), thereby providing the incentive for greater sugar cane cultivation, but this will inevitably result in an increase in price to the consumer or a further burden on the country's resources from increased subsidies.

US sugar imports 1974[5]

	1974	1973	1972
	(metric tons, raw value)		
Argentina	99,557	76,892	79,690
Australia	219,271	240,656	208,377
Belgium	1	0	0
Belize	52,308	43,099	35,904
Bolivia	5,184	6,848	0
Brazil	710,778	591,561	578,176
Colombia	95,099	68,089	71,564
Costa Rica	71,229	90,451	76,345
Dominican Republic	746,165	675,892	681,740
Ecuador	54,055	84,510	85,556
Fiji	41,806	40,465	41,716
Guatemala	87,030	56,746	70,159
Haiti	15,938	13,875	20,431
Honduras	7,670	0	12,091
India	77,022	73,886	76,298
Ireland	0	1,004	4,680
Malagasy Republic	11,873	11,004	11,901
Malawi	9,320	14,166	0
Mauritius	41,301	40,460	28,779
Mexico	488,173	577,724	588,149
Nicaragua	48,311	69,121	72,133
Panama	59,445	47,421	37,781
Paraguay	7,696	6,711	6,936
Peru	442,832	369,596	402,498
Philippines	1,335,894	1,319,389	1,298,858
Salvador	59,073	54,322	49,304
South Africa	62,968	67,026	52,327
Swaziland	37,521	27,384	29,091
Sweden	4	8	9
Taiwan	81,700	78,198	78,090
Thailand	23,786	17,302	17,285
UK	0	4,760	14,284
Venezuela	0	28,940	63,689
West Indies and Guyana	257,037	37,046	158,096
Other countries	16	3	36
	5,250,063	4,834,655	4,952,153

Mexican bagasse newsprint plant in Cuba[6].—Mexico has negotiated a $20 million credit to finance a newsprint plant in Cuba which will use pulp from sugar cane as the raw material. The plant will be built with Mexican technology and machinery.

* * *

East Germany sugar industry expansion[7].—The Director of the East German Sugar Beet Research Institute said in a newspaper interview that the biggest ever sugar beet crop was planned for 1975. The area to be sown to beet will be 266,000 hectares, 30,000 more than in 1974, and by using bigger fields (60 hectares and more), bringing in more mechanization, more agrochemical methods and higher planting density, it was planned to raise the yield to 35–37 metric tons per hectare as against the previous record of 34·4 tons and the 1974 yield of 29·7 tons.

* * *

Finland sugar imports, 1974[8].—Imports of sugar by Finland in 1974 totalled 156,409 metric tons, raw value, compared with 208,181 tons in 1973. Cuba was the major source, with 81,568 tons against 26,089 tons in 1973, while other suppliers included the USSR with 30,804 tons in 1974 (0), Guyana with 14,232 tons (0) and South Africa with 13,204 tons (36,338). Australia and Brazil, the two major suppliers in 1973 with 54,571 and 74,642 tons, respectively, provided no supplies in 1974.

* * *

New Honduras sugar factory[9].—The Banco Centroamericano de Integración Económica is to grant a US $3,700,000 loan towards the construction of a sugar factory, Azucarera Yojoa, on the north coast of Honduras, which will have a milling capacity of 2000 tons of cane per day.

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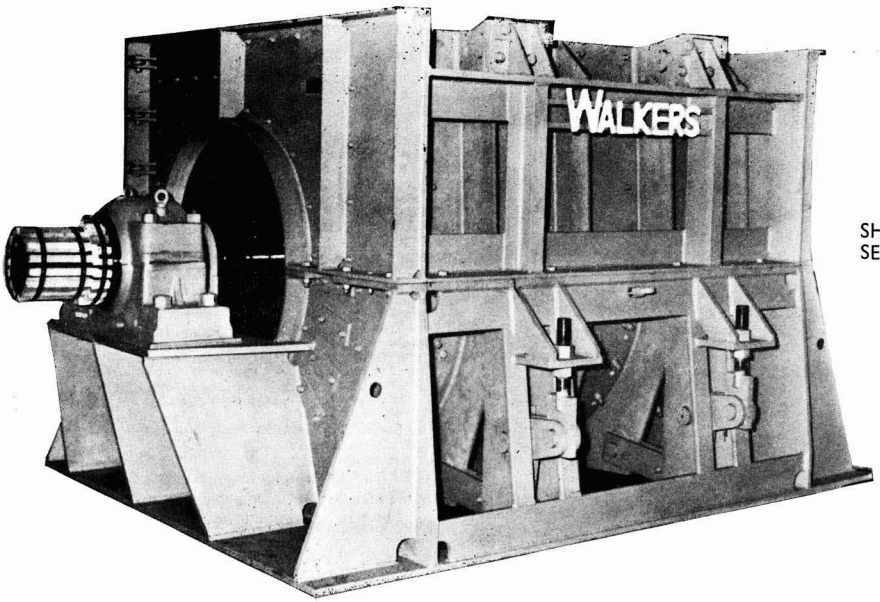
[1] *I.S.O. Stat. Bull.*, 1975, **34**, (3), 18.
[2] *Zeitsch. Zuckerind.*, 1975, **100**, 159.
[3] *Reuter's Sugar Rpt.*, 1st April 1975.
[4] *Standard & Chartered Review*, May 1975, 28.
[5] *I.S.O. Stat. Bull.*, 1975, **34**, (4), 111.
[6] *Moscow Narodny Bank Press Bulletin*, 2nd April 1975.
[7] *Reuter's Sugar Rpt.*, 11th April 1975.
[8] *I.S.O. Stat. Bull.*, 1975, **34**, (3), 44.
[9] *Bank of London & S. America Review*, 1975, **9**, 275.



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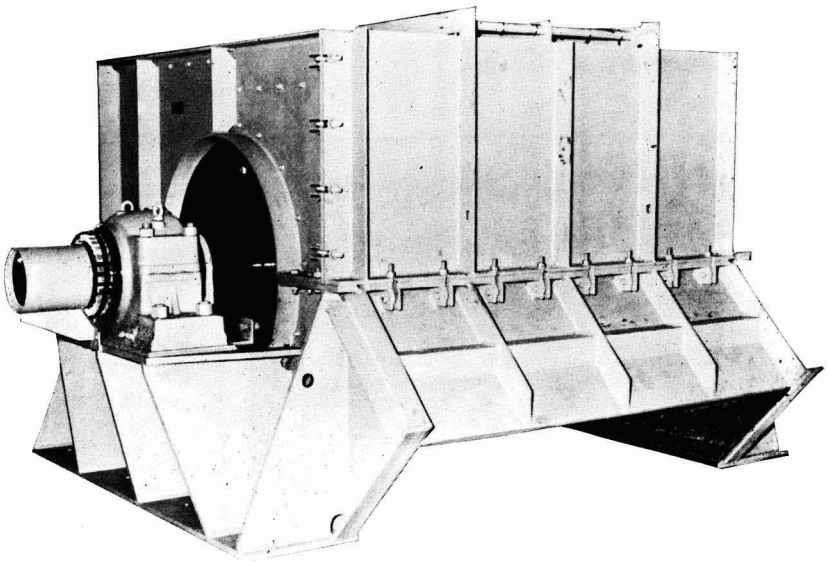

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