# International Sugar Journal

NOVEMBER 1976

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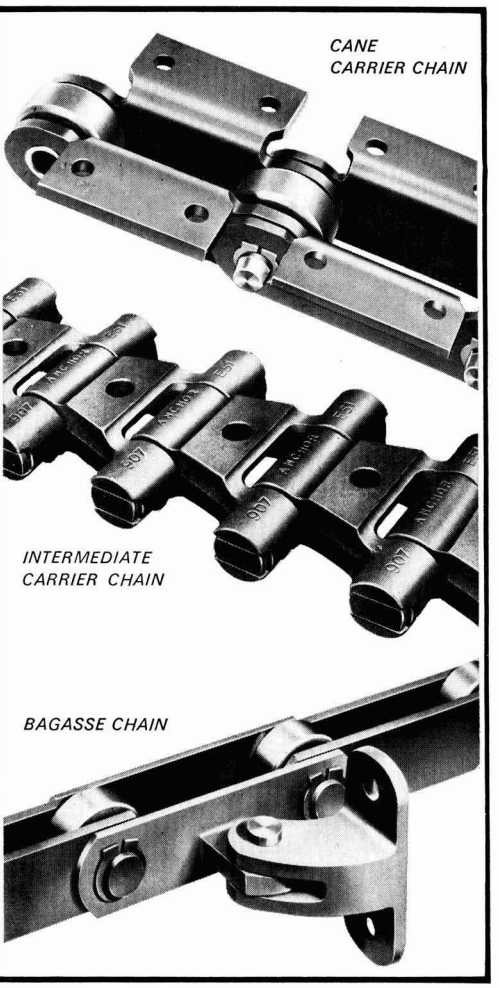

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*INTERMEDIATE CARRIER CHAIN*

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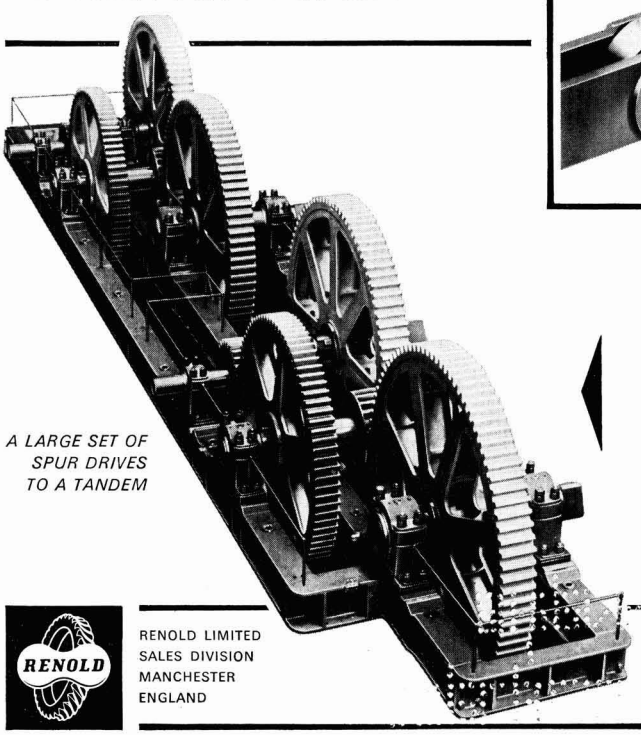

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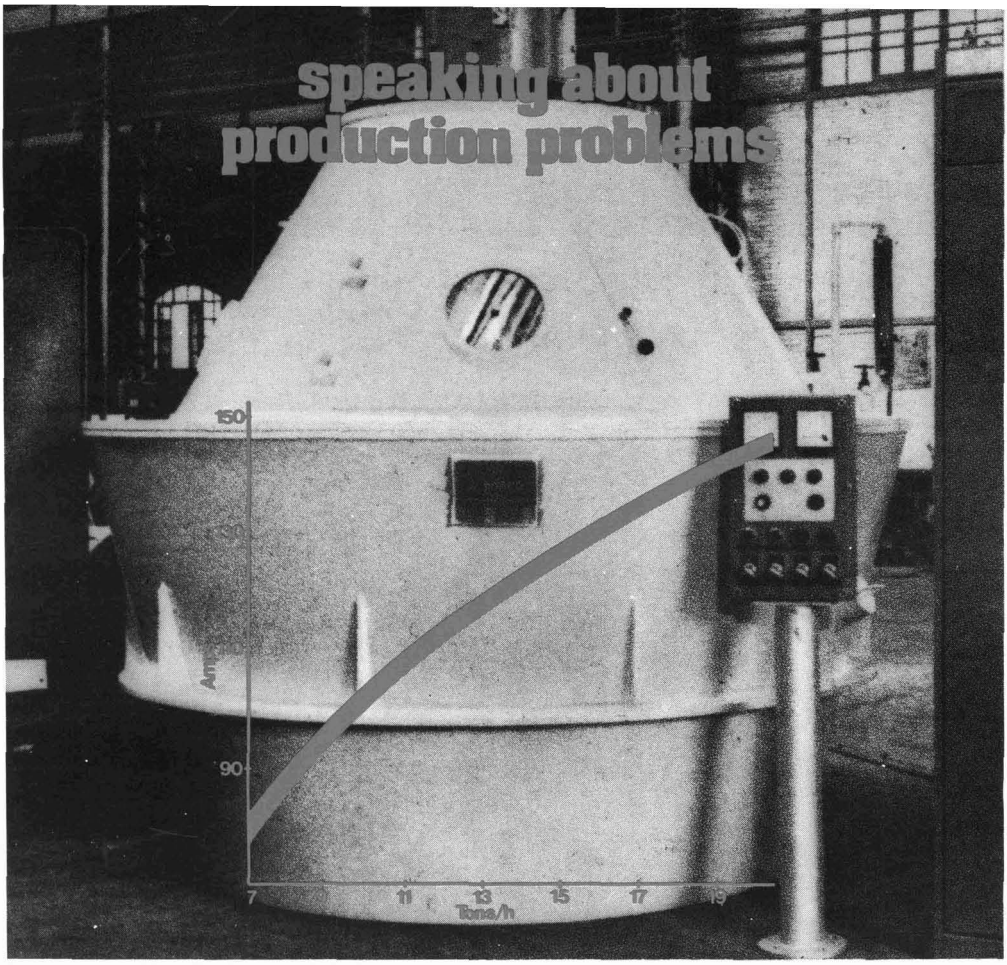


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- massecuite feeding into the basket coaxially with the drive shaft and uniform distribution through a proper device, formed by a cylinder and a cone, which rotates together with the basket.
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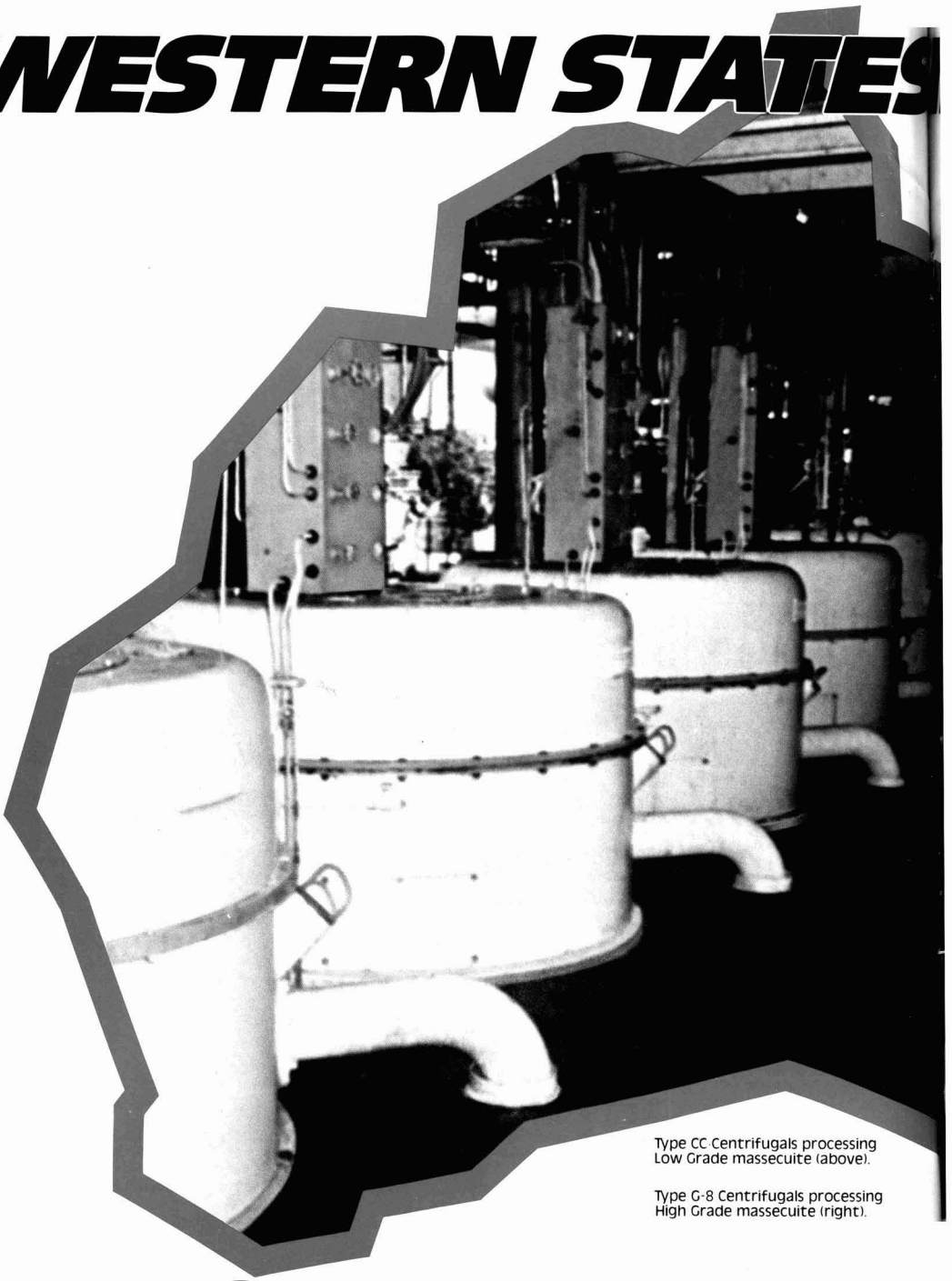

Type CC Centrifugals processing
Low Grade massecuite (above).

Type G-8 Centrifugals processing
High Grade massecuite (right).

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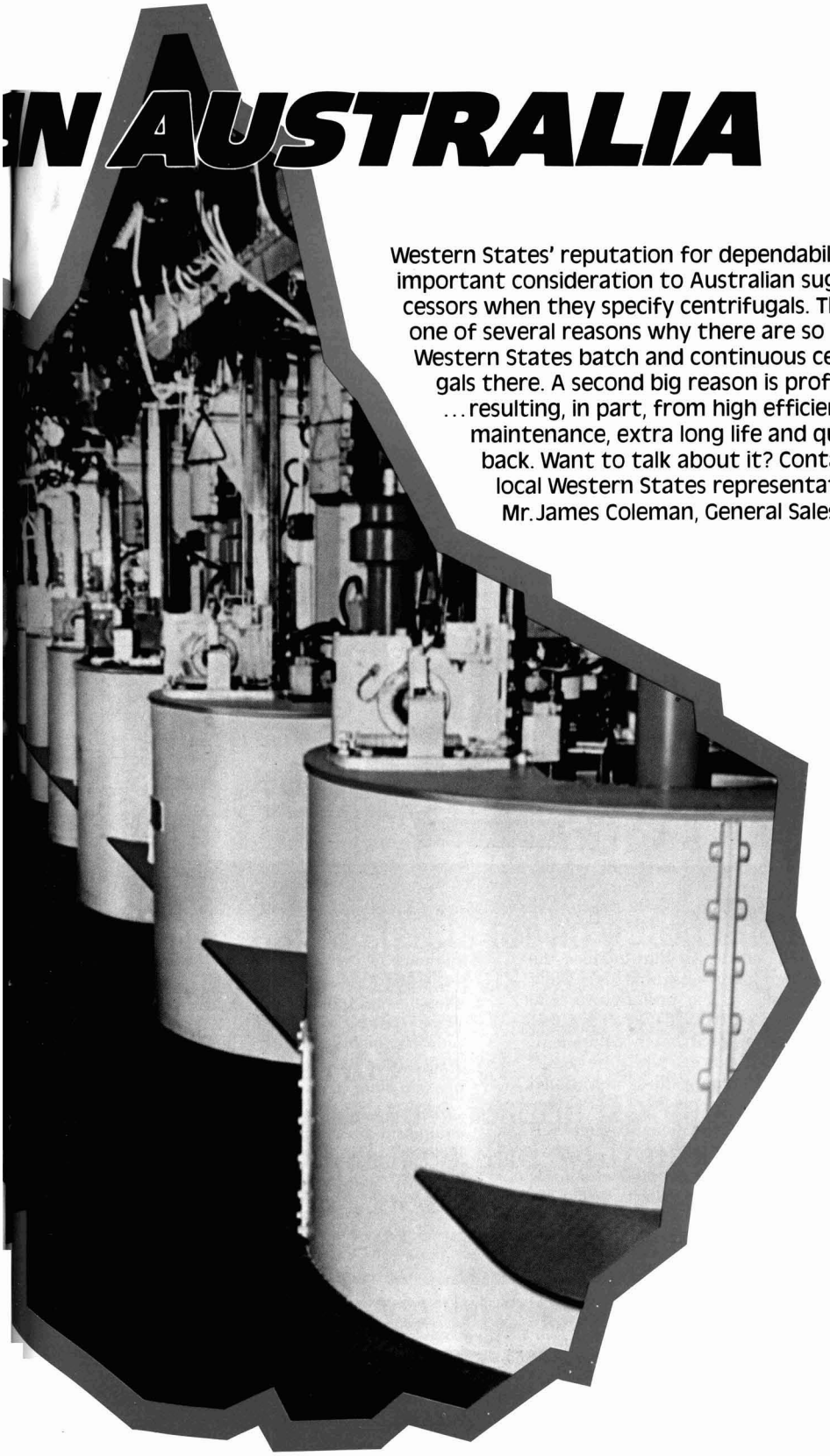

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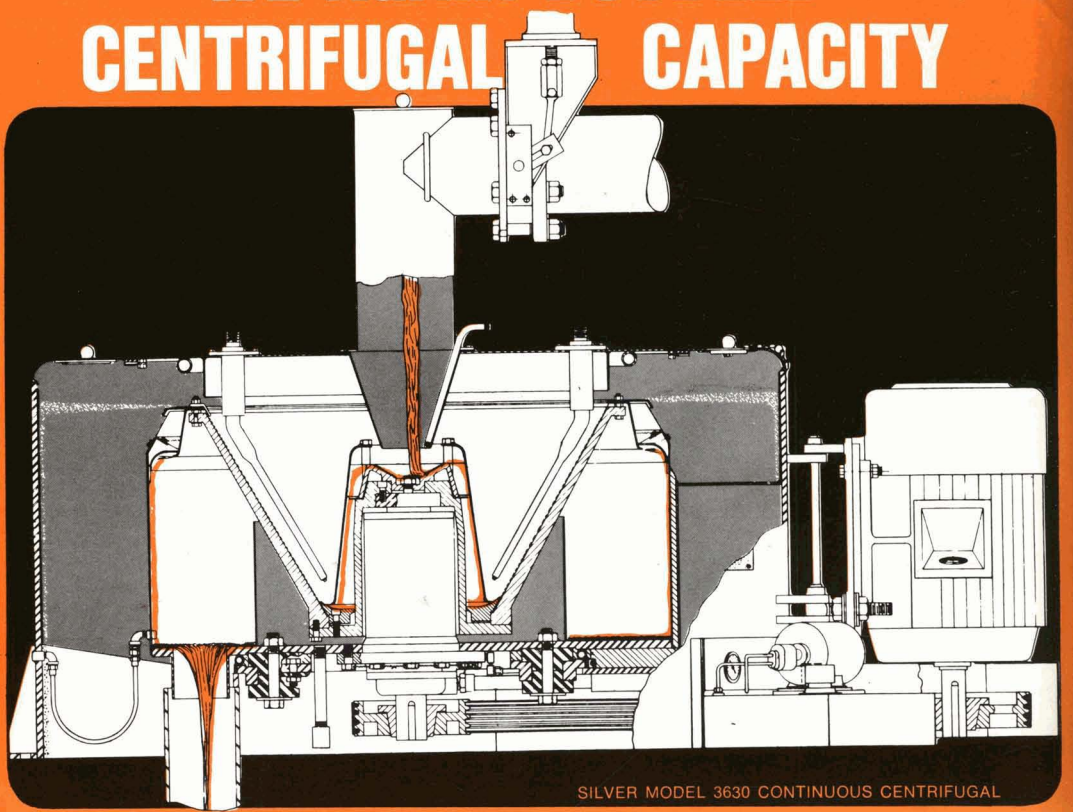

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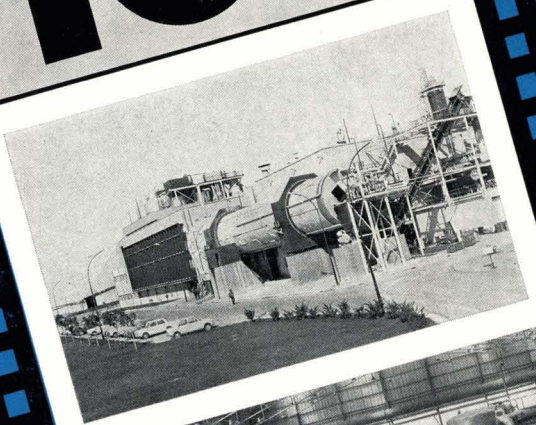
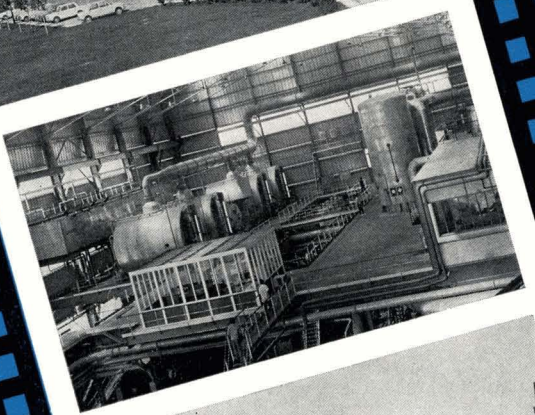


**Beet sugar factories.**



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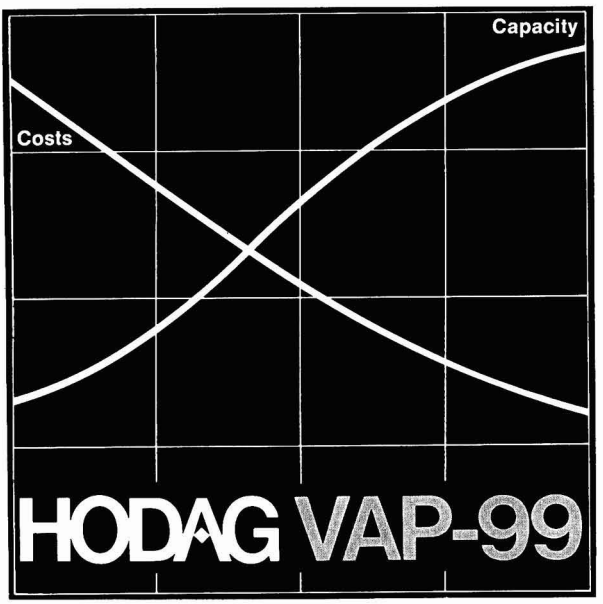


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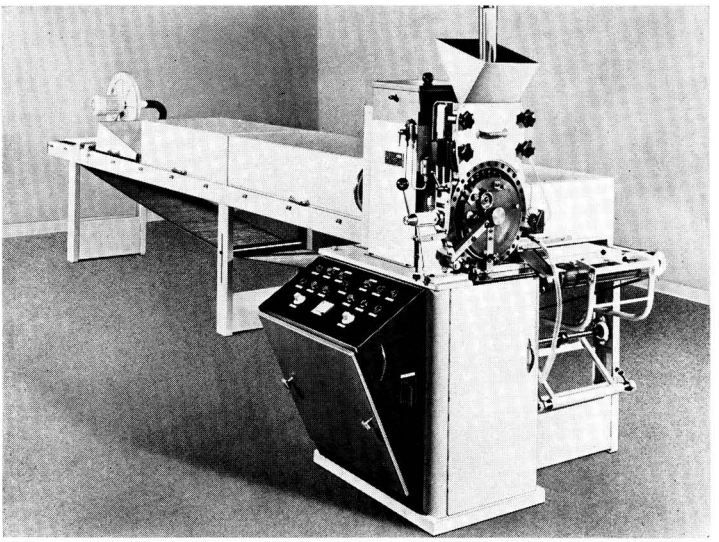

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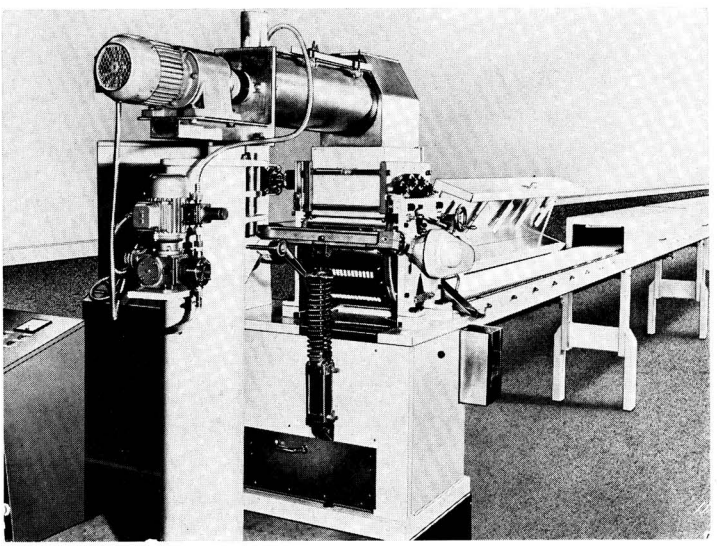

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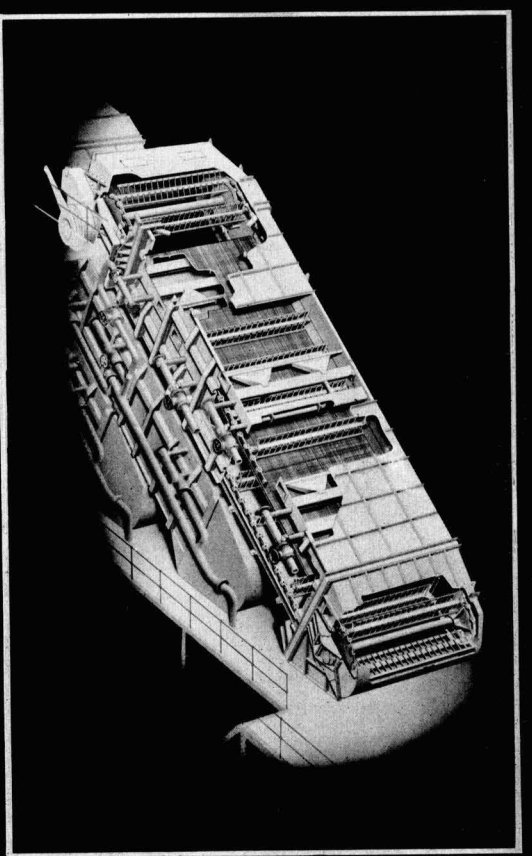

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# International Sugar Journal

## November 1976

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# SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

**Broyage et centrifugation de la canne à sucre pour une meilleure extraction. 1ère Partie.** M. STERZINGER et J. ZDARSKY. *p.* 323–326

On donne les résultats d'essais de laboratoire et d'essais avec une ligne continue dans une sucrerie indienne au cours desquels la canne a été traitée avec un "Gorator" de la firme Hoelschertechnik suivi par une centrifugeuse à poussée et un enlèvement d'eau de la bagasse par deux moulins. Le "Gorator" a pour rôle principal de désintégrer finement la canne préparée, de rompre les cellules et de transférer le mélange jus-bagasse dans la centrifugeuse. En une période de 11 jours, on a obtenu une extraction moyenne de 95,83% en préparant la canne par deux jeux de couteaux et un moulin à 3 cylindres suivi par le "Gorator" et une centrifugeuse contre 90,33% avec deux jeux de couteaux et un défibreur. Les résultats des analyses de défibrage de la canne et de la bagasse par tamisage démontrent l'aptitude du "Gorator". La valeur de la centrifugeuse comme extracteur a également été confirmée.

* * *

**Quelques observations sur le floc dans les boissons acides.** E. H. ROBERTS, M. A. GODSHALL, M. A. CLARKE et F. G. CARPENTER. *p.* 326–329

On a examiné l'aptitude à former un floc de six échantillons de sucre raffiné. Si les polysaccharides hydrolysés isolés de chaque échantillon ont un rapport arabinose:galactose de 1:1 ou plus, l'échantillon de sucre forme un floc ou peut en former un par addition de silicate soluble. On peut empêcher un tel sucre de former un floc en le faisant passé (i) sur un filtre à pré-couche à 25°C, (ii) sur une colonne de résine cationique sous forme acide ou une résine anionique sous forme basique ou (iii) dans une centrifugeuse à grande vitesse. Une filtration à 85°C ou température plus élevée n'empêche pas la formation de floc.

* * *

**Vers une stratégie de contrôle du charbon de la canne à sucre dans les Indes Occidentales.** N. W. SIMMONDS. *p.* 329–330

Etant données les récentes manifestations du charbon de la canne (*Ustilago scitaminea*) dans l'hémisphère occidental, la question se pose de savoir ce qui peut être fait pour réduire les pertes économiques que cette maladie peut provoquer, en supposant certains schémas de culture de cannes plantées et de repousses dans lesquelles les variétés sensibles ont été remplacés par des variétés résistantes. On calcule les bénéfices possibles pour deux types d'action: (1) remplacement d'une variété sensible par une variété résistante pendant une certaine période, sans perturber le cycle de replantation normal et (2) initiation d'un programme de replantation rapide et ajustement subséquent des replantations pour restaurer le cycle normal.

**Kombiniertes Mahlen und Zentrifugieren des Zuckerrohrs zum Zwecke der besseren Extraktion. Teil I.** M. STERZINGER und J. ZDARSKY. *S.* 323–326

Es wird über Laboratoriumsuntersuchungen und Versuche mit einer kontinuierlichen Linie in einer indischen Zuckerfabrik berichtet, bei denen Zuckerrohr mit dem "Gorator" der Fa. Hoelschertechnik und anschliessend mit einer Schubzentrifuge behandelt und die Bagasse in zwei Mühlen entwässert wurde. Die Hauptaufgabe des "Gorator" war die feine Zerkleinerung des vorbehandelten Rohres, das Zerreissen der Zellen und der Transport des Saft-Bagasse-Gemisches zu den Zentrifugen. Der elftägige Mittelwert für die Extraktion, die bei der Rohraufbereitung mit einer Kombination aus zwei Messersätzen, einer Dreiwalzenmühle, einem "Gorator" und einer Zentrifuge erreicht wurde, betrug 95,83% gegenüber 90,33% bei Einsatz von zwei Messersätzen und einem Shredder. Siebanalysen zur Fiberentfernung beim Rohr und bei der Bagasse zeigten die Brauchbarkeit des "Gorator"; die Bedeutung der Zentrifuge als Extraktionseinrichtung wurde ebenfalls bestätigt.

* * *

**Einige Beobachtungen bei der Floc-Bildung in sauren Getränken.** E. H. ROBERTS, M. A. GODSHALL, M. A. CLARKE und F. G. CARPENTER. *S.* 329–230

Die Verfasser haben die Floc-Bildung an sechs Raffinadeproben untersucht. Wenn das aus jeder Probe isolierte hydrolysierte Polysaccharid ein Arabinose-Galactose-Verhältnis von 1:1 oder darüber hatte, war die Zuckerprobe floc-positiv oder konnte durch Zusatz von löslichem Silikat floc-positiv gemacht werden. In derartigen Zuckern konnte die Floc-Bildung verhindert werden durch (a) Durchsatz durch ein Anschwemmfilter bei 25°C; (b) Durchsatz durch einen Kationenaustauscher in der $H^+$-Form oder einen Anionenaustauscher in der $OH^-$-Form; oder (c) durch Zentrifugieren bei hohen Umdrehungszahlen. Durch Filtrieren bei 85°C oder einer höheren Temperatur liess sich die Floc-Bildung nicht verhindern.

* * *

**Zur Strategie der Bekämpfung des Zuckerrohrbrandes in Westindien.** N. W. SIMMONDS. *S.* 326–329

Im Hinblick auf das neuerdings beobachtete Auftreten von Zuckerrohrbrand (*Ustilago scitaminea*) in der westlichen Hemisphäre erhebt sich die Frage, was unternommen werden kann, um die wirtschaftlichen Verluste zu reduzieren, welche die Krankheit bewirken kann. Dabei sind verschiedene Pflanzschemata für die Rohr- und Stoppelrohrernte zu berücksichtigen, bei denen anfällige Sorten durch widerstandsfähige ersetzt werden. Der mögliche Gewinn wird für zwei Massnahmen errechnet: (1) für eine Standzeit den Ersatz der anfälligen Sorte durch eine widerstandsfähige ohne Störung des normalen Nachpflanzrhythmus; und (2) die Einleitung eines schnellen Nachpflanzprogramms und beim nächsten Nachpflanzen die Rückkehr zum normalen Zyklus.

**Molienda-con-centrifugación de caña de azúcar para mayor extracción. Parte I.** M. STERZINGER y J. ZDARSKY. *Pág.* 323–326

Se recuerdan resultas de ensayos en un laboratorio y de experimentos con una línea continua en una fábrica de azúcar en la India en que caña se procesó por una máquina "Gorator" de la compañía Hoelschertechnik y entonces por una centrífuga del tipo empuje, con desagüe del bagazo en dos molinos. El papel mayor de la "Gorator" estuvo disintegración fina de la caña preparada, quebradura de la células, y transferencia de la mezcla jugo-bagazo a la centrífuga. El extracción media, de un período de 11 días, obtenido por preparación de la caña en dos juegos de cuchillas y un molino de tres mazas con, en seguido, la "Gorator" y la centrífuga, fué 95·83% en comparación con 90·33% cuando dos juego de cuchillas y un desmenuzador se emplearon para preparación. Dados del análisis por tamiz para asesar desfibración de caña y bagazo demostraron el aptitud de la "Gorator". El valor de la centrifuga como extractor se confirmó también.

* * *

**Algunos observaciones sobre floc en bebidas ácidas.** E. H. ROBERTS, M. M. GODSHALL, M. M. CLARKE y F. G. CARPENTER. *Pág.* 326–329

Se han examinado las características de seis muestras de azúcar refinado que dan una tendencia formar floc. Si el polisacarido hidrolisado obtenido de la muestra tuvo una relación arabinosa:galactosa de 1:1 o mayor, la muestra de azúcar estuvo floc-positiva o pudo hacerse por adición de silicato soluble. Formación de floc en un tal azúcar puede evitarse por (i) pasaje a través de un filtro con pre-capa a 25°C, (ii) pasaje a través de una columna de résina en forma ácida para cambio de cationes, o una résina en forma básica para cambio de aniones, o (iii) centrifugación en alta velocidad. Filtración a una temperatura de 85°C o más alta no pudo evitar formación de floc.

* * *

**Hasta una strategía para control de carbón de caña de azúcar en las Indias Occidentales.** N. W. SIMMONDS. *Pág.* 329–330

En vista de erupciones recientes de carbón (*Ustilago scitaminea*) en el Hemisferio Occidental, surge la cuestión de lo que puede hacerse para reducir las perdidas económicas que puede causar esta enfermidad. Son asumido esquemas de planteación para una cosecha de planta y varias cosechas de retoño en que variedades susceptibles se reemplazan con variedades resistentes. Los beneficios posibles se calculan para dos modos de acción: (1) donde una variedad susceptible se remplaza durante un período sin alboroto del ciclo normal de replanteación, y (2) donde ùna programa rápida de replanteación es iniciado y replanteación subsecuente es ajustado para devolver al ciclo normal.

# INTERNATIONAL SUGAR JOURNAL

VOL. LXXVIII NOVEMBER 1976 No. 935

# Notes & Comments

**European beet sugar production estimate**

In late August F. O. Licht KG published[1] their first estimate of sugar production in Europe from the 1976/77 crop. A month later, largely as a consequence of rainfall in the beet growing areas, new figures were published[2] showing a net 600,000-tons increase on the earlier forecast and including 400,000 tons more for France and 300,000 tons for Soviet beet sugar production. The later figures are given below:

| | 1976/77 Estimate | 1975/76 | 1974/75 |
|---|---|---|---|
| | (*metric tons, raw value*) | | |
| Belgium-Luxembourg | 652,000 | 711,000 | 607,000 |
| Denmark | 440,000 | 423,000 | 415,000 |
| France | 2,700,000 | 3,230,000 | 2,947,000 |
| Germany, West | 2,610,000 | 2,534,000 | 2,439,000 |
| Holland | 924,000 | 914,000 | 778,000 |
| Ireland | 207,000 | 203,000 | 145,000 |
| Italy | 1,598,000 | 1,442,000 | 1,012,000 |
| United Kingdom | 790,000 | 628,000 | 601,000 |
| *Total EEC* | *9,921,000* | *10,085,000* | *8,944,000* |
| Austria | 380,000 | 512,000 | 394,000 |
| Finland | 95,000 | 88,000 | 82,000 |
| Greece | 315,000 | 307,000 | 187,000 |
| Spain | 1,300,000 | 917,000 | 572,000 |
| Sweden | 308,000 | 277,000 | 305,000 |
| Switzerland | 71,000 | 65,000 | 72,000 |
| Turkey | 1,149,000 | 986,000 | 834,000 |
| Yugoslavia | 560,000 | 483,000 | 556,000 |
| *Total West Europe* | *14,099,000* | *13,720,000* | *11,946,000* |
| Albania | 20,000 | 18,000 | 16,000 |
| Bulgaria | 240,000 | 218,000 | 200,000 |
| Czechoslovakia | 700,000 | 780,000 | 750,000 |
| Germany, East | 595,000 | 665,000 | 655,000 |
| Hungary | 410,000 | 331,000 | 338,000 |
| Poland | 1,960,000 | 1,900,000 | 1,589,000 |
| Rumania | 760,000 | 600,000 | 620,000 |
| USSR | 9,400,000 | 7,700,000 | 8,000,000 |
| *Total East Europe* | *14,085,000* | *12,212,000* | *12,168,000* |
| TOTAL EUROPE | 28,184,000 | 25,932,000 | 24,114,000 |

The estimates reflect the unfavourable weather experienced by many East and West European countries, with inadequate rainfall even from March, low temperatures early in the growing period and later hot dry conditions. The bulk of the overall 2·25 million-ton increase expected arises from a recovery anticipated in the Soviet crop while in Western Europe an increase of 2·8% in sugar production is anticipated in spite of an average 6·3% increase in the beet area. The EEC countries have suffered worst from the drought, the figure for France in particular showing a large decrease.

In their previous reports, however, Licht have emphasized the difficulty of estimating the likely production for this coming campaign because of marked differences not only between countries and parts of the same country but even between fields in the same area. Consequently true production levels may vary considerably from these early estimates which nevertheless provide a basis for market considerations.

* * *

**FAO Commodity Review and Outlook 1975/76[3]**

In their annual Commodity Review and Outlook 1975/76 the Food and Agricultural Organization of the United Nations advise that at least half the total growth in world demand for sugar during the next ten years will be in developing countries. This indicates an annual growth rate of 3·6 to 4·3% per year. They point out that there are many oil-producing countries within this group, most of which are sugar importers, and these are likely to have a relatively fast growth in requirements. Among other developing importing countries there are several where suitable conditions exist for the production of beet or cane sugar. However, they will require substantial financial and technical assistance if they are to develop viable industries.

The FAO suggests that the availability of commercial capital will become a major constraint on expansion plans which will increase the need for international aid. FAO suggest that the slow rate of production growth which was such a feature of the market a few years ago was due largely to the extremely low world market prices. For this reason, they state that it is necessary to negotiate a realistic price range within which world market prices can be stabilized as part of the next International Sugar Agreement.

* * *

**High fructose corn syrups in the EEC**

As reported previously[4], sugar interests in Europe have expressed concern at the advantaged position of producers of isomerized corn syrups. The EEC Commission has now raised the matter with the Council of Ministers and, according to C. Czarnikow Ltd.[5], "it is understood that they proposed the abolition of the production restitution received by manufacturers of HFCS. The Farm Ministers were not prepared to take immediate action, however, and have set the refund on maize used for the production of starch and HFCS in the year commencing 1st August 1976

[1] *International Sugar Rpt.*, 1976, **108**, (24), 2–3.
[2] *ibid.*, (27), 1–3.
[3] C. Czarnikow Ltd., *Sugar Review*, 1976, (1298), 140.
[4] *I.S.J.*, 1976, **78**, 257.
[5] *Sugar Review*, 1976, (1295), 125.

at 10 units of account per metric ton. So far as next season is concerned, the Ministers have in principle agreed that there will be no production restitution for the output of HFCS. At the same time it is understood that the Commission has been asked to recommend to the Member States that they adjust their internal tax arrangements in cases where these place sugar at a disadvantage.

"These arrangements are a step in the right direction so far as the sugar producers are concerned, but they will not meet all of their objections. It can be readily understood that the Ministers felt it inappropriate to make an immediate change in the effective subsidy which HFCS manufacturers will receive, as the latter had presumably already made their calculations on firm figures they had been given by the Commission. Nevertheless, sugar interests will be concerned that the Ministers did not feel it is in order at this stage to do more than take a decision in principle so far as 1977/78 and succeeding years are concerned".

* * *

**Manbré & Garton take-over by Tate & Lyle**

The proposal by Tate & Lyle Ltd. that they should take over the only other cane sugar refining company in the UK—Manbré & Garton Ltd.—had been resisted by Manbré and also was opposed by a number of bodies representing customers of the two. It was proposed that the bid should be examined by the Monopolies Commission, a Government-appointed body which examines such bids to see if they would act against the public interest. Although there seemed to be a case for such examination—which does not presuppose that the merger would have been prevented—the Cabinet decided not to refer the bid to the Commission and the Tate & Lyle offer for the shares of Manbré at £1.70 each was again put forward.

Further resistance from the Manbré Board continued and there were not sufficient acceptances for Tate & Lyle to assume control. Many of the Manbré shares were held by institutional investors who were won over, however, when the offer was raised to £2.00 per share. As a consequence, by the 24th September, Tate & Lyle were able to announce that they held 55% of the shares and that Manbré had become one of the Group's subsidiaries.

* * *

**UK 1977 sugar beet contract**

The 1977 sugar beet contract, asking UK farmers how much sugar beet they will offer to grow next year, has been posted to all growers. The 1977 contract is in a more simplified form than previous ones, and has been sent out far earlier than last year because the terms were this year agreed earlier between the National Farmers' Union and the British Sugar Corporation. The terms offer a single price package of £20 for a metric ton of beet at 16% sugar content, including the pulp and sugar sharing allowances. This is an increase of approximately £2 a ton over the comparable 1976 figure. The British Sugar Corporation has said that next year they are offering contracts for a total area of up to 220,000 hectares (544,000 acres) of sugar beet to be grown.

* * *

**US sugar import duty**

Since the end of 1974, when the US Sugar Act lapsed, purchases of sugar by the US have been from the free market although still limited by a 7-million tons overall import quota. During most of this time raw sugar prices have been higher than the cost of production within the US but, with the fall in values this year, it has become possible for raw sugar imports to be refined and sold below the domestic price of white sugar. Considerable pressure has been brought on the Administration to provide protection to US producers and President FORD bowed to this pressure in announcing that the import duty on raw sugar was to be raised from 0·625 to 1·875 cents/lb with effect from midnight on the 20th September, the exemption for developing countries supplying less than $25 million worth of sugar being continued.

This move seems not to have met with approval by either the importers or domestic industry. Initially there was a fear that US imports would be cut and the sugar diverted to the world market, and this aided the fall in LDP values. A number of exporting countries protested and a South African spokesman stated that shipments to the US would be diverted if the extra duty could not be recovered. It was soon seen, however, that the change in duty would mean little more than an increase of 1·25 cents/lb in sugar cost for the US consumer.

Representatives of the domestic sugar industries have said that they are still vulnerable. A Vice-President of Great Western claimed that beet sugar industry operations were only sound at a price of 17 cents per pound as against the current 15 cents and that unless the price rose many beet sugar processors would have to close down[1]. The President of the US Sugar Corporation felt that the trebling of the duty was a positive step but not yet enough. Recent estimates of production cost in the United States for white sugar from beet or cane have ranged up to more than 18 cents per pound[2] and if this figure is correct refined sugar from imported raws can still undercut domestic production. The US industries are thus recommending further action; they had earlier pressed for quota reduction, setting of individual country quotas and higher tariffs—which sounds like a new Sugar Act. It is not anticipated that any such further action, which might increase domestic sugar prices and thus perhaps alienate voters, will be taken before the Presidential elections.

* * *

**World sugar prices**

At the beginning of September the London Daily Price for raw sugar was £127 per ton but a slow decline through most of the month brought it to £111 on the 24th. Trebling of the US import tariff and the lower value of sterling, combined with the effect of an announcement by Dr. CASTRO that the Cuban crop this year would be reduced by 25% as a consequence of drought in the Eastern Provinces, brought about a recovery to £129 by the 29th September, but trading was very small and a sale to a French refiner at a lower value, and publication by F. O. Licht of a forecast of a better European crop than he had estimated a month earlier, brought the LDP down equally rapidly to £118 by the 1st October.

White sugar prices slid gently down as well, from £170 on the 1st September to £159 per ton on the 24th; they were not so affected by the news which had influenced raw sugar prices so that the associated LDP(W) rise was only to £165 per ton and the subsequent fall to £162.

[1] *Public Ledger*, 2nd October 1976.
[2] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (27), 12.

# Milling-cum-centrifuging of sugar cane for higher extraction

By M. STERZINGER* and J. ZDARSKY†

## PART I

### *Introduction*

IN an effort to extract juice from sugar cane by a simpler and more economical method than that used in most countries, many experts and manufacturers have sought new process techniques.

On the factory scale, the greatest progress has been made with the method based on the diffusion process for juice extraction from cane, although the term "diffusion" is not absolutely correct as only a greater or lesser part of the overall extraction process is represented by diffusion proper. The advantages and disadvantages of the process are well known, and in particular manufacturers of this equipment have carried out many comparisons with the classic milling tandem.

A process in which (as distinct from diffusion or combined milling-diffusion) sucrose extraction from the cells is not temperature-dependent, and which is accomplished in a short period of time, has been developed and evaluated on a laboratory and pilot-plant scale by the staff of the Chemical Engineering Research Institute (VUCHZ) at Hradec Králové in collaboration with Technoexport and the Indian firm, Walchandnagar Industries Ltd. The purpose of this article is to present the results of laboratory experiments and pilot-scale tests conducted at the sugar factory of Ravalgaon Sugar Farm Ltd. in Maharashtra.

### Process Evaluation

#### *Individual test variants*

Laboratory tests were carried out in the 1968 intercampaign with unripened cane. The aim was to check the suitability of using a centrifugal extractor for cane and bagasse extraction. An important component of the extractor was the "Gorator" which was used for fine disintegration, for mechanical rupturing of the cells and for transfer of the juice-cane (bagasse) mixture to the centrifugal. The laboratory test equipment was evaluated in the following combinations:

| | | |
|---|---|---|
| (*A*) | cane preparation | two knife sets and shredder |
| | extraction | "Gorator"+centrifugal (two passes) |
| | final pressing | two mills |
| (*B*) | cane preparation | two knife sets and shredder |
| | extraction | mill and "Gorator"+centrifugal (one pass) |
| | final pressing | two mills |

These tests showed that, because of a low juice purity corresponding to the quality of cane harvested in July and a juice quality partially reduced by batch processing and prolonged evaluation, it would be better to test the process under continuous, pilot-plant conditions.

During the 1970 season a continuous experimental line was constructed in India, which permitted tests to be conducted according to the following combinations:

| | | |
|---|---|---|
| (*C*) | cane preparation | two knife sets and shredder |
| | cane extraction | "Gorator"+centrifugal |
| | final pressing | two mills |
| (*D*) | cane preparation | two knife sets and 3-roller mill |
| | bagasse extraction | "Gorator"+centrifugal |
| | final pressing | two mills |

All process variants were evaluated from the engineering, laboratory processing and biological viewpoints.

Microscopic evaluation of the degree of mechanical damage and rupturing of cane or bagasse cells in the test variants mentioned above and in certain other combinations was intended to establish how the individual pieces of equipment contributed to the number and extent of ruptured cells and the resultant effect on total extraction. Particular attention was paid to the disintegrating capacity of the "Gorator". Relevant chemical analysis was carried out directly in the sugar factory laboratory. At the same time, sieve analysis was used to determine the size distribution of the stepwise disintegrated bagasse.

#### *Description and layout of the continuous test equipment*

The pilot plant used for cane preparation on test Variant (*C*) was as shown in Fig. 1; it comprised two knife sets and a shredder, and had a capacity of 5–10 tons.hr$^{-1}$. For Variant (*D*) use was made of two knife sets and the 1st mill of a tandem comprising six 3-roller 24 in × 48 in mills. Bagasse was continuously taken from the intermediate carrier after the 1st mill at the rate of 10–15 tons.hr$^{-1}$.

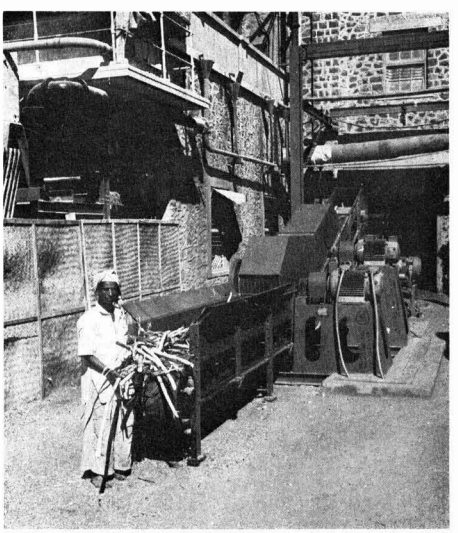

Fig. 1

Main equipment in the line was the combination of "Gorator" (lent by Hoelschertechnik GmbH for the tests) and centrifugal. The "Gorator" chokeless

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centrifugal pump, type ZZQQSH 25.22/12,5/15, was adapted for possible multiple recirculation by using a casing with two outlet branches as shown in Fig. 2.

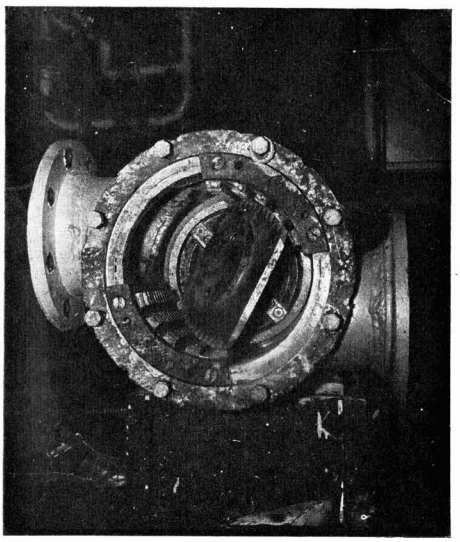


Fig. 2

As originally delivered the "Gorator" (see Fig. 3) chopping-pumping unit featured a notched flat-disc impeller mounted at an oblique angle on the end of the shaft. The notches on the impeller match serrations on a removable liner to create both a chopping and pumping action. This action reduces the relatively large particles of cane, fed to the "Gorator" along with circulation juice, to small fiberized ones, simultaneously with mechanical rupturing of cells and separation of their juice content.

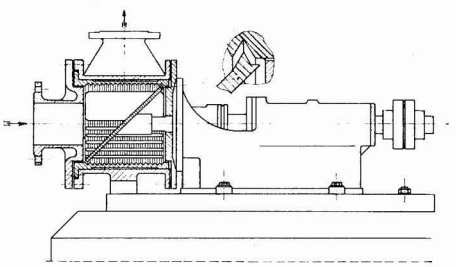


Fig. 3

Prior to arrival at the inclined rotor pump, the shredded cane or bagasse leaving the first mill is sprinkled with juice from the process in the "Gorator" feed hopper in order to obtain a mixture more easily handled by the chopping-pumping unit. The chopped-up mass is pumped by the unit to the KO 1000/4 centrifugal.

The 4-stage push-type centrifugal used, shown in Fig. 4, was a standard KO 1000/4 sugar centrifugal with a basket of minimum diameter 760 mm and maximum dia. 1000 mm corresponding to peripheral speeds of 22·6 m.sec$^{-1}$ and 36 m.sec$^{-1}$ at the minimum and maximum diameters. Basket length was 600 mm, and feed rate 40 mm.sec$^{-1}$. In both test variants, bagasse was dewatered by the last two mills in the milling tandem. Bagasse was transferred from the centrifugal to the intermediate carrier between mills 4 and 5. Individual equipment and sets were first tested and arranged so that subsequent tests could be carried out smoothly.

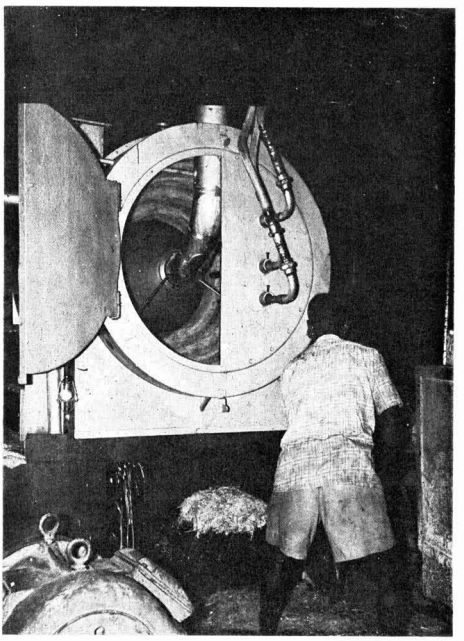


Fig. 4

Greatest attention was focused on transfer of the defibrated cane or bagasse from the "Gorator" to the centrifugal, formation of a uniform layer in the basket and connexion of the imbibition water and juice circuits to the centrifugal stages. This arrangement is demonstrated below for each scheme.

The laboratory tests showed that good results would be achieved in the pilot-plant tests only if equipment were designed to give equivalent performance figures. One of the most important prerequisites was good 1st mill or crusher performance. Since we wanted to check both cane extraction in Variant (*C*) and bagasse extraction in Variant (*D*), we observed the work of the 1st mill in the Ravalgaon tandem from the first tests with cane (after having overcome basic engineering problems). As an indication of the importance of primary extraction we may quote the 1968-69 results for The Phaltan Sugar Works Ltd. sugar factory at Sakharwadi using a DDS diffuser manufactured by Larsen & Toubro. Two 3-roller mills following two knife sets were used for primary extraction, and the bagasse was dewatered by three mills. The diffuser processed a maximum of 1350 tons per day. It was found[1] that pol % bagasse entering the diffuser was 6·9–8·4 (moisture content 52·2–55·5%), while bagasse leaving the diffuser had a pol % of 2·4–2·9 (moisture 70·5–76·5%). Total extraction E was

[1] KULKARNI & UNDE: *Proc. 23rd Conv. Deccan Sugar Tech. Assoc.*, 1969, (1), 41–66.

96·30%, reduced extraction 96·77% and primary extraction 75·35%. According to KULKARNI & UNDE[2], in the period from 12th October to 28th December 1969 extraction was 95·54%, reduced extraction 96·21% and primary extraction 75·49%.

As regards cell rupture, cane preparation with two knife sets and the No. 1 mill of the tandem was inadequate. The average primary extraction during tests on Variant (*D*) was 67·95%, reduced extraction 68·51%, the defibrated bagasse % cane was 46·05, while the quantity of primary juice was only 54·19% on cane or 62·04% of the total juice quantity.

Only on one day during the 18-day investigation period were the primary extraction results such that they assured an adequate total extraction in our tests, i.e. primary extraction in the No. 1 mill of the tandem was 76·55%, reduced extraction 73·45%, primary juice % cane was 60·83%, juice extracted % juice in cane was 68·50%, and 1st mill bagasse % cane was 39·17%. Percentage of cells ruptured was 74·43% (see below).

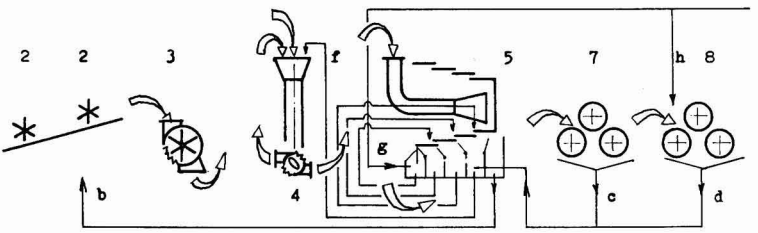



Fig. 5.

KEY:

(1) Revolving knives—full operation
(2) Revolving knives
(3) Shredder
(4) Gorator
(5) Centrifugal
} pilot plant

(6) 1st mill
(7) 5th mill
(8) 6th mill
} of 18-roller tandem

(a) primary juice
(b) centrifugal juice
(c) 1st dewatering mill juice
(d) 2nd „ „ „
(e) mixed juice
(f) circulation juice
(g) imbibition to centrifugal
(h) imbibition to mill

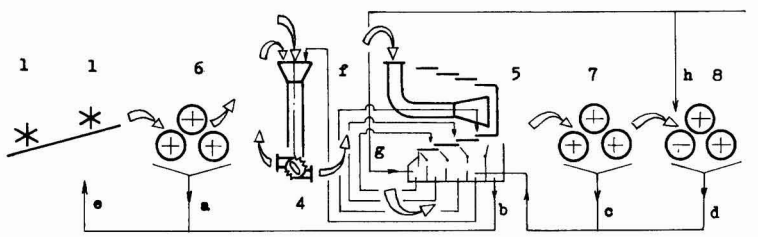



Fig. 6

*Process tests*

(*a*) Cane extraction (Variant *C*) is shown schematically in Fig. 5. Average results from 10 daily analyses:

Throughput 6·1 tons.hr$^{-1}$ of cane.

| | | | |
|---|---|---|---|
| *Cane:* | | *Laboratory crusher juice:* | |
| Pol | 13·85 | Brix | 20·70° |
| Fibre % | 13·75 | Pol | 17·95 |
| Moisture % | 71·00 | Purity | 86·68 |
| *Bagasse from centrifugal:* | | *Juice from centrifugal:* | |
| Pol | 7·04 | Brix | 14·83° |
| Fibre % | 17·04 | Pol | 12·41 |
| Moisture % | 74·70 | Purity | 83·97 |
| *Bagasse from 1st dewatering mill:* | | *Juice from 1st dewatering mill:* | |
| Pol | 5·61 | Brix | 11·71° |
| Fibre % | 37·60 | Pol | 9·49 |
| Moisture % | 57·79 | Purity | 81·03 |
| *Bagasse from 2nd dewatering mill:* | | *Juice from 2nd dewatering mill:* | |
| Pol | 4·17 | Brix | 10·13° |
| Fibre % | 42·66 | Pol | 7·93 |
| Moisture % | 51·80 | Purity | 78·10 |
| *Extraction (E), %* | | *Reduced extraction ($RE_{12\cdot5}$), %* | |
| Centrifugal | 58·69 | Centrifugal | 62·69 |
| 1st mill | 85·23 | 1st mill | 86·52 |
| 2nd mill | 90·33 | 2nd mill | 91·17 |

(*b*) Bagasse extraction (Variant *D*) (see Fig. 6). Average results of 11 daily analyses:

Throughput: 12·27 tons.hr$^{-1}$ of cane; 5·95 tons.hr$^{-1}$ of 1st mill bagasse.

| | | | |
|---|---|---|---|
| *Cane:* | | | |
| Pol | 12·86 | | |
| Fibre % | 12·94 | | |
| Moisture % | 71·30 | | |
| *1st mill bagasse:* | | *Primary juice:* | |
| Pol | 8·46 | Brix | 20·15° |
| Fibre % | 26·60 | Pol | 16·77 |
| Moisture % | 60·36 | Purity | 83·22 |
| % cane | 48·06 | % cane | 51·84 |
| | | % juice in cane | 59·92 |
| *Centrifugal bagasse:* | | *Centrifugal juice:* | |
| Pol | 4·31 | Brix | 9·77° |
| Fibre % | 19·46 | Pol | 7·55 |
| Moisture % | 73·39 | Purity | 77·28 |
| % cane | 68·31 | | |
| *Bagasse from 1st dewatering mill:* | | *Juice from 1st dewatering mill:* | |
| Pol | 3·56 | Brix | 9·00° |
| Fibre % | 41·06 | Pol | 6·60 |
| Moisture % | 52·75 | Purity | 73·25 |
| *Bagasse from 2nd dewatering mill:* | | *Juice from 2nd dewatering mill:* | |
| Pol | 1·95 | Brix | 5·52° |
| Fibre % | 47·01 | Pol | 3·87 |
| Moisture % | 48·32 | Purity | 69·93 |
| *Imbibition % cane:* | | *Mixed juice* | |
| C.I. | 8·98 | Brix | 16·92° |
| M.I. | 16·24 | Pol | 13·98 |
| | | Purity | 82·58 |
| Total | 25·22 | | |

| | *Extraction (E), %* | *Reduced extraction ($RE_{12\cdot5}$), %* |
|---|---|---|
| 1st mill | 68·01 | 68·99 |
| Centrifugal | 77·72 | 78·46 |
| 1st dewatering mill | 91·28 | 91·60 |
| 2nd dewatering mill | 95·83 | 95·98 |

[2] *Proc. 3rd Joint Conv. All-India Sugar Tech.*, 1969, E-1.1–1.19.

The values of E and $RE_{12\cdot5}$ were calculated using the following equations:

$$E = 100 - \left( \frac{(100 \times \text{pol \% bagasse}}{\text{fibre \% bagasse}} \times \frac{\text{fibre \% cane}}{\text{pol \% cane}} \right)$$

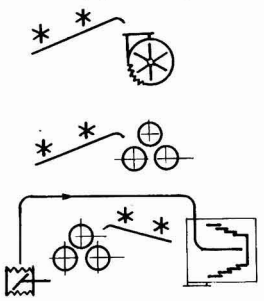
$$RE_{12\cdot5} = 100 - \frac{12\cdot5}{\text{fibre \% cane}} (100 - E)$$

The degree of cane and bagasse defibration was determined on a vibratory sugar screener. The first screen *a* had perforations of 6·5 mm, the second *b* 12·5 mm, the third *c* 20 mm and the fourth *d* 28 mm. The coarsest portion *e* overflowed onto the end of the screener. Some analysis of individual samples are given in Table I.

These tests confirmed the suitability of the "Gorator" by comparing the differences in weight and percentages between fractions *e* and *d* during evaluation of bagasse from the centrifugal, i.e. after the "Gorator" compared with bagasse prepared by the hitherto standard method (1st mill and shredder). The suitability of the centrifugal as extractor is demonstrated by comparing the amount of sugar in bagasse after centrifugalling and in bagasse treated by various means before it.

**Table I. Screen analysis of samples**

*Equipment set-up*



| *Screen fractions* | *Sample weight, kg* | % | *Pol* | *Sugar content, kg* |
|---|---|---|---|---|
| "a" | 37·80 | 42·66 | 11·96 | 4·517 |
| "b" | 18·50 | 20·83 | 11·19 | 2·070 |
| "c" | 17·60 | 19·81 | 9·93 | 1·747 |
| "d" | 7·20 | 8·10 | 10·80 | 0·776 |
| "e" | 7·70 | 8·60 | 8·82 | 0·679 |
| "a" | 20·5 | 25·94 | 9·47 | 1·941 |
| "b" | 12·0 | 15·18 | 8·43 | 1·011 |
| "c" | 21·5 | 27·24 | 7·96 | 1·711 |
| "d" | 12·5 | 15·82 | 8·25 | 1·031 |
| "e" | 12·5 | 15·82 | 11·35 | 1·418 |
| "a" | 37·0 | 41·11 | 2·44 | 0·903 |
| "b" | 19·5 | 21·66 | 3·33 | 0·649 |
| "c" | 22·5 | 25·00 | 3·28 | 0·738 |
| "d" | 10·0 | 11·11 | 3·29 | 0·329 |
| "e" | 1·0 | 1·12 | 2·93 | 0·029 |

(*To be continued*)

# Some observations on acid beverage floc

By

E. J. ROBERTS, M. A. GODSHALL, M. A. CLARKE and F. G. CARPENTER

(Cane Sugar Refining Research Project Inc., Southern Regional Research Centre*, New Orleans, Louisiana, USA)

*Introduction*

THE formation of flocculant precipitates (commonly called floc) in carbonated beverages and acidified syrups has plagued the sugar refining industry sporadically for many years.

At various times one or more of three factors have been considered the cause of floc formation: (*a*) impure water in which the sugar is dissolved; (*b*) impurities in the sugar; and (*c*) products of microbiological origin.

Considerable work has been done to identify floc constituents and pinpoint the cause of floc formation. The work, however, has too often been inconclusive and little has been published on the subject.

STANSBURY & HOFFPAUIR[1] studied five different floc-forming sugars and found that the isolated floc consisted of silica, starch, lipids and waxes, protein, and decolorizing carbon. They reported that the sugars containing the largest amount of decolorizing carbon gave the largest amount of floc; no other constituents were found that gave such significant correlation.

COHEN *et al.*[2] studied alcohol floc (haze formed by adding alcohol to aqueous solutions of sugar[3]) and acid floc formation, and the composition of isolated flocs from 28 samples of refined sugar. They found that all sugars that were acid floc-positive were also alcohol floc-positive, but the reverse was not necessarily true. No sugar was found that was acid floc-positive and alcohol floc-negative. No correlation appeared between the amount of decolorizing carbon and the amount of floc formed, such as was reported by STANSBURY & HOFFPAUIR; however, there was a high correlation between the amount of protein (albumin) present in the sugar and the amount of floc formed. The addition of protein to a solution of acid floc-negative, alcohol floc-positive sugar rendered it acid floc-positive. They concluded, therefore, that protein was the key ingredient in acid floc formation.

ROBERTS & CARPENTER[4] studied the composition of acid beverage floc isolated from refined cane sugar and found that the isolated floc contained silicon compounds, starch, lipids or waxes, proteins, dextran, and a polysaccharide which appeared to be an arabinogalactan[5]. Hydrolysis and subsequent gas-liquid chromatographic analysis of the hydrolysed polysaccharide showed the presence of arabinose, rhamnose, xylose, mannose, galactose, and glucose.

In a recent article, MIKI, SAITO & KAMODA[6] reported they isolated floc from beverages and confirmed the findings of ROBERTS & CARPENTER on the

* One of the facilities of the Southern Region, Agricultural Research Service, U.S. Department of Agriculture.

[1] *J. Agric. Food Chem.*, 1959, **7**, 353–358.
[2] *Proc. 29th Meeting Sugar Ind. Tech.*, 1970, 126–165.
[3] Proc. 14th Session ICUMSA, 1966, 113.
[4] *Proc.* 1974 *Tech. Session Cane Sugar Refining Research*, 39–50.
[5] ROBERTS *et al.*: *I.S.J.*, 1976, **78**, 163–165.
[6] *ibid.*, 1975, **77**, 67–69.

composition of the polysaccharide portion of beverage floc.

In earlier investigations, ROBERTS, JACKSON & VANCE[7] used paper chromatography to analyse partially an indigenous polysaccharide isolated from fresh cane juice. The isolation of the polysaccharide was carried out in such a way that starch and dextran were not included in the separated product. Since this is the indigenous sugar cane polysaccharide that is now believed to be one of the major factors causing beverage floc formation, its composition has recently been re-examined by the more sensitive and accurate gas-liquid chromatography[5].

The present paper is a preliminary report on our work on the cause and prevention of acid beverage floc formation.

## EXPERIMENTAL

### *Definitions*

All solutions were prepared by dissolving 540 g sugar in 460 $cm^3$ distilled water and 50 $cm^3$ of 37% formaldehyde, unless otherwise specified.

Although all sugars displayed more or less turbidity, heavy turbidity, which is caused by colloidal-sized particles suspended in the solution, was not considered floc.

A sugar was considered floc-positive when the colloidal particles in its acidified solution coagulated to form voluminous aggregates that slowly settled to the bottom of the container.

Sugars or treated sugar samples that formed floc when their acidified solutions were allowed to stand for 10 days were termed floc-positive; those that did not form floc under these conditions were considered floc-negative.

### *Description of sugars used*

The sugars used in this study were of the following types and floc dispositions, and will be referred to by the associated numbers:

| | | |
|---|---|---|
| 1. | Fourth strike ..... | floc-negative |
| 2. | Fourth strike ..... | floc-negative |
| 3. | First strike ..... | floc-negative |
| 4. | Commercial blend .. | floc-negative |
| 5. | Commercial blend .. | floc-positive |
| 6. | Commercial blend .. | floc-positive |

### *Analytical methods*

*Determination of silicon:* Total silicon was determined by atomic absorption spectroscopy by the procedure of MORRIS *et al.*[8]; soluble silicon was determined colorimetrically by the procedure of DAVIES, GOMEZ & BOON[9] with the substitution of sodium bisulphite for sodium hydrosulphite as the reducing agent.

*Isolation of alcohol-precipitable polysaccharide:* To 200 g sugar dissolved in 200 $cm^3$ water was added 5 $cm^3$ of acetic acid and 600 $cm^3$ ethanol. The solution was filtered with suction through a ½-inch thick mat of "Celite" analytical filter aid† on a sintered glass funnel. The filter mat was washed with five 200-$cm^3$ portions of 75% ethanol to remove sugars, then was washed again with two 200-$cm^3$ portions of boiling water to dissolve the precipitated polysaccharide.

*Determination of soluble non-dialysable polysaccharides:* Soluble non-dialysable polysaccharides were determined by the procedure of ROBERTS & FRILOUX[10]; hydrolysis of the polysaccharide was carried out as described by ROBERTS & CARPENTER[4]; and gas-liquid chromatographic analysis of the hydrolysed polysaccharide was carried out according to the method of ROBERTS & CARPENTER[4].

### *Inducing floc formation in floc-negative sugars*

Two solutions of sugar No. 1 and one of sugar No. 2 (both floc-negative) were prepared with distilled water. To one solution of sugar No. 1 and the solution of sugar No. 2 was added 0·5 g $Na_2SiO_3,9H_2O$, equivalent to 195 ppm $SiO_2$. To the other solution of sugar No. 1 was added 0·0005 g $Na_2SiO_3,9H_2O$, equivalent to 0·2 ppm $SiO_2$. A fourth solution was prepared, of sugar No. 1, in tap water containing 5 ppm of soluble silicate. The pH of each solution was adjusted to 1·5 with phosphoric acid. Floc was visible in the first 3 solutions after 5 days and in the fourth solution after 9 days.

Two solutions of sugar No. 3 (floc-negative) were prepared. To one solution was added the alcohol-precipitable polysaccharide isolated from 200 g of sugar No. 1 and 0·5 g $Na_2SiO_3,9H_2O$, equivalent to 195 ppm $SiO_2$. To the other solution was added 0·2 g indigenous sugar cane polysaccharide[5] and 0·2 g $Na_2SiO_3,9H_2O$, equivalent to 78 ppm $SiO_2$. The pH of each solution was adjusted to 1·5 with phosphoric acid. Floc was visible in the first solution after 6 days and in the second after 4 days.

Sodium silicate (0·5 g) and 0·5 g indigenous sugar cane polysaccharide were dissolved in 800 $cm^3$ water; the pH was adjusted to 1·5 with phosphoric acid. After 30 days, no floc had formed.

The alcohol-precipitable polysaccharides from 500 g of sugar No. 1 and 0·5 g sodium silicate were dissolved in 800 $cm^3$ water; the pH was adjusted to pH 1·5 with phosphoric acid. After 30 days, no floc had formed.

### *Preventing floc formation in floc-positive sugars*

Solutions of sugar No. 5 (floc-positive) were filtered at 25°C through a ½-in mat of "Celite" analytical filter aid at pH values from 1·5 to 8·5, in steps of one pH unit. The pH of the filtrates was adjusted to 1·5 with phosphoric acid. After 10 days, no floc had formed.

A solution of sugar No. 5 (floc-positive) was filtered at 25°C through a mat of "Celite" analytical filter aid in an effort to recover the floc-forming substance. The "Celite" mat was washed with two 200-$cm^3$ portions of boiling water. The wash water was used to prepare a solution of sugar No. 4 (floc-negative), which was adjusted to pH 1·5 with phosphoric acid. After 10 days, no floc had formed.

Two solutions of sugar No. 5 were diluted with an equal volume of water and subjected to ion exchange. One solution was percolated through a 20 mm i.d. column containing 100 g "Duolite A-7" resin in the base form; the other solution was percolated through a similar column containing 100 g "Dowex 50" resin in the acid form. After ion exchange, the solutions were concentrated to 54°Brix and acidified to pH 1·5 with phosphoric acid. After 10 days, no floc had formed in either solution.

[7] *Proc.* 1964 *Tech. Session on Cane Sugar Refining Research*, 76–84.
[8] *J. Agric. Food Chem.*, 1976, **24**, 45–46.
[9] *I.S.J.*, 1938, **40**, 105–106.
† Mention of companies or commercial products does not imply recommendation or endorsement by the U.S. Department of Agriculture over others not mentioned.
[10] *Sugar y Azúcar*, 1965, **60**, (11), 66–67.

**Table I. Analysis of sugars used**

| *Sugar No.* | *Undialysable polysaccharides, mg/100 g* | *Arabinose:Galactose ratio in polysaccharides* | *Soluble silicon, ppm* | *Total silicon, ppm* | *Flocculating characteristics*[1] |
|---|---|---|---|---|---|
| 1 | 115(46[2]) | 1:3·6 | 2·0 | 10·78 | —[4] |
| 2 | 95 | 1:5 | 4·0 | 6·79 | —[4] |
| 3 | 32 | 1:0·5 | 2·8 | 3·22 | — |
| 4 | 170 | 0[3] | 3·4 | 6·79 | — |
| 5 | 95 | 1:1 | 7·5 | 10·50 | + |
| 6 | 105 | 1:1·25 | 6·6 | 9·97 | + |

[1] + = floc-positive; — = floc-negative
[2] Polysaccharide content after filtration through filter aid mat at 25°C.
[3] Polysaccharide from this sugar contained no arabinose.
[4] Became floc-positive upon addition of soluble silicate.

A 50°Brix solution containing 1000 g of sugar No. 5 (floc-positive) was centrifuged at 40,000 *g* for 30 min; the pH was adjusted to 1·5 with phosphoric acid. After 10 days, no floc was visible in the solution. The sediment was washed 3 times with 75% ethanol, suspended in 15 cm³ of water, and freeze-dried. It weighed 0·0010 g.

## Results and Discussion

As pointed out by Roberts *et al.*[5], the polysaccharides in sugar cane consist of starch, an arabinogalactan, and other glucans. The starch content of refined sugar is usually very low, but the arabinogalactan may be present in significant quantities. Bacterial glucans (dextrans) are almost always present to some extent. Since one or more of the polysaccharides in sugar cane products appear to play an important role in acid beverage floc formation, it was considered important to estimate the quantities of polysaccharide in the samples of sugars being studied. The results are shown in Table I.

The polysaccharides contents of the sugars were similar except for sugar No. 3, which was particularly low, and sugar No. 4, which was significantly high. Sugar No. 3 was a floc-negative first strike sugar, and sugar No. 4 was a floc-negative commercial blend with a high glucan content. The nondialysable polysaccharides were determined in sugar No. 1 before and after filtration. As shown in Table I, filtration removed 60% of the soluble polysaccharides. This sugar (unfiltered) was rendered floc-positive by the addition of soluble silicate before acidification; after filtration the sugar remained floc-negative even when soluble silicate was added.

Addition of a soluble silicate to some floc-negative sugars before acidification rendered them floc-positive. It was, therefore, desirable to determine the silicon content of all the sugars. The results are shown in Table I.

An examination of Table I shows that the soluble silicon is generally higher in the floc-positive sugars than in the floc-negative sugars. Addition of soluble silicates causes some floc-negative sugars to become floc-positive, suggesting that it is the soluble silicon which is implicated in the floc formation. As pointed out by Clarke in a recent article[11], silicon dioxide may exist in various polymer forms such as linear chains, sheets, and other networks. It is possible that a specific type of silicon oxyanion conducive to floc formation is produced when soluble silicates are acidified *in situ*. As the pH is lowered, aggregation of soluble silicate ions increases, whereas at basic pH (> 11) there are no longer any polymeric anions in the solution.

Some floc-negative sugars did not become floc-positive on addition of a soluble silicate alone, but did so if the alcohol precipitable polysaccharide from a floc-positive sugar (or one that became floc-positive on addition of silicate) was added.

Some floc-negative sugars (No. 4) with low arabinose content relative to galactose content remained floc-negative even after addition of precipitable polysaccharides from a floc-positive sugar along with a soluble silicate. The ratio of arabinose to galactose (Table I) was estimated from peaks in gas-liquid chromatographic analysis of the hydrolysed alcohol-precipitated polysaccharide isolated from floc-positive sugars. Sugars with arabinose:galactose ratios of 1:1 or greater were floc-positive or were rendered floc-positive by addition of a soluble silicate.

No conditions were found under which floc formation could be induced by dissolving soluble silicate and indigenous polysaccharides in water alone, i.e. in the absence of sugar, probably because of the organic nature of concentrated sucrose solutions (54°Brix) in which much of the water is involved in hydration of the sucrose molecule.

Floc formation in floc-positive sugars can be prevented by:

(1) filtering the solution through a filter aid mat at any pH from 1·5 to 8·5 at room temperature (25°C), which will reduce the polysaccharide content of the solution by 60%; filtration at 85°C or higher, however, was not effective.

(2) passing a solution of floc-positive sugar through a bed of either anion exchange resin in the base form or cation exchange resin in the acid form; the polysaccharide content of the solution was reduced by 72% by the strongly acidic cation exchange resin and by 62% by the weakly basic anion exchange resin.

(3) centrifuging floc-positive sugar for 30 min at 40,000 *g*; when the sediment (10 ppm of the sugar) was hydrolysed and analysed by GLC, the hydrolysate contained the same sugars as did the floc, in about the same proportions.

When the floc-causing fraction was removed by any of the above methods, the turbidity decreased simultaneously. It appears, therefore, that the factor that causes the floc exists in a colloidal state and constitutes part of the turbidity in floc-positive sugars. After removing the floc-causing factor, the solutions were still somewhat turbid. Solutions of floc-negative sugars are also turbid; therefore, turbidity does not indicate that a sugar is floc-positive.

## Summary

Floc-forming characteristics of six samples of refined sugars were studied. The sugars showing an

[11] *Proc.* 1974 *Tech. Session on Cane Sugar Refining Research*, 66–75.

**How many days work do you lose because of rainy weather in the cane harvest?**

**either** because it has prevented a good and timely burn

**or** because rains fell after you had a good burn and could not harvest?

---

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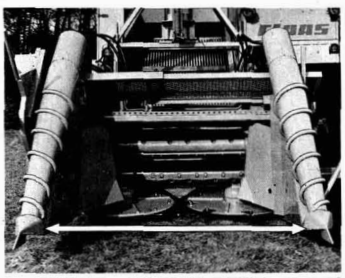

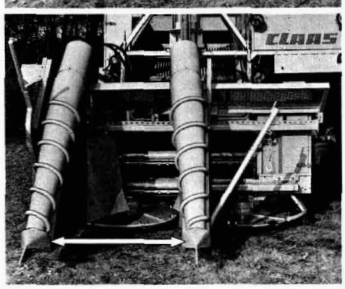

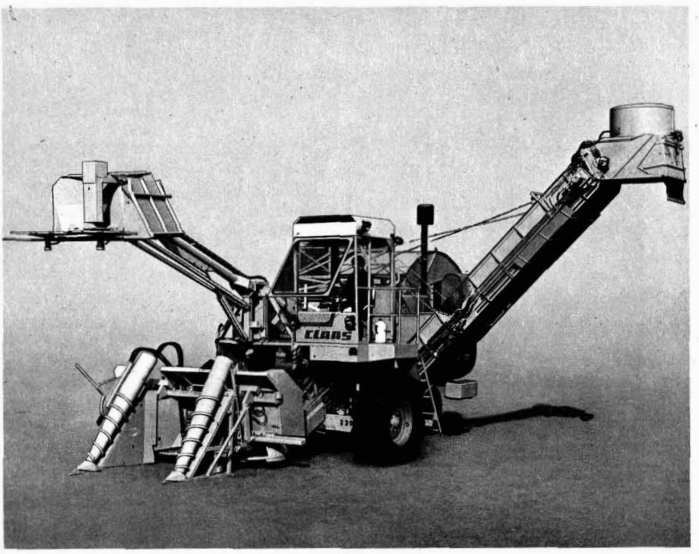

## Because:

1. We harvest GREEN CANE, which has a slower rate of deterioration, at a rate of up to 45 tons per hour. Possible because of

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2. We harvest LAID CROP because of

   **an intake throat with hydraulically driven dividers adjustable in steps of abt 2 inches from 30 inch to 75 inch. • side cutters preventing uprooting of the next (uncut) row**

3. We harvest BURNT CROP even faster, up to 60 tons per hour

   **heavy yields (200 tons/ha) or low yields (40 tons/ha) wide conveyors, a heavy blower system, and infinitely variable speed with a dependable hydraulic drive**

4. We harvest even on SLOPES (where others topple)

   **because of WIDE (10 FT) front drive axle**

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**Dept. for Sugar Cane Machinery**

arabinose:galactose ratio of 1:1 or greater in the hydrolysed polysaccharide isolated from these sugars were floc-positive or could be made floc-positive by the addition of soluble silicate. Floc formation in floc-positive sugars could be prevented by filtration through a tight filter at 25°C, by passing the solution through a column of cation exchange resin in the acid form or an anion resin in the base form, or by centrifugation at high speed. Filtration at 85°C or higher did not prevent floc formation.

# Towards a strategy for sugar cane smut control in the West Indies

By N. W. SIMMONDS
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*Introduction*

SUGAR cane smut, caused by *Ustilago scitaminea*, has long been a troublesome and widespread disease in the Old World[1] but has, until recently, been very local in the New World. However, it appeared in Martinique and Guyana almost simultaneously in 1974 and general distribution in tropical America is clearly to be expected. Probably, spores were (and are still being) carried from tropical Africa in the easterly air streams which STOVER[2] held responsible for the westerly spread of banana leaf spot (*Mycosphaerella musicola*) in the 1930s. With hindsight, spread to tropical America might have been predicted from knowledge of the development of sugar cane agriculture in tropical Africa since World War II and of the fact of the East African outbreak in 1958.

The disease can be destructive but experience elsewhere (evidently now being confirmed in Guyana) is that good resistance, as well as susceptibility (e.g. H.J.5741) is available in any random array of clones. It is not in doubt that resistance alone offers any chance of effective control. The practical question is, therefore, given that some good varieties will prove susceptible, what is the best strategy of replacement by resisters?

*Assumptions*

Consider a planting of a susceptible variety, with equal areas in plant cane and ratoons of various ages. Let the total number of crops be 4, 5, 6 (i.e. plants plus 3, 4, 5 ratoons). Let yield be related to crop so that:

$$Y = p - bt$$

where $p$ = plant yield (here put at 40 tons.acre$^{-1}$), $t$ is crop number (0, 1, 2, 3, etc.) and $b$ is a regression coefficient (here assumed to be 2, 4, 6 tons.acre$^{-1}$). Assume that smut arrives catastrophically and affects the entire planting severely and evenly and that the effect on cane yield is given by:

$$Y = s(p - bt)$$

Here $s < 1$ and may be estimated from the data of WALLER[3] to have been about 0·87 in Kenya, on susceptible varieties. Locally and temporarily, $s$ may of course, be much smaller; DURAIRIJ *et al.*[4] have indicated a value of 0·3–0·6. For this paper, $s$ is conservatively taken to be 0·8.

Further, let us assume the following economic parameters (characteristic of Barbados in 1975[5]: cost of replanting, $E$ = \$2000/acre; cost of maintenance, $m$ = \$200/acre-year; cost of cutting and delivering, $h$ = \$20/ton cane; value of product, $c$ = \$65/ton.

*Strategies*

The objective is to maximize profits in the presence of smut and two courses of action may be considered:

A. Replace the susceptible variety with a resistant one in due course, without disturbing the normal replanting cycle;

B. Initiate a rapid replanting programme and adjust subsequent replanting to restore the normal cycle.

The detailed assumptions are shown in Table I.

**Table I. Assumed planting patterns**

(0 plants, 1–5 ratoons. Crops affected by smut in **bold face.** For significance of asterisks in middle of table, see text.)

| | *Cycle unchanged* | *Accelerated replanting* |
|---|---|---|
| A. 3 ratoons | 0 **3 2 1** | 0 0 **2 1** |
| | 1 **0 3 2** | 1 1 0 0 |
| | 2 1 **0 3** | 2 2 1 1 |
| | 3 2 1 0 | 0 3 2 2 |
| | etc. | 1 0 3 3 |
| | | 2 1 0 4 |
| | | 3 2 1 0 |
| | | etc. |
| B. 4 ratoons | 0 **4 3 2 1** | 0 0 **3 2 1** |
| | * 1 **0 4 3 2** * | 1 1 0 0 **2** |
| | 2 1 **0 4 3** | 2 2 1 1 **0** |
| | 3 2 1 **0 4** | 3 3 2 2 1 |
| | 4 3 2 1 0 | 0 4 3 3 2 |
| | 0 4 3 2 1 | 1 0 4 4 3 |
| | etc. | 2 1 0 5 4 |
| | | 3 2 1 0 5 |
| | | 4 3 2 1 0 |
| | | etc. |
| C. 5 ratoons | 0 **5 4 3 2 1** | 0 0 **4 3 2 1** |
| | 1 **0 5 4 3 2** | 1 1 0 0 **3 2** |
| | 2 1 **0 5 4 3** | 2 2 1 1 0 0 |
| | 3 2 1 **0 5 4** | 3 3 2 2 1 1 |
| | 4 3 2 1 **0 5** | 0 4 3 3 2 2 |
| | 5 4 3 2 1 0 | 2 1 0 5 4 4 |
| | etc. | 3 2 1 0 5 5 |
| | | 4 3 2 1 0 6 |
| | | 5 4 3 2 1 0 |
| | | etc. |

The calculation of expected yields under the stated assumptions is simple, though tedious. For example, the mean yield in the second year of the four-ratoon system with cycle unchanged (line marked with asterisks in Table I) is:

$$Y = [2p - b + s(3p - 9b)] \div 5$$

which, with $p = 40$, $b = 2$ and $s = 0{\cdot}80$ gives $Y = 31{\cdot}9$ tons.acre$^{-1}$. Yield tables can thus be constructed.

[1] ANTOINE: "Sugar cane diseases of the world", Vol. I (Elsevier Amsterdam), 1961, pp. 327–345.
[2] *Trop. Agric.* (Trinidad), 1962, **39**, 327–338.
[3] *E. African Agric. For. J.*, 1967, **32**, 399–403.
[4] *Sugar Cane Pathologists' Newsletter*, 1972, **8**, 34–35.
[5] D. I. T. WALKER: Personal communication.

The profits can be shown to be given by

$$P = Y(c - h) - F$$

where $c$ and $h$ are as above ($c - h = \$45$/ton) and $F$ is fixed costs compounded of $m$ (annual costs, \$200/acre) plus the share of $E$ (\$2000/acre) appropriate to the replanting cycle. For the three fixed cycles, $F$ is constant, thus:

3 ratoons: $F = 0{\cdot}25\,E + m = 700$
4 ratoons: $F = 0{\cdot}20\,E + m = 600$
5 ratoons: $F = 0{\cdot}17\,E + m = 533$

Obviously, $F$ varies greatly in the early years of all three accelerated replanting systems. For example, in the second year of four ratoons with accelerated replanting, it is

$$0{\cdot}4\,E + m = 1000$$

Given the yield tables, expected profits can thus be predicted.

## *Results*

Table II shows that, as is well-known[6] the optimal ratoon cycle depends upon the size of $b$. In what follows it is assumed that near-optimal cycles have, in fact, been chosen and it is necessary therefore to consider further only the three combinations: 3 ratoons, $b = 6$; 4 ratoons, $b = 4$; 5 ratoons, $b = 2$. Undiscounted cash flows of profit are given in Table III. Obviously, from inspection of Table I, strategy A provides a smooth return to normal profits and strategy B a highly erratic one, owing to the dominant effect of large replanting costs. Table IV shows that, despite the different patterns of return, the strategies are, in effect, equal. There is, on balance, little to be gained from accelerated replanting. The cost of smut, estimated as profits foregone, is, predictably, lower the shorter is the cycle. Clearly, to replace susceptible clones by accelerated replanting in mere expectation of the disease would be highly uneconomical. If $s$ were greater than the assumed 0·8 (i.e. disease losses were lower) strategy A would be better than B. If disease losses were greater there would be a level at which strategy B would be preferred; trial calculations with $s = 0{\cdot}7$ (Table IV, bottom) suggest some advantage for B over A only at the longer cycles. The value $s = 0{\cdot}8$ assumes a severe epidemic (see above), so only if there were substantial grounds for assuming exceptional severity would strategy B be preferred. The calculations above all assume, for simplicity if perhaps rather unrealistically, that replanting immediately succeeds the preceding ratoon so that no time is lost. If, for operational reasons, replanting were delayed so that the plant crop were either of short duration or long (running into a second year) the result would be to disfavour strategy B by reducing potential crop early in the sequence. Since the strain on any estate's resources imposed by the need to double the replanting rate would be considerable, this is additional argument in favour of the "do-nothing" policy of strategy A.

**Table II. Annual profits and discounted (10%) total profits per acre for years 0–9 (\$) in absence of smut**

(Near-optima indicated in **bold face**; compare choice of three) cases treated in Tables III and IV.)

| *Ratoons* | 3 | 4 | 5 |
|---|---|---|---|
| $b = 2$ | 965 | 1020 | **1042** |
| | 6514 | 6885 | **7034** |
| $b = 4$ | 830 | **840** | 817 |
| | 5603 | **5670** | 5515 |
| $b = 6$ | **695** | 660 | 525 |
| | **4691** | 4455 | 3544 |

**Table III. Profits as cash flow (\$, undiscounted) for years 0–9**

| Ratoons | | 3 | | 4 | | 5 | |
|---|---|---|---|---|---|---|---|
| $b =$ | | 6 | | 4 | | 2 | |
| Strategy | | *A* | *B* | *A* | *B* | *A* | *B* |
| Time | 0 | 506 | 258 | 624 | 413 | 785 | 573 |
| | 1 | 583 | 465 | 687 | 598 | 844 | 722 |
| | 2 | 646 | 1195 | 746 | 984 | 898 | 843 |
| | 3 | 695 | 628 | 795 | 1204 | 948 | 1420 |
| | 4 | 695 | 628 | 840 | 768 | 997 | 1056 |
| | 5 | 695 | 628 | 840 | 768 | 1042 | 1042 |
| | 6 | 695 | 695 | 840 | 768 | 1042 | 1029 |
| | 7 | 695 | 695 | 840 | 804 | 1042 | 1029 |
| | 8 | 695 | 695 | 840 | 840 | 1042 | 1029 |
| | 9 | 695 | 695 | 840 | 840 | 1042 | 1042 |

**Table IV. Present values (10% years 0–9) of cash flows of Table III**

(For choice of three cases as near-optima, see Table II.)

| *Strategy* | 3 *ratoons* $b = 6$ | 4 *ratoons* $b = 4$ | 5 *ratoons* $b = 2$ |
|---|---|---|---|
| *A.* Normal replanting | 4361 | 5202 | 6376 |
| *B.* Accelerated | 4322 | 5263 | 6382 |
| *C.* No smut | 4691 | 5670 | 7034 |
| *Comparisons* | | | |
| *C* — *A.* Cost of smut | 330 | 468 | 658 |
| *C* — *B.* Cost of smut | 369 | 407 | 652 |
| *A* — *B.* Strategies | +39 | —61 | —6 |
| *Assuming* $s = 0{\cdot}7$ | | | |
| *A.* Normal replanting | 4198 | 4979 | 6053 |
| *B.* Accelerated | 4255 | 5149 | 6234 |
| *A* — *B.* Strategies | —57 | —170 | —181 |

## *Discussion*

The argument set out above is quite general and it seems unlikely that any sugar cane industry, faced with the problem of accommodating itself to smut, would in practice prefer strategy B to A. However, the essential calculations would clearly have to be repeated in each case, using local economic parameters. An important parameter is $b$, the rate of yield decline. If yield decline were curvilinear downwards rather than linear (as it probably is), this would favour strategy B but only slightly[7].

The assumption that smut-resistant varieties (otherwise more or less equivalent to the susceptibles they displace) are available is inherent in these calculations. This assumption is justified by the observation that random arrays of sugar canes contain 40–50% resisters[3,8,9] and Guyana experience thus far does not disagree with this[10]. Hence a crucial element in smooth adaptation to a new disease (smut or any other) is the pre-existence of an effective cane breeding programme that has generated arrays of varieties from which good local choices can quickly be made. The West Indies cane breeding programme of the past 20-odd years has thus provided, not only the stepwise improvement in productive efficiency which is so hard to quantify economically (through nonetheless real), but also the means to meet dramatically adverse situations such as smut. Preliminary calculations suggest, indeed, that the long-term costs of cane breeding will be far exceeded by the benefits of smut resistance alone.

[6] SIMMONDS: *I.S.J.*, 1973, **75**, 107–108.
[7] R. F. INNES: Personal communication.
[8] DURAIRAJ *et al.*: *Pest Arts News Summary*, 1972, **18**, 171–172.
[9] LADD *et al.*: *Proc. 15th Congr. I.S.S.C.T.*, 1974, 36–44.
[10] V. YOUNG-KONG: Personal communication.

# Sugar cane agriculture

**Biological control of *Diatraea* spp. in Pernambuco.** C. E. F. PEREIRA, R. O. R. DE LIMA and A. M. V. BOAS. *Brasil Açuc.*, 1976, **87**, 238–259.—Results of surveys in five areas of Pernambuco are reported; stem borer infestation was less than 5%, while the incidence of *Diatraea flavipennella* was 4–6 times greater than that of *D. saccharalis*. The most susceptible variety grown was CP 5122. Four naturally-occurring parasites were identified; *Paratheresia claripalpis* Wulp., *Metagonistylum minense* Tns., *Ipobracon grenadensis* Ashm. and *Agathis sacchari* Myers. *Thyzanus zostericus* Kerr, a hyper-parasite of the first two of these, was commonly found in low, but in places increasing, numbers. Two exotic parasites have been introduced: *Apanteles flavipes* Cam. and *Lixophaga diatraeae* Tns. Of these, only the former has been recovered from the site of its release.

* * *

**Behaviour of drip-irrigated sugar cane.** R. SCARDUA and J. A. G. C. SOUSA. *Brasil Açuc.*, 1976, **87**, 273–285. Irrigation trials are reported where the water applied was varied as different proportions of Class A Pan evaporation. Highest yield was obtained where the application equalled evaporation, but the most economical treatment was with application of 0·6× evaporation. All yields were greater than the non-irrigated control.

* * *

**Note on the effect of vanadium sulphate (foliar application) on juice quality in sugar cane.** K. C. RAO, S. MARIMUTHAMMAL and A. S. ETHIRAJAN. *Sugar News*, (India), 1976, **7**, (11), 7–9.—A preliminary trial with vanadium sulphate applied as a foliar spray at 200 litres.acre$^{-1}$ in 0·02 and 0·01M concentration (found to be the maximum at which there were no phytotoxic effects on the cane) showed that, up to 5 months after spraying, the chemical had no beneficial effect in terms of increased sugar content of two varieties; in fact, 2–4 weeks after spraying, a 5–6% fall was observed in the sugar content, the fall gradually decreasing until 3–4 months after application, when the sugar content was back to its initial value. In a parallel trial, "Polaris" had a highly significant beneficial effect on sugar content.

* * *

**A note on the effect of aerial spray for the control of *Pyrilla* in the Punjab.** J. S. SANDHU, M. S. DUHRA and G. M. TRIPATHI. *Sugar News* (India), 1976, **7**, (11), 13–14.—While "Endrin" was found to cause drastic reductions in the populations of epipyroses (major parasites of *P. perpusilla*), so that populations of the pest rose during monsoon and post-monsoon periods, "Endosulfan" at 400 cm$^3$, diluted 1:5 in water, per acre and "Fenitrothion" at 200 cm$^3$, diluted 1:10, per acre proved highly effective against the leafhopper when sprayed from the air. Average mortality with "Endosulfan" was 93·9%, while "Fenitrothion" gave an average kill of 96·9%.

**Contour banks conserve soil.** J. WRIGHT. *Cane Growers' Quarterly Bull.*, 1976, **59**, 107–108.—The author explains how rainfall, when it exceeds the absorptive capacity of the soil, can cause erosion unless graded banks are constructed to intercept the run-off before it reaches the velocity at which erosion occurs. It is emphasized that the space between banks should be narrower as the steepness of slopes increases. One cause of bank failure is silting by soil carried by run-off water which has spilt over the rows from an isolated depression where it has accumulated after flowing along cane drills. The banks must be sufficient to cope with a given volume of water and with variation in flow and silting. Generally, they should have a broad, relatively flat channel with a settled cross-sectional area of about 0·75 m$^2$. When they are first constructed their height should be one-third greater than eventually needed to allow for settling. Guidance is given on periodical maintenance of the banks.

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**Effective use of weedicides.** W. A. C. WEBB. *Cane Growers' Quarterly Bull.*, 1976, **39**, 109–111.—Points to watch closely in effective chemical control of weeds in cane fields are discussed, covering mixing of the chemicals, time and volume of application, spray equipment and use of wetting agents.

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**What to plant in the Burdekin area.** I. T. FRESHWATER. *Cane Growers' Quarterly Bull.*, 1976, **39**, 112–113. Information is given on a number of cane varieties in the "Q" series. Mention is also made of Trojan, which was the major variety in the area until 1976 but is now of minor importance. A brief note is appended on the need for treatment to control ratoon stunting.

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**Trickle irrigation—a practical test.** J. F. USHER. *Cane Growers' Quarterly Bull.*, 1976, **39**, 114–116.—Advantages of trickle irrigation are indicated and details given of the system and equipment used by a cane farmer in the Plane Creek area which operates on the basis of pan evaporation measurements. A major drawback is the high initial cost, although it is hoped that this will be offset by the ability to grow more ratoon crops (up to 10) without having to replace any of the original components. The plugging of the fine holes in the bi-wall tubing with mineral or algal matter is the main technical problem; various flushing and chemical injection techniques are helping to overcome it, and laying the tubes with their outlet holes upwards will also prevent blockage.

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**A shed on wheels!** C. D. JONES. *Cane Growers' Quarterly Bull.*, 1976, **39**, 117.—A shed, mounted on wheels which run on a short length of track, houses the pump and motor used for the owner's irrigation system. When work needs to be done on the equipment, two locking bolts are undone and the shed

pulled out of the way by tractor. Normal sheds are unsuitable because they do not allow enough space for such work.

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**Annual earthworks maintenance is essential.** C. R. HENKEL. *Cane Growers' Quarterly Bull.*, 1976, **39,** 118–119.—A list is given of maintenance work which should be carried out, before the onset of the wet season each year, on soil conservation structures and drains (both surface and sub-surface) in cane fields. If this work is not carried out, there is danger that the effectiveness of the systems could be reduced.

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**Copper deficiency can be easily treated.** ANON. *Cane Growers' Quarterly Bull.*, 1976, **39,** 120–121.—Symptoms of soil copper deficiency in cane fields are described. The major disorder caused in cane is droopy top, but it is pointed out that even severe cases can be cured by application of copper sulphate at 20 or 50 kg.ha$^{-1}$, according to the severity of the deficiency. A warning is given about the corrosive properties of copper sulphate and its deleterious effect both on human skin and on cane leaf tissue.

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**Q 90, a new variety in the Isis.** ANON. *Cane Growers' Quarterly Bull.*, 1976, 39, 121.—An outline is given of the properties of this new cane variety.

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**Agricultural contracting.** P. J. NIELSEN. *Cane Growers' Quarterly Bull.*, 1976, **39,** 122–124.—Factors to be considered before purchasing new cane machinery are discussed, and the pros and cons of employing contractors to carry out certain farm operations are examined.

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**The cost of an electric fence.** R. E. KERKWYK. *Cane Growers' Quarterly Bull.*, 1976, **39,** 125.—Information is given on the costs of erecting an electric fence to protect cane from wild pigs.

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**Herbicides and the weather.** E. G. SPRY. *Cane Growers' Quarterly Bull.*, 1976, **39,** 126–127.—While the weather cannot be controlled, knowledge of its effect on the cane crop, weeds and chemicals can be used to plan an effective weed control programme. The author discusses climatic aspects, including moisture availability and humidity, sunlight, wind and temperatures, and indicates those conditions under which herbicides will be most and least effective and where there is need for care in application.

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**Land levelling and forming.** ANON. *Cane Growers' Quarterly Bull.*, 1976, **39,** 128–129.—Illustrations are given of various pieces of machinery used in Queensland for land levelling and forming.

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**New method of identifying ratoon stunting disease.** D. R. L. STEINDL. *Cane Growers' Quarterly Bull.*, 1976, **39,** 130–131.—While the most reliable test for RSD as used in Queensland has been inoculation of sap from the suspect cane into Q 28 and observation of symptoms, if any, the method is slow, and even inoculation into bana grass requires 3–4 weeks for a result. While use of electron microscopy to detect the rod-shaped bacterium associated with the disease is a rapid method, it requires very expensive equipment and specially-trained operators. Tests were therefore conducted on phase-contrast microscopy (an adaptation of optical microscopy by which very small objects can be detected in plant extracts without the need for staining). The technique used is briefly described, particularly extraction of vascular sap and its concentration. Extracts from diseased cane revealed the presence of slender bacterial cells of characteristic appearance. The results were in good agreement with other methods, and phase-contrast microscopy is regarded as a rapid, reliable means of diagnosis in reasonably mature cane stalks when field identification is not reliable.

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**Controlled environment chambers to aid research.** C. C. RYAN. *Cane Growers' Quarterly Bull.*, 1976, **39,** 131–132.—At the Pathology Farm of the Bureau of Sugar Experiment Stations in Brisbane, a bank of four growth chambers was erected during 1975. Each chamber measures 2·44 m long by 2·03 m wide by 3·05 m high at the front and 3·35 m high at the rear. The partitions between the chambers can be removed to allow two or more of the chambers to be used as a single unit. Natural lighting penetrates the glass walls and roof, but temperature and minimum humidity are controlled, each unit having separate controls. Temperature is controlled to within $\pm$ 1°C by means of refrigeration units and thermistor-regulated heaters. A timelock enables different day and night temperatures to be used where necessary. Humidity is regulated by means of an atomizer, the water first being deionized to remove salts and thus prevent salt accumulation on the glass walls and roof as well as in the humidifier. The facilities are considered invaluable for a study of the effects of environment on disease development; typical is an investigation of the effects of environmental factors on symptom expression of leaf scald. The possible application of the system for screening trials, e.g. against yellow spot, is briefly discussed.

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**Nematodes—some facts.** ANON. *Cane Growers' Quarterly Bull.*, 1976, **39,** 133.—Although nematodes cause negligible cane losses in Queensland, they are a problem for certain individual growers. The article briefly discusses various features of the pests, eight of which are known to be parasitic on cane. While nematode damage has little effect on cane sugar content, losses of 25 tons.ha$^{-1}$ in cane can occur in both plant and ratoon crops, though trials have demonstrated yield reductions as high as 40 tons.ha$^{-1}$. Most damage occurs in light-textured, sandy soils, although the pest is found in all cane-growing areas of Queensland. Possible means of control are discussed, but the use of such chemicals as ethylene dibromide and dibromochloropropane ("Nemagon") is considered usually uneconomical. While fumigants can reduce nematode infestation, the variability and unpredictability of nematode attack mean that large areas would have to be treated merely to ensure that a small patch would not be affected; most damage occurs after planting, when it is too late to inject the fumigant except with the aid of a hand injector. It is noted that fumigant action is not completely reliable and that some nematode species are more resistant to treatment than others; cane varieties with vigorous root systems and good ratooning characteristics appear to be less prone to loss from nematode damage.

**"Volunteers" are not wanted.** E. A. PEMBROKE. *Cane Growers' Quarterly Bull.*, 1976, **39**, 134–136.—It is pointed out that those conditions which favour a good cane crop also contribute to the survival of ploughed-out stools from the previous crop which are a possible source of disease. Widespread occurrence of "volunteer" stools in fallow blocks in 1976 has posed a problem because of the difficulty of eradicating them during land preparation. Generally, cane in ploughed-out blocks will have been grown for 4 or more years, so that it is possibly infected with serious disease such as RSD, which can easily spread from volunteers. During harvest, infected juice can be transferred via the harvester base cutter to the stubble of adjacent stools of the new crop, and subsequent harvests can spread the disease throughout the block. Moreover, the presence of diseased volunteers means that the growers is still subject to official restrictions, whereas without the volunteers he would have had the restrictions lifted earlier. The volunteer cane also poses a threat to new varieties. Advice is given on the best approach to planting of new varieties in a block where disease was known to be present in the previous crop cycle, and recommended measures for control of volunteers are described.

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**Studies on some promising sugar cane (*Saccharum officinarum* L.) varieties in relation to cane yield. Quality of juice and commercial cane sugar under north Indian conditions.** K. S. PARASHAR. *Indian Sugar*, 1976, **25**, 853–856.—Field trials of nine cane varieties conducted during 1972–74 at the Indian Agricultural Research Institute farm, New Delhi, are reported.

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**Studies on the varietal susceptibility to and control of the stalk borer (*Chilo auricilius* Ddgn.) in the Punjab.** B. S. KOONER, J. S. SANDHU and M. L. SINGLA. *Indian Sugar*, 1976, **35**, 859–861.—Trials are reported in which the susceptibilities of 15 early, mid- and late-season cane varieties were determined and a number of chemicals tested for their effectiveness against the pest. "Endrin" and "Monocrotophos" gave best control.

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**Field measuring using electronic distance measures.** E. M. POINTING. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 15–19.—The use of infra-red light electronic distance measurers (EDM) for measurement of cane fields is discussed and results reported of tests in which application of an EDM was compared with the conventional method employing a chainman and compassman to circumnavigate the block. It was found that the new method is easier and quicker, but the question of economic justification for an EDM (costing $A6000–8000) requires greater investigation.

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**Cane quality in northern mills.** D. H. FOSTER. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 21–23.—Abnormally high dextran levels in cane crushed by northern Queensland mills in 1975 were attributed to delays in harvesting caused by rain, so that the cane became over-mature as the season was extended into late December (compared with mid-November normally) and was susceptible to infection by *Leuconostoc mesenteroides* in the conditions of high temperature and humidity. The author examines the advantages and disadvantages of harvesting green cane as a possible solution to the problem, but decides that the 50% reduction in harvesting rate associated with this would make the system too costly. An alternative solution would be extension of harvesting into the hours of darkness using three shifts per day, which would reduce the harvest-crushing delay, cut harvesting costs and possibly increase the c.c.s. The costs of a 1-, 2- and 3-shift system are compared, as are possible disadvantages of night-time harvesting. The economic advantages from the processing viewpoint are also examined.

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**High rainfall mill areas need efficient wet weather harvesting.** R. P. VICKERS, W. E. TIEDMANN and G. A. STEWART. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 25–32.—Because of abnormally frequent rain in high-rainfall areas of Queensland, an estimated 750,000 tons of cane remained unharvested in 1973; when a similar situation appeared to be developing in 1975, it was decided to assess the efficiency of conventional mechanical cane harvesting systems under the normal wet conditions of such areas. From the 1973 and 1975 records, factors were derived for converting "rainfall influence indicators" (square root of the product of actual rainfall in mm $\times$ number of wet days) to lost factory operating time where harvesting was completely mechanical. The lost operating hours were then calculated for 51 seasons extending back to 1925, from which the range of harvest finishing dates and % lost time to be expected over a longer term were estimated (given a specified crop and crushing rate). The results showed that conventional harvesting productivity could be expected to be affected by the normal rainy conditions; it is probable, however, that efficient wet weather harvesting could be achieved by using track-mounted harvesters and infield transport, although a slight increase in the cost of harvesting cane (resulting from the greater capital expenditure) would have to be covered. From a study of the advantages to the farmer, it is considered easy to absorb the extra costs. Benefits to the factory operator are also listed. Expansion of factory capacity, to solve the problem of delays caused by rain where conventional harvesting is used, is regarded as merely a complementary activity but not as an alternative solution to wet weather harvesting.

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**Optimizing harvest schedules in the Mackay area.** L. S. CHAPMAN and K. C. LEVERINGTON. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 33–38. Trials at Mackay Experiment Station in 1972 and 1973 showed that there was a significant interaction between variety and time of harvest as regards sugar content and yield, whereby it was desirable to harvest some varieties early and others later. The plant crop harvest time and hence the time of ratooning affected cane and sugar yield but not the sugar content of the ratoon cane, while the ratoon crop harvest time affected the sugar content. Comparison of two schedules involving early- and late-maturing plant and ratoon cane showed that harvesting the late-maturing 3rd, 2nd and 1st ratoon crops followed by the early 3rd, 2nd and 1st ratoon crops, the late-maturing plant cane and, finally, the early-maturing plant cane gave a mean sugar yield of 12·1 tons.ha$^{-1}$, while harvesting early-maturing 2nd ratoon and 1st ratoon crops, early- and late-maturing plant cane,

late-maturing 2nd and 1st ratoon crops and early- and late-maturing 3rd ratoon cane in that order gave 14·1 tons.ha$^{-1}$ mean yield. Apart from advice on varieties, the authors recommend that cane should not be ratooned late in the season, while blocks for ploughing-out should be harvested last. If there is need to alter or extend the harvesting period, an earlier start to crushing is preferable to a later finish, since the higher yields of earlier ratoon cane would outweigh the disadvantage of lower sugar content caused by the earlier start to processing. (See also VALLANCE: *I.S.J.*, 1976, **78**, 273.)

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**A discussion of drainage practices in the Moreton and Rocky Point mill areas.** A. I. LINEDALE. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 39–44. The area in question lies on the coastal fringe of Queensland and in the flood plains of major watercourses, so that there is an inherent flood problem. The drainage systems used are bedding (ploughing of land into several narrow beds with water furrows between), sub-surface drainage with various types of drain, e.g. tile and pipe, to cure local drainage problems but not, in most cases, to drain total blocks, and surface drainage with open channels which are mostly relatively narrow and deep (in order to conserve land and create a fall for infield drainage). Pumping is also carried out in the area. Disadvantages of the drainage schemes are indicated, and the problems which will have to be solved in the future are examined. The need for less of an individualistic approach and adoption of area group schemes is stressed.

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**Rainfall probabilities—agricultural applications.** G. KINGSTON. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 45–46.—Details are given of a computerized analysis system for establishment of probabilities of cumulative rainfall for varying periods down to one week in different cane-growing areas of Queensland. The system, which is based on rainfall data covering up to 59 years preceding 1974, is considered of great value in planning agricultural operations, particularly irrigation and harvesting, as well as in assessing (in conjunction with temperature and sunshine data) the potential of a new region for cane growing.

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**Locusts in the Mackay district 1971-75.** P. J. AMIET. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 63–65.—The extent of infestation by the spur-throated locust in the Mackay area is indicated for each year in the 1971-75 period. Because of variability in the damage caused, assessment of the total crop losses for the district was difficult, but an estimate of 6000 tons is given on the basis of 3 tons lost per ha. The degree of defoliation at which significant yield reductions occur is governed by factors such as weather and stage of crop growth. Control with "Gesapon", "Dibrom" or "Sumithion" has minimized damage, but spraying when nymphs are first observed on grass or headlands affects only those present, but not nymphs which emerge 1–2 days later and for which a separate spraying is necessary. Apart from their limited persistence, the first two chemicals named also become volatile when applied at above 32°C, so that poor control of the nymphs results. The cost of chemicals for control of locusts can be reimbursed under a Queensland subsidy scheme.

**An inconclusive study of the effects of wet soil machine harvesting on ratoon productivity.** R. P. VICKERS, G. A. STEWART and C. R. NALDER. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 57–62.—A series of comparisons was made between 1963 and 1974 of cane yields in the Tully area, with respect to harvesting time and conditions, in an attempt to confirm reports of ratoon yield reductions as high as 10% as a result of conventional harvesting on wet soil. Tabulated and graphed data did not substantiate the claim by growers that harvesting with conventional equipment on wet soil causes damage to soil and stubble and thus significantly affects the yield of subsequent ratoon crops. Possible reasons for the drop in ratoon crop yield are discussed, as is the question of increased inter-row distances to reduce stubble damage as well as the advantages and disadvantages of delaying harvesting under wet conditions.

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**Locust control in the Inkerman mill area, 1974-75.** D. J. WILLIAMS. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 67–70.—The incidence of the spur-throated locust was restricted by chemical control, so that serious damage to cane did not occur. Good control was effected with "Gesapon" sprayed on the ground or by "Dibrom" applied aerially; BHC dust applied on the ground lasted much longer than the other two chemicals. A parasitic fly, *Blaesoxipha* sp., had no significant effect on locust numbers. Mention is made of the subsidy payable to farmers for the chemicals used to control locusts.

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**The use of phase-contrast microscopy in the identification of ratoon stunting disease.** D. R. L. STEINDL. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 71–72.—Details are given of the procedure used to extract vascular sap from the internodal portions of cane stalks for use in phase-contrast microscopy as a means of identifying RSD. The extract was centrifuged at 3000 rpm for 1 hour, the supernatant liquid discarded and the residual pellet suspended in a drop of water, from which a small smear was placed on the microscope slide and examined at a magnification of 1250×. Extracts from diseased plants showed varying numbers of small bacterial cells associated with RSD and undergoing much movement; bacteria of other species were frequently present, but they were bigger and in much smaller numbers. Parallel tests with bana grass inoculated with RSD showed that phase-contrast microscopy is a rapid and satisfactory means of RSD diagnosis.

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**The fall and rise of Fiji disease in southern Queensland.** B. T. EGAN. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 73–77.—The situation in regard to Fiji disease in five areas of Queensland during the period 1938–75 is indicated by a table giving the numbers of Fiji disease-infected stools rogued by staff of local Cane Pest and Disease Control Boards. Of the areas, by far the worst affected in 1974-75 was Bundaberg, where the situation has become critical as a result of considerable infestation by the leafhopper *Perkinsiella saccharicida* (a major vector of the disease) which prefers N:Co 310 cane, a variety widely grown in southern and central Queensland which is reasonably tolerant to Fiji disease, so that evidence of the disease is not obvious in newly-infected stools. It

was failure to identify the disease in its early stages which was the initial cause of the present outbreak in the area.

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**Epidemiology of leaf scald in the Moreton district of Queensland.** G. J. PERSLEY and C. C. RYAN. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 79–82.—The incidence and geographical distribution of leaf scald (*Xanthomonas albilineans*) in the Moreton district in 1951-52, 1960-61 and 1967-75 are reported, whereby it is shown that the disease has tended to spread, with 1968-69 and 1974-75 being years of greatest incidence. The variety Q 71 was the worst affected. The years 1968-69 and 1974-75 were characterized by heavy rainfall and flooding in the summer followed by dry conditions, and it is suggested that water movement is involved in the dispersal of the pathogen in the area, while dry conditions promote symptom expression. Grasses known to act as alternative hosts to the disease are *Paspalum conjugatum* and *Brachiaria piligera*. Recommended control measures are listed.

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**Agronomic aspects of fly-ash disposal by incorporation with filter mud in the Herbert River district.** N. R. MACLEAN. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 83–88.—Trials were conducted on application of a 1:1 mixture of fly-ash and filter cake at about 230 tons.ha$^{-1}$ to land on which 1st and 4th ratoon crops were grown. The mixture, of 65% moisture content, contained silica, P, K, Ca and Mg. Results showed that it gave as good results in terms of sugar yield as did 200 tons.ha$^{-1}$ of filter cake alone (of 70% moisture content) and was much more effective than the controls which received neither filter cake nor mixture. The economics are briefly discussed.

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**From travelling irrigators to fixed-position sprinkler irrigation.** G. KINGSTON and R. E. REHBEIN. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 89–94.—Because of certain problems associated with a travelling irrigation system used on the steeper section of a 114·5-ha cane farm, a modified solid-set sprinkler system was installed on the 21·8 ha in question. Details are given of the scheme and of distribution tests with it, and advantages and disadvantages are discussed. The system has demonstrated its ability to minimize run-off on sloping land while maintaining a high level of productivity.

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**Observations on the effect of row spacing on sugar cane yield.** B. T. ROACH. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 95–101.—Trials are reported in which cane was planted in single or dual drills at various spacings, a specially developed planter being used for the dual drill planting. Results showed that % germination in the dual drills equalled that in the single rows, while sugar yields per ha were greater with the dual drills; optimum dimensions were a distance of 50 cm between the individual drills in the dual drills and a spacing of 180 cm between the centres of the dual drills. A smaller inter-centre distance posed problems, mainly in the early stages of crop growth, and was generally inadequate to permit movement of soil away from the rows, so that early tillering was restricted. At the 180-cm inter-centre spacing, early tillering was considerably greater than in conventional single rows.

**Soil compaction studies in the Goondi mill area.** N. R. MACLEAN. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 103–109.—Studies conducted in 1963 are reported, in which compaction (taking the form of increased bulk density and micro-porosity and decreased total porosity and macro-porosity down to 15 cm) was found to be caused mainly by 4-ton bin loaders, while the effect of harvesters was minimized by the high flotation of their tyres. Tabulated data show that sandy soils were compacted to higher bulk densities than were loams and clay loams. Since maximum compaction density occurs at or near the plastic limit (the highest moisture content at which a soil can be cultivated without puddling), it is difficult for a farmer to avoid compaction when he cultivates the soil to an ideal moisture content for good tilth, although shallow cultivation may be preferable to deep cultivation with the aim of minimizing bogging-down of equipment.

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**A case for engineering standards for cane railway systems.** R. N. CULLEN and R. A. JAMES. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 205–209.—Because of the increase in size of rolling stock and the greater speeds used on cane railways in Queensland, the authors consider it necessary to have a set of engineering standards to cover both rolling stock and permanent way. The areas in question are discussed, viz. cane bin design, axle design, wheel design and profiles, track gauge and wheel set geometry.

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**The "sled" concept in tramline maintenance.** G. B. HANSEN. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 211–214.—Details are given of the design and operational characteristics of a "sled" which will lift existing rail track, excavate below the sleepers to provide a bed for new ballast, remove faulty sleepers and, in conjunction with a following sleeper wagon, enable replacement sleepers to be fitted. The machine was developed to facilitate work on the 113 km of cane railway at Marian factory, where most of the track had become buried in soil to the rail top. The sled was first used in 1975 and permitted installation of new sleepers at a rate which was three times greater than by the conventional method.

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**Response of zinc application on yield and nutrient uptake of sugar cane.** T. C. JUANG, M. M. KAO and C. H. CHANG. *Rpt. Taiwan Sugar Research Inst.*, 1975, (68), 1–16.—Zinc sulphate applied at the rate of 25 or 50 kg Zn per ha on four cane plantations representative of Taiwan soils was found to increase cane and sugar yields by amounts which varied according to site. The trials were carried out in a randomized block design with four replications and involved plant and ratoon cane. An indication of response to Zn was the Fe:Mn ratio in the +1 leaf of the young autumn-planted cane—where there was response, the ratio had a value of at least 4:1, while lack of response was indicated by a ratio of 1:1 or below. It is suggested that the Fe:Mn:Zn balance in the cane plant be established before any recommendation is made on fertilization. A significant correlation was also established between yield and soil Zn content, and between soil Zn and +1 leaf Zn. The economic aspects of Zn application rate at the different sites are discussed.

**The improvement of fertilization practice on the high groundwater table sugar cane field.** S. C. YANG. *Rpt. Taiwan Sugar Research Inst.*, 1975, (68), 17–30. Trials were conducted in cane fields characterized by a high water table, in which a basic application of P and K was followed by 3 top dressings of N (P, K and N were applied as 1st dressing in only one case) as foliar, soil or foliar + soil applications, the total nutrient quantities being the same. The effects on plant and ratoon crop yields were evaluated, wherein foliar + soil application gave a significantly higher cane and sugar yield than did soil application alone, although juice N, P and K contents were also higher with the combined system. Foliar application alone did not give adequate nutrient quantities and would cause yield decline. A fertilization scheme which is applicable to both plant cane and ratoons is described.

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**The physiology and ecology of toxic codominant fungi in a monoculture field of sugar cane.** M. M. H. WU, M. M. KAO, C. C. CHAO and C. L. LIU. *Rpt. Taiwan Sugar Research Inst.*, 1975, (68), 31–41.—Studies were made of the conditions (carbon and nitrogen source, pH, temperature, moisture content and medium) which favour optimum growth of *Ceratocystis* spp. and *Fusarium* spp. found in the soil of a cane field. The fungi were found to grow best at pH 5–6, temperature of 28°C and a soil moisture content of 50%, to use aspartic acid as N source and sucrose as available C source; a sucrose-yeast solution was the best medium, and the fungi readily attacked cane roots. The numbers of *Fusarium* spp. (particularly *F. oxysporum*) were greater in the rhizosphere of poor ratoons than in the rhizosphere of newly planted cane.

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**Biological control of the causal agents of poor ratoon cane in a monoculture field.** C. C. CHAO and M. M. H. WU. *Rpt. Taiwan Sugar Research Inst.*, 1975, (68), 43–54.—Lime and crotalaria green manure were found to inhibit *Fusarium oxysporum* and *F. solani* development in fields of ratoon cane, the yield of which was slightly increased as a result of the treatment compared with the untreated control. Application of lime during autumn planting is suggested, with an additional application at ratooning, with the aim of increasing yield. *Bacillus cereus*, *B. megaterium* and *B. subtilis* were found to be antagonistic towards the *Fusarium* spp. when inoculated into the soil. The first-named was the most antagonistic.

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**The Taiwan Sugar Corporation's Chiayi Tidal Lands Project.** J. F. WILLIAMS. *Sugar y Azúcar*, 1976, **71**, (4), 22–27.—The author reports on the problems encountered by the Taiwan Sugar Corporation in their endeavour to reclaim tidal land bought for cane growing. The 12,300 ha in question were divided into four sections, the first being an area of 1000 ha to be reclaimed by the polder method, i.e. enclosed by dikes. Situated near Ao-ku village, the area was still not ready for cane growing 8 years after completion of the plans, while the work so far completed made each hectare nearly as expensive as the finest paddy land in Taiwan. In 1974 it was decided to abandon the original plans and convert the Ao-ku land to use for domestic animal and fish breeding, with 4000 ha devoted to growing of fodder, mostly Napier grass. It is emphasized that the costs are far higher than they should be for such purposes, but that it was a matter of cutting losses. Lessons to be learnt from the experiences at Ao-ku are indicated.

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**Chopper-harvester operation in Brazil.** L. V. GENTIL. *Sugar y Azúcar*, 1976, **71**, (4), 28–35.—Factors influencing the decision by Brazilian sugar producers to introduce chopper-harvesters are discussed, and the performances of four specific models are briefly reported. One of the major technical problems encountered in harvesting is the excessive wear of the disc knives of standing cutters; this results from the high degree of contact between the knives and the soil, since the cane is in furrows rather than windrows (owing to the fact that field operators are still in the preliminary stage of changeover to mechanical harvesting). The effect is greatest in sandy or lumpy soils because of the presence of silica.

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**Sugar cane transport revolution.** ANON. *Industry* (Dept. Comm. & Ind. Dev., Queensland), 1976, (19), 5.—Two cane transport systems developed by Freighter Industries Ltd. are described, both of them based on use of 20-ton "Canetainer" bins. With the "Freighterlift" system, the harvesters feed the cane billets into elevating and side-tip infield transporters which shuttle between the harvester and the bins which are located on the ground at pick-up sites located strategically in the area. These sites usually have a consolidated gravel surface and can accommodate 6–12 bins. A special skeletal trailer is reversed to an empty space at the site, a hoist and the trailer are elevated through the scissor-lift frame, and the empty bin is lowered onto the ground. The elevated trailer is then reversed onto the front of a full bin and coupled. The hoist on the trailer is then lowered to lift the front of the loaded bin to the top of the trailer main members, the bin then being winched forward on the special trolley and correctly positioned on the trailer; automatic stops and locks are then actuated and the trailer driven to the factory, where it is reversed into a cradle specially prepared to receive the heavy-duty rear pivot structure, which relieves the rear axle weight as the trailer is elevated. The "Freighter Side Transfer" system, designed for high-tonnage areas, involves hydraulic side transfer of the bins, either onto holding stands for transfer to road transport, or direct onto rail trucks. Both systems are used in Queensland and are planned for use in other countries.

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**Sugar cane smut infection in Guyana and Martinique.** G. L. JAMES. *Sugar J.*, 1976, **38**, (12), 17.—It is suggested that the recent outbreak of smut in Guyana originated from spores carried by winds from West Africa rather than from elsewhere in South America. The argument is based on the fact that particles of sand and camel dung have been isolated from deposits in Barbados, and that the wind currents over South America are ill-defined and weak, so that alternative hosts would have to be the basic means of spread. Moreover, smut was also recorded in Martinique soon after the Guyana outbreak, and again the wind pattern from Guyana to Martinique is indefinite, in contrast to the trade winds from Africa. The possible threat to Central and North America of windborne smut spores from Africa (assuming the conclusions to be right) is mentioned; there is particular danger of spread by hurricanes.

# Sugar beet agriculture

**Susceptibility of sugar beet lines to the stalk blight pathogen *Fusarium oxysporum* f.sp. *betae*.** J. D. MACDONALD, L. D. LEACH and J. S. MCFARLANE. *Plant Disease Reporter*, 1976, **60**, 192–196.—Most of the seed used for commercial beet growing in the western USA is produced in the Willamette Valley of Oregon. In 1973, crops were found to be affected by vascular discoloration, leaf wilt, stalk necrosis and eventually death of the bolting plants. The term "stalk blight" was coined for this disease, which was caused by *F. oxysporum* Schlecht.f.sp.*betae* (Stewart) Snyder & Hansen. Since this was the first time that the disease had been reported west of the Rocky Mountains, the parental lines of the USDA hybrids US H9 and US H10, the principal victims of the infection, had not been screened for resistance. Tests were therefore carried out in 1973 and 1974 to determine the degree of susceptibility in USDA lines and to identify possible sources of resistance. Results indicated that susceptibility is carried in the male-sterile components of the hybrids and that the pollinator lines are relatively resistant. However, the hybrids which are grown extensively in California, were found to be less susceptible than their male-sterile components. The USDA has initiated a breeding programme to incorporate resistance into their cytoplasmic male-sterile lines with the possibility of controlling the disease. Observations in Oregon and Colorado, where trial root crops were grown concurrently, suggested that there may be differences between the pathogens in the two states.

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**Evaluation of conservation tillage effectiveness on sugar beet fields in north-eastern Colorado.** S. R. SIMMONS and A. D. DOTZENKO. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 307–311.—Because of severe damage to beet seedlings by wind erosion of soils in north-eastern Colorado, rotary tillers are being used to prepare seedbeds. The advantage of this practice lies in the possible protection of the seedlings by residual surface vegetation, while seedbed preparation, fertilizer and herbicide application and seed drilling can be accomplished in a single operation. Evaluation of the "no-plough" system in 1973 showed that where there was adequate residual vegetation from the previous growing season (corn or rye), potential soil loss through wind erosion was substantially reduced.

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**Effect of irrigation method and late season nitrate-nitrogen concentration on sucrose production by sugar beets.** J. N. CARTER, C. H. PAIR and D. T. WESTERMANN. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 332–342.—Field experiments on a silty loam are reported in which irrigation was found to have little effect on beet fertilization with N and on sugar content, provided adequate water was applied when required. Treatments to reduce the nitrate-N level in the soil and its availability to the beet in order to increase sugar content also had adverse effects on plant growth and yield. For maximum sugar yield, optimum quantities of N should be applied before beet planting or as a side-dressing, the latter preferably after thinning and just before the period of increased N uptake.

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**Influence of nitrogen placement and source on surface nitrate accumulation and sugar beet production.** S. R. WINTER. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 343–348.—When N application to beets was followed by furrow irrigation, nitrate-N accumulated on the bed surface up to 210 ppm; however, the surface accumulations became quickly depleted, apparently as a result of leaching into the active root zone under the effect of rain. Placement of N had only limited effect on these accumulations, while the N source had no significant effect. Neither placement nor source of N affected beet yield or sugar content.

* * *

**Is it necessary to treat beets with insecticides now?** ANON. *Le Betteravier*, 1976, **10**, (98), 9.—The author warns against indiscriminate spraying of beets with insecticides, but admits that some treatment is needed where "Temik" has not been applied against aphids to control yellows.

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**The elimination of wild beets.** A. VIGOUREUX. *Le Betteravier*, 1976, **10**, (98), 10.—See VIGOUREUX & VANSTALLEN: *I.S.J.*, 1976, **78**, 82.

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**Demonstration of sugar factory mud and manure spreading.** A. VIGOUREUX and T. VREVEN. *Le Betteravier*, 1976, **10**, (98), 11.—Brief information and illustrations are given concerning the spreading of farmyard manure and filter cake.

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**Deficiency diseases—prevention is better than cure.** R. VANSTALLEN. *Le Betteravier*, 1976, **10**, (98), 12. See *I.S.J.*, 1976, **78**, 82.

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**Results obtained with foliar fertilizers on beet.** ANON. *Le Betteravier*, 1976, **10**, (98), 13.—Promising results are reported with "Starter" fertilizer, which contains 10:5:5 N:P:K plus 16 trace elements, applied at 5 litres diluted with 500 litres of water per ha when the beet plant has 7–8 leaves; as the name implies, the product gives an excellent start to the young plants. A second application 2–3 weeks later at the 10–12 leaf stage is also recommended. To stimulate sugar accumulation, spraying with "Finisher" (containing 5:7:10 N:P:K) is also advocated. Both fertilizers are usable with practically all pesticides, fungicides

and herbicides, and are the products of Moreelsguano S.A., of Gent, Belgium.

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**Combating aphids and the beet fly.** ANON. *Le Betteravier Franç.*, 1976, **46,** (295), 15–17.—Chemicals for control of green and black fly and the beet fly are listed and recommendations given on optimum time of application. For green fly, optimum treatment is at the 4-leaf stage or when 0·2–0·5 aphids per beet are found in the case of the most seriously affected areas. Treatment for black fly should be carried out before the usual leaf deformation symptoms appear and when one beet in two has a small colony, or about 50–100 aphids per 10 plants. At the end of June, predators usually take care of black fly. As regards the beet fly, treatment should be carried out only when the first larvae have hatched and formed small sinuous galleries, although first warning of the need to spray is given by the underleaf occurrence of eggs. Treatment (when there are 2–4 eggs per leaf and one gallery per 2 leaves) is more important on the younger plant; once 8–10 leaves have formed, the plant is sufficiently developed to withstand normal attacks and treatment will only be necessary in the case of abnormal attacks.

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**Beet loaders.** ANON. *Le Betteravier Franç.*, 1976, **46,** (295), 18.—Information is given on beet loaders which are available in France.

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**The effect of harvesting dates and the interval between last irrigation and harvesting date on the yield and sugar content of sugar beet.** Y. SINGH and S. P. SINGH. *Sugar News* (India), 1976, **7,** (10), 7–8.—In a 2-year field trial to determine the effect of harvesting date (in the range 15th April–15th June) and interval between last irrigation and harvesting (5, 10 or 15 days) on beet yield and sugar content, highest yield was obtained from harvesting on 30th May; earlier or later harvesting resulted in significantly lower yields. The highest sugar content was also obtained on this date; the maximum occurred when the interval between last irrigation and harvesting was 15 days—the shorter the interval, the lower tended to be the sugar content, although in the case of harvesting on 30th May the minimum occurred at a 10-day interval, while the value for the 5-day interval was not much lower than that for 15 days.

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**Effect of nitrogen fertilization on sugar beet yield and quality with different plant densities.** A. VON MÜLLER and C. WINNER. *Zucker*, 1976, **29,** 243–251.—Experiments are reported covering a 7-year period at different locations in the northern and southern areas of West Germany. Beet yield and quality rose to a maximum with increase in plant density from 23,000 to 75,000 per ha, after which it fell. The effects of N differed according to location, but at a rate greater than 160 kg.ha$^{-1}$ there was a tendency for it to reduce sugar yield and, in several instances, even the beet yield.

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**Ionic absorption in triploid beet.** G. C. LUCCI. *Ind. Sacc. Ital.*, 1976, **69,** 38–41.—K ion absorption by beet roots was determined in samples from triploid varieties, and the results compared with those obtained from diploid parents of high absorption and tetraploid parents of low activity. Tabulated data indicate that the K absorption for the $F_1$ triploids was always intermediate between the values for the diploids and tetraploids.

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**Elimination of bolted beets.** ANON. *Le Betteravier Franç.*, 1976, **46,** (296), 15.—Methods of bolter elimination discussed are: (1) removal of the flower heads when they are above the height of the normal beet leaves, one cut to be made at the time of flowering, and a second one a month later. Tests have been carried out on this method in France and elsewhere. (2) Uprooting, for which special machines have been built. The major drawback is the possibility of breaking off part of the plant, the remainder of which would then be difficult to uproot, so that it would ultimately seed. Late uprooting of seeded bolters requires special machinery, and interesting results were achieved in trials in 1974. (3) Chemical control with a non-selective herbicide, which has given the best results, with 95% destruction of viable seed. However, there is risk of contamination of normal beet by the herbicide, either by contact, by splashing (at excessive speeds) or by entrainment when it is raining. Moreover, since the herbicide is not systemic, the roots of bolted or normal beet could undergo partial decomposition and pose problems in storage. Best results have been achieved with 50% "Gramoxone" and 50% oil, e.g. "Sopragal" or "Vegelux". Treatment at high temperatures should be avoided; the ideal time of the year is 1st–15th July, when flowering takes place.

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**Damage by birds?** ANON. *Le Betteravier Franç.*, 1976, **46,** (296), 15.—Damage to beet seed in certain areas of north France in 1976 has been attributed to birds, particularly larks and greenfinches, although the opinion is also held that fieldmice could be responsible. In central Brie, an estimated 5–6 seeds have been unearthed per decametre, and the question of how the birds can detect the seed in the soil is briefly discussed. Two suggestions are that the birds gauge the location of the buried seed from the spaces between seeds which have not been sufficiently buried, and that the birds are guided by static electricity imparted to the seed during processing or transport and which is particularly marked when seed are drilled during a dry spell. Of two proposed means of preventing seed damage, use of an attractant, i.e. a feedstuff which is more easily visible and appetizing than the beet seed, is preferred to use of repellents which do not have sufficient power. It is also pointed out that the dry weather could induce rabbits to eat the beet for moisture, so that it is recommended to provide watering places, e.g. plastic-lined holes, to attract the animals away from the beet.

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**Major beet pests and diseases.** ANON. *Le Betteravier Franç.*, 1976, **46,** (296), 16–18.—Twenty-one pests and diseases are included in this survey. In each case, symptoms of attack, description and biology of the pest (in the case of disease, the pathogen and conditions of disease occurrence), damage caused to the beet, and means of control are given. Brief mention is also made of damage caused to beet by herbicides applied to cereal crops.

**The mechanisms of sugar accumulation in the root cells of the beet.** J. GUERN. *Sucr. Franç.*, 1976, **117**, 195–197.—Investigations have shown that sucrose in the root can be divided into four fractions: (i) that contained in the cells which are damaged by slicing (hence, at the sliced edge) and which is the most rapid to be discharged, (ii) that at the periphery of the cells and probably contained in the walls at some time, and (iii) and (iv) two sub-fractions which are located inside the cells. Hence, aside from (i) which can be considered as purely artificial, there are really two fractions, of which the combination of (iii) and (iv) is the more difficult to remove than is (ii). Tests with labelled sucrose in which root slices were immersed showed that the radioactive molecules accumulated rapidly in compartment (1) corresponding to sucrose fraction (ii), the maximum accumulation being achieved within 20–30 minutes in proportion to the concentration of the solution. Penetration of the sucrose into compartments (2) and (3) corresponding to fractions (iii) and (iv) was slower, particularly in the case of (3), indicating a probable difference between the accumulation mechanism of (2) and (3). The amount of sucrose entering the compartment increased with time then became constant, while the total sucrose content in the slices became stable or fell with time, indicating that sugar was leaving the cells at the same time as it was entering. It was found that divalent ions, especially $Ca^{++}$, markedly reduce the discharge of sucrose; moreover, the pH of a solution, in which beet tissue samples were immersed, substantially modified the rate of discharge, particularly between pH 6·5 and 8. In a solution of low pH, e.g. a citrate buffer solution of pH 3–4, the root cells can be emptied within multiples of 10 minutes, while in distilled water or a buffer solution of pH 6–7 it takes several days for all the sucrose to be discharged. Because fodder beet does not accumulate as much sugar as sugar beet and because the former contains more organic acids, particularly citric acid (which readily chelates Ca ions), it is suggested that there is a correlation between organic acid content and sugar content. Dinitrophenol, found in the cell tissue, prevents sucrose absorption, so that any absorption must be by way of an active transport system. Sucrose penetration is also markedly inhibited by fructose and glucose formed by sucrose hydrolysis, so that reducing sugars in beet will have an adverse effect on sucrose accumulation.

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**Combating yellows.** ANON. *Le Betteravier*, 1976, **10**, (99), 9.—Advice is given on June control of green fly as yellows vector. Treatment is recommended only until the foliage completely covers the soil and only in the case of non-application of "Temik" earlier in the season. Spraying as a means of controlling black fly is recommended only where large colonies accumulate on the beet leaves, which may take place from mid-June. Otherwise, the pest is much less dangerous than the green fly.

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**The destruction of weed beets.** R. VANSTALLEN and A. VIGOUREUX. *Le Betteravier*, 1976, **10**, (99), 10–11. Three methods of control of bolted beet are briefly examined: manual uprooting, manual cutting of the flower heads and mechanical cutting. A table of results obtained in 1975 shows that maximum effects (expressed as number of viable seeds per ha) were achieved with two cuttings approximately 4 weeks apart. Cutting should be carried out 1–2 weeks after the start of flowering.

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**After-effect of "Triazine" derivatives.** R. VANSTALLEN. *Le Betteravier*, 1976, **10**, (99), 12.—Marked damage to cereals and beet have been observed as a result of application of excessive doses of "Triazine" derivatives to the previous crop. Symptoms of beet damage are a yellowing of the first leaves, total destruction of the leaves and final death of the plant, or, in less extreme cases, a marked growth retardation from the 4–6 leaf stage, while the leaves have a yellowish-green tinge.

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**A survey of the N status of sugar beet in the areas around Platy sugar factory.** D. D. ANALOGIDE. *Hellenic Sugar Ind. Quarterly Bull.*, 1976, (25), 103–118.—The nitrate-N in the petioles of mature beet leaves was measured by the phenoldisulphonic acid method as an indicator of the plant N status; there was wide variation between the 38 fields investigated, the values ranging from 780 to 20,280 ppm $NO_3$-N. The fields were divided into six groups based on the $NO_3$-N, the first two (up to 1885 ppm) representing half of the total number of fields. A visual colorimetric method involving diphenylamine applied directly to the cut surfaces of fresh petioles gave values significantly correlated to the actual $NO_3$-N concentration and so could be regarded as a semi-quantitative N index. A negative linear correlation was found between N and root sugar content. However, the sugar content fell after 1st August, despite an already marginal N content, so that it is suggested that other factors play a more important role in sucrose accumulation. Generally, the fields in the 1st group (of 780–1222 ppm beet petiole $NO_3$-N) gave lower sugar yields than did the other groups, but no differences attributable to N status were found between the other groups.

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**Results of comparative sugar beet varietal trials in Belgium, 1973 to 1975.** N. ROUSSEL, W. ROELANTS and T. VREVEN. *Publ. Trim. Inst. Belge Amél. Betterav.*, 1976, **44**, 1–55.—Full details are given of trials at six sites in which 43 varieties were tested; 27 were grown from monogerm seed and the rest from precision seed. While sugar yield from "Monohil", "Zwaan Poly" and "Tribel", used as standards, was greater than from the other varieties tested, all of which are listed in the national recommendations, there are indications that some of the newer varieties will be as good or almost as good as the best of the established varieties.

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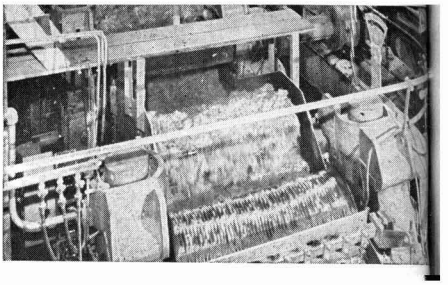
**Profitable use of phosphate.** A. P. DRAYCOTT and M. J. DURRANT. *British Sugar Beet Rev.*, 1976, **44**, (2), 31–32.—The response of beet to phosphate application falls with increase in soil P availability, but even where yield is increased by P application, the increase may not be sufficient to justify the amount used, if a smaller quantity would give an increase which gave a higher return. It is stressed that the other crops in the rotation should be considered when deciding on the amount of phosphate to apply, and the long-term fertility of the soil should not be put at risk.

# Cane sugar manufacture



**Some aspects of flocculant use in clarification and filtration.** J. P. MURRAY and G. S. SHEPHARD. *S. African Sugar J.*, 1976, **60**, 69–79.—See *I.S.J.*, 1976, **78**, 182.

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**Practical importance of clarification in the gur industry.** K. M. BHARDWAJ, M. SINGH, R. K. SHARMA and B. N. DIXIT. *Sugar News* (India), 1976, **7**, (11), 19–22, 28.—Clarification trials during 1972–75 are reported in which the most effective additives were powdered groundnut, a preparation obtained from the deola plant, and an aqueous lime solution. Results are tabulated.

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**Technological achievements in the biggest sugar factory in India.** P. J. M. RAO. *Indian Sugar*, 1976, **25**, 835–851.—Details are given of the equipment and processes used at the Vuyyuru factory of K.C.P. Ltd., in Andhra Pradesh, which has a daily crushing capacity of 6000 tons. Performance data are tabulated for 1970–75.

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**Auxiliary power supplies for Queensland cane sugar factories.** R. J. MCINTYRE. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 111–118.—Because of the increasing demand for electrical power resulting from growth in factory crushing rates, available grid supplies are approaching their limit in Australia. The author examines alternative methods of developing auxiliary power supplies to meet anticipated starting demands. Installation of a high-voltage sub-station near the factory has a number of technical and economic advantages over an oil engine generating set, outlay for which can only be justified on the basis of its role as an emergency standby power source when the grid supply fails (although its principal role would be that of making up power at peak demand). Comparison is made between a diesel engine and a gas-turbine generating set. Installation of a small diesel set with just sufficient capacity to start the boiler station in the event of a grid failure is much cheaper and would be of benefit in providing power for emergency repairs and for mills on a limited basis. H.V. sub-station equipment and control are described.

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**Computer control of a sugar mill power house.** R. A. ALLAWAY and C. R. GRAVES. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 119–125. Because of a shortage of skilled powerhouse personnel at Mossman, it was decided to introduce remote control from the milling train console using a computer. Full details are given of the hardware and software, and results obtained with the system are reported with the aid of recorder chart strips. The scheme proved successful during the latter half of the 1975 crushing season and has met requirements of official bodies.

**Computer-controlled cane bin handling.** G. D. MACLEAN and D. B. BATSTONE. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 127–132.—Of three possible systems considered for automatic control of cane yard operations at Bingera, viz. (i) a solid-state switching device, (ii) a programmable logic controller, and (iii) a computer interfaced with electro-mechanical relay logic, system (iii) was chosen for reasons which are discussed. Details are given of the system design, programming and operation. After elimination of teething troubles during the commissioning period (occupying the first 3 weeks of crushing), the system operated successfully during 1975. It was possible to incorporate existing yard equipment with a new weighbridge-tippler installation for the 3- and 6-ton bins, so that capital and operating costs were minimized.

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**Development of a standard juice sampler.** L. KELSO and S. REICHARD. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 133–136.—Information is given on electronic systems developed by the Sugar Research Institute for 1st expressed juice sampling, and suggestions are made regarding application of the electronic circuits for pre-selection of a rate of juice flow commensurate with the amount of cane to be sampled.

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**The North Eton double-bin rotary tippler.** R. E. BICKLE and H. E. CHILDS. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 137–139.—Brief information is given on the tippler at North Eton which was extended to take two bins at a time and modified to make its operations automatically controlled. After teething troubles, the system operated satisfactorily, the only manual operations being recoupling of the bins, starting and stopping of the empty bin conveyor, and diversion of damaged bins. In time trials, a tipping rate greater than 400 t.c.h. was established.

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**Development of a mill return plate to process 1,000,000 tonnes of cane.** A. H. CHANCELLOR and J. S. GLASS. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 141–144.—Developments in treatment of mill turnplates at Bingera to increase their life are described. The first was a cast iron plate with heat-treated surface which was worn to an unserviceable condition after handling 230,000 tons of cane; the latest is a No. 6 mill cast steel plate, which was ground to bright metal and surfaced with a backing layer of 318 stainless steel, this being finally overlaid with a "Cobalarc Nine" electrode. After handling 827,000 tons of cane of 15·5% fibre at a plate loading of 213·7 kg.m$^{-2}$, the plate width was reduced by only 6 mm as a result of wear, while the surface and tooth

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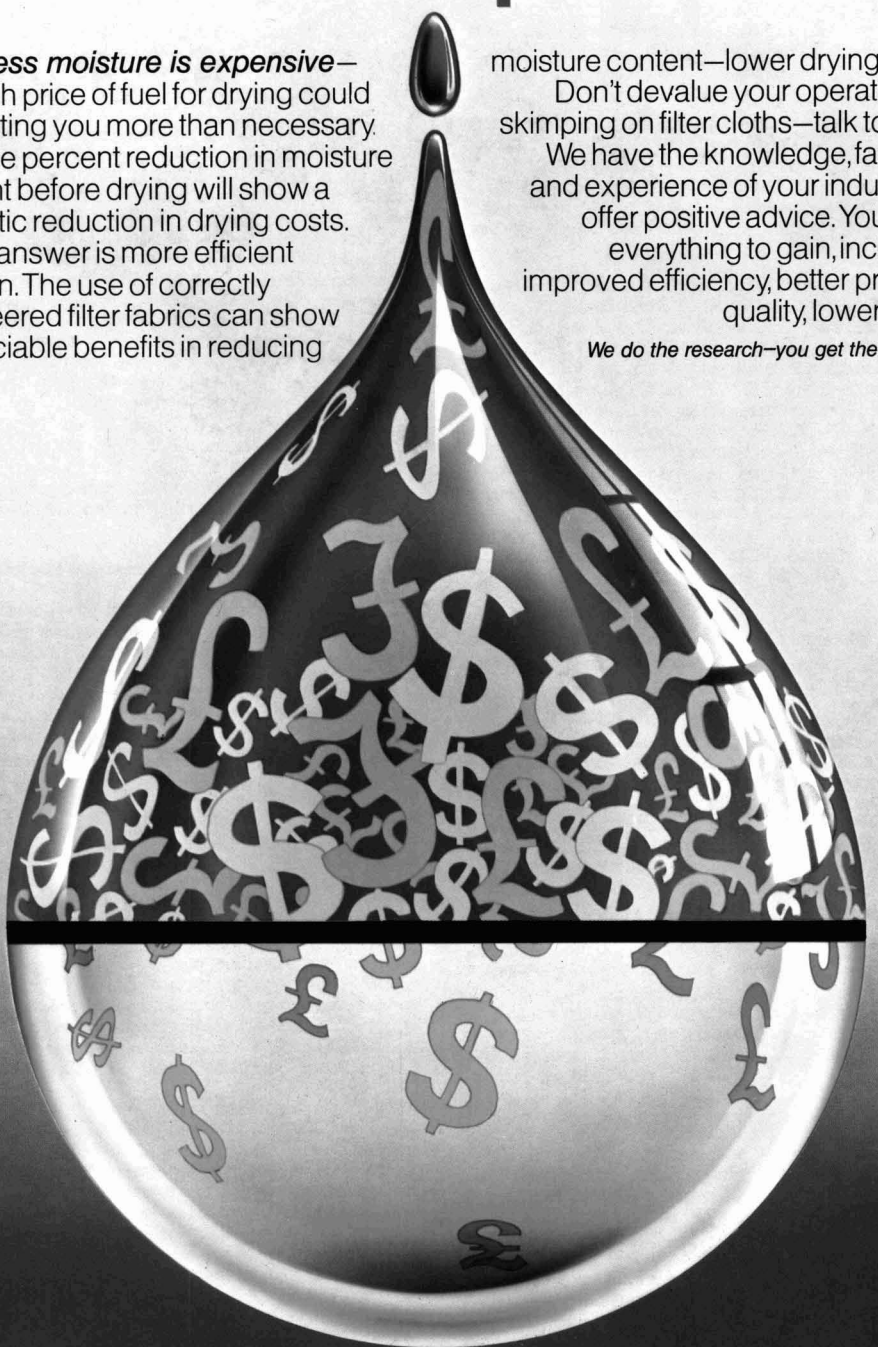

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**Shredder hammer failure.** S. G. CLARKE and B. C. H. MATTHEWS. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 145–148.—Application of hard facing material to shredder hammers by arc welding necessitates adequate and correct earthing; failure to observe this may have serious consequences, as exemplified by the failure of a hammer shank caused by the presence of a fatigue crack which developed because of electrically-applied deposits where the earth clamp was possibly faulty. Another example cited is that of a hammer, produced from mild steel by oxy-acetylene burning, failure of which was attributed to inadequate machining, so that fatigue cracks developed. Advice is given on hammer reclamation by welding, where the hammer has suffered from surface abrasion and wear. It is considered that a limit should be set on the operating life of all hammers in view of their operating conditions and the risk of faulty repairs.

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**Vibration and balancing of shredders, centrifugals and fans.** D. MACEY. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 149–156.—Static and dynamic balancing methods are classified and application of SOMERVAILLE's dynamic method[1] to a BMA K1000 continuous centrifugal is described. While balancing of fans is considered a relatively simple operation, since (unlike centrifugals) rotational frequency of the shaft is usually the dominant component of the vibration, cane shredders require rapid and frequent balancing, although the degree of balance required is not as great as with centrifugals. It is economically advisable to operate shredders at maximum rated speed, and balance must be maintained within set limits. While conventional four-run and stroboscopic methods of balancing are not suitable for shredders, instruments are available which indicate phase and synchronous amplitude of a vibration signal, given a one-per-revolution synchronization pulse from the rotor. The application of such an instrument, a lock-in amplifier, to shredder balancing is described. While the instrument is expensive, it has been found to increase shredder performance at full speed; in operation, the amplifier rejects components of a vibration signal other than that at shaft frequency.

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**Racecourse boiler ash handling system.** E. E. MCDOUGALL, G. M. MESSITER and G. M. SAWYER. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 157–163.—A description is given of the system used at Racecourse for boiler fly-ash treatment and disposal. Water is recirculated through a wetted-louvre flue gas scrubber and forms a slurry which is pumped to a point above curved bar screens through which it falls into a subsider; the "clean" overflow from this is returned to the scrubber, while the underflow is discharged onto a horizontal vacuum filter belt for dewatering. The "dry" ash cake drops into the ash bunker below and is then discharged into motor transport. In 1975 (the first season in which the system operated), the underflow solids from the subsider was 19% and from the vacuum filter belt 50%. Although satisfactory in performance, the system is to be modified so as to give even better results, and a brief mention is made of these modifications.

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**Rotary screw oil-free air compressors.** D. C. HARDAKER. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 165–169.—The development of two-stage oil-free rotary screw compressors is described and comparison made between screw-type, piston-type and centrifugal compressors.

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**Progress in continuous boiling of low-grade massecuites.** R. BROADFOOT, P. G. WRIGHT, K. F. MILLER and R. J. STEINDL. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 171–177.—In tests at Rocky Point, a high-quality *C*-massecuite was obtained by continuous boiling when *A* "full" grain grown in a batch pan was used for seeding; the nominal residence time was 4·3 hours compared with 5·5–6 hours in a batch pan. The test pan operated quite steadily, with very little supervision required. When self-seeded undiluted *A*-molasses was used for graining, the resultant massecuite was of good crystal content, but the quality was considered unsuitable for low-grade massecuite because of wide variation in crystal size and the presence of some very large crystals. The costs of continuous boiling systems are briefly examined, from which continuous *C*-massecuite boiling on seed grown in a batch pan is considered a viable alternative to batch boiling.

* * *

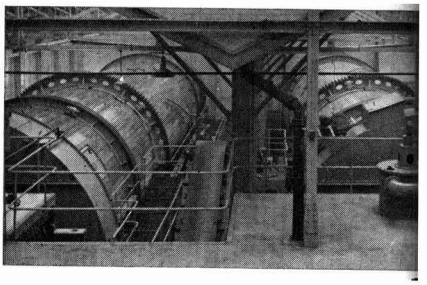
**Experiments with a low head boiling vacuum pan.** D. GOTTHARD, J. S. KENIRY and R. C. WEARNE. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 183–190.—Good circulation leads to improvements in crystallization rate in boiling and hence to higher raw sugar quality, and boiling at lower hydrostatic heads is an effective means of increasing circulation, although evaporation rate limits the circulation rate and, hence, the crystallization process once a certain hydrostatic head is reached. On the basis of these principles, attempts have been made at CSR Ltd. to design vacuum pans of increased heating surface: volume ratio which could operate at lower final boiling head. Details are given of preliminary boiling-on trials with a conventional pan and with an experimental pan. For the sake of comparison between low-head and conventional boiling, a Rate Index was derived

$$\left(=\frac{\text{final mass} - \text{initial mass}}{\text{final mass}} \times \frac{1}{\text{number of minutes}}\right).$$

While results for *A*-massecuite boiling in terms of Rate Index and sugar quality were inconclusive, those for *B*-massecuite showed a marked improvement as a consequence of a massecuite level which was about 500 mm above the calandria top plate and a heating surface:massecuite volume ratio ($m^2$:$m^3$) of about 7·5:1 in contrast to 1·5 m and 6·5:1, respectively, in the conventional pan. In the experimental pan, the head was 510 mm and the heating surface: massecuite volume ratio 8:1. Details are given of a number of trials, and recorder chart sections are reproduced. Tabulated data show that the crystallization rate for *A*-massecuite was up to four times greater than in conventional batch pans.

[1] *Engineering*, 1954, **177**, 241.

# Beet sugar manufacture



**Technological parameters of an industrial compartmented carbonatation vessel.** L. P. REVA *et al. Sakhar. Prom.*, 1976, (4), 26–31.—Tests on a compartmented carbonatation vessel having a rated daily throughput equivalent to 2500 tons of beet are reported. The vertical vessel is separated by radial partitions into compartments of equal volume with bubblers installed in the lower half. The juice surface in the first and every other compartment is at 3 m, while in the intervening compartments it is 0·2 m lower. Juice is fed into the lower section of the first compartment for gassing with $CO_2$, then flows through a horizontal aperture into the next compartment below the bubbler, and so on. Results for two campaigns showed that the vessel was considerably more efficient in terms of 1st and 2nd carbonatation juice parameters than was a conventional vessel. However, comparison between the results obtained with 3, 4 and 6 compartments showed that 4 sections gave almost the same values as did 6, while 3 sections were less effective. Hence, a 4-sectioned vessel was constructed and tested in the 1975/76 campaign; results again demonstrated the improvements obtained compared with a conventional tank.

* * *

**Foam in flume-wash waters in beet sugar manufacture.** A. G. KIRICHENKO, V. E. TARASENKO and B. I. GONCHARENKO. *Sakhar. Prom.*, 1976, (4), 32–35. Results are reported of investigations into the composition and properties of foam which forms on the surface of flume-wash water and which is attributed to the presence of mechanical impurities, surface-active substances and other substances passing into the water from damaged beet. The major contributor was found to be saponin; its content varied from 25–50 mg.litre$^{-1}$ at the start of a campaign to 40–150 mg per litre at the finish. The best means of removing surface-active substances and the surface layer of suspended matter is considered to be flotation.

* * *

**Rationalizing the condensate economy in beet sugar manufacture.** V. I. DOVGOPOL, O. N. NEDOBOR, L. P. IGNAT'EV and V. N. USYCHENKO. *Sakhar. Prom.*, 1976, (4), 54–60.—As a contribution to establishment of a more efficient condensate removal and utilization system in a sugar factory, the authors examine various aspects of a scheme and describe modifications to condensers to reduce steam leakage and condensate entrainment in bled-off steam. Recommendations are given on condensate removal and on means of improving entrainment separation.

* * *

**The quantity of gases entering the condenser unit of a sugar factory.** V. N. GOROKH and K. O. SHTANGEEV. *Sakhar. Prom.*, 1976, (4), 60–64.—Reasons for incondensable gas presence in steam transferred to a condenser and its effect on the level of vacuum obtained in an evaporator are discussed, and a method of determining the quantity of incondensable gases in samples taken from the condenser is described.

* * *

**A cost analysis of various methods of operation in wash water supply to white sugar centrifugals.** T. CRONEWITZ, W. JÄKEL and K. KORN. *Zucker*, 1976, **29**, 230–237.—After results at a number of factories of Süddeutsche Zucker-AG had shown that use of small-capacity nozzles led to high-quality sugar or reduction in the amount of wash water used, experiments were carried out at two factories with the aim of establishing a number of cost factors affected by variation in flow rate, water pressure, angle of distribution as well as massecuite and centrifugalling parameters. Details are given of the centrifugals and nozzles used, and results are given in the form of graphs and tabulated data. These showed that a feed rate of 0·3–0·5 litre per second was optimum for a given product quality, although the findings referred to markedly different massecuite qualities.

* * *

**Preventive measures at beet flumes.** R. KRÖCHER. *Zucker*, 1976, **29**, 241–242.—Mention is made of accidents in which factory personnel have fallen into beet flumes (in two cases, the elderly victims drowned), and means of preventing these are described with the aid of illustrations.

* * *

**The conditioning of white sugar silos.** V. MAURANDI and G. MANTOVANI. *Ind. Sacc. Ital.*, 1976, **69**, 29–37. See *I.S.J.*, 1976, **78**, 55.

* * *

**Beet juice purification with magnesium oxide.** J. ŠTUDNICKÝ, A. DANDÁR and J. VAŠÁTKO. *Sucr. Belge*, 1976, **95**, 191–195.—In laboratory tests, which are reported, activated magnesium oxide was added at the rate of 1·5% (w/v) to cold raw juice which was then heated to 95°C before filtration. Comparison of results with those obtained for juice treated by normal liming and gassing to optimum 2nd carbonatation alkalinity showed that the MgO-treated juice was better in terms of sugar content, purity, Brix, colloid content, colour, Ca and invert sugar; the total ash, Na and K contents were about the same for both juices. Filtrability of the MgO-treated juice was inadequate, but settling was satisfactory.

* * *

**Industrial research on a plate-type dryer for sugar.** W. STANKIEWICZ, E. WALERIAŃCZYK, H. BIESZK and W. LEWANDOWSKI. *Prace Inst. Lab. Badaw. Przem. Spozyw.*, 1974, **24**, 529–545; through *S.I.A.*, 1976, **38**, Abs. 76-602.—The dryer installed at Nowy Staw factory in 1973–74 and its associated plant are described with diagrams, performance tests are reported

and results are discussed. The dryer is 6·5 m high and 2 m in diameter. Sugar, fed from the centrifugals by a 20-m bucket elevator, falls onto a series of discs rotated on a central vertical axle; the sugar on each disc is thrown outwards by centrifugal force and returns inwards to the next disc via a conical surface; it then passes to a bucket elevator and conveyor. The suction line of a fan is connected to the top of the dryer, so that steam-heated air at approx. 105°C is drawn in through a chamber at the base; after the fan there is a dry-and-wet system for removing sugar dust. When 22·9 tons of sugar per hour was dried with air heated to 115°C at ambient temperature of 25°C, the sugar temperature was 66°C after the centrifugals, 54°C after the feed elevator and 38°C after the dryer, while moisture contents were 0·49, 0·31 and 0·09%, respectively; the dried sugar was thus suitable for bagging but not for bulk storage. Pressure and temperature of air at points throughout the system are shown for operation with and without sugar. The evaporation coefficient of the dryer was 2·5 $kg.hr^{-1}.m^{-3}$ water, and the steam consumption was about 0·11% on sugar.

* * *

**Operational control of cube sugar manufacture.** F. X. KAMMERER. *Zeitsch. Zuckerind.*, 1976, **101,** 309–311. Factors of importance for cube sugar manufacture and quality are listed and details given of tests to establish the extent of influence each has on quality. The equipment used was as applied in the pharmaceutical industry, but it was found to be suitable for cube sugar evaluation without any modifications. The equipment and methods are briefly described, and graphs reproduced in which the pattern of the curve for each factor is plotted against drying in the actual production stage (length of drying section) and against after-drying (time in hours from the end of the production drying up to 144 hours).

* * *

**Investigations of an evaporator station during the campaign.** K. MOSICH. *Zeitsch. Zuckerind.*, 1976, **101,** 312–317.—The investigations were conducted into the performance of a triple-effect evaporator in which the third stage comprises two vessels: one for supply of vapour to the pan station and the other for vapour supply to juice heaters. Since the first of these two effects suffers considerably from a fall in heat transfer as a result of scaling as the campaign progresses, and the fall in thick juice concentration results in increased vapour consumption in boiling, an additional standby 3rd effect is switched in to compensate. By this means, there is no need for boiling-out during the campaign. The heat transfer in evaporation was assessed on the 11th and 67th days of the campaign and the scale thickness calculated. The values are tabulated and plotted on graphs, and flow schemes are given for evaporation on the two days. Fluctuations in vapour consumption by the pan station were considerably reduced by adjusting the time when the process in each individual pan was started. Further tests were conducted on determination of the thick juice residence time in evaporation using sorbitol as a tracer. Curves are plotted.

* * *

**The influence of cossette thickness on beet diffuser efficiency.** G. V. GENIE. *Zeitsch. Zuckerind.*, 1976, **101,** 317–322.—It is pointed out that continuous beet diffusion cannot be evaluated in terms of transfer units, as previously suggested[1], since the theory takes no account of cossette extractability or thickness, nor is extraction time considered. The number of transfer units of a given diffuser is a useful parameter for predicting the effect of change in juice draft, but not for determining the effects of beet slicer adjustments. Instead, the author proposes use of a model of batch counter-current diffusion in which the individual stages do not achieve diffusion equilibrium because the total diffusion time is the same as that for continuous diffusion. The efficiency is then found in terms of the number of theoretical stages. Equations and diagrams are presented for use in evaluating the number, and a method is described for calculating its minimum value in conformity with local factory conditions. The method is suitable for comparison of diffusers and for predicting the effect of changes in parameters, particularly the cossette thickness. This is demonstrated in the case of a DDS diffuser, the efficiency of which is calculated for a given cossette half thickness (volume:area ratio) and cossette juice concentration reduction in a given time. (See also *I.S.J.*, 1975, **77,** 133–138.)

* * *

**Reasons for the urge to automate multiple-effect evaporators.** R. WASMUND. *Zeitsch. Zuckerind.*, 1976, **101,** 329–330.—The author lists 17 parameters and conditions which can alter at any stage during evaporation. Since the frequency, extent and duration of such changes are unknown beforehand, it is considered highly desirable to effect as much control as is possible over the process as as to achieve optimum conditions.

* * *

**Simulation and drawing up of a balance of a production scheme by means of a computer.** J. UHEREK and V. VALTER. *Listy Cukr.*, 1976, **92,** 83–90.—Details are given of a UPCBIL computer programme for establishing a boiling house balance. Use of simulation to control processing by comparing actual with theoretical data has proved to be of value; during the campaign no variance was found between predicted and actual results with respect to massecuite and syrup concentration and flow.

* * *

**Increasing the durability of beet slicer knives by electrolytic boron plating.** I. M. SPIRIDONOVA, V. F. RAFAL'SKII and N. P. ROMENSKII. *Sakhar. Prom.*, 1976, (5), 16–22.—The title process involves electrolytic application of boron from a borax melt to form FeB and $Fe_2B$ and create a protective layer on the knife, the life of which is prolonged, as demonstrated by results of tests conducted at a number of Soviet sugar factories. Details are given of the technique used in treatment of beet knives and on regeneration of the borax melt for further use in the process.

* * *

**Introduction of crop irrigation with waste waters at Timashevo sugar factory.** V. T. DODOLINA *et al. Sakhar. Prom.*, 1976, (5), 22–26.—A description is given of the system at Timashevo where Class III effluent is transferred from the settling tanks to lagoons and subsequently used to irrigate crops such as lucerne, maize, oats and peas. The water has a maximum $BOD_5$ of 300 $mg.litre^{-1}$ and contains 13–38 $mg.litre^{-1}$ N and 65–83 $mg.litre^{-1}$ K. Application of 1000–2000 $m^3.ha^{-1}$ water increased crop yield and

[1] *I.S.J.*, 1975, 77, 214.

quality compared with the unirrigated control, which suffered from shorter stalks and gappy rows. The yield rose as the amount of irrigation water was increased.

* * *

**Conversion of sugar factories to non-effluent undertakings.** B. K. KUBRAK and N. A. RONSKAYA. *Sakhar. Prom.*, 1976, (5), 26–30.—The authors examine the situation as regards sugar factory effluent and its treatment in the USSR and complain that insufficient is being done to reduce fresh water usage and effluent volume, despite the pressing need for modernization of treatment processes and plant resulting from the growth of factories and shortage of land for conventional waste water treatment. Various means of improving the system are suggested, whereby the final goal would be virtual elimination of pollution risk, any effluent having a BOD still too high for recycling or disposal in waterways being used to irrigate crops (see preceding abstract).

* * *

**Utilization of sugar factory waste waters on low-capacity fields outside the growth period.** K. Z. PIVEN'. *Sakhar. Prom.*, 1976, (5), 30–35.—The suggestion is that sugar factory effluent could be applied to fields outside the normal crop growth periods but not during factory operation; the waste water would be fed in small regular quantities to create an adequate water-table level while also providing the soil with nutrients. During crop growth and field work at each end of the vegetation period, the effluent could be transferred to the normal filter beds. Advice is given on the quantities and equipment involved, and the economics are discussed.

* * *

**Calculation of the basic parameters of a high-capacity flow pneumatic conveying system for white sugar via horizontal pipelines.** A. F. ZABORSIN and T. K. VASIL'EVA. *Sakhar. Prom.*, 1976, (5), 35–40.—Laboratory and pilot plant experiments were conducted on white sugar pneumatic conveying, and empirical equations derived from which graphs and nomograms were plotted relating various parameters, including the air flow for a given weight of sugar to be conveyed along a pipeline of given length and diameter at a given hourly rate.

* * *

**Automation of massecuite boiling on the basis of electrical resistance measurement.** V. I. TUZHILKIN *et al. Sakhar. Prom.*, 1976, (5), 40–46.—Details are given of the semi-automatic pan boiling control scheme introduced at Timashevo in 1972, and advantages of the system over the normal manual control are indicated. The parameters controlled include: the temperature in the syrup and run-off tanks, pan and condenser vacuum, minimum level in the pan while the massecuite is being heavied-up, and the resistance:level ratio during crystal growth (based on the fact that a given resistance corresponds to a supersaturation at which syrup drinks are required for nucleation).

* * *

**Centralized lubrication of equipment at sugar factories in the Khar'kov trust.** A. YU. VOLOKHOV. *Sakhar. Prom.*, 1976, (5), 47–50.—Details are given of the two-line centralized lubrication system used for factory equipment in one part of the Ukraine.

**Modernization of a KDA-15-58 diffuser.** A. P. PARKHOD'KO, M. A. ZHURBITSKII and V. S. KHOMENKO. *Sakhar. Prom.*, 1976, (5), 50–52.—By increasing the height of this tower diffuser and enlarging the diameter of the juice lines, it was found possible to increase the daily throughput and reduce losses (at the same juice draft) compared with the results before the modifications.

* * *

**Disc filters—without gland packing.** N. A. KAVUN. *Sakhar. Prom.*, 1976, (5), 52—53.—Because of serious juice and syrup leakages past the gland packing on the disc filters at the author's factory, the packing was replaced with rubber sealing rings, which have worked completely satisfactorily.

* * *

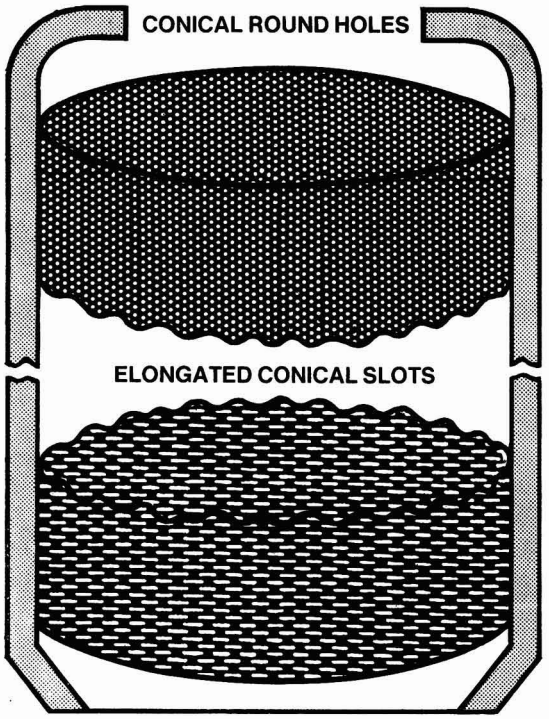
**Flume-wash water treatment at Luka sugar factory.** N. I. BESEDOVSKII and I. D. KOVALENKO. *Sakhar. Prom.*, 1976, (5), 53–55.—At this Soviet factory the flume-wash water is treated in two vertical settling tanks, from which the mud goes to a Class III effluent mixing tank while the supernatant is recycled to the flumes. At pH 9·5–10 purification efficiency is 85–90% and foam is easily reduced without the use of water.

* * *

**Means of condensing vacuum pan vapours.** R. V. KOREN', E. G. FEDECHKIN, G. I. LISTOPAD and V. I. SEMENCHENKO. *Sakhar. Prom.*, 1976, (5), 58–61. Because of the considerable quantity of water used to condense evaporator and vacuum pan vapours (calculated to be 522% on weight of beet), there is need for a close examination of condenser operation to see if the amount of cooling water can be reduced. While the major problem with mixing condensers is sugar entrainment, experiences at certain factories with the use of surface condensers have shown that their performances fall drastically as a result of entrainment and consequent fouling of the heat exchange surfaces. The use of air as coolant has not proved a satisfactory answer, since the volume of air required is four times greater than the volume of water needed, and the power consumption by the fans delivering such large quantities would be considerable, while the noise of the motors would exceed permissible levels. For an area having inadequate water supplies, a scheme used in Hungary offers a solution. This involves cooling of the pass-out steam from a turbine by pure condensate which circulates in a closed circuit incorporating an air-water surface heat exchanger; a hydro-turbine in the circuit acts as a throttle to maintain pressure. Part of the condensate-cooling water mixture is pumped to the feedwater tank serving the boiler, while the rest passes to the surface heat exchanger.

* * *

**Tests with a DDS pilot-scale diffuser.** O. C. AKYAR and E. ÖZER. *Zucker*, 1976, **29**, 320–324.—Tests conducted at the Turkish Sugar Institute were aimed at reducing hourly throughput while maintaining acceptible diffusion conditions. Details are given of operating conditions and plant modifications which permitted a drop in throughput from 30 to 8–10 kg per hour; because of wide scatter in extraction results and a high rate of back-mixing of the cossettes, the pilot plant is recommended only for evaluating the technical quality of sugar beet samples on a limited scale, however.

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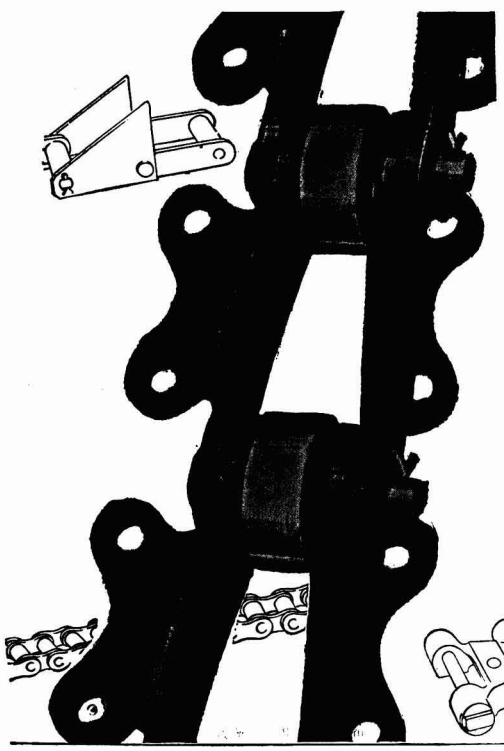

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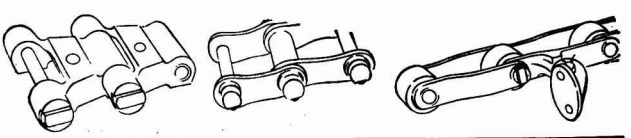
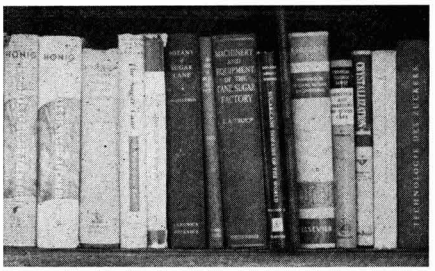




# New books

**Outline of the world sugar economy.** G. B. HAGELBERG. 61 pp; 14·7 × 20·2 cm. (Institut für Zuckerindustrie, Amrumer Strasse 32, 1000 Berlin 65, Germany.) 1976. Price: DM 10.00.

This is a concise, interesting and up-to-date outline of the world sugar economy and its development, in the form of an expansion of the author's chapter on sugar prepared for a new book to be published on commodity trade of the third world. While it contains no material that would be new to our readers, it surveys the production and the history of trading in sugar, systems of manufacture for cane and beet sugar, molasses and its importance, structural and institutional features of the industry, and concludes with a discussion of trends in production and consumption. The author disagrees with the belief that, apart from brief periods of relative shortage, sugar supply chronically outstrips demand; he points out the unavoidable errors in assessing consumption, the effect of time lag between production and consumption data related to the same sugar, and the need for a surplus to allow for these points and preservation of adequate stock:consumption ratios. He discusses the planned production capacity increase, the significance of consumption decrease in Europe and North America during 1974/75 owing to high prices, the emergence of corn sweeteners and potential for non-food uses of sugar. The format is a photographically reduced typewritten page which is nevertheless clear.

* * *

**The Australian Sugar Year Book, Volume 35, 1976.** Ed. W. P. KERR. 400 pp; 18·5 × 25 cm. (Strand Publishing Pty. Ltd., Brisbane, Queensland, Australia.) 1976. Price: $15.70.

The Australian Sugar Year Book seems to have gained in popularity outside its own country of origin as well as (it is assumed) in Australia. Such support for the publication is well placed, since the book offers much material which will be of interest to readers wishing to find out more about the Australian sugar industry and wanting to learn of those problems encountered by the Australians, particularly concerning aspects of cane agriculture (such as irrigation and land drainage), and solutions found; it is true to say that the Australian sugar industry is one of the most progressive in the world, so that what answers they have found to certain difficulties may be applicable in other countries where the cane is grown under similar conditions.

The general layout of the latest Year Book is as before. The contents include details of the various offical organizations and their officers, reports from conferences and field days, articles on various topics, mostly of an agricultural nature, and a survey of Australian sugar factories and districts, with details of executives, equipment and production figures for a number of years up to 1974. The book is well illustrated and packed with enough material to justify its appearance on the shelves of sugar libraries.

* * *

**Essex and sugar.** F. LEWIS. 132 pp; 14 × 22·5 cm. (Phillimore & Co. Ltd., Shopwyke Hall, Chichester, Sussex, England PO20 6BQ.) 1976. Price: £3.50.

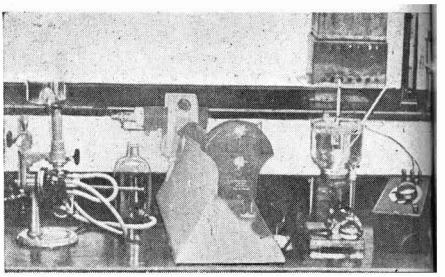
This small volume is concerned with the history of sugar refining and beet processing in the county of Essex. The title may mean little to the reader outside England, but if it is pointed out that Essex starts in the outer fringes of East London and thus includes that area in which the first major London sugar refineries were built, then it will be seen that there is much that can be talked about in such a book. In fact, the author was panman for many years at the Plaistow Wharf refinery of Tate & Lyle Ltd., so that he has been able to combine his past experience as a refinery worker with his historian's expertise to present a very interesting picture of sugar from its introduction into England in the Middle Ages (when it started to supplant honey as the chief sweetener), via the mid-18th Century, when London boasted 120 refineries (small family businesses producing about 5 tons weekly), to what was possibly the first refinery in Essex (at Stratford) and the creation of the large Silvertown refineries, finishing with the closure of Plaistow Wharf and the uncertainty of refining's future in the UK.

In the course of his book, the author gives accounts of the association of Essex with the West Indies, describes the failures of certain enterprises such as the first of the large Silvertown refineries—that of Duncan, Bell & Scott—and the refinery erected by members of the Martineau family, which was so seriously damaged by fire in 1893 that, coupled with other misfortunes, it forced the family into liquidation and thus ended the production of commercial loaf sugar in England. (A new company, Martineaus Ltd., was later started by a younger member of the family and finally became a member of the Manbré Group.)

Mention is made of the philanthropic activities of certain refiners, and much space is devoted to the British beet sugar industry, in which Tate & Lyle played a role with the erection of a factory at Bury St. Edmunds. The first beet sugar factory in the UK was built near Hoe Mill in 1832 and operated as the business of Marriage, Read & Marriage, but only for some two years, its failure being attributed to financial trouble and to certain "inimical influences". Felsted is now the only beet sugar factory in Essex.

The author has set out to give an interesting, historical account of the sugar industry in one part of England, and in this he has succeeded.

# Laboratory methods & Chemical reports



**Automated determination of chloride and phosphate in cane juice, molasses and sugar.** W. C. CHENG, H. I. SHIUE and H. T. CHENG. *Taiwan Sugar*, 1976, **23**, 17–20.—See *I.S.J.*, 1975, **77**, 124.

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**Direct determination of trace metals in cane juice, sugar and molasses by atomic absorption spectrophotometry.** S. L. SANG, W. C. CHENG, H. I. SHIUE and H. T. CHENG. *Taiwan Sugar*, 1976, **23**, 22–28. See *I.S.J.*, 1975, **77**. 71–75.

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**Towards knowledge on molasses colorants.** V. PREY and H. ANDRES. *Zeitsch. Zuckerind.*, 1976, **101**, 245–248.—In studies on molasses colorants, "Sephadex G-25" was used for separation into a number of fractions ranging in M.W. from 5000 down to 82. The fractions having a M.W. in the range 120–170 were found also to contain components of M.W. similar to that of sucrose; the sugar eluted with the fractions was also found to interfere with the analyses, so that attempts were made to remove it by preliminary treatment of the molasses with lead acetate. Details are given of the procedure which, however, failed to provide quantitative separation of the individual fractions. Polarimetry showed that sugar was not precipitated with the acetate. The highest M.W. components in the precipitable and non-precipitable fractions as separated by subsequent gel filtration were compared; both were eluted at the exclusion limit, were coloured, formed a dry powder, were not hygroscopic, were levorotatory and had almost the same formula. In aqueous solution they had approximately the same conductivity and exhibited acid reaction. The precipitable fraction had, on the other hand, a bromine number which was almost double that of the non-precipitable fraction, while it showed a marked Tillmann reaction and had a relatively high iron content. Full details are given of the properties of the other eight precipitable fractions and the other four non-precipitable fractions, and infra-red spectra are discussed. It is pointed out that much uncertainty surrounds the findings. (See also PREY & ANDRES: *I.S.J.*, 1976, **78**, 318.)

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**The application of aluminium salts instead of basic lead acetate for clarification of cold, aqueous beet brei extracts.** M. BURBA and W. PUSCZ. *Zeitsch. Zuckerind.*, 1976, **101**, 249–251.—The use of an aluminium salt (preferably chloride because it does not hydrolyse in aqueous solution at the concentration used) in place of basic lead acetate for clarification of beet brei extract was tested. Results confirmed the findings of LIPETS & OLEINIK[1] that use of aluminium chloride or sulphate led to almost identical polarimeter readings as with lead acetate; moreover, the aluminium salt is considerably cheaper and is non-toxic. Similar results between the two clarifying agents were found for K, Na and amino-N (found fluorometrically or by the ninhydrin method). Optimum aluminium chloride concentration is 1 g water-free salt per litre, though no effect on the polarimeter reading was observed at up to 2 g.litre$^{-1}$; despite a low filtrate pH (3·6), no sucrose inversion was observed after some hours at room temperature. Precipitation with the Al salt takes about half the time taken with lead acetate. At pH 9 the alkali content of the aluminium filtrate can be determined with K- or Na-sensitive electrodes in contrast to lead acetate filtrate. Flame photometric determination of Ca is difficult, however.

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**Non-sugars affecting sucrose habit modification.** G. MANTOVANI, C. A. ACCORSI and G. VACCARI. *Zeitsch. Zuckerind.*, 1976, **101**, 251–255.—See *I.S.J.*, 1976, **78**, 91.

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**The melassigenic role of peptides in sugar manufacture.** G. P. VOLOSHANENKO, I. A. PRIKHOD'KO and G. E. RUDENKO-GRITSYUK. *Pishch. Prom.*, 1975, **21**, 28–30. The melassigenic coefficients of di- and tripeptides as well as certain amino-acids were determined by adding a known quantity of crystal sugar of given size range together with peptide or amino-acid to a molasses of known quantity and composition. The Brix and sugar content of 1:1 dilutions were then determined and crystallization carried out at 40°C for 4 days. The mother-liquor was then separated under vacuum by a special method and the Brix, sugar content and viscosity measured. Results showed that peptides and amino-acids reduced viscosity, the maximum reduction being caused by the dipeptide glycyl-L-α-alanine and the minimum by leucine. The dipeptides glycyl glycine, DL-α-alanyl-DL-asparagine, DL-α-alanyl-DL-α-alanine and glycyl-DL-leucine are thus regarded as weakly melassigenic, while the tripeptide DL-α-alanyl glycyl glycine and the dipeptide glycyl-L-α-alanine are negatively melassigenic.

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**Molar concentration of sugar solutions.** D. E. SINAT-RADCHENKO, V. D. POPOV, K. I. TREBIN, A. A. DREVAL' and I. B. PETRICHENKO. *Pishch. Prom.*, 1975, **21**, 31–33.—A formula is presented for calculation of the molar concentration of pure sugar solutions from their dry solids concentration, and a nomogram is presented which is based on the formula. A table is also given which shows the mass concentration and molar concentration of the components in a molasses of average composition. The values demonstrate the effect of the components on the molar concentration of sucrose in impure solutions. The effect of changes brought about by dilution, evaporation or crystallization is shown mathematically, whereby knowledge

[1] *I.S.J.*, 1973, **75**, 323.

of molasses non-sugars will permit approximate calculation of those non-sugars earlier in processing as well as the mean molecular weight of any intermediate product.

* * *

**The core sampler.** R. M. HEBERT. *Sugar J.*, 1976, **38,** (10), 23–26.—Information is given on the system used by St. Martin Sugar Cooperative Inc. in Louisiana to sample and analyse cane. A J & L X-2 core sampler is used to retrieve a 30-lb sample, which is shredded by a pre-breaker and passed to a short screw conveyor. A 3-lb portion of the sample is removed from a separator placed after the screw conveyor, and the sub-sample, in a plastic bag with tag for identification, is transferred to the laboratory. The bagasse yield and moisture content and juice Brix and pol are recorded on magnetic tape by means of a mini-computer, which also provides a print-out; the complete set of data is transmitted daily by telephone to a computer centre which processes the data and returns the results to the laboratory. The computer centre is provided each week with the price to be paid to the cane growers, so that at the end of each day the laboratory has the cane payment figures for each grower who has supplied cane that day. The benefits of the scheme are discussed.

* * *

**Comparison of the polarimetric and isotope dilution methods for determination of the sucrose content in sugar beet.** K. MALEC, A. SZUCHNIK, S. RYDEL and E. WALERIAŃCZYK. *Gaz. Cukr.*, 1976, **84,** 77–79, 82. Comparison was made between polarimetric determination of beet sucrose content and two isotope dilution methods: the direct method[1] and a double dilution method (intended for use where the sucrose content is lower than 14%) which is based on artificial raising of the sucrose content by adding a known quantity of $^{14}$C-labelled sucrose before proceeding as with the direct method and allowing in calculations for the added sucrose. Results of the comparative tests on beet from the 1974/75 campaign using alcohol or water extraction showed that direct isotope dilution gave values which were from 0·20% (absolute) lower to 0·70% higher than the polarimetric values with water extraction, and from 0·10% lower to 0·80% higher with alcohol extraction; the double dilution method gave values which ranged from 0·26% lower to 1·24% higher than the polarimetric values with water extraction, and from 0·49% to 1·30% higher with alcohol extraction. The polarimetric values ranged from 13·15% to 23·50% with water extraction and from 12·20% to 22·90% with alcohol extraction.

* * *

**Application of alpha-galactosidase to raffinose hydrolysis in molasses.** D. OSTASZEWICZ. *Gaz. Cukr.*, 1976, **84,** 81–82.—The use of galactosidase to hydrolyse raffinose in beet molasses is discussed and production of galactosidase preparations from cultures of *Mortierella vinacea* briefly described.

* * *

**The spectral photometric determination of sucrose in sugar beets and sugar beet products via specific enzyme systems.** K. W. R. SCHOENROCK and D. COSTESSO. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18,** 349–359. Details are given of two enzymatic methods used to determine sucrose in beet. Enzyme (i) was invertase hexokinase glucose-6-phosphate dehydrogenase, and enzyme (ii) was invertase hexokinase-phosphoglucose isomerase glucose-6-phosphate dehydrogenase. The enzyme reaction mechanisms are described. Results showed that both enzymes gave results which were very close to values given by gas-liquid chromatography, although (ii) gave a higher mean value (while the other enzyme gave a slightly lower mean value) than did GLC because of the presence of raffinose. While enzyme (i) has the advantage of being unaffected by raffinose, however, greater care needs to be taken in the analytical procedure used with it, and the method is not as precise as with enzyme (ii).

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**Evaluation of the sugar beet according to its technical quality.** M. BURBA. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18,** 360–377.—Evaluation of beet processing quality is discussed at some length with 79 references being given to the literature. Particular attention is focused on the KWS white sugar yield index[2].

* * *

**Chromatographic method of determining micro-quantities of polychloropinene in sugar.** A. Z. USMENTSEVA, N. I. KISELEVA, M. A. KLISENKO and A. YA. ZAGORUL'KO. *Sakhar. Prom.*, 1976, (4), 51–54.—Details are given of a thin-layer chromatographic method for determining polychloropinene (a chlorinated terpene used as insecticide in beet fields) which has an accuracy of 90 ± 5% in the presence of 0·01–0·02 mg.kg$^{-1}$.

* * *

**Investigations of diffusion in pure and technical sucrose solutions. I. Sucrose diffusion in pure aqueous solutions.** F. SCHNEIDER, A. EMMERICH, D. FINKE and N. PANITZ. *Zucker*, 1976, **29,** 222–229.—Descriptions are given of two methods for determination of the sucrose auto-diffusion coefficient at temperatures above 25°C. In the first, three intercommunicating cells were placed one above the other and sucrose solution fed into them; a fourth cell received $^{14}$C-labelled sucrose solution of the same concentration as the other cells. The three cells with the unlabelled solution were then carefully slid over the fourth cell so that no intermixing of the contents in this and the bottom cell of the other three took place. After a given time at a pre-set temperature, the four cells were slid apart and the relative activities of the contents measured by a scintillation counter. The second method involved use of a capillary tube open at one end and filled with labelled sucrose solution. The tube was immersed in a large quantity of unlabelled solution of identical concentration in a special double-walled glass vessel and agitated so as to ensure distribution of the radio-active sucrose in the unlabelled sucrose. After a specified time, the contents of the vessel were removed by capillary tubes and their activities measured as in method 1. Comparison of results for both methods showed identical reproducibility and agreement which was as good as the best quoted in the literature. However, the capillary method was considered more suitable for certain reasons which are stated. Comparison of sucrose auto-diffusion coefficients at 25°C showed that the values given by the capillary method were higher at the lowest sucrose concentration than values obtained by IRANI & ADAMSON[3] and TILLEY & MILLS[4], but

[1] MALEC *et al.*: *I.S.J.*, 1976, **78,** 188.
[2] BURBA: *ibid.*, 1971, **73,** 374.
[3] *J. Physic. Chem.*, 1958, **62,** 1517.
[4] *ibid.*, 1967, **71,** 2756.

fell below the results obtained by the earlier authors as the concentration rose in the range 0–60%. Tabulated values obtained by the capillary method cover the temperature range 20–80°C.

* * *

**Enzymatically determined sucrose and sugar factory balances.** P. DEVILLERS, R. DETAVERNIER and J. ROGER. *Sucr. Franç.*, 1976, **117**, 199–206.—Determination of sucrose with glucose oxidase[1] was compared with polarimetric determination, whereby the differences were sufficiently great to justify application of the enzymatic method to calculation of unknown losses. While, at 25 factories investigated, polarization gave higher raw juice sugar contents than the values given by the enzymatic method, in the case of molasses the polarimetric readings were lower at the start and higher at the end of the campaign than were the enzymatic values. The average unknown loss as given by polarization was 0·144% absolute higher (on beet) than the enzymatic value.

* * *

**Separation of aldoses and polysaccharides by cellulose thin-layer chromatography and a new spray reagent for the sensitive detection of these carbohydrates.** M. HOTON-DORGE. *J. Chromatog.*, 1976, **116**, 417–423. Fourteen sugars were separated by one-dimensional thin-layer chromatography using (i) 5:4:4:10:2 ethyl acetate:pyridine:water:*n*-butanol:acetic acid in preference to (ii) 5:1:2 *n*-butanol:acetic acid:water or (iii) solvent (i) plus 5% water, because it provided best monosaccharide separation. The spots were revealed by *p*-aminohippuric acid:phosphoric acid:ethanol (0·3 g:0·5 ml:100 ml) or *p*-aminohippuric acid; thiobarbituric acid:phosphoric acid:ethanol (0·15 g:0·25 g: 1 ml:100 ml). The colours of the spots in visible light and in U.V. light at 350 nm are tabulated as well as the limits of detection.

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**Fluorometric determination of amino-acids in sugar beet and sugar factory products with fluorescamine and *o*-phthalaldehyde.** M. BURBA and B. GEORGI. *Zeitsch. Zuckerind.*, 1975, **100**, 667–673; 1976, **101**, 322–329. After explaining the fundamentals of fluorometric measurement and the construction and operation of a fluorometer, the authors describe a method based on UDENFRIEND's technique for determination of primary amines (amino-acids, peptides and proteins) with fluorescamine and ROTH's method using *o*-phthalaldehyde. The non-fluorescing fluorescamine [4-phenyl spiro-(furan-2(3H),1'-phthalane) 3,3'-dione] reacts with the amino-acids to form a fluorophore, followed by complete hydrolysis of the reagent to water-soluble non-fluorescing products. The fluorescamine is stable for at least 2 weeks in water-free acetone at room temperature. Secondary amino-acids do not react with it, but they are considered of little importance in beet. On the other hand, *o*-phthalaldehyde (OPT) has a number of advantages over fluorescamine in amino-acid determination in the absence of lead salts: the reagent is more sensitive, more specific and is water-soluble and much cheaper than fluorescamine and can be used with a borate or bicin buffer solution, thus obviating the need for separate reagent and buffering agent. Disadvantages of the OPT method include low stability of the solution and prolonged reaction times, so that it is not suitable for routine tests. Unlike the ninhydrin method, ammonia does not interfere with the measurements, since the colorant formed has a fluorescence intensity which is only one-thousandth of that of the amino-acids. This is of particular importance as regards white sugar amino-acids, which are present in concentrations below the analytical limit of the ninhydrin method. Both fluorometric methods described are suitable for measurement of amino-acids in the nM range, and selectivity is independent of turbidity and colour. The fluorescamine method is applicable to brei extracts clarified with lead acetate, while the OPT method requires pre-clarification of the brei extract with an aluminium salt, although juice and molasses can be analysed directly after dilution.

* * *

**Errors in quartz-wedge polarimetry.** R. S. WATTS. *Proc. 43rd Conf. Queensland Soc. Sugar Cane Tech.*, 1976, 283–285.—The Mueller calculus was used to simulate the performance of a quartz-wedge polarimeter in measuring the rotation of a dark raw sugar solution. A computer was applied to solution of the equation by numerical integration and inverse interpolation. Tabulated and plotted results showed that the error varied approximately linearly with solution colour, although the reading error for a rotating-analyser polarimeter would be much greater than for the quartz-wedge polarimeter. The question of error importance is discussed, and it is suggested that the analysis method used for payment be standardized with respect to the instrument used, and that unclarified solutions be used for process control polarimetry.

* * *

**Rheological properties of massecuites. I.** K. Čížek. *Listy Cukr.*, 1976, **92**, 79–82.—Classification of sugar factory juices and solutions according to their behaviour under the effect of shearing force is discussed with the aid of rheograms demonstrating the effect of shearing and tangential forces on deformation in the case of Newtonian, Bingham and pseudo-plastic liquids. Reference is made to the findings of a number of authors, and details are given of experiments with a Contraves rotary viscometer ("Viscometr TV") driven by synchonous motor, and a Höppler rheoviscometer. Results obtained at 70°C for six massecuite of known crystal composition showed that the Höppler instrument gave readings which were 20–30% lower than with the rotary viscometer, the difference increasing with increase in crystal size and content. This was attributed to settling of crystals on the bottom of the tube and to occasional crystal breakage by the measuring piece. Further tests were conducted with the rotary viscometer which was found to give good reproducibility. Artificial massecuites of known crystal content up to 60% and four mesh sizes were added to filtered molasses. Apparent viscosity as measured at 40, 60 and 80°C tended to rise with increase in crystal content and size, although the value for the massecuite of greatest crystal content and largest fraction size was slightly below the maximum found for the third in order of crystal size and content. Observations during the campaign at Čakovice factory showed wide fluctuation in the viscosity of low-grade massecuite in the continuous crystallizer, even when the results were reduced to a common temperature. The variation is attributed to irregularity of flow, solid phase content and water addition.

[1] *I.S.J.*, 1967, **78**, 91.

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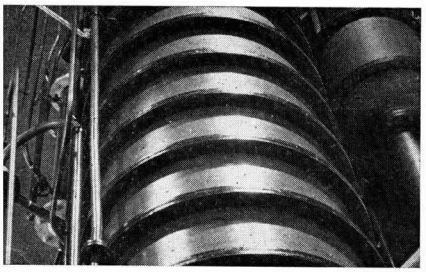

# By-products

**Examination of the factors affecting energy consumption and dust emission from pulp dryers with reference to residence time of the pulp in the dryer.** T. CRONEWITZ, G. MULLER, B. BISSINGER and F. STADLER. *Sucr. Belge*, 1976, **95**, 47–59.—See *I.S.J.*, 1976, **78**, 126.

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**Dust burning in a pulp dryer at Lippe-Weser Zucker AG.** R. HENZE. *Zucker*, 1976, **29**, 113–115.—Difficulties in handling dust produced by mechanical stress effects on dry pulp are discussed. The dust poses a particular problem in its high organic load and poor miscibility with water. Details are given of an experimental unit developed for burning fine dust together with oil. From tests, a number of requirements for efficient operation have been established and these are listed. The unit was started 20 days after the beginning of the campaign and operated until the end of the campaign. Consumption was 0·024 kg dust per 100 kg beet, and dust calorific value was found to be 2931 kcal per kg, giving the same heat output as 7·4 kg of oil per 100 metric tons of beet. The economics are briefly considered.

* * *

**Establishment of bagasse-based mini paper plants by sugar factories.** P. J. M. RAO. *Indian Sugar*, 1975, **25**, 527–552.—Bagasse yields in the various Indian sugar-producing states are indicated, and the point made that a number of sugar factories have been saving quantities of bagasse by improving their steam economies. The use of bagasse to make paper is discussed, with mention of the number of bagasse paper plants in various countries and particular reference to the San Cristóbal plant in Mexico. Details are given of Indian bagasse paper plants (some of which have ceased production or have changed over to use of other raw materials), and information is given on Indian government plans for expansion of bagasse paper production. However, in view of the financial problems and difficulty of securing large quantities of bagasse, there has been lack of interest in erecting large plants (having a daily output of at least 100 metric tons), and the author proposes the construction of small plants capable of producing 15 tons of paper a day. Lists are given of suppliers of complete "mini" factories and of paper industry consultants in India. The equipment required for such plants is listed, and details are given of the basic processes. Also mentioned are sugar factories in India which have already obtained licences for the establishment of paper mills, and suitable locations for small plants are suggested.

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**Sterilization of molasses in ultra-high frequency electromagnetic fields.** A. M. OSTAPENKOV and V. A. MATISON. *Izv. Vuzov, Pishch. Tekh.*, 1975, (6), 77–79. Diluted molasses of given composition and cultured with a number of specified bacilli and yeasts was exposed to the effects of a UHF field of 2450 MHz for 10–140 sec. Survival was assessed for each species and the results tabulated. These showed that the time taken to act on the bacteria depended on the concentration of the initial bacterial suspension, but complete sterilization of yeasts required half the time needed for sterilization of bacilli at the same initial concentration, e.g. 140 seconds for complete kill of bacilli compared with 60 seconds for yeasts. Heat treatment of the cultures at the same temperature at which the magnetic field caused complete sterilization was not as effective as the UHF treatment.

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**Alcohol recovery, quality and steam economy.** A. C. CHATTERJEE and B. M. DUTT. *Sugar News* (India), 1975, **7**, (8), 7–9.—The theoretically possible ranges of alcohol recoveries by fermentation from cane molasses of three grades are calculated, but it is indicated that because of considerable temperature fluctuations and fresh water supply problems in India, particularly in the summer, the recovery will be much reduced. Still further reduction results from losses in distillation, bringing the normal total recovery to 82–87% of the theoretical. The need for a close check on processing to minimize losses is stressed; separation of fermentation by-products poses some problems, and some advice is given on how to maintain the requisite product quality. Control of steam consumption is also discussed.

* * *

**Variations in final molasses composition in the eastern Caribbean and Guyana and their possible effect on beef cattle performance.** E. F. UNSWORTH and P. O. OSUJI. *Trop. Agric.* (Trinidad), 1976, **53**, 151–156. From cane molasses analyses supplied by Barbados, Trinidad and Guyana factories for 1969–73, pooled mean values were derived for dry matter, sulphated ash, reducing sugars, sucrose and total sugars. The data were compared with those for molasses from Cuba, Mauritius, Philippines and Rhodesia, and showed appreciable variation. The differences are regards as a possible explanation of discrepancies in animal performance (as reported in the literature) where molasses is used as fodder. This suggests that complex energy-protein-mineral interactions are involved which have not yet been clarified.

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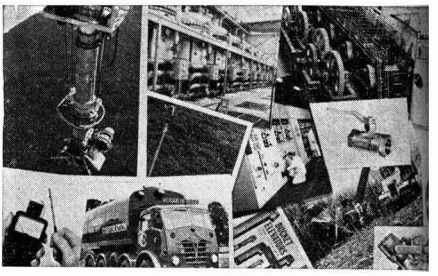
**Comparative analyses of ethanol distillery scale.** L. G. DE SOUZA, M. M. MISCHAN, U. DE A. LIMA and A. M. S. M. LLISTÓ. *Brasil Açuc.*, 1976, **87**, 8–13. Comparison of analysis of scale formed in distillation columns at a number of Brazilian distilleries with the corresponding scale from the Bacardi distillery in Puerto Rico showed that the latter had slightly lower contents of Ca and sulphite but a higher loss on ignition and an appreciably higher $SiO_2$ content.

# Trade notices



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

**New 4-wheel-drive tractor.** J & L/Honiron Engineering Co. Inc., PO Box 620, Jeanerette, LA, USA 70544.

A new 4-wheel-drive tractor with a full 24-inch ground clearance is announced by J & L/Honiron. The Model 4-250 is designed specifically for the cane farmer and is provided with a Caterpillar 3306 turbo-charged 6-cylinder in-line engine, sun canopy with safety roll-over protection bar and a 135-gal fuel tank. Total dry weight is 19,000 lb.

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**Beet trash pressing.** Stord Bartz Industri A/S, Bergen, Norway.

In "Stord Bartz Review", 1976, (2), details are given of trials on pressing of beet trash from the washer. Results from use of twin-screw presses have shown an increase in dry solids from 10–14% to 20–25% and even exceeding 30% in isolated cases; experience with a press supplied to Attin sugar factory in France has shown an average of 23·45% dry solids. The pressed trash is mixed with pressed pulp before drying and use as cattle fodder. In the same issue of the "Review" is mentioned the RS-80S, the largest screw-press in the world, which was supplied by Stord to the Plattling factory of Süddeutsche Zucker-AG and has a daily capacity equivalent to 1500–2000 tons of beet.

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## PUBLICATIONS RECEIVED

**STORK-AMSTERDAM ACTIVITIES.** Stork-Amsterdam B.V., Postbox 108, Amstelveen, Holland.

A brochure available in English, French, German and Spanish as well as Dutch outlines the various activities conducted at the Research & Development Centre of Stork-Amsterdam covering many fields. The operations include corrosion control and water treatment, concentration and drying, cleaning and disinfection, pneumatic and mechanical handling and product preservation.

* * *

**TATE & LYLE ENGINEERING BULLETIN.** Tate & Lyle Engineering Ltd., Cosmos House, Bromley Common, Bromley, Kent, England BR2 9NA.

The Spring 1976 issue of the TLE Bulletin gives illustrations concerning various TLE activities and equipment orders, including four cane mills for Sena in Mozambique, erection of a factory of 3000 t.c.d. capacity at Nusantara in Indonesia, a contract for expansion of Nakambala factory in Zambia, and orders for fully-automatic and continuous centrifugals as well as other factory equipment. Details are also given of the Farrow "Dolphin" self-travelling irrigator for use in cane fields, and illustrations clearly show the outstanding points of the Tongaat shredder (manufactured under licence). Factory results from Khoski in Pakistan demonstrate the increased mill extraction resulting from the use of a Searby shredder (also supplied by Tate & Lyle) in contrast to non-use of shredders, while other advantages of a shredder are also indicated.

* * *

**SCALEAWAY DESCALING EQUIPMENT.** Scaleaway Tools & Equipment Ltd., Clinton Lane, Kenilworth, Warwicks., England CV8 1AS.

Brochure ST75 gives details of Scaleaway TA toolheads for descaling juice heaters and evaporator tubes, RC toolheads for descaling condenser, evaporator and boiler tubes having thick deposits of scale, and DS toolheads for descaling of process pipework and boiler tubes and for removal of thicker deposits of scale from juice heater and vacuum pan tubes.

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**EWART "COBRA" CONVEYORS.** Ewart Chainbelt Co. Ltd., Colombo St., Derby, England.

A new leaflet from Ewart features the "Cobra" (Conveyor OutBoard Roller Assemblies) heavy-duty, overlapping apron conveyors used to transfer such materials as dripping-wet cane from the washers. Special emphasis is placed on the way in which the full load is evenly distributed on the conveyor via through-rods to the large-diameter outboard rollers which run on rails and free the chain for power transmission only.

* * *

**POLARIMETER SAMPLE TUBES AND REPLACEMENT PARTS.** Rudolph Research, Pier Lane, Fairfield, NJ, USA 07006.

Technical Bulletin 413 from Rudolph Research gives details of polarimeter sample tubes and advice on their cleaning, filling and testing. Replacement parts for the sample tubes available from Rudolph are also listed.

* * *

**CLAAS "LIBERTADORA 1400" CANE HARVESTER.** Gebr. Claas Maschinenfabrik GmbH, Postfach 140, D-4834 Harsewinkel, Germany.

A well-produced brochure, with many colour illustrations, features the "Libertadora 1400" harvester which is designed for high-capacity work with green or burnt cane.

* * *

**"WEED-FREE AT LOWER OVERALL COST!".** May & Baker Ltd., Agrochemicals Division, 37–39 Manor Road, Romford, Essex, England RM1 2TL.

May & Baker Ltd. have produced a new booklet giving details of their "Asulox 40" and "Actril DS" herbicides which are specifically intended for the control of broad-leaved weeds and grasses in cane fields. They may be used separately or as a tank-mix, and a delayed spraying programme and a two-step application programme are described. Apart from guidance on time and rate of application, the booklet gives a long list of weeds which are susceptible to the action of the herbicides. It is stated that the "unique technical properties of 'Asulox 40' and 'Actril DS' provide an approach to weed control not possible with other products". The booklet is available in an English version (P27E/5606) and a Spanish version (P27E/5607) from the above address.

* * *

**ENGINEERING AND CONSTRUCTION SERVICES FOR THE SUGAR INDUSTRY.** Arthur G. McKee & Co., 10 South Riverside Plaza, Chicago, IL, USA 60606.

A recent brochure from Arthur G. McKee describes the activities of the company in the sugar industry, for which it can provide all inter-related services from project inception to final construction, including planning, procurement, personnel training and plant start-up. The company also offers its services in the field of by-product utilization, covering bagasse, filter cake and molasses.

# International Society of Sugar Cane Technologists

**16th Congress 1977**

For the 16th Congress of the ISSCT in 1977 the month of September was chosen as it is the beginning of Spring in Brazil when the rainy season has not started in São Paulo and when it is reaching its end in the North and North-East regions of the country. Usually the temperature is mild and the weather steady, and the sugar cane in full harvest in the areas to be visited. The Pre-Congress part will begin on 9th September with a meeting of the delegates in Rio de Janeiro and will continue in this city until 11th September.

On the 12th and 13th, the delegates will start their technical visits in the interior of the state of São Paulo. The opening of the Congress will be in the city of São Paulo on the 14th (Wednesday) with the registering of delegates, followed by a cocktail party. The technical sessions will be held concomitantly in the various auditoria of the Convention Centre of the Parque Anhembi in São Paulo, with two periods each of three hours, on the 15th, 16th, 17th and 19th of September. The plenary meeting will be held on the morning of Tuesday, the 20th September, with the closing ceremonies, followed by a banquet that evening.

It is planned to organize two optional Post-Congress programmes of 3–4 days, starting on the 21st. One will include technical visits to the states of Pernambuco and Alagoas in Brazil, while the other will include a visit to the North-West of Argentina (Provinces of Tucumán, Jujuy and Salta). Further details of these programmes will be available later.

Intending participants are urged to write to their regional vice-chairman for a registration form; names and addresses were published in our January 1976 issue. Alternatively they can write direct to: Sr. ROBERTO CALZA, General Superintendent, ISSCT XVI Congress, P.O. Box 5691, 00014 São Paulo, SP, Brazil.

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**Tanzania sugar plans.**—Sugar Development Corporation has plans to erect medium-sized sugar factories in Kagera, Marwa, Nyatwali and Tunduru for 1980. Tanganyika Planting Co. Ltd. expects to be producing 100,000 tons by 1978, while the Mgera complex will probably begin production within two or three years. The goal is to reach a national production of 450,000 tons in 1980. An Indian firm has received the order, worth $23 million, for a turn-key plant of 2500 t.c.d. capacity in Kagera, in the Bukoba district, all the machinery to be designed and manufactured in India. The project is to be completed in 34 months and facilities will be provided for expansion to 3500 t.c.d.

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**Turkey sugar expansion**[1].—Between 1976 and 1980 ten new sugar factories are to be erected, seven of them in the underdeveloped region of eastern Anatolia. The first will be at Mus, near Lake Van, and will slice 3000 tons of beet per day. Each factory will cost 1000 Turkish pounds (US $64 million) and 80% of the equipment will be supplied by Turkish firms.

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**Bagasse paper plant in Argentina**[2].—Papel de Tucumán is to set up a $130 million (equivalent) newsprint mill to produce 100,000 tons annually of newsprint from bagasse, thereby saving the country $50 million a year in imports.

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**New Turkish sugar factory**[3].—A sugar factory is to be erected in Elbistan in south-east Turkey, where successful trials have been made in beet cultivation. Plantings are to be expanded so that a crop of 400,000 tons of beet will be available when the factory starts operations.

# Chile sugar statistics[4]

| | 1975 | 1974 | 1973 |
|---|---|---|---|
| | (metric tons, raw value) | | |
| Initial stocks | 43,083 | 57,662 | 46,600 |
| Production .. | 219,181 | 116,489 | 79,824 |
| Imports: | | | |
| Australia .. | 0 | 0 | 18,669 |
| Argentina .. | 0 | 43,072 | 57,547 |
| Bolivia .... | 3,247 | 7,394 | 30,000 |
| Brazil .... | 0 | 72,200 | 32,435 |
| Colombia .. | 35,653 | 35,837 | 0 |
| Cuba ..... | 0 | 0 | 146,391 |
| Dominican Republic | 0 | 15,372 | 0 |
| Peru ..... | 107,050 | 0 | 5,000 |
| Other countries | 31,925 | 0 | 6,522 |
| | 177,875 | 173,875 | 296,564 |
| | 440,139 | 348,026 | 422,988 |
| Exports ..... | 55,652 | 11,373 | 0 |
| Consumption | 321,879 | 293,570 | 365,326 |
| Final stocks .. | 62,608 | 43,083 | 57,662 |

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**New Honduras sugar factory**[5].—The annual processing capacity of the 4·1-million lempira ($2,000,000) sugar mill complex at Canterranas will amount to 124,000 tons of cane when the plant begins operating in March 1977, and is to be increased to 300,000 tons by 1979.

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**St. Vincent sugar plan**[6].—The Ministry of Agriculture in St. Vincent has urged the Government to take urgent action to get the sugar industry going in view of the island's frequent shortages and continuously rising prices of sugar. They have recommended that, initially, 1500 acres of cane be planted for an estimated production of 5250 tons of washed grey sugar crystals for local consumption, and that 1978 should be fixed as the sugar production date. Among the other reasons the Ministry gives for making sugar locally is that it would save two to three million dollars in foreign exchange by not having to import it; and also the industry is labour intensive and so would help absorb a great number of unemployed.

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**New Guatemala sugar factory**[7].—Construction of a $10 million sugar factory in Guatemala was to begin in August 1976 and is expected to be completed for the 1977–78 season. The plant, El Pilar S.A. in Cuyotenango, will process cane grown in the south coast region between Mazatanengo and San Felipe Retalhuleu and will have an initial capacity of 5000 t.c.d., later to be increased to 7000 t.c.d.

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**Maine sugar industry revival**[8].—The 4000-ton Easton, Maine, USA, beet sugar factory built by BMA and operated during 1965/69 but then closed, is to be re-opened for the 1976/77 campaign by a group including ACLI International Inc. (30%), the Patzenhofer Group from Austria (30%) and the Pine Tree Sugar Corp., a US farmers' group (40%). Agricultural and technical expertise will be provided by the Austrian partners. Between 4100 and 4800 ha have been sown to beet this year and next year it is planned to raise the beet area to 13,000 ha. For 1976 growers have been guaranteed a minimum price of $18 per short ton. The whole complex has been acquired from the State of Maine for $1·8 million.

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**Ecuador sugar expansion**[9].—The International Finance Corporation, together with private British and US banks, has agreed to lend the equivalent of $21·1 million to Sociedad Agrícola e Industrial San Carlos to finance the expansion of sugar production.

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[1] *Amerop Noticias*, 1976, (32), 5.
[2] *Bank of London & S. America Rev.*, 1976, **10**, 380.
[3] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (19), 6.
[4] *I.S.O. Stat. Bull.*, 1976, **35**, (7), 28.
[5] *Bank of London & S. America Rev.*, 1976, **10**, 392.
[6] *W. Indies Chron., News Section*, July 1976.
[7] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (19), 7; *Amerop Noticias*, 1976, (33), 13.
[8] *Zeitsch. Zuckerind.*, 1976, **101**, 566.
[9] *Bank of London & S. America Rev.*, 1976, **10**, 398.

# Greece sugar imports[1]

| | 1975 | 1974 | 1973 |
|---|---|---|---|
| | (metric tons, white value) | | |
| Austria | 0 | 100 | 70 |
| Belgium-Luxembourg | 482 | 2,552 | 8,861 |
| Brazil | 204 | 1,428 | 4,747 |
| Canada | 15,051 | 0 | 0 |
| Czechoslovakia | 0 | 0 | 500 |
| Denmark | 0 | 1,390 | 865 |
| France | 404 | 4,045 | 14,546 |
| Germany,East | 20,985 | 0 | 0 |
| Germany, West | 1,693 | 732 | 76 |
| Holland | 23 | 14,256 | 12,243 |
| Japan | 11,162 | 0 | 12 |
| Paraguay | 0 | 0 | 2 |
| Portugal | 17,150 | 0 | 0 |
| Spain | 0 | 60 | 4,530 |
| Switzerland | 0 | 0 | 20 |
| UK | 12,404 | 25,022 | 14,254 |
| USA | 210 | 0 | 5 |
| | 79,768 | 49,585 | 60,731 |

**Nigerian sugar project**[2].—An agreement has been signed by the Governments of Benin and Nigeria and Lonrho Ltd. under which a company has been set up to develop a sugar estate at Save. The project will cost about £67 million and Lonrho Ltd. have secured the management contract.

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**Morocco sugar production**[3].—In the 1975/76 campaign, 262,700 metric tons of sugar, raw value, was produced from beet and 4000 tons, raw value, from cane.

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**New Polish sugar factory**[4].—Construction of a new sugar factory in Glinojek in the eastern province of Ciechanów has started.

* * *

**New Indonesian sugar factory**[5].—The first sugar factory in the region is to be built in Lombok. It will have a production capacity of 35,000 tons per year.

* * *

**New Nepal sugar factory**[6].—The Government of Nepal is understood to have sanctioned the establishment of a fourth sugar factory by a private firm. At present there are three factories in Nepal.

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**Italy sugar factory closure**[7].—The Ostiglia raw sugar factory was closed after the 1975/76 campaign.

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**Distillery in Paraguay**[8].—A total of 1051 million guaraníes is to be invested in a plant to produce annually 16·2 million litres of alcohol from sugar cane in the Province of Guairá; the plant is to be built by the Administración Paraguaya de Alcoholes (APAL), which will finance 10% of the project with Government and foreign sources providing the remaining 30% and 60%, respectively.

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**India 1975/76 sugar crop**[9].—Despite an area some 4% higher in 1975/76, a number of factors including bad weather reduced the yield per hectare so that total cane tonnage was about the same as in 1974/75. Of the total of 140 million metric tons, about 42·5 million tons were crushed by sugar factories, i.e. 30% as against the 48·4 million tons or 34·5% of the 1974/75 total cane crop. Sugar production fell from 4,740,000 tons to 4,250,000 tons in 1975/76.

* * *

**New sugar factory in West Germany**[10].—Pfeifer & Langen are building a new raw sugar factory at Appeldorn in Niederrhein Province. It will have a capacity of 4000 tons of beet per day and is to go into operation for the 1977/78 campaign.

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**Iran sugar expansion plans**[11].—Sugar production in Iran is to be increased from the present 690,000/700,000 tons to 1·4 million tons annually in the period up to 1983. Production in 1993 is to be in the region of 2·8 million tons per year. The sugar beet area is to be increased from the present 175,000 hectares to 283,000 hectares by 1983 and 305,000 hectares in 1993 with sugar beet production levels of around 8 million and 13·6 million tons, respectively. It is hoped that beet sugar production can be increased to 1·1 and 2 million tons. The area under sugar cane is to be increased to 27,000 hectares by 1983 and to 70,000 hectares by 1993, with cane sugar production increased to 303,000 tons and 786,000 tons, respectively.

# Jamaica sugar statistics[12]

| | 1975 | | 1974 | |
|---|---|---|---|---|
| | (metric tons, raw value) | | | |
| Initial stocks | | 10,297 | | 13,649 |
| Production | | 366,441 | | 378,445 |
| Imports | | 4,347 | | 0 |
| | | 381,085 | | 392,094 |
| Consumption | | 109,193 | | 103,433 |
| Exports: | | | | |
| Canada | 0 | | 21,714 | |
| China | 0 | | 10,183 | |
| UK | 130,799 | | 157,285 | |
| USA | 74,536 | | 89,182 | |
| Other countries | 59,568 | | 0 | |
| | | 264,903 | | 278,364 |
| Final stocks | | 6,989 | | 10,297 |

**Florida record sugar crop**[13].—A record production of sugar was achieved by the Florida industry in 1975/76, with 1,061,911 short tons of raw sugar produced from 10,807,496 tons of cane. The outturn almost equalled that of Hawaii (1,107,197 tons), historically the largest domestic producer of cane sugar, and compares with 793,340 tons of raw sugar produced in 1974/75 and the previous record of 960,562 tons produced in 1972/73.

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**Citric acid from molasses in Greece**[14].—The Greek state company Hellenic Sugar Industry is to build a 560-million drachmae factory for production of 3500 tons/annum of citric acid using beet molasses as raw material.

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**Japan cane crop 1975/76**[15].—The Japanese 1975/76 sugar cane crop, grown in the Provinces of Kagoshima and Okinawa, totalled 1,973,200 metric tons, an increase of 8% on that of 1974/75. The increase arose partly from the 2% increase in cane area to 30,600 hectares and partly to the 6% improvement in yield to 64·5 tons.ha$^{-1}$.

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**British sugar crop estimate.**—The British Sugar Corporation announced on 20th September that the 1976 sugar beet crop is likely to produce between 700,000 and 800,000 metric tons of sugar. Sugar produced last year was 640,000 tons. PETER DYKE, the company's chief agriculturist, said: "Even with several weeks root sampling completed it would be sheer guesswork to give a more precise figure at this stage, hence our need to give a bracket from low to high estimate". Mr. DYKE explained that the difficulty of estimating this year stemmed from a growing season of unprecedented weather. "The drought has caused inconsistent growing patterns in the various beet growing regions, and the recent rains, while they can do the crop nothing but good, have produced variations in the growth rate of the crop, which add a further complication to estimating". The Corporation also gave the provisional opening dates for their factories for the 1976 campaign, which ranged from 27th September (Allscott) to 17th October (Felsted).

* * *

**International Sugar Research Foundation.**—The Annual Meeting of members of the Foundation was held in Palm Beach, Florida, on 11th March 1976 and the *Proceedings*, which have just been published under the title "Sugar's Bounty", includes the text of the papers presented. These include "This royal carbohydrate *or* Sucrose, Bounty of the earth" by J. A. C. HUGILL, "Sugar in nutrition" by Dr. H. VELEZ A., "The contribution of sugar to the economy of Latin America" by M. CARVALLO G. and "Sucrochemistry and fermentation processes" by Prof. A. J. VLITOS.

[1] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (18), ix.
[2] *The Times*, 27th July 1976.
[3] *Zeitsch. Zuckerind.*, 1976, **101**, 492.
[4] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (20), 9.
[5] *Zeitsch. Zuckerind.*, 1976, **101**, 492.
[6] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (20), 13.
[7] *Zeitsch. Zuckerind.*, 1976, **101**, 491.
[8] *Bank of London & S. America Review*, 1976, **10**, 467.
[9] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (22), 11–12.
[10] *Zeitsch. Zuckerind.*, 1976, **101**, 540.
[11] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (22), 12.
[12] *I.S.O. Stat. Bull.*, 1976, **35**, (4), 61.
[13] *Willett & Gray*, 1976, **100**, 321.
[14] *Zeitsch. Zuckerind.*, 1976, **101**, 564–565.
[15] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (24), 12.

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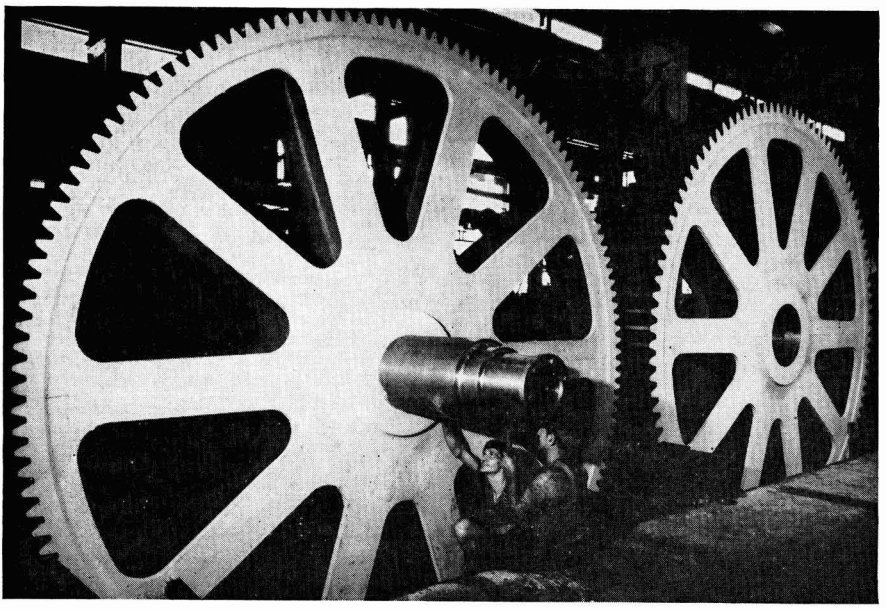

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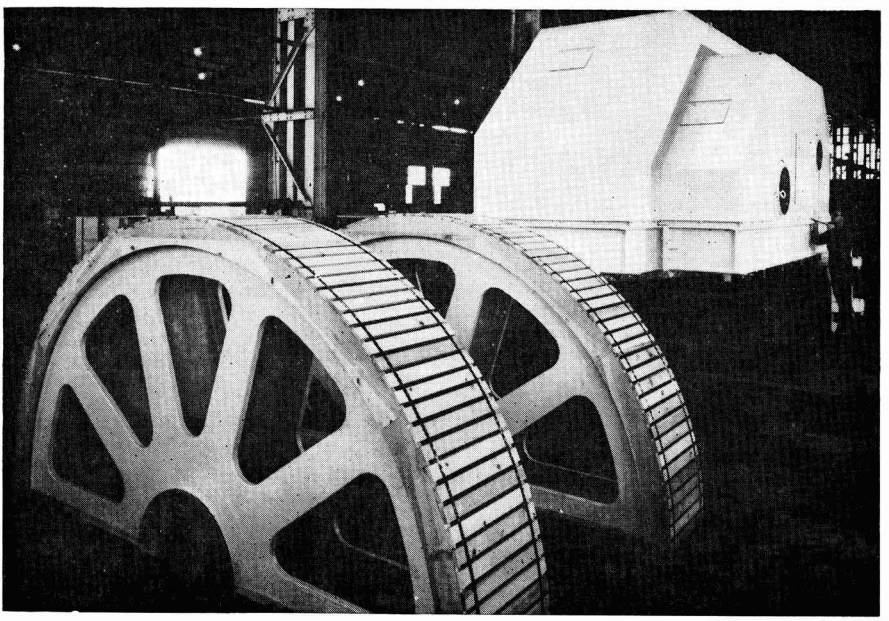

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