International Sugar Journal

AUGUST 1976

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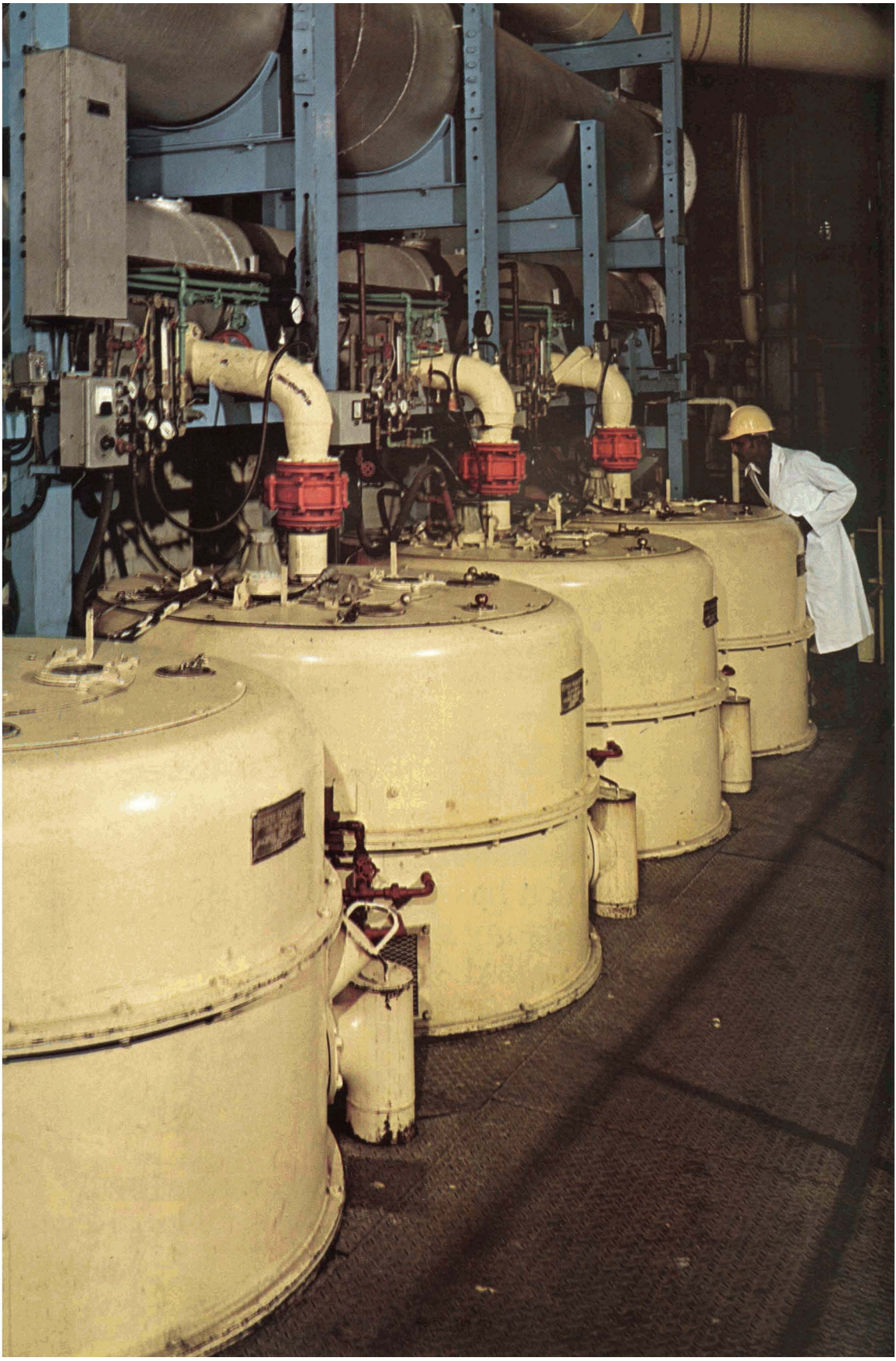
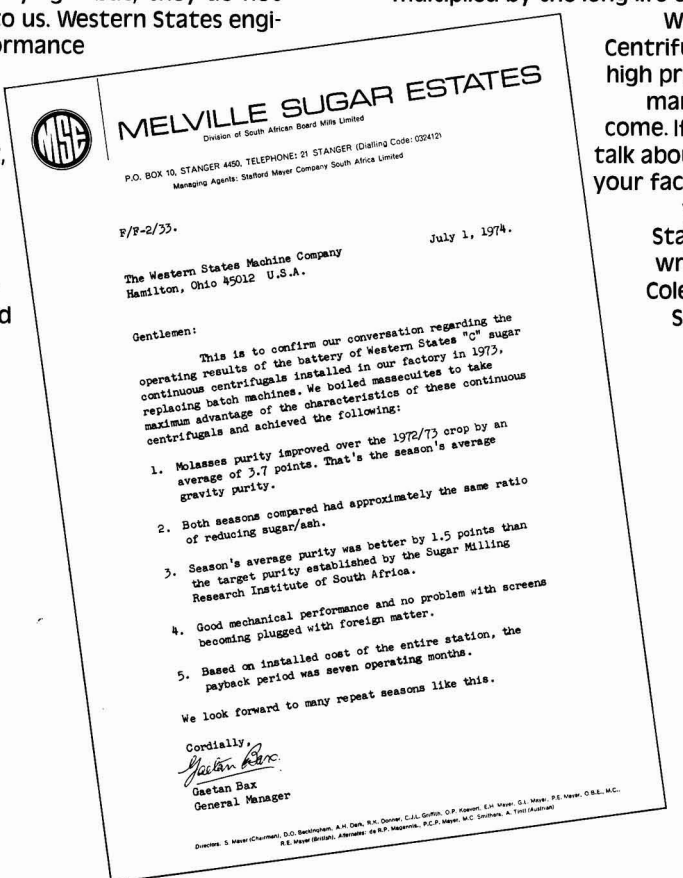


PAYBACK: 7 MONTHS

Molasses Purity (season's average)
...down 3.7 points from previous year.
...1.5 points below target purity.

The operating statistics reported by Mr. Bax (see letter) are gratifying... but, they do not come as a surprise to us. Western States engineers plan for performance like this. They also plan for ruggedness, durability, minimum labor cost, high productivity, low maintenance cost and minimum downtime.
Result: An unusually quick payback period like that reported by Mr. Bax. These results multiplied by the long life expectancy of Western States Centrifugals promise high profitability for many seasons to come. If you'd like to talk about results for your factory, contact your Western States agent, or write: Mr. James Coleman, General Sales Manager.



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Division of South African Board Mills Limited

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Managing Agents: Stafford Meyer Company South Africa Limited

F/P-2/33. July 1, 1974.

The Western States Machine Company
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Gentlemen:

This is to confirm our conversation regarding the operating results of the battery of Western States "C" sugar continuous centrifugals installed in our factory in 1973, replacing batch machines. We boiled massecuites to take maximum advantage of the characteristics of these continuous centrifugals and achieved the following:

1. Molasses purity improved over the 1972/73 crop by an average of 3.7 points. That's the season's average gravity purity.
2. Both seasons compared had approximately the same ratio of reducing sugar/ash.
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4. Good mechanical performance and no problem with screens becoming plugged with foreign matter.
5. Based on installed cost of the entire station, the payback period was seven operating months.

We look forward to many repeat seasons like this.

Cordially,
Gaetan Bax
General Manager

Directors: S. Meyer (Chairman), D.O. Beckingham, A.H. Dick, R.K. Donner, C.J.L. Griffin, O.P. Kjerulf, E.H. Meyer, G.L. Meyer, P.E. Meyer, O.B.E., M.C., R.E. Meyer (British). Alternates: de R.P. Meyer, P.C.P. Meyer, M.C. Smithers, A. Timl (Austrian)

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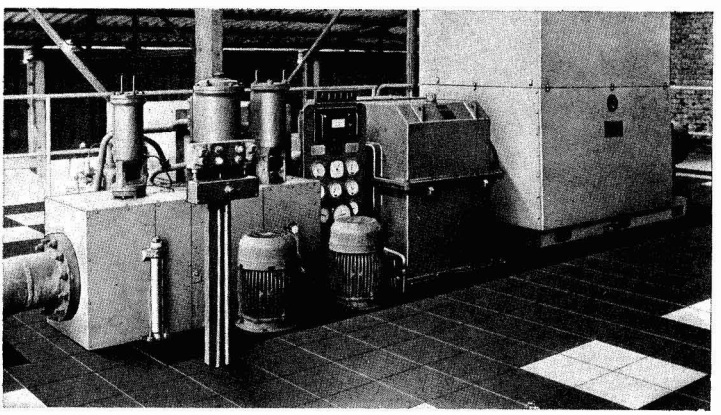

A 3000 kW Allen steam turbo-alternator set installed in a Mexican Sugar Mill.

An Allen Gwynnes suspended axial-flow pump.

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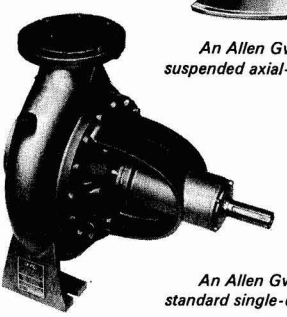

An Allen Gwynnes standard single-entry pump.

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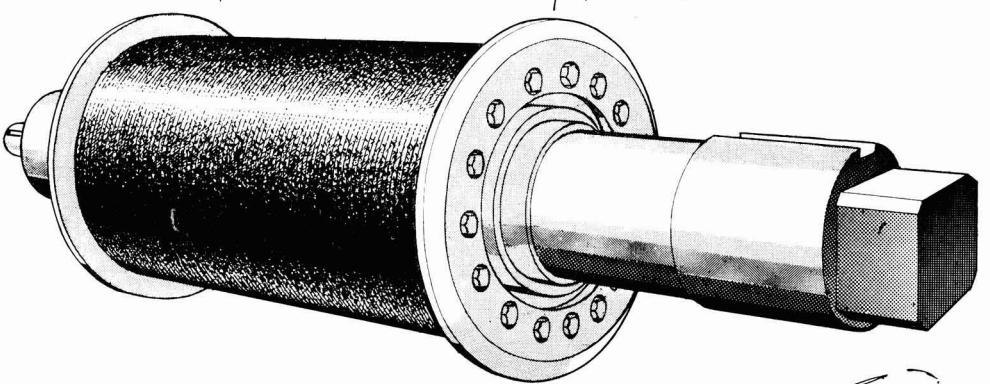
Enlarged view of the surface of a 'GRANO' casting



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'Grano' is a special metal from which our sugar mill roller shells are cast.

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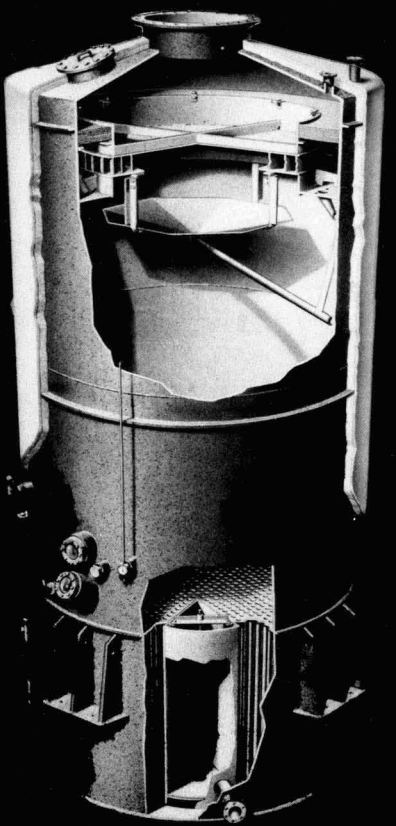

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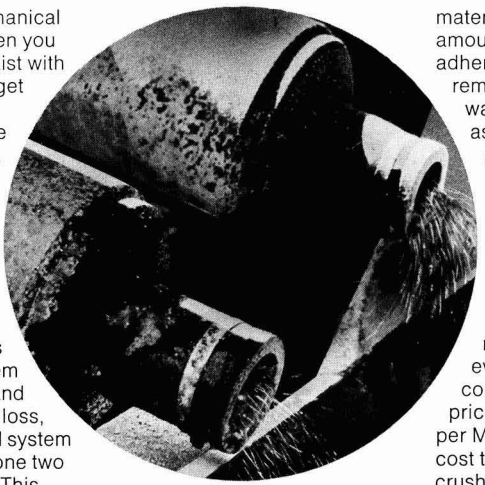
If you are involved with mechanical harvesting of sugar cane, then you face a problem that didn't exist with hand cutting. Soil and sand get into the process. Thorough washing won't always get the sand out. And all it takes is a little bit of sand to ruin expensive machinery. Or to overload equipment. And contaminate your juice.



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Ordinary desanding systems can't handle the sand problem adequately. For complete sand removal, with minimal sugar loss, you need the most advanced system on the market — the DorrClone two stage sand removal system. This economical system is designed to remove approximately 95% of coarse and fine material, up to about 300 mesh (50 microns). It handles any mill capacity.

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The compact packaged system can be located in any convenient area or elevation. And if you already have existing pumps, tanks or other machinery, your initial cost is even lower than if you buy the complete package. The package price is as little as $3-$6 (U.S.) per M.T.C.D., ex works. The actual cost to any given user depends on crushing capacity. Total installed cost depends on factory layout and location.

For further information, write Larry Engel, Dorr-Oliver, International Headquarters, Stamford, Connecticut U.S.A. 06904.

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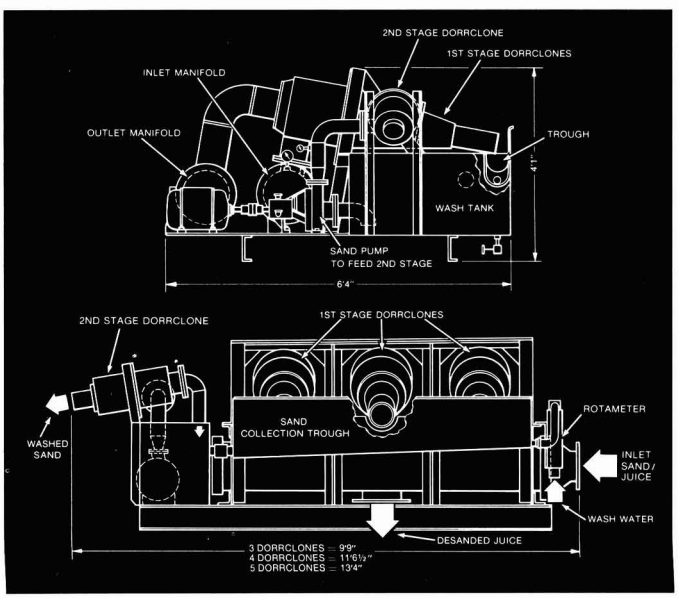

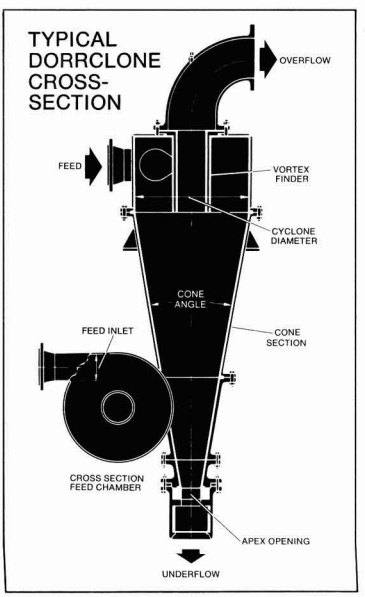

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Whether built in Farrel's U.S.A. plants, or made to our designs and specifications by licensed manufacturers in other countries, the Farrel name ensures the best.

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  Ambala District
  Haryana, India
- **POMINI-FARREL S.p.A.**
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  Mexico 18, D. F., Mexico
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For other sources consult Farrel headquarters in Ansonia, Conn., U.S.A.

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Farrel also pioneered the larger mill sizes that are meeting increased demand in today's sugar factories. We produced our first 90" mill in 1877 and have consistently maintained a position of leadership through a continuing program of design refinement.

For further information send for a copy of Bulletin 312B which describes in detail Farrel equipment and services for the sugar industry. Write to Farrel Company Division, USM Corporation, Ansonia, Conn. 06401.

A-1-42

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USM Corporation

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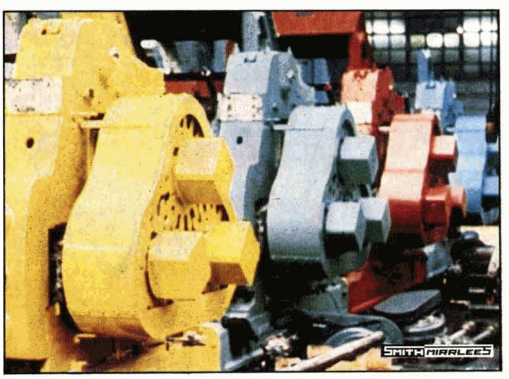

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August 1976

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SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Echantillons pour doser le sucre des diverses variétés de cannes dans des lots d'essais récoltés mécaniquement. J. C. SKINNER. *p.* 227–230

On donne le compte rendu d'expériences ayant pour but de comparer des échantillons de cannes de 15 pouces (bûchettes) obtenus avec l'arracheuse avec les échantillons de tiges entières utilisés précédemment dans les stations expérimentales du Queensland pour la mesure de la teneur en sucre. Les résultats montrent que les bûchettes fournissent une mesure directe du sucre à la fois dans les tiges de la canne et les matières étrangères en même temps qu'elles montrent moins de penchants systématiques que les échantillons de tiges. D'un autre côté, les échantillons de tiges donnent une meilleure indication des performances des variétés et montrent moins d'erreurs d'échantillonage au hasard. La sélection indirecte basée sur les échantillons de tiges est plus efficace que la sélection direct basée sur les échantillons de bûchettes. On estime que la dimension optimale de l'échantillon est de 6 tiges ou 60 bûchettes au hasard par lot.

* * *

British Sugar Corporation Ltd. 23ème Conférence Technique. *p.* 230–231

On donne un compte rendu de la 23ème Conférence Technique de la British Sugar Corporation qui s'est tenue à Eastbourne du 7 au 10 juin 1976. On donne un bref aperçu des communications présentées.

* * *

Morceaux de sucre suédois. *p.* 232–234

On donne des informations sur la méthode continue de production de morceaux à partir de sucre humide par vibration mise au point par la Corporation Sucrière Suédoise. L'emballage des morceaux, qui se caractérisent par une dissolution rapide, est synchronisé avec la mise en forme et le séchage des morceaux, la capacité nominale étant de 2.400 kg/heure.

* * *

Congrès 1976 des Sugar Industry Technologists. *p.* 235–237

On donne un compte rendu du 35ème congrès des Sugar Industry Technologists Inc. qui s'est tenu à Toronto, Canada, au début de mai 1976. On donne un bref aperçu des communications présentées et quelques notes sur la raffinerie Redpath, Toronto, et la raffinerie Westcane, Oshawa, qui ont toutes deux été visitées par les participants au congrès.

* * *

Beet Sugar Developments Ltd. *p.* 237

On donne des informations sur cette nouvelle société formée par la British Sugar Corporation Ltd. et le groupe W. S. Atkins, une des plus importantes firmes de conseils d'Europe. La société formée a pour but d'offrir une gamme complète de services allant de l'étude des possibilités d'un projet à la formation du personnel local pour faire fonctionner les installations et vendre le sucre en passant par la conception d'installations et d'usines de traitement des betteraves, la construction et l'adjudication.

Proben zur Bestimmung des Zuckergehaltes von Zuckerrohrsorten in maschinell geernteten Versuchen. J. C. SKINNER. *S.* 227–230

Es wird über einen Versuch berichtet, bei dem 15-Zoll-Rohrproben (Billets), die mit einer Erntemaschine erhalten wurden, mit den vorher in der Versuchsstation in Queensland zur Bestimmung des Zuckergehaltes verwendeten Proben mit ganzem Rohrstengel verglichen wurden. Die Resultate haben gezeigt, dass die Billets ein direktes Mass für den Gesamtgehalt an Zucker in Rohrstengel, Spitz und Blätter sind, aber eine weniger systematische Tendenz als Stengelproben zeigen. Auf der anderen Seite gaben die Stengelproben einen besseren Hinweis auf die Leistung einer Sorte und zeigten weniger Zufallsfehler bei der Probenahme. Die indirekte Selektierung an Hand der Stengelproben war wirksamer als die direkte Selektierung an Hand der Billet-Proben. Als optimale Probengrösse wurden 6 beliebig ausgewählte Stengel oder 60 Billets pro Parzelle ermittelt.

* * *

23. Technische Konferenz der British Sugar Corporation Ltd. *S.* 230–231

Es wird über die 23. Technische Konferenz der British Sugar Corporation berichtet, die vom 7. bis zum 10. Juni in Eastbourne abgehalten wirde. Ueber die vorgelegten Arbeiten wird ein Ueberblick gegeben.

* * *

Schwedischer Würfelzucker. *S.* 232–234

Es werden Einzelheiten über das kontinuierliche Vibro-Verfahren der Svenska Sockerfabriks Aktiebolaget mitgeteilt, bei dem Würfelzucker aus feuchtem Zucker durch Vibration hergestellt wird. Das Abpacken der leichtlöslichen Würfel erfolgt synchron mit dem Schneiden und Trocknen der Würfel mit einer Leistung von 2400 kg pro Stunde.

* * *

Zusammenkunft 1976 der Sugar Industry Technologists Inc. *S.* 235–237

Es wird über die 35. Zusammenkunft der Sugar Industry Technologists Inc. berichtet, die Anfang Mai 1976 in Toronto/Kanada abgehalten wirde. Ueber die vorgelegten Arbeiten wird ein Ueberblick gegeben. Ferner wird über einen Besuch der Tagungsteilnehmer in der Redpath-Raffinerie in Toronto und in der Westcane-Raffinerie in Oshawa berichtet.

* * *

Beet Sugar Developments Ltd. *S.* 237

Es wird über diese neue Gesellschaft berichtet, die von der British Sugar Corporation Ltd. und der W. S. Atkins-Gruppe, einer der grössten Konsultationsfirmen in Europa, mit dem Ziel gegründet wirde, ein vollständiges Spektrum an Dienstleistungen auf dem Gebiete von Projektsstudien, Bau von Rübenzuckerfabriken sowie Unterweisung von heimischem Personal hinsichtlich der Herstellung und der Vermarktung von Zucker anzubieten.

Muestras para medir el contenido de azúcar de variedades de caña de azúcar en experimentos con cosecha mecánica. J. C. SKINNER. *Pág.* 227–230

Se recuerdan experimentos con el fin de comparar muestras de caña en trozos de 15 pulgadas de largo con muestras de tallos enteros como utilizado en el pasado en los estaciones experimentales de Queensland para medir el contenido de azúcar. Los resultados demuestran que uso de los trozos provee una medida directa de azúcar en el tallo más materia extranea de la caña, mientras que tiene menos prejuicio sistemático que uso de muestras de tallo entero. Por otra parte, muestras de tallo entero proveen una mejor indicación de comportamiento varietal y tiene menos error aleatorio de muestreo. Selección indirecta, basado en muestras de tallo entero, es más efectivo que selección directa basado en muestras en trozos. El tamaño óptimo de la muestra es estimado como seis tallos seleccionado al azar o 60 trozos por parcela.

* * *

British Sugar Corporation Ltd. 23a Conferencia Técnica. *Pág.* 230–231

Se presenta una memoria de la 23a Conferencia Técnica de la BSC celebrado las 7–10 junio 1976 en Eastbourne, Inglaterra. Se delinean los varios papeles presentados.

* * *

Azúcar sueco en cubos. *Pág.* 232–234

Se presentan detalles del método continuo de la Swedish Sugar Corporation para producir cubos de azúcar húmedo por medio de vibraciones. Embalaje de los cubos rapidamente-disolubles es emparajado con la formación y secado de los cubos, siendo capacidad nominal 2400 kg por hora.

* * *

Sugar Industry Technologists—reunión 1976. *Pág.* 235–237

Se presenta un informe de la 35a reunión de Sugar Industry Technologists Inc. celebrado en Toronto, Canada, a principios de mayo de 1976. Se delinean los papeles presentados, y se dan notas sobre la refinería Redpath en Toronto y la refinería Westpath en Oshawa, siendo ambos visitado por participantes en la reunión.

* * *

Beet Sugar Developments Ltd. *Pág.* 237

Se presenta información sobre esta nueva compañía formado por la British Sugar Corporation Ltd. y el Grupo W. S. Atkins (uno de los mayores compañías consultores en Europa) con el fin de ofrecer una gama completa de servicios, de estudios de factibilidad, diseño de planta y fábricas para elaborar azúcar de remolacha, construcción y poniendo en servicio activo, hasta instrucción de personal local en operaciones y venta de azúcar.

INTERNATIONAL SUGAR JOURNAL

VOL. LXXVIII AUGUST 1976 No. 932

Notes & Comments

International Sugar Organization

In accordance with a decision taken at the last meeting in April, the International Sugar Council met in London during June 1976 for its seventh session.

On the recommendation of the Consultative Committee, the Council agreed that (a) a Conference should be held with a view to negotiating a new International Sugar Agreement; (b) the Executive Director should request the Secretary-General of UNCTAD, pursuant to the provisions of paragraph (2) of Article 31, to convene such a Negotiating Conference; (c) the Conference should be called for the spring of 1977, if it can be so arranged, and should be given sufficient time to enable it to complete its work in one session; (d) all such preparatory work as may contribute to the success of the Conference should be carried out in the meantime. At the normal session of the Council, to be held 10th–19th November 1976, it will review the situation and in the light of developments take such measures as may be appropriate.

* * *

World sugar balance 1975/76

F. O. Licht have recently published[1] their second estimate of the world sugar balance for the crop year September 1975/August 1976, as follows, with comparative figures for the previous two crop years:

	1975/76	1974/75	1973/74
	(metric tons, raw value)		
Initial stocks	17,074,000	15,897,000	16,072,000
Production	82,047,000	79,282,000	80,673,000
Imports	22,761,000	24,386,000	24,705,000
	121,882,000	119,565,000	121,450,000
Exports	22,710,000	24,415,000	24,685,000
Consumption	79,855,000	78,076,000	80,868,000
Final stocks	19,317,000	17,074,000	15,897,000
Production change	+2,765,000	—1,391,000	+3,324,000
,, ,, %	+3·49	—1·72	+4·30
Consumption change	+1,779,000	—2,792,000	+2,912,000
,, ,, %	+2·28	—3·45	+3·74
Final stocks % consumption	24·19	21·87	19·66

The figures are substantially changed from the first estimate in February[2], especially in respect of consumption which is now estimated at a level more than a million tons lower. In addition, corrected figures for 1974/75 resulted in a somewhat higher figure for the initial stocks at September 1975. Thus, although production is now set a million tons lower than first expected, sugar availability is greater than the likely consumption, so contributing to a rise of over 2·2 million tons in the final stock figure compared with August 1975. The revisions in consumption estimates were generally for reductions in Europe and Asia, partly offset by increases for North and South America. Stocks for the end of the 1975/76 crop year are set at over 24% or almost the traditional 3 months' supply which used to be considered normal.

Dr. HELMUT AHLFELD, Managing Director of F. O. Licht KG, took part in a recent seminar organized by the US refiners, Amstar Corporation, and has been quoted as offering tentative projections for 1976/77 for which he put production at 86·5–87·5 million tons against a consumption of 82·9–84·7 million tons. This would mean a further increase in stocks, bringing the world sugar economy nearer the situation where price reductions would result and maybe then restore the former consumption habits which were so drastically and seemingly almost permanently changed by the higher costs to the consumer which came in 1974.

* * *

World sugar prices

The London Daily Price for raw sugar fluctuated between £173 and £182 per ton in June after falling from the level of £186 at the 1st of the month. The LDP(W) in the same period fell from £197 to £189 but then recovered and lay between £197 and £202 for much of the month. There have been two counteracting influences: the continuing drought in northwest Europe has persisted and forecasts of damage to the crop, particularly in France and Belgium, have had a bullish influence, although there has been rain in Eastern Europe and good crops have been reported from Italy and Spain.

As a bearish factor, the Brazilian Sugar Institute has announced a target of 130 million 60-kg bags, equivalent to more than 8·3 million metric tons, raw value, and this has been reinforced by reports of other good cane crops in the Southern Hemisphere, particularly from Australia, where the Director of the Bureau of Sugar Experiment Stations, Mr. O. W. STURGESS, announced that 1976 production is now estimated at 3·57 million tons, compared with 2,856,000 tons in 1975. Mr. STURGESS pointed out, incidentally, that Queensland's sugar growing productivity, at 86 tons of cane and 12·2 tons of sugar per hectare, was still climbing unlike other countries where productivity has reached a plateau.

In the meantime there has been a lack of improvement in consumption levels in the USA, Europe and Japan in spite of low price levels.

[1] *International Sugar Rpt.*, 1976, **108**, (16), 1–2.
[2] *I.S.J.*, 1976, **78**, 97.

E. D. & F. Man comment[1]: "Any major market movement during July will depend largely upon the weather in West Europe. If the drought continues, the outturn of the beet crop could be substantially reduced from earlier estimates. For example, in France, where north-eastern areas are seriously affected, production could be as low as 1·8 million tons compared with 3·0 million tons last year, unless there is a dramatic increase in rainfall between now and the end of July."

* * *

EEC—ACP sugar negotiations

The negotiations between the EEC and developing sugar-producing countries which took place on 29th April[2] broke down with the producers accusing the Community of "clear discrimination" against their group. The EEC had increased its minimum price offer from 255 Units of Account per metric ton of raws to 260 (equivalent to £180). The ACP countries in turn reduced their demand from 281 to 275 U.A. but the gap could not be bridged at the time.

Negotiations recommenced after the negotiators had attended the UNCTAD IV meetings in Nairobi and agreement was finally reached, albeit grudgingly, on the 5th June. The price to be guaranteed is 267 U.A. for a supply of sugar which will amount to some 1·25 million metric tons and will be backdated to 1st April. This latter is also a compromise; the ACP producers wanted the guarantee to be backdated to 1st January while the Farm Ministers had wanted it to apply to the EEC agricultural year which runs from 1st July. The guaranteed price is understood to take into account a refining margin of 0·5 U.A. per ton, and to include a contribution of 0·6 U.A. towards the storage levy and a quality premium of 0·48 U.A. per ton.

The ACP producers have said they accepted the offer because of their realization that world prices were falling and that the EEC had a surplus of production over consumption; nevertheless, in their view, the offer fell short of the terms of the Lomé Convention which provides that the EEC's sugar import price shall be fixed "within the price range obtaining in the Community" and so, they claim, should have been at least 281·5 U.A.

The EEC view was that the earlier offer of 260 U.A. was the best price guaranteed to Community producers and that for only part of their crops. With an obligation to buy ACP sugar and to sell an equivalent quantity of white sugar on the world market, the purchase involves a subsidy of some $60 million to the ACP producers. The Commissioner for Agriculture, Mr. LARDINOIS, who led the EEC negotiators, faced criticism for having offered too much, the UK Minister referring to the consequent £1,500,000 loss to British refiners because of the backdating. Nevertheless, the agreement was subsequently endorsed by the EEC Council of Ministers at a meeting later in June.

* * *

Booker's Guyana interests acquisition by Government

It was announced on 14th February that there were to be discussions between the Guyana Government and Booker McConnell Ltd. for the acquisition of the company's interests in Guyana. An agreement has now been reached with the Guyana Government and this was signed in Georgetown on 25th May. The agreement took effect from 26th May, the tenth anniversary of Guyana's independence.

At the same time, various agreements were concluded with the Government of Guyana for the continuation of services which certain Booker McConnell subsidiaries in the United Kingdom have been providing for the businesses being taken over. These ongoing relationships will cover the international marketing of sugar and bulk rum, the provision of technical and agricultural services, and the purchasing and shipping of capital equipment and supplies.

A new company, Guyana Sugar Corporation Limited, has been formed by the Government to control and manage all the estates and factories in Guyana. This Corporation has concluded an agreement with Bookers Sugar Company whereby the latter will be responsible for the international marketing of Guyana's sugar for an initial period of four years in accordance with agreed Guyana Government policies.

The total amount receivable by the company for its shareholdings, after settlement of liabilities, should be around £10m in the form of £1,800,000 cash and the balance in the form of Guyana Government promissory notes payable with 6% interest over 20 years. The amount to be received is certainly below the real value of the assets acquired, estimated at £19m in the Company Report for 1975, and will be spread over a long period, but the board of Booker McConnell, in consultation with its legal and financial advisers, has reached the conclusion that in the circumstances prevailing in Guyana the agreement for the transfer of the businesses should be accepted as being the best that could be achieved in the interests of the shareholders.

The 1975 report and accounts showed that, following payment of the export levy on sugar of £33m, there was an attributable loss of £784,000 in Bookers Sugar Estates in Guyana. After allowing for this, the attributable after-tax profit from the Guyana companies in 1975 was £355,000. With the sugar levy unchanged, the Guyana companies would together have shown a substantial loss in 1976. The Guyana Government introduced the export levy on sugar in 1974 with the steep rise in the world price. It absorbed £21m of Bookers Sugar Estates' £48m revenue in 1974 and £33m of its £57½m revenue in 1975.

The company's activities in the United Kingdom and elsewhere are continuing satisfactorily. The latest estimates indicate that Booker McConnell's profit this year, without the Guyana companies, should not be much below the total achieved in 1975. The board sees no reason at this time why the 1976 results should not justify an increase in the company's ordinary dividend up to the maximum amount currently permitted.

* * *

Thailand 1975/76 campaign results[3].—According to reports from Thailand, the 1975/76 sugar season ended with a total cane tonnage crushed of 19,099,066 metric tons, substantially more than in the year before (13,413,442 tons). From this cane quantity 1,123,518·7 tons of raw sugar, 40,515·3 tons of refined sugar and 439,558·5 tons of plantation white sugar were produced, the corresponding figures from 1974/75 being 548,991 tons, nil and 511,337·4 tons. The average yield was 8·395% compared with 8·083% in 1974/75.

[1] *The Sugar Situation*, 30th June 1976.
[2] *I.S.J.*, 1976, **78**, 161.
[3] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (17), 16.

Samples for measuring sugar content of sugar cane varieties in mechanically harvested trials

By J. C. SKINNER
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Introduction

IN 1973 and 1974 all of the Bureau's experiment stations changed from manual to mechanical harvesting, making it necessary to develop new methods for obtaining quantitative data from field experiments. A bin-mounted weighing machine was constructed at Meringa Experiment Station in 1974[1], providing rapid weighing of cane harvested from small plots by the chopper-harvester. Experiments were carried out on several other aspects, including the question of whether samples of billets (portions of stalk about 380 mm or 15 inches long) from the harvester should replace the whole-stalk samples used previously for measuring c.c.s. (sugar content). For manually harvested trials, a sample consisting of six random stalks was taken from each plot. Only sound stalks were sampled, dead stalks and suckers not being included, and the green top portion normally discarded during manual harvesting was discarded before analysing the samples. These samples provided an estimate of c.c.s. higher than that obtained at the factory for cane from the trials, but provided a good indication of the relative c.c.s. of different varieties. Sampling experiments have shown that this sample size was adequate for the standard plots (about 0·004 ha), and the grading system[2] penalizes varieties which have characters such as dead stalks, suckering or lodging which would reduce sugar content below the estimate provided by the sample. When a yield sampling method was developed[3] to obtain results from mechanically harvested trials on farms, the whole-stalk c.c.s. sample was retained. No method was available for obtaining samples of billets from these trials, whereas they could be obtained from trials harvested mechanically on the experiment stations. The billets produced by the chopper-harvester include sound cane, dead cane, suckers and, in lodged cane, the heavier (spindle or cabbage) part of the tops. On general grounds, it seemed likely that billet samples would be superior to whole-stalk samples, especially in lodged and suckered trials, providing a better sample of the material sent to the factory from each plot.

MATERIAL AND METHODS

The experiments were conducted on the final replicated yield trials harvested on Meringa Experiment Station from 1973 to 1975. Details of the experiments are summarized in Table I.

In all experiments, 1·5 units of c.c.s. was subtracted from each billet and whole-stalk c.c.s. estimate, this being a standard procedure to allow for an average amount by which c.c.s. estimated by crushing stalks in a laboratory mill exceeds c.c.s. measured on first expressed juice at the factory[4].

Experiment 1

The trial was harvested in December 1973, following a clean burn. The cane was mainly sprawled, with moderate suckering. Two whole-stalk and two billet samples were taken from the middle row of each plot and analysed for sugar content, in order to provide estimates of sampling error. Each stalk sample consisted of six random stalks. Each billet sample consisted of about 30 billets: It was collected, bagged and labelled by two men in the mill bin, after the billets were weighed and released from the weighing device on top of the bin (Fig. 1). The only materials omitted from the sample were leaves with little or no cabbage, and completely dried rotten billets. No attempt was made to obtain an even distribution of tops, middles and butts. Suckers as well as rotten juicy billets were included. The sample was collected very rapidly and this ensured that subjective choice had very little influence on the billets included. It was necessary to use this type of sample, because it would have taken too long to collect a completely random sample.

Optimum sample size was estimated using the methods described by SKINNER[5].

Experiment 2

This trial was harvested immediately after Experiment 1. A clean burn was obtained. The cane was sprawled-to-lodged and heavily suckered, some plots having large suckers with millable cane. One whole-stalk sample and one billet sample were collected from each plot, using the method given for Experiment 1.

[1] BARNARD & SKINNER: *I.S.S.C.T. Sugarcane Breeders' Newsletter*, 1974, **34**, 4–9.
[2] SKINNER: *Proc. 12th Congr. I.S.S.C.T.*, 1965, 938–949.
[3] HOGARTH & SKINNER: *Tech. Comm. Bureau Sugar Expt. Sta.*, 1967, (1).
[4] MOLLER: *Ann. Rpt. Bureau Sugar Expt. Sta.*, 1971, 32.
[5] SKINNER: *Proc. 15th Congr. I.S.S.C.T.*, 1974, 153–167.

Table I. Details of all experiments, with general means and coefficients of variation

Experiment	Year of harvest	Plant (*P*) or ratoon (*R*)	Design*	Number of replications	Plot size (ha)	Number of treatments: New varieties	Number of treatments: Standard variety	Number of treatments: Total	General mean: Billet c.c.s.	General mean: Stalk c.c.s.	Coefficient of variation: Billet c.c.s.	Coefficient of variation: Stalk c.c.s.	Coefficient of variation: Metric tons per ha
1	1973	*R*	5×6 *RL*	2	0·00325	27	3	30	14·23	14·86	4·4	3·1	8·9
2	1973	*R*	7×8 *RL*	2	0·00373	51	5	56	13·14	14·00	7·4	4·5	11·9
3A	1974	*P*	5×6 *RL*	2	0·00389	27	3	30	11·85		8·2		9·7
3B	1974	*P*	*RCB*	2	0·00534	18	2	20	12·01		7·9		21·0
3C	1974	*R*	5×6 *RL*	2	0·00368	27	3	30	14·62		4·5		7·9
3D	1974	*R*	5×6 *RL*	2	0·00368	27	3	30	14·74		3·2		10·4
3E	1975	*P*	*RCB*	3	0·00534	38	7	45	11·46		6·4		10·6
4	1975	*P*	*RCB*	2	0·00403	30	5	35	9·46	11·86	14·4	6·2	11·2

* *RCB* = Randomized complete blocks, *RL* = Rectangular lattice. An *RCB* analysis was used when calculating variance components in Experiment 1. An *RCB* analysis was used for billet c.c.s. only in Experiment 2, because four billet samples had deteriorated, resulting in missing plots.

Experiment 3

Billet samples were used instead of whole-stalk samples for four trials harvested in 1974 and for one trial harvested in 1975. These trials provided practical experience with billet sampling, as well as estimates of coefficient of variation, and routine trial results. In the 1974 trials the billets were collected by hand using the method already described. A billet-collecting chute was constructed for the 1975 trials. It consisted of an open metal trough 1·027 m long, 0·303 m wide and 0·140 m deep. It was suspended below the middle of the weighing machine and collected a sample of about 30 billets when the load was released after weighing. One end was attached to a pivot point on the sub-frame of the weighing machine. The other end had bag hooks and a chain to hang it from the sub-frame. After a bag was attached, this end was lowered and the contents of the chute emptied into the bag. Some manipulation was necessary to get the billets into the bag, but it was convenient and objective, although not necessarily a completely random sample. When the mill bin became too full the chute could not be used, and similar samples were collected by hand.

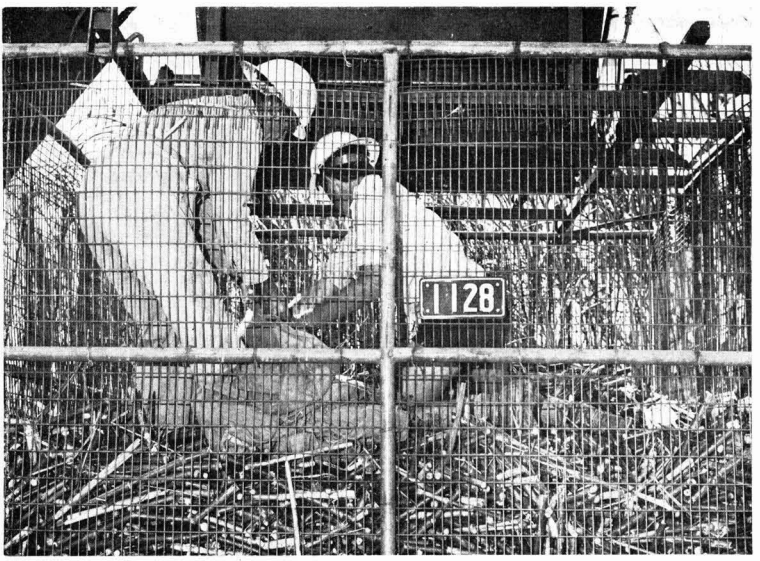


Fig. 1

Experiment 4

This was a rich land trial with lodging and very bad suckering in a number of plots. One whole-stalk sample and one billet sample were collected from each plot and genotypic, phenotypic, and environmental correlations between billet c.c.s. and stalk c.c.s. were calculated.

Results

The optimum sample size for billet and stalk c.c.s. samples can be decided from data presented in Table II. These figures are based on the following estimates of the variance components obtained from the analysis of variance of Experiment 1. The components of error variance due to error at a plot level (σ_e^2) and to sampling a plot (σ_s^2) are given, together with the total genetic variance between the varieties in the trial (σ_G^2):—

	Billets	*Whole stalks*
σ_s^2	0·298	0·163
σ_e^2	0·088	0·043
σ_G^2	0·580	0·611
General mean ..	14·233	14·862

Correlations between billet and stalk c.c.s. are given in Table III, and Table IV compares the two sampling methods in Experiment 4. General means and coefficients of variation for c.c.s. samples in comparison with tons cane per hectare are given in Table I.

Table II. Effect of size of sample on coefficient of variation (CV), degree of genetic determination (g^2), gain from selection(ΔG), and correlated response to selection (CR_Y), in Experiment 1.

Type of sample	*Number of units**	*CV*	g^2	ΔG (%)	CR_Y** (%)	$\frac{100\ CR_Y}{\Delta G_Y}$ (%)
Billets (Y)	1	4·4	0·60	5·8		
	2	3·4	0·71	6·3		
	3	3·0	0·76	6·5		
	4	2·8	0·78	6·6		
	5	2·7	0·80	6·7		
	10	2·4	0·83	6·8		
Stalks (X)	1	3·1	0·75	6·4	5·9	102
	2	2·4	0·83	6·7	6·2	99
	3	2·1	0·86	6·8	6·4	98
	4	1·9	0·88	6·9	6·4	97
	5	1·8	0·89	6·9	6·5	97
	10	1·6	0·91	7·0	6·5	96

* One sampling unit = 30 billets = 6 whole stalks.

** Adjusted means from the rectangular lattice analysis were used to calculate correlations whereas the CV, g^2 and ΔG are based on a randomized complete blocks analysis. However, the error introduced into the estimates of CR_Y would be small, because the efficiency of the rectangular lattice design over randomized complete blocks was fairly low, being 125% for billet c.c.s. and 111% for stalk c.c.s.

Table III. Correlations between billet c.c.s. and stalk c.c.s. Where available, the standard error is given after the ± sign.

Experiment	*Number of samples per plot*	*Correlation*		
		Genotypic	*Phenotypic*	*Environmental*
1	2	0·91±0·06	0·85±0·03	0·44±0·15
2	1		0·84	
4	1	1·02±0·07	0·86±0·02	0·28±0·17

Table IV. Efficiency of billet and stalk c.c.s. samples, as shown by coefficient of variation (CV), degree of genetic determination (g^2), gain from selection (ΔG) and correlated response to selection (CR_Y), in Experiment 4.

Type of sample	*CV*	g^2	ΔG (%)	CR_Y (%)	$\frac{100\ CR_Y}{\Delta G_Y}$ (%)
Billets (Y)	14·4	0·57	17·5		
Whole stalks (X)	6·2	0·74	12·7	20·0	114

Discussion

One whole-stalk sample (six random stalks) contains about the same amount of cane as one billet

sample (about 30 billets) but billet samples are more variable (Table II). This may be partly due to a less adequate sampling technique. However, it is probably mainly due to the fact that the stalks represent only healthy millable cane whereas the billet sample covers a wider range of material including sound cane, partly rotted cane, suckers, and spindle material from the tops. Although statistically significant results are provided by one billet sample, the optimum sample size for billets is two units (60 billets), there being little gain in accuracy by using larger samples. Two whole-stalk samples (that is, 12 random stalks) would be worthwhile if very precise c.c.s. results were required, but one sample of six stalks is sufficient for routine variety trials. In these trials, c.c.s. estimates are mainly used to calculate metric tons sugar per hectare, i.e. the product of c.c.s. and tons cane per hectare. In Experiment 1, the coefficient of variation was about three times as large for tons cane per hectare as for c.c.s. estimated from one sample of six stalks (8·9 *vs.* 3·1, Table I), so a reduction in the sampling error for c.c.s. would have little effect on variability of tons sugar per hectare.

The coefficient of variation for billet sampling was much higher in Experiment 2 than in Experiment 1 (Table I). Experiment 2 was harvested immediately after Experiment 1 and, because of a large amount of c.c.s. analysis involved in experiments in the first trial, analysis of some samples from Experiment 2 was delayed for slightly more than 24 hours. This delay had no obvious effect on the whole-stalk samples but the billet samples deteriorated under the hot conditions, and four of them gave juice that could not be clarified or analysed. Billet samples must be analysed as promptly as possible so that the coefficient of variation will then be low enough to be acceptable. Billet sampling with one sample (30 billets) per plot was adopted as standard practice for all trials harvested in 1974 and for the first trial harvested in 1975. The results were satisfactory, although the coefficient of variation was fairly high in some trials (Experiment 3, Table I).

As successive trials in Experiment 3 were harvested the practical limitations of billet sampling were realized. It was found that one man working on the ground could sample whole stalks from each plot in a trial more rapidly than two men in the cane bin could sample billets. This became more obvious in 1975 when an improved version of the weighing machine overcame the need to have a man in the mill bin to spread the load, and the two men needed in the bin to collect billet samples could not keep pace with the weighing machine, thus slowing down the harvest operation. The billet-collecting chute was partially successful but could not be used once the mill bin became too full of cane. A chute attached to the small crushing mill assisted crushing of billets, but it took about twice as long to crush a billet sample compared with a whole stalk sample.

After the first trial had been harvested in 1975, whole-stalk samples again became the standard method. Late in the season the rich land trials were found to be in poor condition, with very bad suckering and lodging. More than 50% of the weight of some plots consisted of immature suckers. It seemed likely that billet samples would be much superior to stalk samples in such trials, so Experiment 4 was conducted. The results were quite unexpected, stalk samples being more efficient than billet samples. The genotypic correlation between c.c.s. estimated from billet and stalk samples was 1·0, the phenotypic correlation being lower (0·86) because of a very low environmental correlation (Table III). The stalk samples gave a much lower coefficient of variation and a higher degree of genetic determination, but billets gave a larger estimated gain from selection (Table IV), so that these criteria did not permit a clear choice between the two sampling methods. However, when selection was based on stalk samples, the correlated response in billet c.c.s. was 14% greater than the response from direct selection based on billet samples (Table IV). The true c.c.s. of each plot could not be measured in these experiments but its phenotypic correlation with billet c.c.s. would be less than 1·0, so the present experiment tends to underestimate the value of whole-stalk samples relative to billet samples.

A similar analysis was then applied to Experiment 1 and again indicated stalk samples to be superior. In this case (one unit in sample, Table II) selection based on stalk samples gave a response in billet c.c.s. 2% higher than that obtained by direct selection using billets, and stalk samples were superior in all other criteria (lower CV, higher degree of genetic determination and higher gain from selection). In this experiment the genotypic correlation between stalk and billet c.c.s. was less than 1·0 (0·91, Table III) but it showed the same pattern as Experiment 4 with a high genotypic correlation, a low environmental correlation, and an intermediate phenotypic correlation.

The unexpected superiority of stalk samples in Experiment 4 can be understood by examining the formulae used[6] to estimate gain from direct (ΔG) and indirect (CR_Y) selection for billet c.c.s., both being expressed as a percentage of the general mean for billet c.c.s. (GM_Y):

$$\frac{\Delta G_Y}{CR_Y} = \frac{140\, g_Y^2\, \sigma_Y}{GM_Y} \div \frac{140\, r_G\, g_X\, g_Y\, \sigma_Y}{GM_Y}$$

$$= r_G \cdot \frac{g_X}{g_Y}$$

Thus, indirect selection will be more effective than direct selection if the product of the genetic correlation (r_G) and the square root of the degree of genetic determination for stalk c.c.s. (g_X) is greater than the square root of the degree of genetic determination for billet c.c.s. (g_Y).

FALCONER[6] pointed out that, if the desired character is difficult to measure with precision, the errors of measurement may so reduce the heritability that indirect selection becomes advantageous. He stated that threshold characters in general are likely, for this reason, to repay a search for a suitable correlated character. Indirect selection based on stalk samples was more effective than direct selection based on billet samples, because the genetic correlations were high and the degree of genetic determination was substantially higher for stalk c.c.s. than billet c.c.s. It is difficult to measure billet c.c.s. with precision, and lodging may be regarded as a threshold character. Lodging usually occurs when a threshold (due to lodging resistance of the variety) is exceeded because of wet soil conditions combined with wind. Lodging is often variable and associated with more severe suckering, extraneous matter and low sugar content.

[6] "Introduction to Quantitative Genetics". (Oliver & Boyd, Edinburgh), 1960, pp. 320–321.

It is generally considered that a sampling method should meet the following requirements:—

(i) Sampling error should be small compared with other sources of variation.

(ii) It should be free from bias.

For the first requirement, stalk samples are clearly superior but, because they sample only sound cane free from extraneous matter, they provide a biased sample of the material harvested for milling from each plot. Each billet and stalk c.c.s. estimate was reduced by 1·5 units before analysis. Without this routine adjustment the mean values in Experiment 4 were:

	Billet c.c.s.	*Stalk c.c.s.*
General mean	10·96	13·36
Difference from factory c.c.s.	+1·16	+3·56

It is not known why the direct billet samples averaged 1·16 units above the factory c.c.s. of 9·80 for the cane harvested from this trial but possible factors include deterioration of the cane between harvest and milling and differences in composition of first expressed juice at the factory compared with the laboratory mill. The stalk samples show a bias 2·40 units of c.c.s. more than that shown by the billet samples. A sampling method with so much bias is not completely satisfactory. However, provided the relative values of different varieties are not altered much, this type of bias is not very serious in variety trials. It would be reduced by the independent adjustments made for suckering, lodging and dying stalks when grading varieties and is reduced in trials which are in good condition. The billet sample provides a direct measure of the harvested material with less bias and fewer assumptions than stalk samples. However, because of increased sampling error, billet samples are inferior to stalk samples for selection purposes. The superiority of stalk samples in a badly suckered and lodged trial (Experiment 4) indicates that stalk samples can be used in variety trials with confidence.

Although stalk samples are preferable for variety trials, the systematic bias they introduce may be serious in other trials, for example agronomy trials in which treatments affect lodging and suckering. The present experiments show that billet samples can be used for large-scale experiments, but the technical problems of collecting and analysing numerous billet samples have not all been solved.

ACKNOWLEDGMENTS

The author wishes to thank Dr. D. M. HOGARTH for statistical analysis of the data, the staff of the plant breeding division at Meringa for assistance in conducting the experiments, and Mr. D. LEBROCQ for the photograph.

SUMMARY

Samples of billets were compared with the standard six-stalk samples for estimating sugar content of plots in variety trials cut by a chopper-harvester. Billet samples provide a direct measure of all material (sound cane plus extraneous matter) harvested for milling from each plot and show less systematic bias than stalk samples, especially when lodging and suckering are extensive. However, stalk samples are more efficient for variety trials, showing less random sampling error and giving a better indication of relative performance. Considering all cane harvested from each plot (sound cane plus extraneous matter) indirect selection based on stalk samples was more effective than direct selection based on billet samples.

The optimum sample size was estimated to be six random stalks or 60 billets from a plot.

British Sugar Corporation Ltd.

23rd Technical Conference

IN addition to Corporation staff, guests from ten European countries, including Austria, Belgium, Denmark, Finland, France, Germany, Holland, Ireland, Sweden and Switzerland, and a representative of this *Journal* gathered during the 7th June at the Grand Hotel, Eastbourne, for the 23rd Technical Conference of the British Sugar Corporation Ltd. The proceedings were opened on the following morning by the Chairman, Mr. T. RODGERS, Production Director of the Corporation and a member of our Panel of Referees, who welcomed the overseas visitors and the UK participants. These included the Works Managers of the Corporation's 17 sugar factories, personnel from the Technical Headquarters, Central Laboratories and Research Laboratories, and five retired former senior staff.

Mr. RODGERS referred to UK membership of the EEC, confirmed by referendum since the previous Technical Conference, and spoke of the possibility of well-meaning but uninformed legislation from Brussels —similar to anti-trust legislation in the USA—which might restrict interchange of information among sugar companies and at an extreme case prohibit such conferences of EEC sugar technologists as the present.

The first paper, presented by J. V. DUTTON and colleagues from the B.S.C. Research Laboratories, described a study made to determine the important factors governing beet quality in the UK and the changes in these which have resulted in poorer juice quality. Top tare had increased over the past ten years as a consequence of mechanical harvesting of beet sown to a stand, which gives less accurate topping, higher tare and losses to both grower and the Corporation. The major cause of low juice purity, however, is the presence of pyrrolidone carboxylic acid formed from an excessive quantity of glutamine in the beets as a result of nitrogen fertilization in amounts greater than required for optimum growth. This is again expensive to both grower and Corporation and needlessly so.

The second paper, presented by MM. J. PONANT and G. WINDAL of U.C.B., France, described a new instrument they have developed for on-line thick juice and molasses purity measurement, using a conductivity ash signal as a measure of purity after dilution to a Brix of about 30°. The prototype instrument was tested in two factories with satisfactory results and a modified instrument is now in production.

The occurrence in dried molassed pulp of the elements classified as undesirable for animal feeding by EEC legislation has been examined by the Central Laboratories, as described in a paper by D. HIBBERT and colleagues; values found for lead, mercury, copper, fluorine, cobalt, manganese and vanadium were well below the limits set by the appropriate directive and only arsenic gave any cause for concern since a level higher than the limit had been found in the fines from dryers which had been heated with flue gases from a coal-fired furnace, there being a wide variation in the arsenic content of coal from different sources. A remedy may be found in use of oil or gas firing, selection of low-As coal, or elimination of the pulp dust which contains the highest concentrations of arsenic.

After lunch, J. F. T. OLDFIELD, B.S.C. Agricultural and Research Director, described the present situation in the UK so far as the beet crop was concerned and discussed prospects for the 1976 harvest. After an early start, cold dry weather had slowed germination and there had been some damage by pests and disease. Adequate rain had fallen from mid-May except in parts of eastern England and, while there had been a heavy incidence of aphids, it was not known how many were disease-bearing, although 30% of the crop had been sprayed as a precaution against virus yellows. With an area of 207,000 hectares,12,000 more than in 1975, an average to above-average crop could be expected if weather conditions were favourable during the rest of the growing season.

Similar conditions were reported from the other countries represented, with a potentially good crop in prospect if weather was favourable. Small increases in area were reported from all, with the exception of Belgium where farmers had planted only 100,000 ha as against 119,000 ha in 1975.

A new process for the separation of molasses into higher- and lower-purity fractions was then described by H. HONGISTO of the Finnish Sugar Co. Ltd., the process being a type of chromatography on ion exchange resin. With control based on purity measurement, a molasses of e.g. 63 purity is fractionated into a 92-purity sugar solution and a 20-purity high-ash residual molasses. Little labour is required and the payback period of the plant is calculated as less than 1½ years.

The last paper of the day, by P. M. S. DIXON, Industrial Relations Manager of B.S.C., discussed the effects of recent changes in attitudes to work and the combination of trade union strength and legislation in the UK. The measures which can be taken to maintain industrial harmony require improved communications throughout the labour force, including management, training and flexibility for workers, and provision of amenities and minimization of boring and unpleasant tasks. Another possibility discussed included the introduction of four-shift instead of three-shift working.

At the Conference Dinner, given the same evening, guests were welcomed by Mr. J. BECKETT, Chief Executive of the Corporation, whose toast of "The Guests" was replied to by Mr. B. DIEDEN of Sweden, who had attended many of the previous Conferences. The evening concluded with a cabaret.

On the 9th June, the first paper was presented by R. F. MADSEN, of the Danish Sugar Company Ltd., who described the new technique used in Denmark for preparation of a seed slurry using polyethylene glycols as carrier media for the micro-crystals. These glycols are water-miscible, like *iso*-propanol as used elsewhere, but have higher viscosity and boiling point so that they do not evaporate or allow crystal sedimentation and are thus suitable for automated seeding of pans. The advantages and disadvantages of resistance measurement, refractometric and rheometric control of boiling were discussed and a description given of the fully automatic operation of a pan in Denmark. Application of a mini-computer at Saxjöbing factory was also described, and construction of pans discussed.

R. J. BASS and J. DONOVAN then presented an instructive demonstration with slides and examples of the micro-circuits used in modern computers and discussed the production and use of the micro-computer in the sugar factory, with particular reference to pan boiling control where the latest small units can be adequately protected from atmospheric contamination which would cause trouble and are sufficiently small and low-cost and have plug-in facilities to permit rapid change-over to a standby unit in the event of failure, as well as installation on the pan floor itself instead of a separate special control room.

The next paper, presented by P. MOTTARD and P. BONNENFANT, of G.T.S., France, discussed the improvement of molasses exhaustion and the determining factors—supersaturation, temperature and viscosity—which govern the purity achievable. The kinetics of low-grade massecuite crystallization provides a theoretical "ideal" curve and a means of holding conditions close to this curve has been devised which involves the use of a series of large vertical crystallizers, water-cooled and with a slowly-rotating stirrer, with the last unit used for reheating before the centrifugals.

After lunch, visits were arranged to places of interest nearby, while, for those so inclined, golf and fishing provided a pastime for the afternoon. The first paper of the following morning, presented by M. SHORE and N. W. BROUGHTON of B.S.C. Research Laboratories, provided a summary of work which had been carried out on the relationship between beet diffuser bacterial activity, lactic acid formation, corrosion, pulp pressing and sugar losses, and described trials on the elimination of bacterial activity and sugar loss by high formalin dosage with acidification using sulphuric acid to maintain sufficiently low pH for good pulp pressing. Corrosion was not significant while the savings through losses reduction were very much greater than the costs involved.

Mr. H. R. BRUNNER, of Aarberg sugar factory, Switzerland, described the geophysical layout of the Aarberg area and the measures taken by the factory to eliminate pollution of water discharged, by use of bio-filtration, surface aeration and biological sludge techniques, as well as experiments using a Lefrançois rapid fermenter and a new mechanical filter. The last paper of the Conference was a description by B. HUTCHINSON and D. HOGAN of experimental work on modifications to a pulp dryer and the economies achieved by these changes which permitted recycling of exhaust gases as dilution for the ingoing combustion gases. The Chairman then thanked the participants and organizers of the Conference and brought it to a close.

Swedish cube sugar

THE Swedish market has a large assortment of sugars, altogether 21 qualities spread over 52 different brands, as indicated in Table I.

In department stores, the sugar products are usually displayed in a prominent position, where the large assortment on sale offers the customers a wide choice.

The cube sugar assortment plays an important part, reaching about one-eighth of consumption. Apart from supplying the percentage allowance to cover fixed costs, cube sugar is considered to have a market stabilizing effect, as the large assortment nfluences the customers to develop stable buying habits. The various kinds are indicated in Table II.

Table II

Cube sugar qualities	*Brand*	*Manufacturing method*	*Tons/year*
Hard cubes cut from slabs	1 kg unranged	Pressing	22,600
	Portion	,,	1,100
	20 kg unranged	,,	1,200
Adant or similar	1 kg ranged	Vibration	5,700
Quick-dissolving	1 kg ranged	,,	10,700
	0·5 kg ranged	,,	1,300
	Portion	,,	1,400
		Total:	44,000

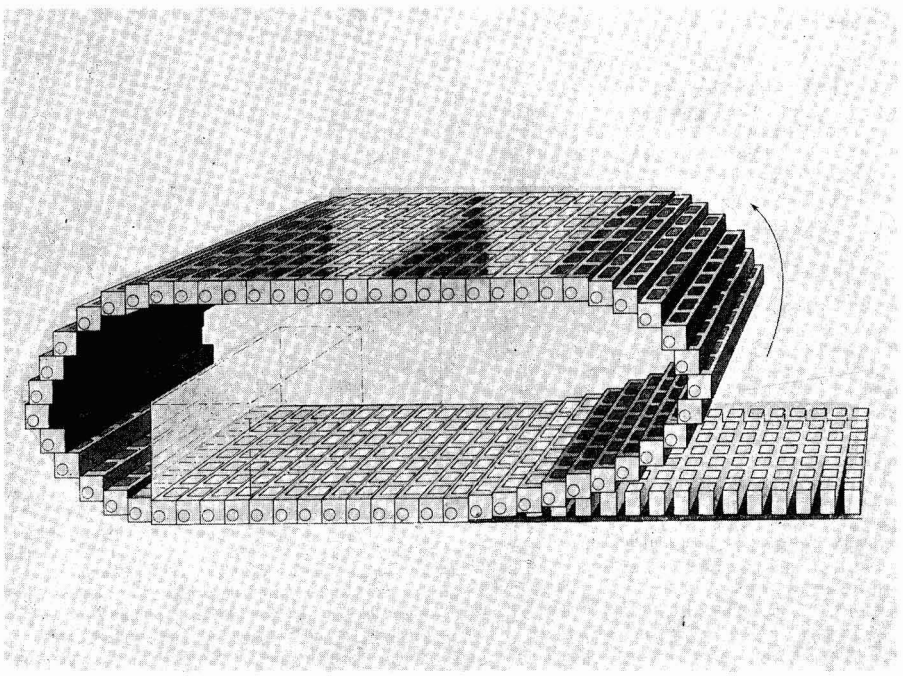


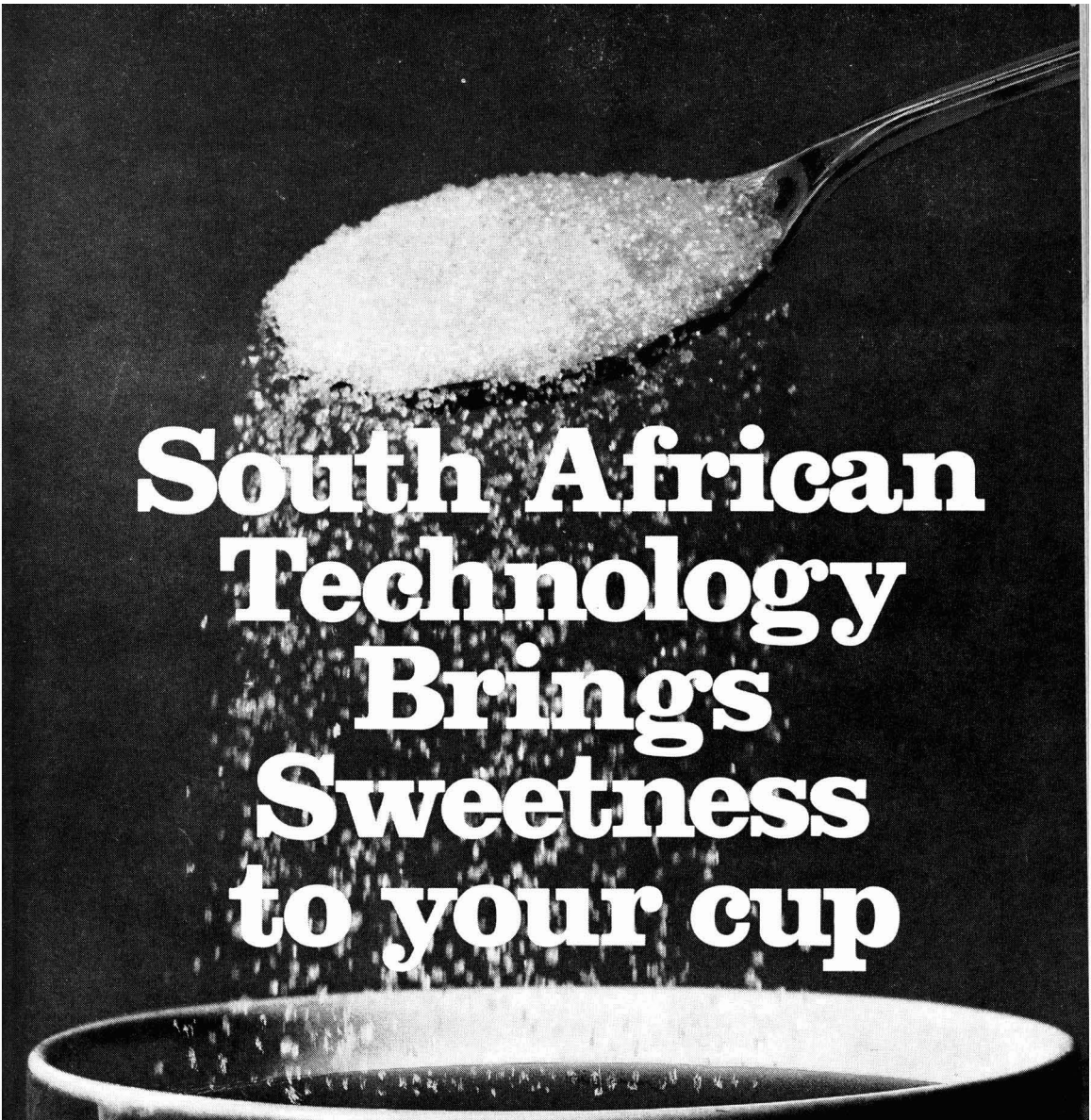
Fig. 1. The SSA cube sugar system vibrates moist sugar into cubes. The forming unit comprises about 250 "Teflon"-coated form elements, which move in a continuous cycle through the filling, compacting, emptying and cleaning stations. The cubes are deposited on a steel belt that conveys them to the drying and packing.

Table I

	No. of qualities	*No. of brands*	*Tons/year*	*% of total*	*kg per head/year*
Granulated sugar	8	18	280,000	79·1	34·1
Cube sugar	3	8	44,000	12·4	5·4
Misc. sugar products	6	9	12,000	3·4	1·5
Table syrup	4	17	18,000	5·1	2·2
Total	21	52	354,000	100·0	43·2

Cube sugar made by the vibration method was introduced as a trial in 1960. Since then, it has been sold in increasing amounts, at the expense of the pressed cubes. This method of producing sugar is unique. It was developed by Svenska Sockerfabriks AB. (SSA), to replace the labour-demanding Adant method in the production of high-quality cube sugar. The vibration system very soon proved to be an even greater marketing success when it was used to manufacture quick-dissolving cube sugar. The four cube-sugar brands that are now being manufactured by the vibration method each have their own cube size, which shows the diversity of the system.

When SSA decided to develop a new method for cube sugar production, there were already a number of modern machines in existence based on the pressing method. In spite of this, it was decided that the SSA system should be developed because its unique production technique provides a valuable freedom of choice regarding the hardness, size and shape of the cube sugar, as well as in the design of the packs. The system has been designed on the basis of continuous production as a rational, modern, large-scale manufacturing process for cube sugar. The SSA system is tailored to a cube sugar market where assortment adaptability is especially important. In addition, the appearance of the vibrated cube sugar has a characteristic beauty, as the crystals are not crushed and cannot be polluted by a releasing-agent, which is the case in the pressing method.



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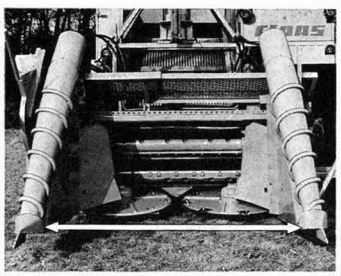

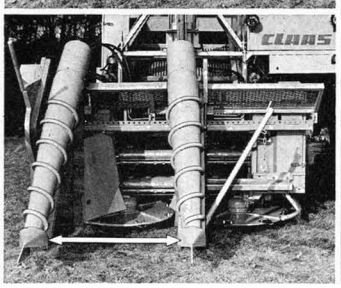

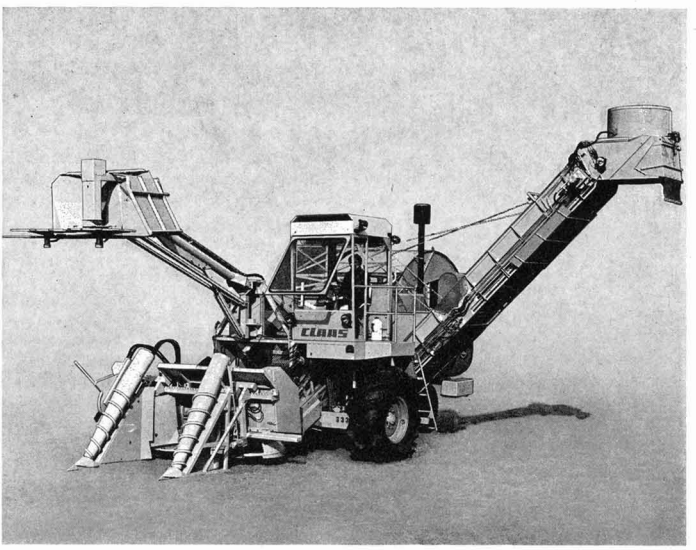

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The principle of the SSA system for forming the cubes was adopted from the modern concrete technique, which uses vibration to homogenize and densify the concrete. The forming of the sugar entails the use of form elements: bars of "Teflon"-coated aluminium with holes of the same shape as the sugar cubes.

The forming machine chiefly comprises a circuit of approx. 250 form elements which are successively filled, compacted and emptied, washed and dried, in a continuous cycle.

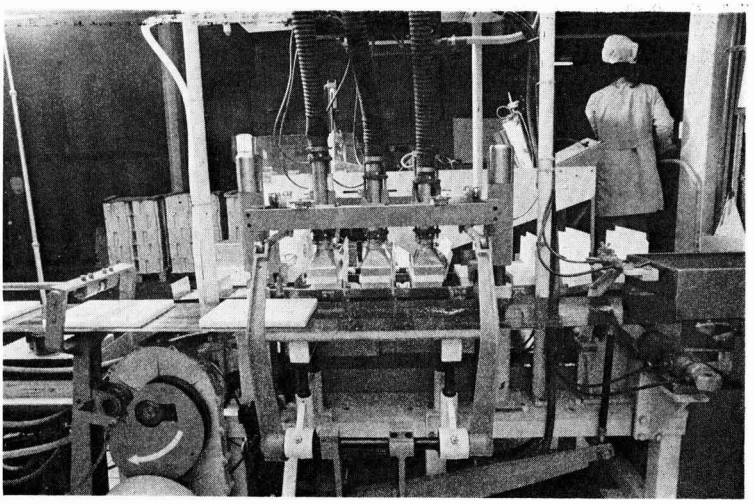

Fig. 2. After grouping, the sugar cubes are transferred into the cartons by means of suction pads. The cartons are filled three at a time. The packing machine operates at a rate of 40 cartons a minute.

Controlled vibration gives the sugar cubes the correct weight; the moist sugar (water content approx. 2%) is filled into the holes in the forms at the same time as it is vibrated. The vibration is regulated by an electronic weigher, which senses the weight of the ready-packed transport cases. If underweight is registered, the amplitude of the vibration is increased and vice-versa. In this way the weight deviations caused by variation in the sugar quality are counteracted. The filling process takes only about one second.

After filling, the cubes are compacted by another, similar vibration. During this phase, the size of the cubes is regulated so that they can be ranged with a suitable tolerance into the cartons.

After compacting, the cubes are loosened from the form holes by vibration. The cubes then remain on a steel belt conveyor that moves them along through the drying and cooling zones, and on to the packing.

After emptying, the form elements continue in their cycle, and are flushed clean by hot-water jets, then blown dry by an air-stream from a fan. They then recycle for a new filling, and the process is repeated. The "Teflon" coating needs renewing after approx. 400 hours of operation. This renewal procedure can normally be repeated about 5 times, after which the forms are scrapped. It is advantageous to coat at one's own workshop. The total costs for the forms are as a rule not more than about 5% of the packing material cost, based on a 1-kg, ranged carton in a transport case.

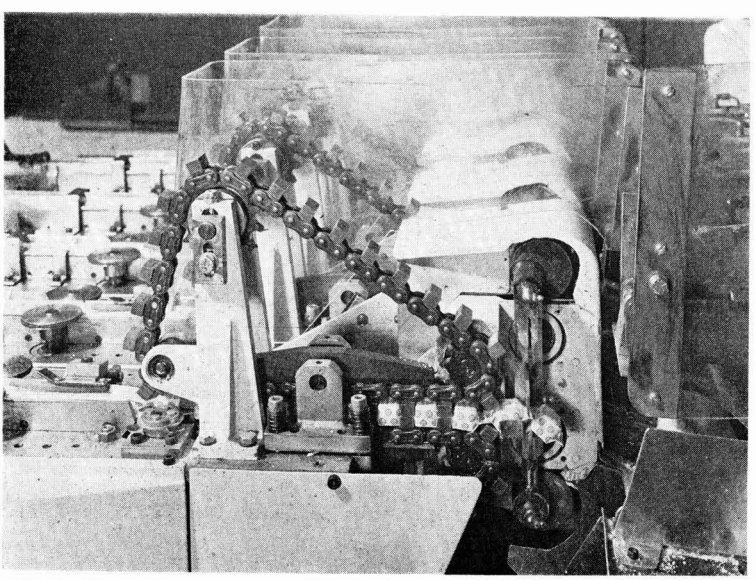

Fig. 3. The portion-wrapper wraps 3000 double-cube portions per minute. The wrapping paper is formed into a tube, which is cold sealed and cut between each pair of sugar cubes.

The sugar cubes on the steel belt pass through a quick-drying stage before they reach the packers at the end of the conveyor. A period of approx. 40 seconds and 80 kWh per ton of sugar are sufficient, when high-frequency energy is used, even if the cubes have a quality similar to Adant, i.e. higher density (1·04) and lower porosity (0·35) than quick-dissolving sugar cubes. This is the way in which the older installations are equipped at the Arlov refinery, as cubes similar to Adant sugar were an important commodity on the market when the SSA system was introduced. The higher density is obtained by a

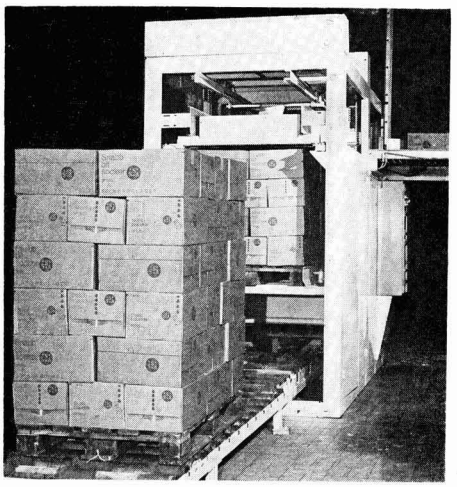

Fig. 4. The SSA system also comprises automatic palletizing of transport cases containing the ready-packed cartons or portions of cube sugar.

blending of different crystal populations. However, the quick-dissolving cube sugar with lower density (0·95) and higher porosity (0·40) is easy to dry, using air that is steam-heated to a temperature of approx. 150°C. The steam consumption is about 100 kg/ton of sugar. Drying and cooling are completed in about 2½ minutes, and the cubes are then ready for packing. The remaining water content (approx. ¾%) disappears quickly, owing to the high heat retention of the sugar (approx. 65°C), and does not create any complications. After a few days, the palletized cube sugar is practically dry.

The ranged packing into cartons starts on the conveyor, where the sugar cubes are divided into groups correponding to the contents of one carton. Suction pads transfer the groups into the cartons, which are prepared from flat material. The filled cartons are sealed and then ranged for packing in transport cases. This is followed by a weight check and, finally, by fully-automated palletizing. The electronic weigher controls the filling phase in the process. The packing is synchronized to the cube shaping and drying, and the nominal capacity is 2400 kg.hr^{-1}.

Packing into cartons runs very smoothly and therefore the sugar cubes retain their beauty. The carton is crumb-sealed, yet is still easy to open and reseal. It is designed for upright, space-saving storage.

Portion wrapping is also entirely synchronized to the forming and drying of the cubes. In this case, special form elements are used, which line up the cubes on the steel belt in 5 rows of 2. As a result, the capacity of the SSA plant is reduced to approx. 1·2 ton.hr^{-1}; however, this is a record capacity in the world of portion packing machines, which is why the machine is called the SSA "Super Wrapper", producing 50 wrapped double-cube portions per second.

All the movements are continuous, and a cold-seal material is used for the wrapping. These two factors make it possible to attain such a high capacity. Despite the high speed involved, the wrapping operation runs very smoothly. The wrapped portion is easy to open, and uses only one wrapper per portion. The finished portions are then packed in cases for transport (net weight 7·5 kg) and palletized.

The number of personnel required is small in relation to the production output. The operating staff consists of 3 persons/shift for ranged carton packing, and 5 persons/shift for portion wrapping. Their job is to supervise the plant and to replenish packing material, etc. Owing to automation, cube forming, drying and cooling need very little attention, so little, in fact, that at Arlöv 1 employee supervises 4 plants up to the packing stage, where the remainder of the personnel are occupied.

The vibrators are noisy and therefore the forming machine should be installed in a sound-insulated room. But once this has been done, the plant meets high demands for a good operational environment.

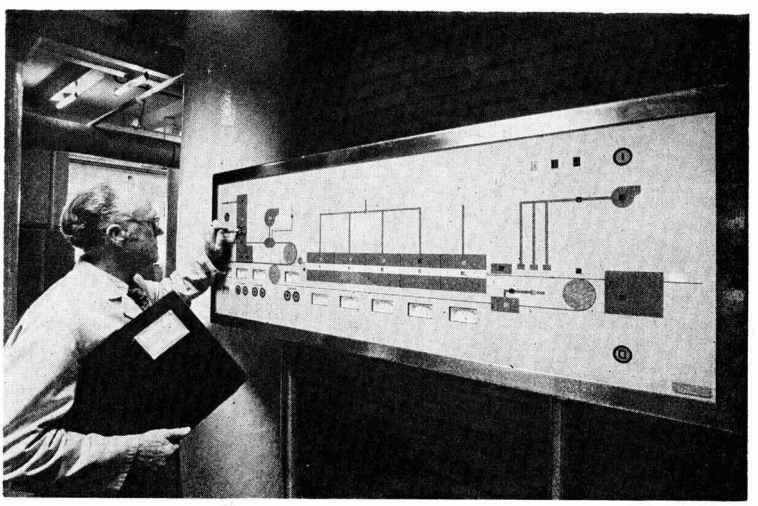

Fig. 5. Production, which is fully-automatic, is regulated from a control and monitoring panel. The control panel is positioned so that it can be easily observed, but at the same time it is designed to prevent accidental disturbance of settings.

Sugar Industry Technologists 1976 meeting

THE 35th meeting of Sugar Industry Technologists Inc. was held in Toronto, Canada, during early May 1976. More than 300 members gathered at the Four Seasons Sheraton Hotel to register during the 2nd May and were entertained at a mixer reception during the evening.

On the following morning they were welcomed by GEORGE FAWCETT, President of SIT for 1975/76, who was followed by J. LOPEZ-OÑA to present the first technical paper, describing experimental work carried out at National Sugar Refining Co., Philadelphia, on the comparison of the characteristics and performance of a range of flocculants available commercially, the experiments being subjected to statistical analysis to determine significant differences between the results obtained for each with a number of sugars.

Dr. MARGARET A. CLARKE then presented a paper describing work of the Cane Sugar Refining Research Project in New Orleans in analysing and preparing a refinery materials balance for soluble silicate, describing the techniques used and problems encountered, as well as pointing out some unexpected observations.

Use of activated carbon in refining was then discussed in a paper presented by A. Y. HYNDSHAW who also described a new technique for the thermal regeneration of spent powdered carbon. The last paper of the morning, by J. E. HAMILTON of Savannah Sugar Refinery, described, with projected slides, the installation of a new recovery pan at his refinery and the changes made in the recovery house following the elimination and replacement of some old equipment and rearrangement of batch crystallizers to a continuous system.

At the business meeting which followed, Mr. FAWCETT reported on the growth of SIT during the previous twelve months, with new corporate members representing refineries in France, Japan, Korea, Taiwan and the USA. Nominations by the Directors for office-holders were read by GEORGE W. MULLER, Jr., Executive Secretary, and accepted unanimously by the meeting.

After lunch, ANGUS KENNEDY of CSR Ltd. read his paper on colour in refineries, describing how differently the natural cane flavonoid pigments behaved from those colour materials (caramels, melanoidins, reducing sugar alkaline degradation products) formed in the raw sugar factory and refinery. He spoke of the characteristics of colour removal by different methods and discussed recent work in Australia on the assay of sugars in terms of reflectance colour measurement.

A presentation was then made by Mr. G. BIGGS of Kodak Canada Ltd. on techniques for planning and presenting material in the form of slides and film to audiences such as were present at the meeting.

In the evening, members gathered for a reception, followed by the Annual Banquet at which the Master of Ceremonies was Mr. MICHAEL HEENAN, General Refinery Manager of Redpath Sugars Ltd., Toronto. During the Banquet, members and their ladies were again welcomed by Mr. FAWCETT, while Mr. A. M. BARTOLO presented the George & Eleanore Meade Award for 1975 to PETER H. PETRI for his paper, "The continuous vacuum pan" which had been judged by the Award Committee as the best presented at the 1975 meeting.

Mr. FAWCETT then presented the SIT Achievement Award in Sugar Technology to FRANK C. STAPLES, Retired Chairman and Director of Sucrest Corporation, who had been a founding member, ex-President and long-active participant in the affairs of SIT. The Presidential Gavel was then passed by Mr. FAWCETT to Mr. BARTOLO, President for 1976/77, and the function came to a close.

On the next morning, 4th May, Mr. J. DEGEEST described an investigation at Raffinerie Tirlemontoise in Belgium of the causes of a steady increase in recent years of pol losses in the refinery. There were considerable difficulties because of the wide range of raw materials entering the refinery but it became evident that the losses were not the result of poor work but of a declining quality of material particularly in beets and second crop syrup from other sugar factories.

Dr. K. J. PARKER then presented a survey on sweeteners other than sugar, including some known for many years and others relatively new, both naturally-occurring and synthetic. He discussed the question of relative economic cost per unit of "sweetness" and showed what were prospects for the sweeteners in relation to sugar.

Prof. A. J. VLITOS then described the possible applications of sugar as a raw material not for simple substances more easily obtainable from oil-based ethylene but for the more complicated special chemical materials, especially those obtained by fermentation with specific organisms to create a product required to fill a commercial need.

The final paper was one by F. L. CARSON of Corn Products Co. who described a process for the reactivation of spent powdered active carbon using an

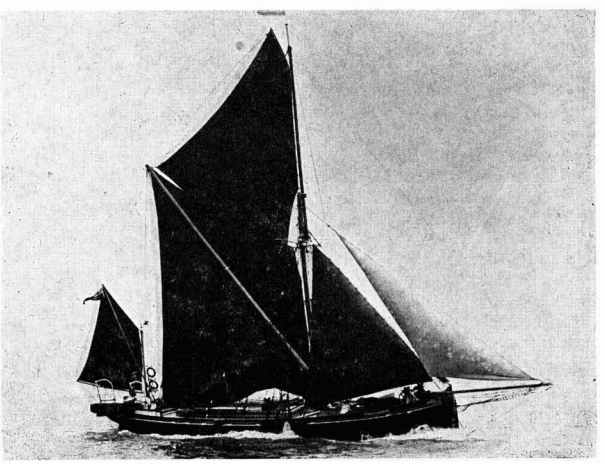

Fig. 1. Sailing barge "May"

Fig. 2. Packing house at Redpath, Toronto

atomized suspension technique whereby pyrolysis at 1500–1600°F, coupled with a recycling system, gave a reactivated product from which organic impurities had been burnt off while the carbon loss was only small.

In the afternoon a small group of members were able to go for a sail on Lake Ontario in the Thames River sailing barge *May* which belongs to Tate and Lyle Ltd. and is on a goodwill tour of North America. The vessel is the only one of its type still carrying cargoes and was launched in 1891, spending most of the years since working on the Thames, carrying cargoes of grain, flour and sugar to ports on the south coast of England.

For the remaining members there was, after lunch, a symposium on metric conversion in which the participants, all from Canadian refineries but chaired by KENNETH HANSON of Amstar Corporation, described the Canadian sugar industry's approach to metrication, the overall planning involved, conversion of packages and packing machinery, forms, reports, computer programmes, technical records and refinery data.

Members then discussed the changes by metrication elsewhere, notable contributions being made by GEORGE LENZ of Tate & Lyle Ltd. and JOHN WILSON of CSR Ltd.

On the next morning members were given the option of guided tours through the refineries of Redpath Sugars Ltd. in Toronto and the Westcane Sugars Ltd. in Oshawa, both groups returning to be joined by their ladies at an official luncheon at the Harbour Castle Hotel. Members who visited the Redpath Refinery were able to visit the Westcane plant on the following morning.

The Toronto refinery, built in 1959, was completed to coincide with the opening of the St. Lawrence Seaway which allows ocean-going vessels to bring raws to the Port of Toronto. Since its opening, capacity has risen from 25 to 40 short tons per hour. The vessels are unloaded by cranes and the raw sugar conveyed to an A-frame shed of 72,500 tons capacity from which it is reclaimed through floor openings to a conveyor system feeding the refinery. The process used is a conventional one of affination, carbonatation and decolorizing with bone char followed by three white sugar strikes and char treatment of the 2nd and 3rd run-offs, part of which is returned to white sugar boiling and the remainder to the recovery house.

A computer system was installed in 1969 to monitor and control part of the process, parameters controlled at present being raw sugar input, magma Brix, affination feed trough level and melter level. The refinery produces 2-kg and 4-kg packages and 20-kg and 40-kg sacks of granulated sugar, 500-g packages of icing sugar and individual sachets of sugar for restaurant use.

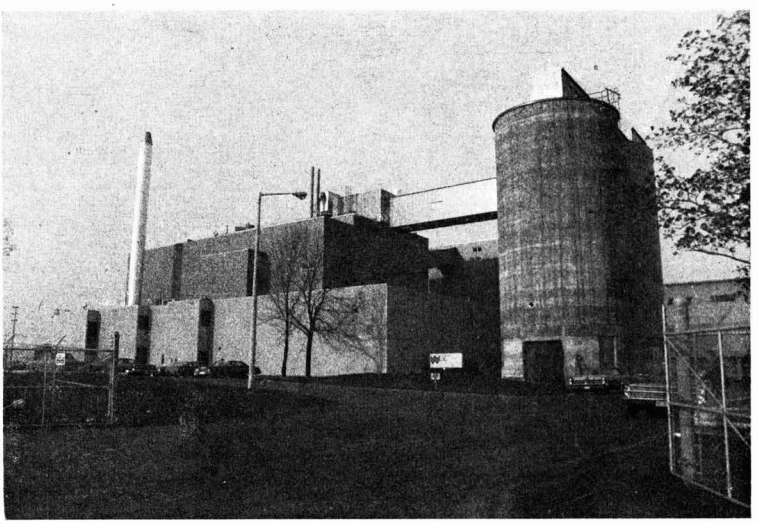

Fig. 3. Westcane sugar refinery, Oshawa

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ASEA-WEIBULL centrifugals are fully automatic and designed for curing all grades of cane or beet massecuite. They are available in two sizes, 48″×42″ and 48″×30″, for any centrifuging speed between 1000 and 1700 rpm. This flexibility, combined with a choice of basket shell material and thickness, means that a centrifugal battery can be built to meet any capacity and duty requirements.

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The Oshawa refinery was built only in 1973 and storage bins are still under construction. It is smaller than the Redpath plant and much more unconventional in its process. Melter liquor is clarified in a Jacobs clarifier and then decolorized with granular carbon and resins followed by de-ionization. This fresh liquor is mixed with first strike run-off to give a pan feed of a required constant ash and colour content and by this means a single white sugar grade of extremely uniform characteristics is obtained. This is sold locally in granulated and liquid sugar form, while the production of other grades is a development which will have to wait for the future.

Raw sugar, processed at the rate of about 450 tons per day, is held in a 35,000-ton warehouse to allow processing through the winter when the Seaway is closed. The white sugar from the granulators is screened and the fractions passed to daybins which feed the packing plant and also the bulk loading plants, one inside for railcars and the other combining inside and outside loading of road tankers.

The ladies' programme, organized by Mrs. PAM HEENAN, included a bus tour of the city of Toronto with a visit to a mock medieval castle, the "Casa Loma", as well as a sailing trip on the *May*, a trip to Niagara Falls, and a visit to the Black Creek Pioneer Village which is maintained in a style comparable with the life of the country in the early 19th century.

Beet Sugar Developments Ltd.

IN early 1975 an International Sugar Colloquium was held in London[1] during which forecasts were made of likely sugar consumption by 1985. While it was beginning to be recognized that the high prices of late 1974 were having an effect on the hitherto-supposed price-inelastic level of sugar consumption in developed countries, the full extent did not become apparent until later in the year. As a consequence, Dr. A. VITON, Chief of the Sugar and Beverages Division of the FAO, has modified his earlier requirements forecast of 104–108 million metric tons, raw value, and has recently estimated 1985 needs as 100 million tons. This figure takes into consideration both the observed effects on consumption of high prices and also the inroads into industrial sucrose usage of high-fructose corn syrups.

British Sugar Corporation Ltd., the largest beet sugar company in the Western world, made a study of the increased requirements and, assuming that the existing ratio of about 60:40 for cane and beet sugar would be maintained, concluded that, over the next ten years, about 60 new beet sugar factories would be required to help meet world demand. The study was concerned with countries where sugar beet was already grown, where both beet and cane were grown and areas where beet was considered a potential sugar crop. Where beet and cane were both grown, the estimate of factories required used only the circumstances where beet sugar production would be expanded in preference to cane sugar. Nevertheless, with this total of 60 new beet sugar factories required, a capital investment programme is envisaged totalling some £2,300,000,000.

For many years the Corporation has seconded staff to act as consultants on overseas beet sugar projects, in Afghanistan, the Azores, Chile, Greece, Iran, Iraq, Lebanon, Portugal and the USSR, while advice is also being given to South Africa and elsewhere on beet growing and processing. As a logical development to this provision of expertise, the Corporation has now formed a new company in partnership with the W. S. Atkins Group, one of the largest integrated consultancies in Europe, in order to be able to offer a complete range of services from feasibility studies, design of plant and factories, construction and commissioning to training of local personnel in operations and marketing. The new company, Beet Sugar Developments Ltd., will also be involved in expanding and improving the efficiency of existing beet sugar operations.

The new company will have a small permanent staff, led by the General Manager and Director, ROBERT CHAPPELL, but will be able to call on experts in beet growing and sugar production from the British Sugar Corporation and experts in factory construction, organization and infrastructure from the W. S. Atkins Group. Training of local personnel can be provided in B.S.C. sugar factories and back-up agricultural and process research facilities can be used to optimize conditions in the customer industry. The new company will be based at the Corporation headquarters, Oundle Road, (P.O. Box 26), Peterborough, England PE2 9QU, as is the Corporation's other subsidiary, British Sugar Allied Products Ltd., which handles the marketing of beet pulp and molasses, the former having reached a proportion of 25% of the animal feedstuffs sold in the UK.

World's largest sugar complex for Sudan.—Compagnie Française d'Etudes et de Construction TECHNIP have announced the signing of a contract with Kenana Sugar Co. Ltd. for the construction of a cane sugar factory and refinery at Rabak, 120 miles south of Khartoum on the White Nile. This is to be part of a huge sugar complex being set up under the direction of Lonrho Ltd.[2] in the Guezireh area, a triangle formed by the junction of the White Nile and Blue Nile; the overall plan includes, in the first stage, the doubling of existing installations and construction of new facilities at Sennar and Rabak, and is aimed at making Sudan a sugar exporter in 1977/78, with a target production of 1 million tons in the 1980s. At present, the demand of 278,000 tons of sugar annually is met by imports in addition to the 120,000 tons produced by El Girba and Guneid factories. The Rabak factory and refinery production capacity will be 350,000 tons a year, making the plant the largest in Africa and one of the biggest in the world. A capital investment of $350,000,000 is involved. TECHNIP will be responsible for the process plant installation, while basic design and overall process work will be carried out by Arkel International of the USA. The cane will be processed in two lines, each having a crushing capacity of 8500 tcd and each comprising a Fives-Cail Babcock milling tandem.

[1] *I.S.J.*, 1975, 77, 138.
[2] *ibid.*, 96.

Sugar cane agriculture

General phosphate and potash status of sugar cane fields of small planters: preliminary observations. R. BRUNET and S. P. MAUREE. *Rev. Agric. Sucr. Maurice*, 1975, **54**, 104–106.—While small planters' fields were found, by foliar diagnosis, to have at least adequate P contents, with only 10% showing a deficiency, almost half showed a K deficiency. Optimum leaf values of the two nutrients are given for Mauritius.

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Corn intercropping with ratoon cane. ANON. *Rev. Agric. Sucr. Maurice*, 1975, **54**, 107–109.—Tests conducted during 1971–74 have shown that an intercrop of early corn lasting 90–110 days has no effect on ratoon cane and sugar yield. Optimum conditions are a corn crop of 19,000 plants per ha and 380:190:104 kg.ha^{-1} of ammonium sulphate:superphosphate: muriate of potash.

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Some soil moisture data and their application to irrigation of sugar cane. P. Y. CHAN and L. LI PI SHAN. *Rev. Agric. Sucr. Maurice*, 1975, **54**, 115–119.—Results are given of a study to determine the water-holding capacity of most of the soil groups under cane cultivation in Mauritius. Methods of scheduling irrigation are briefly described; it is stressed that the amount of water and when to apply are governed by availability of water and irrigation economics as well as the water-holding capacity of the soil and the crop requirements.

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Sugar cane: heat treatment against ratoon stunting. J. A. G. C. SOUSA. *Brasil Açuc.*, 1975, **86**, 313–320. Ratoon stunting disease is described—its history, symptoms, transmissions and losses caused—and examples quoted from the literature of yield benefits from heat treatment of setts. The range of treatments used in various parts of the world is briefly described and experience in Brazil reported. With the establishment of a hot water treatment unit in 1959 in Araras, using a temperature of 50°C ± 0·5°C for 2 hours, it became possible for the local farmers to plant treated setts and this is recommended; disinfection practices and roguing procedures to eliminate diseased cane are also listed.

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Sugar cane cultivation in the Bundelkhand area of UP. S. K. OJHA, B. N. DIXIT and R. SINGH. *Sugar News* (India), 1975, **7**, (5), 16–19.—The soil and climatic conditions of the Bundelkhand area of Uttar Pradesh are briefly indicated and the varieties best suited to the area are listed. Varietal trials are held every year, and results are given for 1972-74, including the quality of gur obtained.

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Cane scrapping. L. L. LAUDEN. *Sugar Bull.*, 1975, **54**, (3), 4.—While the amount of cane left in the fields in Louisiana in 1975 was much lower than in previous years, growers are still leaving 1–3 tons of recoverable cane in some fields. A very rapid and easy method of determining the amount of scrappable cane left in the field is described and its use illustrated by reference to specific cases.

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Nematodes in cane fields. L. G. VALLANCE. *Australian Sugar J.*, 1975, **67**, 289–292.—Little interest has been shown in nematode control in Queensland, although trials have been conducted in which cane yields have been increased by treatment with nematicides. Differences in varietal resistance to this kind of pest, eight species of which were found in cane fields exhibiting poor growth, have been established. It is thought that widespread use of irrigation in areas of sandy soil coupled with adequate fertilization result in satisfactory yields despite the possibility of root damage by nematodes. The situation in Australia is contrasted with that in South Africa, where much activity in nematode control has been carried on.

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Cane breeding in the West Indies. ANON. *Ann. Rpts. W.I. Central Sugar Cane Breeding Sta. & Barbados Sugar Cane Variety Testing Sta.*, 1971–72, 10–21, 51–56.—Details are given of the basic breeding and commercial seedling programmes; seedlings in nurseries from 1971 crosses and selection of B 73' series (1970 seedlings) are set out in tables as is other information such as chromosome numbers, results of backcrossing experiments and sample analyses of F_1 families for 1972.

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Barbados variety trials. ANON. *Ann. Rpts. W.I. Central Sugar Cane Breeding Sta. & Barbados Sugar Cane Variety Testing Sta.*, 1971–72, 22–34.—Details are given of varietal trials at a number of sites in Barbados, as well as tests to determine the extent of post-harvest deterioration. Since a good uniform burn was difficult to obtain in small plots, tests were conducted in which whole stalks of fresh cut cane were laid on a bed of dry trash which was then burnt. Varietal differences in press juice pol, purity and reducing sugars were found, although there were no significant differences in the increase in fibre content caused by drying. One particular variety, B 63118, suffered no apparent loss after 8 days' storage; however, analysis of samples after grinding rather than in the field showed that after 8 days in the full sun, the cane had lost some 20% of its initial sugar, which offset a rise in Brix. Nevertheless, after 5 days' storage of chopped burnt and unburnt samples in the open, no significant differences were found in pol between the two treatments, purity had dropped about 2%, Brix and pol had increased slightly, fibre had risen by about 1% and the weight loss was about 6%, while reducing sugars had doubled. There was also little difference between burnt and unburnt samples of whole stalks from this variety after 5 days' storage in the open.

Control of flowering. ANON. *Ann. Rpts. W.I. Central Sugar Cane Breeding Sta. & Barbados Sugar Cane Variety Testing Sta.*, 1971-72, 35–38.—Out of seven late-flowering clones used in tests to advance flowering by shortening the natural daylength during August (flower bud initiation normally occurred in early October) only one failed to respond, while most of the others were used in the subsequent crossing programme. Disappointing results were obtained in tests to delay flowering of early-flowering F_1 clones by giving night light break during the normal induction time followed by an artificially extended daylength. Inconsistent results were obtained in tests to delay flowering in early-flowering clones by extending the daylength during the period of emergence.

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Mutation studies. ANON. *Ann. Rpts. W.I. Central Sugar Cane Breeding Sta. & Barbados Sugar Cane Variety Testing Sta.*, 1971–72, 39–45.—Treatment of CP 52/43 cane with four doses of gamma-ray irradiation had a considerable effect on emergence and plant survival percentages, mean height and mean vigour. In all cases, bud emergence and plant survival fell with increase in dosage; mean height with the largest dose was greater than with the smallest dose, although below that of the untreated control, while mean vigour with the largest dose was greater than that of the control; the values for the other three doses were about the same. The reduction in emergence % was almost mainly due to the failure of root initials to grow; in some cases, shoots did start to grow but failed to develop further because of lack of synchronization between root and shoot growth and through lack of nutrient supply. Some shoots stayed alive for 4 months and then died. Attempts to induce root growth by applying growth-promoting chemicals failed. The irradiated cane exhibited some morphological variation, mainly in the form of stunted plants with the lower 2–3 leaves being thick, short and dark green, while the upper leaves were normal. In the field, considerable differences between the mutants for vigour, tillering and height were found. Morphological changes were found in irradiated cane of a non-flowering variety, B 52107; studies are to be made to establish whether the treatment is successful in inducing flowering. No difference in purity and fibre content was found between flowering and non-flowering canes from the same variety, although the sugar content of flowering canes expressed on a weight/volume basis was lower than in non-flowering canes. Rind thickness in the flowering cane tops was calculated to be as little as half that in non-flowering cane tops.

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Sugar accumulation studies. ANON. *Ann. Rpts. W.I. Central Sugar Cane Breeding Sta. & Barbados Sugar Cane Variety Testing Sta.*, 1971–72, 46–47.—Sugar accumulation in 16 cane varieties was observed at intervals during the growth period from 6 to 16 months. The assimilation rate was found to have a significant negative correlation with leaf weight per unit cane weight. Greater sugar accumulation occurred in varieties having a high leaf weight and low assimilation rate; while leaf weight was the main factor affecting the assimilation rate, at least four other characteristics may play a role which governs the rate: fibre % fresh weight, pattern of tillering, rate of leaf appearance, and sugar storage ability.

Trends in variety usage. ANON. *Ann. Rpts. W.I. Central Sugar Cane Breeding Sta. & Barbados Sugar Cane Variety Testing Sta.*, 1971–72, 48–49.—The varieties grown in Jamaica, Guyana, Trinidad, Barbados, Guadeloupe and on lands belonging to Central Romana (Dominican Republic) in 1972 are indicated, with the area percentages tabulated.

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Rejuvenation of old deteriorated sugar cane varieties through heat therapy. M. L. AGARWAL and S. C. GUPTA. *Cane Grower's Bull.*, 1975, **2,** (3), 1–3.—Tests on hot water treatment of cane setts for 2 hours at 50°C proved this to be better than 1½ hours at 52°C as regards germination and yield. The results were generally much better than for untreated controls. Tabulated data are given for a number of varieties.

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Improving sugar cane yield and juice quality in bhat soils of eastern Uttar Pradesh. B. K. MATHUR. *Cane Grower's Bull.*, 1975, **2,** (3), 4–7.—One pre-monsoon irrigation plus mulching with a 15–20 cm bed of trash proved better in terms of yield and millable canes per ha than one irrigation without trash mulching and far better than unmulched and unirrigated cane. Autumn-planted cane proved superior to spring-planted cane in the tests, which were conducted in 1966–69.

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Assessment of the mechanical control campaign conducted against the Gurdaspur borer, *Bissetia steniella* **Hmpsn.** S. KUMAR. *Cane Grower's Bull.*, 1975, **2,** (3), 8–10.—A study was made to assess the effectiveness of the programme under which cane tops containing borer larvae in the gregarious phase are cut and buried before the larvae disperse. Only 22·6% of the collected tops showed the larvae to be in the gregarious phase, while over 58% showed that segregation had already taken place. The rest of the tops were empty. It is therefore suggested that cutting of the tops should be started before symptoms of borer attack appear, i.e. when the top is green.

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Grassy shoot virus and its host range. A. JHA, H. C. PRASAD and B. MISHRA. *Cane Grower's Bull.*, 1975, **2,** (3), 11–12.—Of a large number of plants investigated, only one (*Chenopodium amaranticolar*) proved to be an alternative host of the grassy shoot virus. Use of the inoculation technique confirmed that the other plants were not carrying the virus without exhibiting symptoms.

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Record of *Sturmiopsis inferens* **Towns. (Diptera:Tachinidae), potential parasite on** *Chilo auricilius* **Ddgn.** O. P. SINGH, Y. P. MADAN and S. Y. YADAV. *Cane Grower's Bull.*, 1975, **2,** (3), 13–14.—Reference is made to parasitization of the stalk borer by *S. inferens*. Work is being conducted on rearing and breeding of the parasite.

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Advances in the interpretation of foliar analysis of sugar cane in the South African sugar industry. J. H. MEYER. *S. African Sugar J.*, 1975, **59,** 569–585.—See *I.S.J.*, 1976, **78,** 147.

400 mechanical harvesters operating in South Africa by 1985 is marketing forecast. S. W. D. BAXTER. *S. African Sugar J.*, 1975, **59**, 597–599.—A representative of Massey-Ferguson looks at the prospects for mechanical cane harvesting in South Africa. Advice is given on field preparation with mechanization in mind, and the question of using mechanical harvesters on small farms is discussed. The advantages of group ownership and the way such a system works are explained. The author does not think that mechanical harvesting of cane on steep hillsides, such as occur in Natal, is impossible.

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Jumping borer control in Jamaica. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 9–12.—Ploughing with a mouldboard 4 days after harvesting on one cane farm resulted in a significant reduction in the percentage of deadhearts caused by the jumping borer (*Elasmopalpus lignosellus*) compared with no treatment, but also caused a reduction in shoot population 2–3 weeks after treatment. Visual observation indicated, however, that covering with trash would give a lower percentage of deadhearts than would mouldboard ploughing. Studies on the effectiveness of jumping borer parasites showed that an unidentified tachinid (possibly *Stomatomyia* sp.) was responsible for the greatest percentage parasitism; but since this was very low (4·75%) and the number of parasites is small, the jumping borer is well protected from natural enemies. Field populations of predators destroyed by cane burning are in the process of rebuilding when borer infestations are greatest.

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Termite control. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 12. "Mirex", a slow-acting insecticide, was dissolved in dioxane and sprayed onto bagasse and sawdust used as termite bait, while stale cane, also used as bait, was soaked in the insecticide solution for 14 hours. The treatment gave an equivalent of 2 lb a.i. "Mirex" per acre. The baits were applied by hand over the rows, while the stale cane was partly buried. "Chlordane" and "Kepone" were also tested as sprays at 2 lb a.i. per acre. None of the treatments succeeded in eliminating termites, although treated stale cane showed promise, and further work is to be conducted with it.

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Chemical ripening of sugar cane. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 21–26.—Block tests on the use of "Polaris" showed that, if applied to cane in an area of high rainfall and poor natural ripening conditions, the chemical will ripen cane at the start of the harvest period and prevent sugar loss towards the end of the crop. However, on irrigated farms it does not have any pronounced ripening or sugar-retaining activity when the period of application coincides with the drying-off period. Regardless of its ripening effectiveness, "Polaris" was found to induce severe physiognomic effects in mature cane, including leaf desiccation and discoloration and the sprouting of axiliary buds at the top of the cane stalk. "Polaris"-treated cane showed a "flush" of ratoon shoot growth soon after harvest.

Effect of fungicides on germination and yield of sugar cane. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 26–27.—Field trials to study the effects of sett treatment with fungicides and growth regulators on germination and final cane yields showed that germination was rather poor (because the middle one-third of the cane stalk was used in which the eyes are known to have low germinating capacity), although such planting material was expected to show high response to treatment. Germination was stimulated, though not to any great extent, by treatment with the organo-mercurial fungicide "Tillex-C" at 0·015% mercury in aqueous solution, and by the plant growth regulator "Cycocel" at 5×10^{-3} M in aqueous solution. Some varietal differences were found in response, B 51129 showing greater germination and yield than UCW 5465. It is concluded that, provided proper attention is paid to selection and preparation of planting material and to correct planting procedure, pre-planting treatment of setts is not necessary.

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Trials with "N-Serve" and sulphur-coated urea. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 31–33.—"N-Serve", containing 2-chloro-6-trichloromethyl pyridine as active ingredient, is a Dow Chemical Co. product aimed at inhibiting nitrification of the ammonium ion in the soil by bacteria of the *Nitrosomonas* genus, and thereby giving more efficient cane utilization of e.g. sulphate of ammonia. Trials with "N-Serve" and sulphur-coated urea are reported; since plant cane was involved in all cases, the results were not as good as might be expected with ratoon crops, which respond better to N than does plant cane. The results were inconclusive, response to N being unaffected by the presence of "N-Serve" at one site, while at another there was no response to N, and "N-Serve" appeared to have a phytotoxic effect; at a third site, there was marked increase in cane yield with N at 60 and 120 lb.acre^{-1}, sulphate of ammonia treated with "N-Serve" at 0·5 lb.acre^{-1} a.i. proving the most efficient form of N. Sulphur-coated urea was better than normal urea, but was somewhat less effective than sulphate of ammonia.

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Cane selection and varietal trials. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 36-66.—Details are given of cane selection work and of varietal trials in Jamaica, as well as the percentages of the cane area under specific varieties.

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Herbicide trials. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 67–70. Results are given of pre- and post-emergence trials with a number of herbicides. One week after spraying, almost all the weeds (mainly *Leptochloa filiformis, Echinochloa colonum, Mikania* sp., *Euphorbia hypericifolia* and *Borreria* sp.) had been killed by "Gramoxone" + "Actril-D" at the rate of 1 pt + 1 pt per acre. "Glyphosate" ("Roundup") at 0·75 lb a.i. per acre on its own or with "Actril-D" (1 pt per acre) was the second best treatment. However, although after three weeks "Glyphosate" had killed the main weeds, it had also caused marked systemic damage to the cane. Emerging leaves were chlorotic and slightly

deformed, while growth seemed to have been checked, since adjacent untreated plots had cane which was 6–9 inches taller. The chemical proved highly effective against volunteer cane stools and against *Brachiaria mutica* (para grass) and *Paspalum distachyon*.

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Salt tolerance of two sugar cane varieties. ANON. *Ann. Rpt. Sugar Ind. Research Inst., Sugar Ind. Authority* (Jamaica), 1974, 74–75.—Experiments in which two varieties were irrigated with water containing up to 6000 ppm salt are reported. Yield differences were found between the two varieties under the influence of the salt, as were differences in the uptakes of K, Na, Ca, Mg, P, S and Cl, which tended to increase with salt concentration. At the maximum salt concentration, the two varieties absorbed similar quantities of each element. Since the Na uptake was greater than that of K with increase in salt, the K:Na ratio decreased for both varieties with rise in the NaCl level.

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Control of rats in sugar cane. L. M. BLAQUIER. *La Ind. Azuc.*, 1975, **82**, 152–154.—The author provides a brief summary of 40 articles on the subject of rat control.

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"Polaris"—its possibilities as a cane ripener. L. G. VALLANCE. *Australian Sugar J.*, 1975, **67**, 337–340. As an introduction to the theme of chemical cane ripeners, the author looks at two other methods by which cane ripening can be controlled: drying-off by limiting the amount of irrigation water available, or adjusting the time and amount of nitrogen application in order to restrict growth and encourage sugar at harvest time. The disadvantages of these methods are discussed. Reference is then made to the use of chemical ripeners, and particular mention is made of various trials reported in the literature involving "Polaris".

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Area required for a sugar cane improvement programme. R. CESNIK. *Brasil Açuc.*, 1975, **86**, 394–396.—A programme, based on an initial total of 600,000 seedlings (500,000 under test and 100,000 comparative commercial varieties), with subsequent selection stages of 5%, 10%, 15% and 10%, with adequate roadways and borders, etc., areas for installation of the variety collection and crossing, for phytopathology and entomology trials, is calculated to require an area of approximately 150 hectares.

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Determination of the freezing point of leaves, stalks and buds of some varieties of sugar cane (*Saccharum* spp.). O. BRINHOLI, E. C. FERRAZ, J. NAKAGAWA, J. R. MACHADO and D. A. S. MARCONDES. *Brasil Açuc.*, 1975, **86**, 451–454.—A comparison was made between 11 varieties recommended for the State of São Paulo as to their resistance to cold. Leaf freezing points varied from —3·6 to —5·6°C, stalk freezing points from —3·3 to —4·4°C and bud freezing points from —3·7 to —4·3°C. Different varieties showed different resistances to freezing of the various tissues, so that no one could be identified as offering greatest advantage over the others.

Control of gramineous weeds in sugar cane in Taiwan with "Asulam". S. Y. PENG, W. B. SZE, H. J. YEH and L. T. TWU. *Taiwan Sugar*, 1975, **22**, 165–170. Trials are reported in which "Asulam" proved superior to other herbicides against *Dactyloctenium aegyptiacum*, *Digitaria sanguinalis* and *Elusine indica* annual grasses as well as *Cyperus* spp., *Cynodon dactylon* and *Panicum repens* perennial grasses. "Asulam" combined with 2,4-D or "Actril-D" was much more effective than "Asulam" alone.

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A simplified method for testing tolerance of sugar cane varieties to herbicides. S. Y. PENG. *Taiwan Sugar*, 1975, **22**, 178–182.—The variance ratio (F distribution) method of grading sugar cane varieties for their susceptibility or resistance to herbicide effects is outlined, N:Co 310 being used as standard. F values are given for a large number of varieties as grown in Taiwan, indicating their susceptibilities to six herbicides.

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The use of herbicides in Louisiana sugar cane. D. T. LOUPE. *Sugar y Azúcar*, 1976, **71**, (1), 26–27.—The history of chemical weed control in Louisiana is briefly discussed, and the herbicides now in use and the weeds against which they are effective are reported. Amongst the major weeds mentioned are Johnson grass (*Sorghum halepense*), itch grass (*Rottboellia exaltata*) and brown top panicum (*Panicum reptans*); the last-named has been found to increase in the absence of other weed species where "Terbacil" has been used repeatedly over a number of years.

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Attacking the sugar cane borer. ANON. *World Farming*, 1976, **18**, (1), 4–6.—Information is given on the programme for rearing and releasing *Lixophaga diatraeae* (Cuban fly) at Houma (Louisiana) and Canal Point (Florida) as a means of controlling *Diatraea saccharalis*. Preliminary investigations have revealed a reduction in the number of cane internodes damaged by the borer as a result of release of the parasite.

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Urea—will it become the most popular nitrogen carrier? O. P. ENGELSTAD and R. D. HAUCK. *World Farming*, 1976, **18**, (1), 7, 30–31.—The advantages of urea over other forms of N fertilizer are listed and advice given on its use in crops generally. Advice is given on its application, particularly in relation to the hazards of contamination by biuret (a similar compound formed at high temperatures during urea manufacture). Foliar application, as used in cane, is suitable provided the biuret content is low (e.g. no greater than 0·25%); otherwise, leaf damage may occur. It is stressed that urea, although containing 45–46% N, is subject to N losses to the atmosphere and can cause plant damage more readily than other N fertilizers, so that broadcast application and immediate incorporation are necessary.

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Nematicide application to ratoon crops of sugar cane grown on some sandy soils of the Natal sugar belt. S. RAU and P. K. MOBERLY. *S. African Sugar J.*, 1976, **60**, 21–27.—See *I.S.J.*, 1976, **78**, 174.

Sugar beet agriculture

Genetic and ecological factors affecting the soluble ash content. V. STEHLÍK and L. SCHMIDT. *Listy Cukr.*, 1975, **91**, 217–223.—Investigations of the soluble ash content A_k of beet in Czechoslovakia have revealed an increase during the period 1958–74. While variety has some effect, ecological conditions have a far greater influence. The most effective of factors investigated were lateness of sowing (in extreme cases doubling the value of A_k if not accompanied by a corresponding late harvest), N dosage and lack of rainfall in August and September.

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Predicting nitrogen needs for sugar beets from residual nitrate and mineralizable nitrogen. J. N. CARTER, D. T. WESTERMANN, M. E. JENSEN and S. M. BOSMA. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 232–244. The validity of an equation for prediction of beet yield from crop and soil N parameters was investigated in tests at a number of sites in southern Idaho where four levels of N were applied and the root and sugar yield, sugar content, impurity index (10 amino-N + 3·5 Na + 2·5 K) and N uptake determined as functions of residual, mineralizable and original fertilizer N and beet leaf petiole nitrate-N. Details are given of a soil test for measurement of mineralizable and nitrate-N which has proved to be a valuable guide to N requirements. Of the 24 sites involved in the tests, more than 70% showed N levels which were excess to requirements and led to sugar contents and yields below the maximum, as obtained in the other fields.

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Naturally occurring hybrids between sugar beet and *Beta macrocarpa* in the Imperial Valley of California. J. S. MCFARLANE. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 245–251.—*B. macrocarpa* occurs widely in the Imperial Valley and is thought to have been introduced from the Mediterranean area some time before 1928. It crosses readily with cultivated beet, but this is normally prevented by the considerable difference in flowering dates of the two species. Hybridization apparently occurred a few years ago, since when intercrossing has taken place, so that wild beet hybrids varying greatly in plant and root characteristics now exist in an area of 10–12 square miles. The wild beet and its hybrids are a serious weed problem; control is possible through removal of the wild beet from fallow areas and by prevention of hybridization with commercial beet. It is not recommended to grow beet in a field which has become badly infested with wild beet seed until the infestation is brought under control.

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Plastic isolation chambers for sugar beet seed production. R. J. HECKER and J. O. GASKILL. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 264–268.—A description is given of a relatively inexpensive isolation chamber, consisting of polyethylene sheeting and a special air filter system, which is suitable for beet seed production inside or outside a greenhouse without fear of contamination by stray pollen.

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Introgressive hybridization as a breeding method in *Beta vulgaris*. R. K. OLDEMEYER. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 269–273.—Trials on hybridization of a high-yielding fodder beet variety with a sugar beet variety of high sugar content based on ANDERSON'S introgressive hybridization theory failed to provide offspring of the required characteristics, any small gain in sugar content being countered by a loss of weight. It is suggested that root yield and sugar content are physiologically dependent, so that change in one parameter always results in a corresponding change in the other but in the opposite direction. Since both appear to be products of photosynthesis, no basic change in productivity will occur without change in photosynthetic efficiency.

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Effect of row spacing and nitrogen rate on root and sucrose yield of sugar beets in southern Idaho. J. N. CARTER, M. E. JENSEN and S. M. BOSMA. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 274–279.—In trials involving six row spacings and two N dosages, root yields were essentially the same for all treatments, average root size decreased as the average row spacing decreased, sugar content was unaffected by plant population or root size but tended to be lower with the higher N level (although this trend was not consistent), while no consistent changes occurred in the impurity index as a function of plant population, although it was greater with the higher N level. Hence, there is no advantage in spacings of less than 22 inches, at a constant in-row spacing of 12 inches, regardless of the N level.

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Controlling virus yellows—an interim report. N. B. DAVIS. *British Sugar Beet Rev.*, 1975, **43**, 177. "Temik" has proved highly effective against aphids and thus against beet virus yellows in UK beet fields. Warnings are given that failure to carry out the necessary precautions in applying it could involve risk to humans and wildlife. Some problems encountered in applying the chemical are noted. From counts made of aphids and virus incidence, it is suggested that application of "Temik" alone may be more effective than when followed by a late spraying which may kill aphid predators.

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The rye technique for preventing soil erosion on light sands and black peats. W. J. A. ASCROFT-LEIGH. *British Sugar Beet Rev.*, 1975, **43**, 179–180.—The technique described has been widely practised in Holland for many years. It involves sowing rye in September and spraying it with "Gramoxone" in the following spring just before beet drilling. The beet

can be sown while the rye is still green but dying, the only cutting needed being where the beet is drilled. The rye roots hold the soil, the dead foliage protects the soil and prevents its movement, and a minimum of soil disturbance in the spring gives a firm surface; moreover, soil moisture retention may be improved. If the rye appears to be growing too well, it can be kept in check by further applications of "Gramoxone" before beet drilling. The technique should not be used where there is a perennial weed problem.

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Drilling: the 4-mph barrier. G. L. MAUGHAN. *British Sugar Beet Rev.*, 1975, **43,** 185–187.—The performances of a number of beet drills tested in the spring of 1975 are assessed. From the number and length of inter-plant spaces greater than 6 inches and emergence percentages, it is suggested that a drilling speed greater than 4 mph is inadvisable. A slightly lower percentage of emergence recorded at 4 and 5 mph drilling speeds than at 2–3 mph was possibly caused by inadequate seed covering.

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Drilling: what it can cost to be late. A. S. KENNEDY and J. V. TOPPER. *British Sugar Beet Rev.*, 1975, **43,** 189.—Trials have shown that an average loss of about 1 ton of beet per acre can occur as a result of delayed drilling. While it is desirable to complete drilling as quickly as possible, it is stressed that drilling at speeds greater than 3 mph can have an adverse effect on emergence and spacing. To illustrate their point, the authors compare the cases of two farmers growing beet on 200 acres.

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Six-row machines dominate. D. R. BRISBOURNE and H. T. BREAY. *British Sugar Beet Rev.*, 1975, **43,** 190–191.—A brief report is presented on the beet harvester demonstration held in France in 1975; out of 14 machines, 10 were six-row harvesters.

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Weed control. W. E. BRAY. *British Sugar Beet Rev.*, 1975, **43,** 194–196.—The use of herbicides in the UK in 1975 is discussed, and the increase in herbicide usage during 1970–75 indicated. Lists are given of herbicides recommended for pre-drilling, for application between drilling and emergence and for post-emergence application. Herbicide effectiveness is classified under couch grass, wild oat, wild oat and annual broad-leaved weeds, and annual broad-leaved weeds.

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Effect of plant density and row width on yield and quality of sugar beet drilled to a stand. I. Simulated plant spacing. C. WINNER and R. MERKES. *Zucker*, 1975, **28,** 655–660.—Beet populations of 30,000, 40,000, 50,000, 60,000 and 80,000 per ha and row widths of 35, 40, 45 and 50 cm were compared in terms of beet yield and quality. In both years, maximum beet and sugar yield resulted when the population was 80,000 plants per ha and both yields fell with decrease in population. The most suitable row spacing was 40 or 45 cm at a seed spacing of 18 cm.

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Choice of a scheme of treatment with insecticides. E. SEUTIN and L. VAN STEYVOORT. *Le Betteravier*, 1975, **9,** (93), 14.—Insecticides recommended for use against wireworm, millepedes, aphids and mangold fly are listed and treatment schemes outlined for farmers with and without microgranulators. A new granular chemical, "Curater", has proved effective against wireworm and mangold fly, and has a secondary effect on early-developing aphids. It includes 5% "Carbofuran" and is recommended at a rate of 15 kg.ha^{-1}.

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The growth, pests and diseases of sugar beet in Belgium, 1974. L. VAN STEYVOORT. *Publ. Trimest. Inst. Belge Amél. Betterav.*, 1975, **43,** 103–117.—A report on the 1974 beet season in Belgium indicates the unfavourable weather conditions and mentions exceptionally early development of aphids and, hence, outbreaks of yellows which were almost as severe as in the disastrous year of 1959. While on average 90–100% of the beets in a field became infected, treatment with 10 kg.ha^{-1} of "Temik 10G" reduced the incidence to below 50% and often to 15–30%. About one-sixth of the total beet area was treated with the chemical; as a result, losses from the disease were estimated at 26% compared with only 7·3% in the previous year, but it is calculated that the losses would have been 38% without any treatment.

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Study on "Metamitron" in regard to its application for selective weed control in sugar beet in Belgium. J. M. BELIEN, J. F. SALEMBIER and M. GOMAND. *Publ. Trimest. Inst. Belge Amél. Betterav.*, 1975, **43,** 119–135.—See *I.S.J.*, 1975, **77,** 340.

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Regularity of sowing and soil profiles. M. T. AMADUCCI, G. BARALDI, C. DE ZANCHE and G. VENTURI. *Ind. Sacc. Ital.*, 1975, **68,** 119–128.—The effects of soil preparation on sowing uniformity for sugar beet and maize were studied, using comparative trials with factorial combination of two sowing machines, two forward speeds, two types of seed and two methods of soil preparation. Even though the two soil preparation methods influenced the longitudinal soil profiles, their effects on plant emergence and therefore on average inter-plant distance were limited. Rather than single effects, all of the factors examined showed combined effects with emergence and distribution uniformity figures which differed according to the various combinations examined.

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Results of national varietal trials with sugar beet in 1972-74. L. KARAMAN. *Listy Cukr.*, 1975, **91,** 265–271. Tabulated results are presented of beet varietal trials held in Czechoslovakia in 1972, 1973 and 1974. Five released varieties (three of them from other countries), four new monogerm varieties of foreign origin and five new domestic selections were tested, with Dobrovická A as control. Beet and sugar yield and processing quality were determined, whereby Dobrovická A still proved the outstanding variety.

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The harvesting and loading demonstration at Macogny (Aisne) 22nd October 1975. ANON. *Le Betteravier Franç.*, 1975, **45,** (287), 24–26.—Details and illustrations are presented of beet harvesting and loading equipment demonstrated at Macogny in France.

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Some components of beet yield. H. LABY. *Hautes Etudes Betterav. Agric.*, 1976, **8,** (32), 7–17.—References are made to recent literature concerning factors exercising influence on beet yield, covering length of

growth period and its effect on both beet yield and juice purity, rainfall and water requirements, temperature, initial plant growth rate, factors affecting root development and particularly its fanginess, and factors affecting beet composition, especially the crown:root weight ratio, which should be reduced as much as possible.

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Beet yellowing, irrigation and cultural methods. E. DALLEINNE. *Hautes Etudes Betterav. Agric.*, 1976, **8,** (32), 18–20.—Mention is made of scattered yellowing of beet in a district of Loiret *département* which was not due to virus infection, since green leaves sprouted after the onset of yellowing and there was no progressive transition from green to yellow leaves. It is suggested that the phenomenon was caused by reaction of the plant to physico-chemical conditions of the environment, and several suggestions have been put forward concerning irrigation, nature of the soil, retarded decomposition of organic matter such as straw, corn stalks and farmyard manure incorporated into the soil before sowing (possibly affecting the available nitrogen content), toxicity of ammonia (the content of which in the soil was found to be maximum at the peak of yellowing), soil compaction by equipment and nematode infestation. The author is of the opinion that the phenomenon was the result of a convergence of phenomena favoured by bad soil preparation and sparked off by a factor associated with irrigation.

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Effect of plant density and row width on yield and quality of sugar beet drilled to a stand. II. Plant spacing by drilling to a stand. C. WINNER, R. MERKES and R. TEICHMANN. *Zucker*, 1976, **29,** 2–8.—Results of plant spacing/row width trials conducted at three sites in 1972 and 1973 are discussed. Generally, a row width of 50 cm and a plant spacing of 6 cm (achieved by manual thinning), a row width of 42 cm and a plant spacing of 18 cm, and a row width of 36 cm and a beet spacing of 22 inches (both combinations achieved by drilling to a stand) gave best beet and sugar yields. However, it is conceded that the decision on optimum row width and beet spacing will be dependent on the advantages to be expected from any one combination under given conditions. Since the advantage gained by reducing plant competition on high-yielding soils is generally greater than on low-yielding soils, the incentive to reduce row width and increase plant spacing in areas of relatively high yields would be greater from the purely agricultural viewpoint than in lower yielding locations.

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Present level of harvesting technology. J. PICHENEZ. *Sucr. Franç.*, 1976, **117,** 33–36.—Since not only the quality of equipment used but also the density of beet population are important factors in harvesting, the author first examines the quality of the seed and the significance of precision drilling. While it is not possible to produce a pelleted seed which is well calibrated and provides good germination, uncoated seed has been found to provide both high rates of germination and precise spacing. While the Institut Technique de la Betterave (ITB) has spent as much effort and time on precision drilling research as on beet yields and processing quality, for which it has often been criticized, the author admits that so far they have failed to produce any real evidence of precision drilling influence on the beet crop, although precision cannot be a drawback and such drilling is no more laborious than other types of planting. As regards harvesting, the six-row machine has generally found favour; while 35–40% of the harvesters built in France are exported, it is pointed out that the most popular machines in France are not as good technically as the exported models. Reference is also made to topping and to a number of problems associated with harvester operation, particularly dirt tare. Features which the author considers desirable in both toppers and harvesters are listed.

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Results of sugar beet varietal trials. N. ROUSSEL, W. ROELANTS and T. VREVEN. *Le Betteravier*, 1976, **10,** (94), 11–14.—Details are given of beet varietal trials carried out in Belgium in 1975, and average results are also given for the two preceding years. Early- and late-season varieties were tested. For all three years, the most profitable as regards root and sugar yield and sugar content was the early-season "Monohil" of Swedish origin.

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Learn from difficult years! Experiences should be remembered. W. C. VON KESSEL. *Die Zuckerrübe*, 1976, **25,** (1), 8–12.—Since beet agriculture is affected by weather, the author stresses the need for the farmer to remember the lessons learnt in a year of adverse weather conditions and looks back at the crop of 1975 and the various problems encountered.

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Results of tests on the performance of sugar beet harvesters. W. STIEGER. *Die Zuckerrübe*, 1976, **10,** (1), 16–19, 22.—Tests on various types of harvesters are reported and the results tabulated, showing the dirt tare percentage, topping quality and proportion of damaged roots at given linear speeds.

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Heat, water, fertilizer, sweat—and what came out of it. J. HOBOHM and H. G. TIEDGE. *Die Zuckerrübe*, 1976, **10,** (1), 23–26.—The authors examine the poor results of the 1975 beet crop in the Uelzen region of West Germany and point to the lack of rain as the chief cause of the difficulties.

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Was the early sowing in 1975 successful? H. FELTZ. *Die Zuckerrübe*, 1976, **10,** (1), 26–27.—Drilling on 25th April gave a higher beet and sugar yield than did sowing on 5th March in the same location, while the early sowing resulted in a high level of bolting, with concomitant hindrance to harvesting; moreover, the bolted beet had a higher sugar content than did "normal" beet. The risk of sowing before mid-March is underlined, particularly where drilling is followed by a period of cold weather.

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Comparative trials with genetically monogerm sugar beet varieties in 1973 and 1974. L. LUKÁCS and J. ZANA. *Cukoripar*, 1975, **28,** 204–208; 1976, **29,** 1–4. Trials at three sites in Hungary are reported in which Beta M-102 generally proved superior in terms of root and sugar yield as well as processing quality.

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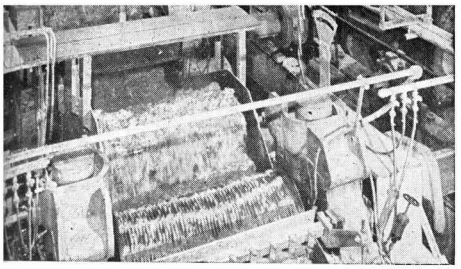
Beet top harvester trials. ANON. *Le Betterav. Franç.*, 1976, **46,** (289), 18, 23–24.—Trials with beet top harvesters conducted at a location in France are reported. Mixed-rotor types proved superior to the twin-rotor machines.



Cane sugar manufacture

What is the economical size of a sugar factory? J. FERRAN O. *ATAC*, 1975, **34**, (4), 4–21.—The various factors affecting the production cost per ton of sugar which influence the relationship between this cost and factory size are discussed and attempts made to eliminate these influences. Reference is made to factories, especially of large size, in various parts of the world. Factories with an annual capacity of 1,000,000–1,400,000 arrobas (approx. 11,400–16,000 metric tons) have shown themselves to produce sugar at lowest cost, and the reasons why increasing capacity has first a decreasing and then a negative return in terms of sugar cost are explained. The application of such conclusions to the Cuban industry's development and investment programme is discussed.

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Rheology and its importance in food processing. D. V. BOGER and C. TIU. *Process Industries in Australia. 2nd National Chem. Eng. Conf.*, 1974, 449–460; through *S.I.A.*, 1975, **37**, Abs. 75-1610.—Rheological data for a Qunaba *C*-molasses are used in conjunction with the mechanical energy balance to show how power requirements can be calculated for pumping this non-Newtonian fluid under actual factory conditions. The optimum pipe diameter and optimum pumping temperature were also calculated. There was excellent agreement between the calculated values of the diameter and temperature and the conditions being employed in one factory studied.

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Production and chemical composition of gur from sugar cane in India. J. ŽĎÁRSKÝ and A. SVOBODA. *Listy Cukr.*, 1975, **91**, 258–259.—Gur manufacture is briefly described and the analyses and ash contents given of two samples.

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Self-synchronizing motors for automatic controllers. R. C. SHARMA. *Sugar News* (India), 1975, **7**, (5), 12–13. The various types of self-synchronizing motors available for automatic control signal transmission are described.

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Mechanistic studies of cane mud flocculation. E. WHAYMAN and O. L. CREES. *Sugar J.*, 1975, **38**, (6), 20–24.—See *I.S.J.*, 1975, **77**, 119.

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High-speed photography inside a continuous sugar centrifugal at Millaquin mill. ANON. *Australian Sugar J.*, 1975, **67**, 315.—Brief mention is made of experimental work on the development of a high-grade continuous centrifugal at Millaquin for which high-speed photography is being used. The sugar crystals are photographed as they leave the walls of the basket at speeds of 300 mph in order to measure their coefficient of drag. Continuous filming is possible for only $1\frac{1}{2}$ seconds because of the intense heat generated in the camera.

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Treatment and disposal of cane mill wastes. R. WELLNER. *Sugar News* (Philippines), 1975, **51**, 344–346.—The author outlines means of treating cane sugar factory waste water, which he divides into concentrated waste (mostly from wash processes) and cooling water/condenser waste. Anaerobic treatment of the former followed by aerobic treatment in storage lagoons will give good results provided it is carried out efficiently; cooling water is best recycled, since the sugar in it can raise the BOD to a level higher that that in concentrated waste and pose a serious problem if the waste is discharged into a river without treatment, despite the high dilution.

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Formation and inhibition of colour substances from the products of alkaline degradation of sugar. L. BOBROVNIK, L. KOTELNIKOVA, A. SAPRONOV, R. RUSO and R. FAJARDO. *CubaAzúcar*, 1975, (Oct./Dec.), 8–20. The mechanism whereby sodium sulphite inhibits colour formation from glyceraldehyde and dihydroxyacetone are described. It has been found that application of a sodium sulphite solution during centrifugalling of raw sugar inhibits colour formation and pH drop when the sugar is heated over a long period, and two methods are proposed for so treating raw sugar (washing sugar in the centrifugal with a solution of Na_2SO_3, and affining the raw sugar with a syrup containing 0·5% Na_2SO_3) in order to reduce colour development during storage.

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Storage of sugar in bulk. E. CARDET, M. ALAYÓN and R. RODRÍGUEZ. *CubaAzúcar*, 1975, (Oct./Dec.), 21–31.—A survey of the subject is presented with 27 references to the literature.

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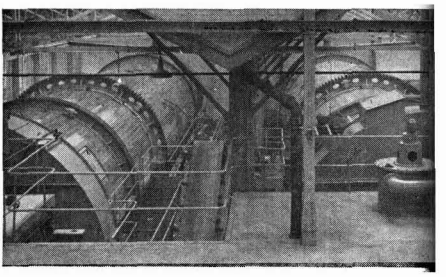
Mathematical model of a raw sugar pan. I. Formulation. II. Ideal control. T. DÍAZ and P. FRIEDMAN. *CubaAzúcar*, 1975, (Oct./Dec.), 34–38, 39–46.—A mathematical model is developed to predict the dynamic behaviour of a raw sugar pan based on mass and energy balances, on phase balance ratios and on expressions for crystallization, evaporation and heat transfer flows. The model is shown at open loop, i.e. the set of expressions which determine such behaviour in the absence of some control system. Based on ideal control alternatives, a control model is then developed to complete the closed-loop model which predicts the dynamic behaviour of a pan. Two alternatives are given: one using supersaturation for control purposes, and the other using Brix. Results obtained from runs of demonstration cases are shown; the observed qualitative behaviour of the model is satisfactory.

Beet sugar manufacture



Physico-chemical properties of thick juices for prolonged storage. T. P. KHVALKOVSKII, A. L. SHOIKHET, T. V. ZAKHAROVA and I. V. ZAKHAROVA. *Sakhar. Prom.*, 1975, (9), 16–19.—The saturation and supersaturation coefficients, dynamic and kinematic viscosity, conductimetric ash, conductivity, boiling and freezing points of 14 thick juice samples of varying composition prepared for storage were determined and optimum Brix calculated, as a function of purity and temperature after saturation, at which stability occurs. The effect of Brix on viscosity and freezing point was also determined. Since the freezing point was found to be between —32 and —33°C, there is no need for thermal insulation of storage tanks; to prevent deposition of sugar in the tanks, the Brix of the newly stored juice should be slightly lower than that of thick juice saturated at 0°C.

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Industrial use of fluidized bed for classifying sugar. L. NEUŽIL and L. BROŽ. *Potravin Chladici Tech.*, 1974, **5**, (6), 172; through *S.I.A.*, 1975, **37**, Abs. 75-1605.—At Trebišov factory, sugar is fed at approx. 10 tons.hr^{-1} to a 15,000-ton silo via a fluidized bed 2 m long and 63 cm wide supplied with 4900–5800 m^3 of air per hour; the equipment has operated reliably since 1966, removing about 80% of the particles finer than 0·315 mm (0·6% on total weight of sugar) at an average power consumption of 2·86 kWh per ton. The risks of caking and explosion in the silo are thus greatly decreased. Larger beds processing 30 and 40 tons.hr^{-1} have been installed at Kostelec and Melník factories. Icing sugar has been successfully classified at 1 ton.hr^{-1} using a bed 3 m long and 5 cm wide; the coarse fraction not entrained is returned to the mill, and the size range of the product is controlled by air flow rate.

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Invert sugar destruction during juice purification in the presence of atmospheric oxygen. H. SCHIWECK. *Zucker*, 1975, **28**, 670–674.—See *I.S.J.*, 1976, **78**, 26.

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The possibility of increasing sugar yield by addition of sulphur dioxide and calcium bisulphite during diffusion. S. ZAGRODZKI. *Zucker*, 1975, **28**, 674–676.—See *I.S.J.*, 1976, **78**, 26.

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Preventive measures against dust explosions in the sugar industry. G. SCHNEIDER. *Zucker*, 1975, **28**, 677–680. Means of preventing dust explosions are discussed, with mention of three major sugar dust explosions which have caused deaths and injuries. The most important means of reducing the risk of powerful explosions is, according to the author, one which is not always observed, viz. avoidance of dust accumulation. Official regulations and guidelines on explosion prevention are examined, and prediction of the maximum possible pressure that could occur with an explosion is explained. Since it is not possible to prevent explosions completely, the aim is to restrict the effects by pressure relief; this is illustrated by reference to dust separation units.

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Adsorption of sugar factory juice colorants on calcium carbonate. K. VUKOV. *Cukoripar*, 1975, **28**, 209–213. See *I.S.J.*, 1976, **78**, 26.

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Experiences with operation of the VSZ-5 vibratory screen. L. PÁLFALVAI. *Cukoripar*, 1975, **28**, 213–215. The operation of a VSZ-5 vibratory screen, used at Kaposvár to treat milk-of-lime, is reported.

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The heat pump in sugar factory evaporation. A. FÉNYES. *Cukoripar*, 1975, **28**, 222–227.—The second law of thermodynamics (as stated by Clausius) is explained in its application to the theory of the heat pump. Various means of upgrading steam heat for evaporation are then examined, including use of the heat pump and thermocompression using a steam injector. The latter method is preferred since the injector is considered cheaper to operate than the heat pump.

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The rheometer automatic boiling control system, a new process for the fully-automatic execution of the boiling process. H. THIELE and A. LANGEN. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 187–203.—The theory and practice of the Pfeifer & Langen fully-automatic boiling control system based on massecuite viscosity are described. (See also *I.S.J.*, 1974, **76**, 136–140, 169–173.)

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Use of condensate for sugar extraction from beet cossettes in diffusion. A. I. SHAPIRO. *Sakhar. Prom.*, 1975, (11), 21–23.—Instead of condenser water, which contains mineral and organic salts as well as bacteria, the author advocates the use of condensate for beet diffusion (at 50–55% on weight of beet). The pH, usually 9·0–9·3, has to be adjusted to about 6·0, for which treatment with SO_2 is recommended. Calculation of the SO_2 requirement (and of the solid sulphur from which the gas is generated) is demonstrated.

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Biological treatment of sugar factory waste waters. N. E. PARAKHIN. *Sakhar. Prom.*, 1975, (11), 23–27. Treatment of Class III waste water by aeration and the activated sludge process is discussed and a complex scheme described.

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Means of improving (intensifying) the performance of filter beds at existing sugar factories. A. N. SAKUN. *Sakhar. Prom.*, 1975, (11), 27–29.—Where 30–100 ha of land is already used for treatment of waste water and the filter beds are overloaded because of increased

beet throughput, the author advocates a number of measures for reducing the amount of waste water needing treatment and increasing the throughput of the beds.

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Experience in reassembling twin-scroll trough-type diffusers. A. SH. TESHEV, A. T. MIKHAILYUK and A. M. LITVINOV. *Sakhar. Prom.*, 1975, (11), 35–37. The sequence of operations to follow in dismantling and reassembling a twin-scroll, trough-type diffuser of the DDS pattern is described.

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Complexing properties of boiler feed water on a purely condensate system. E. D. YARMILKO. *Sakhar. Prom.*, 1975, (11), 49–54.—Condensate used as boiler feed contains Ca, Mg and Fe cations which form highly-soluble complexes; these are concentrated in the water and may be discharged with blow-through water. The complexing properties disappear only at a pH greater than 9·3. Treatment of condensate with phosphate to prevent scale formation is only recommended where some softened water is added, and only then when the pH exceeds 9·3.

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Thermodynamic steam traps and their use in the sugar factory. A. I. KHOMENKO. *Sakhar. Prom.*, 1975, (11), 54–57.—The principle of operation of the thermodynamic steam trap for condensate removal on the basis of a reduction in static pressure with increase in steam flow is described.

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Theory of diffusion. The hypothesis of Silin. J. C. GIORGI and B. RICHARD. *Sucr. Franç.*, 1975, **116**, 487–490.—Two mathematical models were developed for description of counter-current diffusion where the cossette was defined as (i) a cylinder and (ii) a rectangular plate of width greater than its thickness. Calculation of pulp losses under given diffusion conditions showed agreement between the value given by the SILIN formula (which also assumes a cylindrical model for the cossette) and programme (i). The SILIN formula is thus considered valid for calculation of losses under the effect of juice draft and diffusion time; the validity for influence of cossette length is not as high, but is still considered acceptable.

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Determination of standard molasses by means of the "Saturoscope" and crystallization tests. M. FRIML and S. POCHYLÁ. *Listy Cukr.*, 1975, **91**, 247–251. The saturation temperature, pol content and purity of standard molasses (having Brix of 84·5° at 40°C) were determined by the "Saturoscope" method and by crystallization under controlled conditions. Comparison of results showed close agreement for 25 molasses samples, but the "Saturoscope" method was more rapid and sufficiently accurate for low-grade massecuite work.

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Inhibition of the microbial activity in extraction juices of beet sugar factories by some antiseptic substances. D. MATTEUZZI, G. MANTOVANI, G. L. CIVERRA and G. VACCARI. *Zeitsch. Zuckerind.*, 1975, **100**, 675–678. See *I.S.J.*, 1976, **78**, 27.

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Sequestering agents instead of soda and ion exchange for reduction of scale formation in sugar factory evaporators. G. VERNOIS. *Zeitsch. Zuckerind.*, 1975, **100**, 693.—While "Masquol CH" (stabilized sodium salt of EDTA) has been found to be effective in reducing scale formation in evaporators, its use in the French food industry is forbidden. In 1974/75, tests were conducted at four French sugar factories in which the effects of sequestering agents against lime salts and hence in reducing evaporator scale were determined. In one factory, evaporator tubes were clean after 1 month compared with the need to shut down for cleaning every two weeks before use of the agent. The use of sequestering agents is preferred to the use of sodium carbonate or ion exchange for reasons which are stated.

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Investigation of sucrose passage through ion exchange membranes during electrodialysis. L. A. FEDORENCHENKO, V. T. DEREVYANCHENKO and L. D. BOBROVNIK. *Izv. Vuzov, Pishch. Tekh.*, 1975, (4), 41–44.—A mathematical model of the electrodialysis process is developed in which the electro-osmotic transfer of sucrose is expressed in terms of a number of independent variables. Values of their regression coefficients obtained from a number of time-randomized tests are substituted in the orthogonal second-order polynomial, which is valid for establishing optimum conditions for electrodialysis.

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Mass crystallization of aragonite needles in scale deposits in sugar industry vessels. A. T. BOGOROSH, I. S. GULYI, I. M. FEDOTKIN and V. G. VOITKEVICH. *Izv. Vuzov, Pishch. Tekh.*, 1975, (4), 168–172.—Analysis of scale in carbonatation vessels and juice heaters as well as juice lines was carried out by an X-ray scanning method and a quantitative assessment made with a scintillation counter. The presence of aragonite needles was revealed at the metal-scale interface, such crystals breaking up the scale at a rate which increased with increase in the rate of scale deposition. The nature of the scale was governed by the change in flow pattern of the juice to bubble flow.

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The fundamentals of filtration. F. HEITZ. *Sucr. Belge*, 1975, **94**, 439–452, 487–498.—Liquid filtration theory is explained in detail, including filtration resistance, filtration energy, porosity and filtrability; compressibility and incompressibility of muds; calculation of the volume filtered and flow at a constant pressure, at constant flow rate or where a centrifugal pump is used; corrections necessary in making allowance for the presence of a support element, whether non-clogging or otherwise; application of mathematical expressions to the work of filter-presses, rotary filters and candle filters; pressure loss in mud; the various laws governing filtration; the effect of compressibility and pressure on such factors as porosity and specific resistance; the advantages of filter aid utilization; and descriptions of equipment used for experimental measurements of filtration parameters and values obtained.

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Factory determination of the recycle volume and lime addition during recirculation. J. ČEPELÁK and R. OSVALD. *Listy Cukr.*, 1975, **91**, 272–274.—Equations are presented for calculation of the quantities involved in juice purification where 1st carbonatation mud or juice is recycled to preliming or where some 1st and 2nd carbonatation mud is recycled. The expressions are intended to help in factory control of lime addition under recirculation conditions.

Small-scale tests of a method for juice purification with calcium sucrocarbonate colloids. J. BURIÁNEK, J. RAIS, Z. SCHNIDEROVÁ and I. ŠAFROVÁ. *Listy Cukr.*, 1975, **91**, 275–282.—Small-scale tests were conducted on the process described earlier[1], in which juice flow was 15 litres.min^{-1}. Results indicated that the prelimed juice had the same filtrability as did 1st carbonatation juice obtained by the conventional method, recirculation of treated mud to the raw juice having a decisive effect. However, if mud separation from the prelimed juice was incomplete, at the alkalinity level obtaining in 2nd carbonatation the particles disintegrated and the juice colour rose. The pH at which colloid coagulation took place in the raw juice was noticeably lower than in conventional processes; optimum coagulation and maximum juice filtrability were obtained at an alkalinity of 0·080–0·100% CaO, i.e. the levels usual for 1st carbonatation.

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Sugar extraction by diffusion under non-steady conditions. G. V. GENIE. *Zucker*, 1976, **29**, 9–14.—See *I.S.J.*, 1975, **77**, 133–138.

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The vibratory spray washer and its application in the sugar industry. R. SEBASTIAN. *Zucker*, 1976, **29**, 15–20.—The construction, operation and advantages of the vibratory spray beet washer are discussed with the aid of a number of illustrations and references to units installed in sugar factories.

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The system for effluent treatment and measures taken to reduce the water requirement in beet sugar factories in Sweden. N. AKERMARK. *Socker Handl.*, 1975, **27**, (1), 1–22.—Waste water treatment in the Swedish sugar industry is discussed and problems listed which have occurred as a result of recycling. The equipment installed for effluent treatment at Örtofta factory during 1957–74 is listed together with its costs. Details are given of developments at Örtofta, Hasslarp and Karpalund factories followed by a description of a method introduced in various forms at these and other factories in which the basic steps are: (i) 4–7 days' anaerobic treatment of the limed waste water to convert sugar and the more complex substances to organic acids, CO_2, NH_3 and H_2S, (ii) their reduction to CH_4 by bacteria, (iii) aerobic treatment with surface aerators (after mud settling), and (iv) storage of the effluent in ponds (after further sludge separation) where the BOD is reduced to below 25 mg.litre^{-1}. Mud recirculation takes place from both anaerobic stages for further treatment.

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Extraction of sugar and non-sugars—optimization of the draft and sugar loss parameters. J. BLOK and P. W. VAN DER POEL. *Zeitsch. Zuckerind.*, 1976, **101**, 8–12.—See *I.S.J.*, 1976, **78**, 26.

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The effect of air in heating steam on the temperature gradient in heat transfer processes. R. WASMUND. *Zeitsch. Zuckerind.*, 1976, **101**, 13–18.—Air in heating steam adversely affects heat transfer and the effective temperature difference between the condensing steam and the material to be heated. The effect on the temperature gradient is quantified as a function of the more important heat transfer variables.

Trash in beet sugar factories. ANON. *Sugar J.*, 1975, **38**, (7), 18–19.—See *I.S.J.*, 1976, **78**, 215.

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Investigation under factory conditions of a new carbonatation scheme. N. D. TANTSYURA and YA. A. KAUFMAN. *Sakhar. Prom.*, 1975, (12), 15–19.—In the scheme described, a horizontal preliming tank is used which is divided into seven compartments by partitions not extending completely to the bottom of the trough. Passing through the compartments is a shaft carrying mixer paddles, while above the partition in each compartment is a plate which can be adjusted to a desired angle of slope by means of a lever. Raw juice at 50–55°C is fed into the first compartment, 1st carbonatation juice at 0·09–0·10% CaO alkalinity is fed (at 150% on juice) into compartments 2, 3 and 4, while milk-of-lime (0·3–0·5% CaO) is fed into compartment 7. The raw juice is thus progressively limed to pH 10·8–11·0 during 20 minutes' retention, the alkalinity achieved in each compartment being governed by the mixer shaft rotary speed and the angle of the plates. The juice is then transferred to a "ripener" for 10 minutes, after which it flows under gravity to cold liming for 15 minutes' treatment with 2·5% CaO, followed by heating to 90°C and 5 minutes' hot liming with 0·2–0·3% CaO. Subsequent treatment is as in conventional carbonatation. Results of tests in 1973/74 and 1974/75 showed that non-sugars content of 1st and 2nd carbonatation juice was lower and the sugar content and purity higher than with conventional processing, while the colour of 2nd carbonatation juice, thick juice, standard liquor and sugar were also lower than with the standard scheme. The new system is of particular value in the treatment of juice from beet of poor quality.

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Manufacture of liquid sugar at Lokhvitskii sugar combine. E. E. BELOKON' and V. K. SEVRYUK. *Sakhar. Prom.*, 1975, (12), 19–21.—Information is given on the system used at this Soviet factory to melt a portion of its white sugar for transfer to the nearest refinery. The melted sugar, of 63–68°Bx, is transported in railway tank trucks. The system has proved much more economical than the conventional bagged sugar scheme which requires more than 180 men a day. In 1974/75 some 22% of the total production was carried in liquid form.

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Effect of the height of the feeding devices in conical centrifugals on the percolation rate in the field of centrifugal forces. V. F. KOLOMIETS, L. I. TOVBIN, V. G. ANDREEV and E. E. EGISERYAN. *Sakhar. Prom.*, 1975, (12), 28–32.—The effect of feeder height in continuous conical centrifugals on molasses separation at varying basket speeds and massecuite properties was investigated theoretically and experimentally. Results, given in graph form and applicable to centrifugal design, indicated that the separation rate rose with increase in the height of the feeder and tended towards a constant value which was governed by massecuite properties and process variables.

* * *

Automation of molasses calculation. A. L. ANTONOVICH and V. S. PETRIK. *Sakhar. Prom.*, 1975, (12), 35–36.—A mathematical model is presented for calculation of molasses yield and sugar content by computer as an integral part of an automatic control system.

[1] BURIÁNEK: *I.S.J.*, 1975, **77**, 280.

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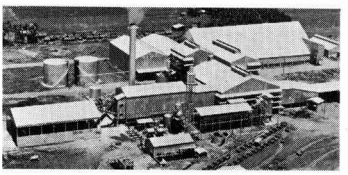

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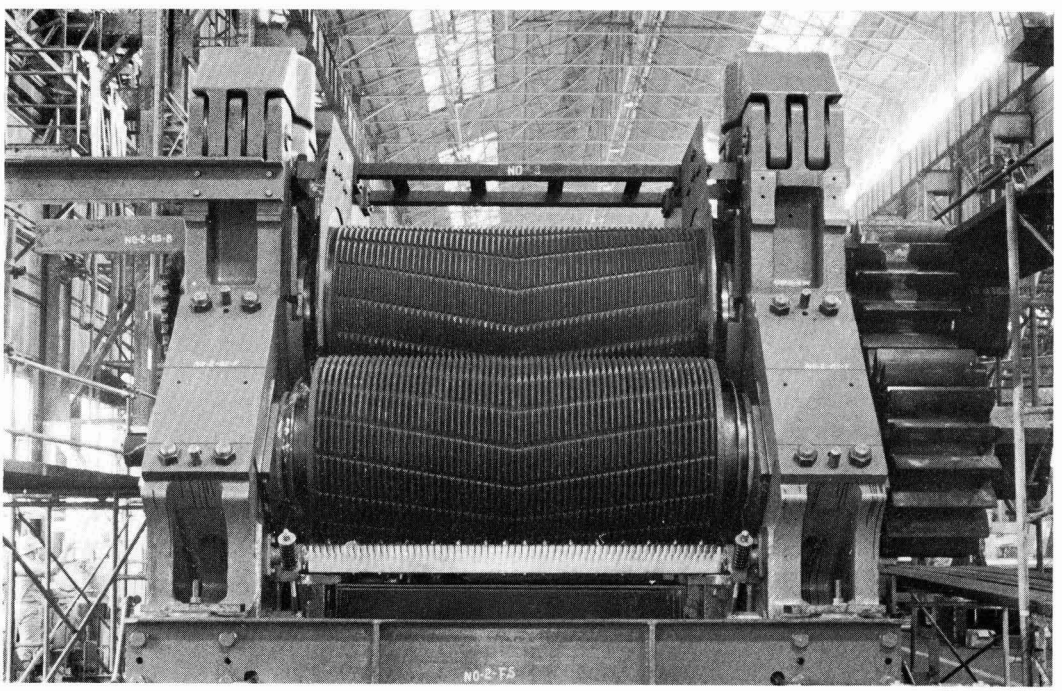

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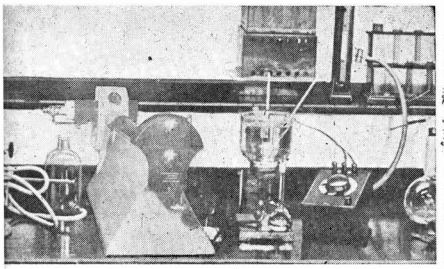

Laboratory methods & Chemical reports

A statistical analysis of the effect of cane quality on extraction performance. P. W. REIN. *S. African Sugar J.*, 1975, **59**, 615–625.—See *I.S.J.*, 1976, **78**, 189.

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Genetic viewpoints of molasses formation. V. A. GOLYBIN, S. Z. IVANOV and V. G. CHERNIKINA. *Gaz. Cukr.*, 1975, **83**, 239–240.—See *I.S.J.*, 1976, **78**, 92.

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Development and balance of sugars at six sugar factories during the 1974-75 campaign. P. DEVILLERS, R. DETAVERNIER and J. ROGER. *Sucr. Franç.*, 1975, **116**, 441–452.—The beet and molasses glucose, raffinose and sucrose contents are tabulated for samples from six French sugar factories; the results given by polarization with and without correction for raffinose are also given. The discrepancy created by the presence of raffinose is equivalent to an unknown loss in the range 0·03–0·32% pol on beet but, since it is extremely variable with time and sample, no constant correction can be made for it.

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Sugar laboratory problems. V. New table for correction of conductimetric ash readings obtained in the Buse-Todt-Gollnow Universal Rafinometer. E. R. DE OLIVEIRA and J. P. STUPIELLO. *Brasil Açuc.*, 1975, **85**, 236–240.—A new table of temperature correction factors to be applied to readings with the title instrument, which is used quite widely in Brazil, is proposed. The old table gives factors for ash contents from 0·5 to 3·0% of the sample in 0·1% steps and from —5° to +5°C on either side of the standard 20°C in steps of 0·1°C, providing some 650 correction factors. The new table is of factors applying to a solution diluted to 5 g per 100 cm^3 and covering a range of 15·0°C to 25·0°C in 0·1° steps. Having only 100 values, it is simpler to use.

* * *

The moisture content of sugar. F. SCHNEIDER, A. EMMERICH and U. TICMANIS. *Zucker*, 1975, **28**, 606–615.—Comparison of results given by the HILL & DOBBS method[1] with those given by a modification of the KARL FISCHER titration method[2] revealed wide divergencies, so that a further independent method was required. Attempts to use calcium carbide and a number of hydrides were unsuccessful. However, a modified saponification method was devised on the basis of ethyl acetate hydrolysis in dimethyl sulphoxide (used as sugar solvent) under the action of potassium ethoxide, consumption of which corresponds to the water content in the sample. Full details are given of the method, which gives a complete, stoichiometric reaction, and results are tabulated showing close agreement between it and the modified KARL FISCHER method (± 0·001%) for pure sucrose and white sugar.

The absorptive behaviour of fructose, glucose and sucrose melts subjected to varying heat intensity. W. MAUCH and S. ASSEILY. *Dissertation* (Technical University, Berlin), 1975, 127 pp.—Dry melts were prepared from pure fructose, glucose and sucrose and from white sugar samples by exposure to heat for varying periods at varying temperatures. The composition of the melts was examined by paper and gas-liquid chromatography and enzymatically, showing the effects of heat treatment on decomposition. Determination of the water content showed that it was much higher in melts exposed to intensive heating than where only slight heating was applied; this is attributed to the formation of water molecules during decomposition and condensation of the sugar molecules. It was found that the moisture equilibrium of fructose melt rose as the heating intensity increased, while that of glucose fell; in the case of sucrose melt, the moisture equilibium first fell, then rose as heating was increased.

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Investigation of the thermal stability of sugar refinery products. S. A. BRENMAN, I. L. ZDANOVICH, F. P. ALEKSEENKO and L. V. OGORODNIICHUK. *Sakhar. Prom.*, 1975, (10), 28–32.—The amount of sucrose decomposed during syrup decolorization and massecuite boiling was determined as a function of pH and temperature. The increase in losses with fall in pH and rise in temperature and with exposure to protracted constant high temperature is shown by data which relate to 1st, 2nd and 3rd refined and 1st, 2nd and 3rd crop massecuites and the syrups from which they were obtained.

* * *

Linear and mass rate of growth of sucrose crystal faces. J. MALCZEWSKI. *Gaz. Cukr.*, 1975, **83**, 254–259.—A description is given of an apparatus for determining crystal growth from an aqueous refined sugar solution previously heated to 15°C above saturation temperature. Measured results are discussed, and comparison made between the values obtained under two sets of conditions and those obtained by KUKHARENKO under less precise conditions.

* * *

Dissociation of sucrose in alkaline solution. F. COCCIOLI and M. VICEDOMINI. *Annali di Chimica*, 1974, **64**, 369–375; through *S.I.A.*, 1975, **37**, Abs. 75-1598. Sucrose dissociation in 0·05–0·2M solution at 25°C in the presence of M $NaClO_4$ was studied in the pOH range 0·6–2·7 by potentiometry *vs.* NaOH with a Pt hydrogen electrode; slight deviation from linearity was observed in the *E vs.* $[OH^-]$ graph at $[OH^-]$ greater than 0·25M. The negative logarithms of the 1st and 2nd dissociation constants K_1 and K_2 were found to be 12·57 ± 0·06 and 13·45 ± 0·1, respecively.

[1] *I.S.J.*, 1959, **61**, 121.
[2] *ibid.*, 1976, **78**, 93.

Interference of nitrite in the iodometric determination of sulphite. R. B. LEW. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 252–256.—Determination of sulphite remaining in thin juice after sulphitation by titration with iodine or with potassium iodate solution using starch as indicator has sometimes proved difficult because of an abnormal end-point or because of a dark blue coloration when starch or potassium iodide is added to the test solution. Subsequent investigations have shown that this is caused by the presence of nitrite in the juices. Details are given of a proposed method for sulphite determination in the presence of nitrite which involves reacting nitrite with hydrazine sulphate, transference of the sample to a flask containing potassium iodate and iodide, back-titration with sodium thiosulphate until the solution changes from brown to yellow, and, after adding starch, the titration with sodium thiosulphate continued until the blue colour disappears. Recovery of sodium sulphite added to 50 ml thin juice was in the range 98·4–99·5% using the method, which gave higher sulphite values than did direct titration with potassium iodate. Where the nitrite concentration was abnormally high, titration of sulphite was not possible without nitrite elimination.

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False polarization: quantitation and characterization in sugar beet processing juices. G. W. MAAG and G. H. SISLER. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 257–263.—Comparison of sucrose determination in raw, thin and thick juice, standard liquor and molasses by polarization and gas-liquid chromatography showed that the pol readings indicated consistently higher sucrose than the GLC measurements, although the differences were significant only with the standard liquor and molasses samples. The discrepancy is attributed to the effects of dextrorotatory compounds; it was found that glucose (dextrorotatory) cancelled the levorotatory effect of amino-acids, amides and pyrrolidone carboxylic acid except in the standard liquor and molasses where excess levorotation was minimal. Allowing for the dextrorotatory effect of raffinose accounted for most of the disparity, but galactinol and kestoses could contribute to the distortion.

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Gas chromatographic method of determining acids in technical sugar juices. E. REINEFELD, K. M. BLIESENER and L. REXILIUS. *Zucker*, 1975, **28**, 661–670.—Details are given of a gas-liquid chromatographic method for determination of organic acids as their trimethylsilyl derivatives. Procedures are described for volatile and non-volatile acids; the former are first separated by steam distillation, while the latter are separated from the juice by ion exchange. A flame ionization detector is used for qualitative determination of the non-volatile acids, but since this is unsuitable for formic acid, volatile acids are qualitatively determined with a thermal conductivity detector.

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Effects of hydroxy acid salts on sucrose decomposition kinetics. S. Z. IVANOV, Z. A. MIL'KOVA, R. I. KHARITONOVA, V. V. NAVOLOKIN and B. I. BELOLIPETSKII. *Sakhar. Prom.*, 1975, (11), 29–30.—The effects of 0·01 mol.litre^{-1} potassium malate and 0·05 mol.litre^{1} potassium tartrate on sucrose decomposition in 0·5M solutions at 100°C were studied. In the presence of the salts, sucrose inversion was auto-catalytic; the salts had an inhibiting effect, in contrast to lactates which have been found to catalyse the inversion. K malate had a greater inhibiting effect than K tartrate: a five-fold reduction in malate still gave a 6-fold increase in the induction period compared with the tartrate.

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Results from analysis of average molasses samples from 33 sugar factories. A. YA. ZAGORUL'KO *et al. Sakhar. Prom.*, 1975, (11), 39–42.—The compositions of molasses samples from 33 factories in the Russian Federation in the latter half of 1972 are discussed with the aid of tabulated data.

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Determination of the phosphate content in sugar factory products. T. P. KHVALKOVSKII and T. V. ZAKHAROVA. *Sakhar. Prom.*, 1975, (11), 42–45.—Eight methods were tested for phosphate determination in molasses. Two which gave acceptable results were both colorimetric methods, one using stannous chloride and hydrazine sulphate as reducing agents, and the other ascorbic acid.

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Determination of colour in crystal sugar: influence of filtration medium and of pH. J. A. WEBER. *Brasil Açuc.*, 1975, **86**, 404–415.—The influence of membrane filter porosity and pH on colour measurement by the ICUMSA Method 4 has been studied, using standard, superior and special crystal sugar manufactured directly by Brazilian sugar factories. Membrane pore sizes ranged from 0·45 to 3·0 microns, and the degree of colour retention of each and the number of membranes needed to filter 70 cm^3 of solution were measured, filter paper plus filter aid being used also for comparison. The 0·45 micron membrane removed 9–17% of ICUMSA colour on filtration of standard crystal sugar solution with corresponding values of 14–28% for superior crystal and 13–28% for special crystal, all related to the colour in 3·0 micron filtrate. It is concluded that the 3·0 micron filter membrane offers the best conditions. Comparison of colour at the original pH (6·5–6·7) and at a pH adjusted to values between 5·0 and 9·0 showed marked increases at pH greater than 7 and it is suggested that the pH should not be adjusted from its natural value.

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Quantitative determination of D-glucaric acid by gas chromatography. V. PREY, H. GRUBER, S. K. FISCHER and W. LORENZ. *Zeitsch. Zuckerind.*, 1975, **100**, 673–674.—A gas-liquid chromatographic method is described for determination of glucaric acid which is formed by oxidation of glucose and sucrose with nitric acid.

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Effect of dextrins on sucrose nucleation rate. A. I. BYVAL'TSEV and A. V. ZUBCHENKO. *Izv. Vuzov, Pishch. Tekh.*, 1975, (4), 84–86.—The nucleation rate of sugar was reduced by the presence of dextrin, the decrease being greater with increase in the amount of dextrin (2·5 and 5·0 g per 100 g sugar). Dispersion of the crystalline mass increased with rise in the dextrin quantity. The interphase energy at the nucleus-solution boundary had greatest effect on

nucleation rate while changes in viscosity had least influence.

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The role of convective mass transfer during growth and dissolution of sucrose crystals. V. M. KHARIN and A. L. ZHARKOV. *Izv. Vuzov, Pishch. Tekh.*, 1975, (4), 133–136.—Mass transfer from the mother-liquor to the crystal surface and *vice-versa* takes place under the effects of molecular and convective diffusion. Convection is divided into forced convection, i.e. where the difference in density between the crystal and mother-liquor causes gravity fall of the crystal, and natural convection, whereby differences in density of the mother-liquor itself result from a concentration gradient near the surface of the crystal and cause movement of the solution. Experiments are reported which showed that convective transfer was more dominant than purely molecular transfer over a wide range of conditions, and that natural convection made an insignificant contribution to the total mass transfer in the case of a falling crystal.

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Effect of the size of crystals on their growth and dissolution rate. I. G. BAZHAL *et al. Izv. Vuzov, Pishch. Tekh.*, 1975, (4), 137–140.—The asymmetric effect of crystal size in the dispersed phase on crystal growth and dissolution rates was investigated theoretically and confirmed experimentally, from which it was found that with periodic fluctuations in temperature and concentration of the mother-liquor the crystals grow by recrystallization in a fluctuating manner.

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Determination of the granulometric composition of sugar and intermediate products using the microscope. L. CARRAZANA R. and A. P. KOZYAVKIN. *CubaAzúcar*, 1975, (July/Sept.), 3–8.—The sugar or intermediate product is added to a 3 mm high solvent layer in a Petri dish (20 mg of sample per cm^2 of surface) and the molasses layer eliminated and conglomerates thus removed, permitting examination of the crystals under the microscope for measurement of MA and CV. The most suitable solvent found is a sucrose-saturated 1:1 mixture of distilled glycerol and methanol.

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Influence of non-sugars on the viscosity of final molasses. L. CARRAZANA R., A. P. KOZYAVKIN, M. BORROTO, G. DÍAZ and C. DOUVAL. *CubaAzúcar*, 1975, (July/Sept.), 45–53.—Analyses and viscosity measurements were made on final molasses from various Cuban factories and graphs drawn to indicate the relationship between viscosity at different temperatures and the non-sugars content, and the colloid, dextran, reducing sugars and reducing sugars and ash % non-sugars as well as refractometric Brix. The colloids and especially the dextran had the major influence on viscosity, low levels permitting better exhaustion. It is feasible to construct a nomogram for calculating viscosity from concentration and temperature which may be used to control low-grade boiling.

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Notes on temperature control in polarimetry and refractometry. M. RANDABEL. *Rev. Agric. Sucr. Maurice*, 1975, **54**, 110–114.—In answer to requests for information on the subject, the author presents notes for guidance, including recommendations on laboratory air-conditioning.

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Study on the physical state of sucrose after lyophilization. II. Lyophilized sucrose. M. MATHLOUTHI. *Ind. Alim. Agric.*, 1975, **92**, 1279–1285.—Freeze-drying of a 10% sucrose solution under controlled conditions gave a product which differed from vitreous sucrose obtained by rapid freezing of melted sucrose at —196°C. The lyophilized sucrose comprised an amorphous mass sprinkled with micro-crystals which were so small that they could not be detected by X-ray diffraction but necessitated use of electron diffraction. The existence of these micro-crystals and the highly dispersed state of the product indicates that moisture absorption quickly leads to crystallization of the lyophilized sucrose. The product became stable in ambient air, but its compactness resulted in loss of the readiness with which lyophilized products usually dissolve. Reheating of the sucrose to various temperatures under vacuum at the end of the lyophilization process revealed, by X-ray analysis, an increase in the intensity of the diffraction rays with temperature, indicating an increase in the size of the micro-crystals. However, the crystalline structure obtained at 120°C was still sufficiently compact for dissolution to be less easy than for the initial lyophilized product.

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Colorant formation under refining conditions. F. G. CARPENTER and E. J. ROBERTS. *Proc.* 1974 *Tech. Session Cane Sugar Refining Research*, 106–115. Recent work on colorant formation during refining is reviewed and details given of laboratory studies in which a 50°Bx sugar solution was kept at 85°C for 5 days, after which the pH was about 3 and some colour had developed. Colorant extraction with ethyl acetate was followed by high-voltage paper electrophoresis of the extract. The electrophoregram revealed a bright green fluorescent spot which was compared chromatographically with laboratory-prepared 3,4-dideoxyglucosulose-3-ene (DGU) and found to be identical. Thirteen other spots occurring on the electrophoregram were isolated, washed off the paper, heated and then subjected to further electrophoresis. The content of each was found to be lower than the initial content, while the DGU concentration was higher, indicating that all 13 compounds were steps in the production of DGU. The overall reaction is given as: sucrose → fructose → DGU → 5-hydroxymethyl-2-furfural (HMF) → colour. The reactions leading to colour formation under alkaline conditions and at constant pH have been studied and are discussed.

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Trace constituents in molasses. A. C. MORRISS and W. M. NICOL. *Proc.* 1974 *Tech. Session Cane Sugar Refining Research*, 116–124.—Molasses analysis for organo-chlorine pesticide residues by gas-liquid chromatography and for copper, lead, zinc and cadmium by flame atomic absorption (found to be better than the ICUMSA methods for reasons which are given) is described. Levels of the impurities permitted under legislation in specific countries covering their contents in animal fodder are discussed. Tabulated results indicate that none of the samples (which originated from a number of countries) contained cadmium.

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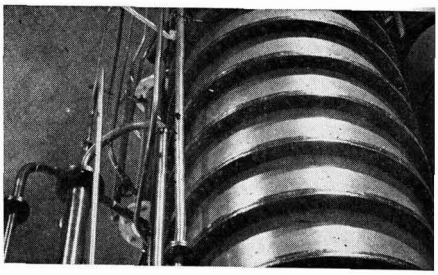

Sugar beet tops—a vital winter fodder. D. CHARLESWORTH. *British Sugar Beet Rev.*, 1975, **43**, 173–174. Reference is made to the winter feed system for 400 head of cattle on a farm in Leicestershire, which is based on barley straw and tops from beet grown on 130 acres.

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Why ensiling pays a double dividend. E. W. HART. *British Sugar Beet Rev.*, 1975, **43**, 175–176.—Beet top ensilage at a farm in Yorkshire is discussed. The silage is used to feed cattle during the winter once crops of ryegrass and swedes have been exhausted.

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Invaluable as a feed—the cows love them. D. CHARLESWORTH. *British Sugar Beet Rev.*, 1975, **43**, 176. Brief mention is made of the feeding of beet tops in the winter to a herd of Friesian dairy cattle.

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Distillation process and practice. A. C. CHATTERJEE and B. M. DUTT. *Sugar News* (India), 1975, **7**, (5), 3–7.—The equipment and processes used in the manufacture of ethyl alcohol from cane molasses are described.

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The effect of molasses colorants on the zeta-potential of yeast cells. V. N. SHVETS *et al. Izv. Vuzov, Pishch. Tekh.*, 1975, (4), 45–48.—The possible effect of melanoidins and caramelan in molasses on the zeta-potential of yeasts during alcohol fermentation was studied. At pH 3–7 the negative zeta-potential of two yeast strains fell under the effect of melanoidin adsorption (melanoidin having a positive zeta-potential); at pH 3 it was less than half of the zeta-potential of yeast suspension containing no melanoidins. After 24 hours, colorant adsorption had killed all of the yeast cells at pH 3 compared with only 18% killed in the absence of the colorants. In continuous fermentation, yeast colour rose gradually through adsorption of the melanoidins while the colour of the molasses mash fell. Caramelan was found to have no effect on the zeta-potential of yeast.

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Change in the coefficients of friction of dried beet pulp and its mixture with other components under conditions of pressing. M. G. PARFENOPULO and N. E. KARAULOV. *Izv. Vuzov, Pishch. Tekh.*, 1975, (4), 129–132.—The determination of coefficients of friction at varying pressure during briquetting of beet pulp and molasses-pulp mixtures in an experimental unit led to empirical formulae which are presented. A graph of the results illustrates the decrease in the coefficients with rise in applied pressure.

* * *

Utilization of distillery slops for continuous propagation of Torula yeast. J. T. AGUINALDO. *Sugar News* (Philippines), 1975, **51**, 354–356.—Yeast culture on distillery slops, containing an average of 0·23% reducing sugars and 0·5% alcohol and having a pH of 4·8, was investigated. Results showed that the residual sugars and other fermentable substances were utilized, thus reducing the pollution load. Addition of molasses to the slops increased the yeast yield compared with that obtained from slops alone. The economics are considered sufficiently favourable to justify the process, for which a number of other advantages are listed.

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Process for concentrating and purifying itaconic acid from fermented liquor with electrodialysis. M. NAKAGAWA, I. NAKAMURA and T. KOBAYASHI. *Hakko Kogaku Zasshi* (Osaka), 1975, **53**, (5), 286–293; through *S.I.A.*, 1975, **37**, Abs. 75-1704.—Media based on raw cane sugar, high-test molasses or cane molasses were fermented to give itaconic acid. High-test molasses was a suitable raw material. The itaconic acid was concentrated by electrodialysis after pretreatment by ultrafiltration with the cut-off point at a molecular weight of about 1000. Costs are estimated for a proposed plant to produce annually 1320 tons of itaconic acid of 99·9% purity.

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Comparison of various carbon sources in itaconic acid fermentation from the viewpoint of the product separation. M. NAKAGAWA, I. NAKAMURA and T. KOBAYASHI. *Hakko Kogaku Zasshi* (Osaka), 1975, **53**, (5), 294–302; through *S.I.A.*, 1975, **37**, Abs. 75-1705. With media based on raw sugar, fermentation rate and yield of itaconic acid were about the same as with glucose-based media. With high-test molasses, removal of K^+ ions was essential, and with cane molasses, organic acids also had to be removed to obtain about 50% yield of acid on sugar consumed. Optimum pH values of the medium were 2–6 for raw sugar, 2·5–3·5 for high-test molasses and about 3·5 for cane molasses. Maintenance of pH at approx. 2·2 in the acid accumulation phase gave high fermentation rate and acid yield. A simple evaporation-crystallization procedure enabled 81–96% of the total acid to be recovered as crystals of 95–98% purity.

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Process for the preparation of fatty acid sugar esters. A. UJHIDY, J. SZÉPVÖLGYI and Z. SZABO. *Hungarian J. Ind. Chem.*, 1973, **1**, 513–532; through *S.I.A.*, 1975, **37**, Abs. 75-1766.—Optimum reaction conditions for the preparation of sucrose palmitate and sucrose stearate were investigated. The aim was to increase the percentage of monoester, without decreasing the total yield of ester. Since the micro-emulsion method gave poor results in preliminary tests, transesterification in the presence of a solvent was used for the main experiments. Tabulated results show that optimum conditions were: reaction at 105°C for 11 hours, followed by addition of 1·2% water on the

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total weight of reactants and reaction for a further 1 hr; molar ratio sugar:methyl ester 2·88:1; solvent dimethylformamide, 3·3 $cm^3.g^{-1}$ sugar; catalyst Na_2CO_3, of which two-thirds was added initially and the remainder after 4 hr. Under these conditions 99·4% of the methyl ester was converted, and the yield of sucrose monoester was 82·7%. A thin-film reactor which was used in tests on semi-continuous transesterification is described. Although it enabled the reaction time to be shortened somewhat, it is not considered that the reactor would be economically justified.

* * *

Agricultural utilization of vinasse. N. A. DA GLÓRIA. *Brasil Açuc.*, 1975, **86**, 397–403.—The composition of various types of vinasse in respect of organic matter and N-P-K contents is tabulated, and its use as a fertilizer discussed. Methods of distribution are listed including the application as a dry powder obtained by spray-drying. The total plant nutrients produced per day by a typical distillery is calculated and the costs involved in returning the vinasse to the fields discussed, while it is mentioned that this form of utilization eliminates discharge to and pollution of waterways.

* * *

Comparative study of the fibres of annual plants with a view to their utilization in the paper industry. M. D. GONZÁLEZ F. and M. A. VÁZQUEZ G. *Revista Icidca*, 1975, **9**, (2), 9–17.—Using as standard the chemical and morphological properties of wood normally used in the paper industry, a study was made of fibres from a number of plants including sugar cane. The fibre length of bagasse was found to be similar to that of wood but the length:diameter ratio is greater so that it is more flexible. Cane trash fibres are short and thin and far from the length:diameter ratio necessary for paper pulp. Compared with bagasse, the cellulose, lignin and pentosan contents are much lower while the ash and matter soluble in hot and cold water and in 1% caustic soda are higher.

* * *

Investigation of the insoluble particles produced by the partial hydrolysis of bagasse cellulose. G. TRIANA, H. LANG, O. GELABERT, R. MORALES and M. GONZÁLEZ. *Revista Icidca*, 1975, **9**, (2), 18–33.—The insoluble residue from moderate hydrolysis of bagasse cellulose with nitric acid has been examined by hydrolysis under various conditions with HCl-ethanol mixtures and photomicrography; it is concluded that no relationship exists between the yield of residue and the particle size distribution, and that in the hydrolysis little mechanical degradation of the cellulose fibres is observed, they being subdivided in a range of lengths about 30 μm. The hydrolysis regimes are considered to afford partial degradation of the original cellulose owing to their gentle and selective characteristics.

* * *

Optimization of a method of treatment for increasing the digestibility of cellulosic residues from sugar cane. A. CABELLO and P. C. MARTÍN. *Revista Icidca*, 1975, (2), 34–47.—The influence of liquid solid ratio, NaOH concentration, pressure and time on the treatment of whole bagasse and bagacillo, destined for animal fodder, are analysed. Three different biological techniques were used for the evaluation of the treated material: *in vivo* digestibility, biodegradation with cellulolytic bacteria, and biodegradation with a commercial enzyme preparation. The results are presented in graph and tabular form. Bagacillo was more responsive to NaOH concentration, while bagasse showed a maximum degradation with 6% NaOH. A liquid:solid ratio of 5:1 was more suitable than 10:1, which permitted greater loss of soluble material on filtration. Pressure/temperature tests were limited to 6 bar, owing to difficulty and cost of exceeding this; however, the results of higher pressures were negative, perhaps through formation of furfural, and less NaOH was needed at lower pressure than at higher.

* * *

Sugar cane by-products as crop boosters. R. P. HUMBERT. *Sugar News* (Philippines), 1975, **51**, 434. See *I.S.J.*, 1976, **78**, 94.

* * *

Pulp pressing. M. DEMAUX. *Le Betteravier Franç.*, 1975, **45**, (287), 16–17.—The reduction of beet pulp moisture by pressing is compared with drying to the same moisture level and shown, in terms of energy consumption, to be much more suitable. Factors affecting pressing efficiency are discussed, including: screw press design; pulp feeding (which should exclude air as much as possible so that the energy of the press is not absorbed by this compressible gas); pH (which is optimum at 5—under acid conditions pectins are less soluble and favour pressing through their rigidity); diffusion temperature (which also affects pectin solubility); pulp feed temperature (which should not be below 60°C for reasons of cell wall permeability); beet quality; and use of additives such as sulphuric acid, aluminium sulphate and $CaCl_2$ which promote pressing. The costs of pressing are examined, followed by a brief discussion of the optimum dry matter content of pressed pulp (given as 23–24%)—beyond this point, any reduction in moisture will be accompanied by a proportionate loss of solids which will balance the extra fuel used.

* * *

Effect of methanol on citric acid production from sugar cane molasses by *Aspergillus niger*. H. S. DHANKHAR, S. ETHIRAJ and S. R. VYAS. *Indian J. Tech.*, 1974, **12**, 316–317; through *S.I.A.*, 1976, **38**, Abs. 76–56.—In media based on untreated molasses, the presence of 4% methanol increased the citric acid yield from 35% to 55% on initial sugars. In media based on charcoal-treated molasses, addition of 1–5% methanol decreased the yield to below 25%.

* * *

Particle boards from bagasse. H. FRERS. *Azúcar y Diversificación* (Santo Domingo), 1974, **33**, (2/3), 52–56.—See *I.S.J.*, 1975, **77**, 94.

* * *

Feeding animals on beet wastes. F. ÖNALAN. *Pancar*, 1975, **24**, (276), 9–11; through *S.I.A.*, 1976, **38**, Abs. 76-83.—Precautions which should be taken when beet wastes are fed to cattle or sheep are listed. The high oxalic acid content can cause loss of appetite and have other harmful effects, and the high Mg and K contents have a laxative action. The amount of wet pulp fed per day should be no greater than 5% of the body weight; it should be mixed with other feedstuffs, and Ca and other minerals should be added. Beet wastes should not be fed to lactating cows.

Cuba sugar exports[1]

	1975	1974	1973
	(*metric tons, raw value*)		
Albania	14,171	12,850	13,855
Algeria	46,495	7,182	5,974
Bulgaria	185,728	190,144	212,634
Canada	156,192	115,669	46,681
Chile	0	0	129,609
China	182,877	358,670	302,030
Czechoslovakia	55,745	160,484	163,018
Denmark	21,089	0	0
Egypt	13,699	0	5,172
Finland	95,978	82,702	26,399
France	12,127	0	0
Germany, East	169,195	276,003	259,488
Holland	0	0	11
Honduras	0	0	11,157
Hungary	41,762	51,369	52,422
Iraq	78,395	65,162	0
Jamaica	4,468	0	0
Japan	338,825	1,151,981	984,558
Kenya	0	0	37,739
Korea, North	50,441	55,305	135,576
Lebanon	22,035	10,920	9,322
Malaysia	0	64,222	29,223
Mali	22,143	0	0
Mongolia	2,698	2,702	2,670
Morocco	100,280	40,793	61,757
New Zealand	93,673	38,736	13,282
Panama	0	0	1,150
Poland	43,100	28,278	55,124
Portugal	115,656	51,502	0
Rumania	11,224	77,953	78,174
Senegal	31,831	0	0
Singapore	0	0	14,280
Spain	326,523	363,127	103,522
Sudan	27,260	0	0
Sweden	35,252	50,818	56,308
Switzerland	1,038	2,806	2,282
Syria	52,794	41,311	106,754
Trinidad & Tobago	4,073	0	0
Tunisia	12,442	0	0
Turkey	22,828	11,925	0
UK	16,671	70,951	121,880
USSR	3,186,724	1,974,761	1,660,681
Venezuela	0	0	5,193
Vietnam, North	86,918	78,018	75,910
Yugoslavia	60,767	50,371	11,804
Other countries*	594	4,532	1,738
	5,743,711	5,491,247	4,797,377

* Donations of sugar.

Erratum.—On p. 76 of our March issue, the abstract entitled "Cane diseases in Réunion" is incorrectly worded. It should read "While outbreaks of gummosis, leaf scald, smut, yellow spot, rust and pokkah boeng have been insignificant, one important disease which has re-appeared after a very long absence is wilt caused by *Cephalosporium sacchari*, a disease which in the past had been reported to be often associated with red rot caused by *Colletotrichum falcatum*. Symptoms are given of wilt disease as well as the damage it causes to cane and possible means of control".

* * *

UK national sugar beet demonstrations 1976/77.—Following the successful National Sugar Beet Spring Demonstration at Newmarket, Suffolk, in May 1976, which attracted 6000 people, the British Sugar Corporation has announced the dates for forthcoming demonstrations, which will be on 3rd November 1976 at Stetchworth Estate Farms, Newmarket, Suffolk (the National Sugar Beet Autumn Harvester Demonstration); 2nd June 1977 at Waddingham, Gainsborough, Lincolnshire (the National Sugar Beet Spring Demonstration), and 26th and 27th October 1977, again at Waddingham (the National Sugar Beet Autumn Demonstration).

* * *

Polish sugar factories for Pakistan[2].—The Polish Government has signed an agreement with the Pakistan Heavy Mechanical Complex, Taxila, for the combined construction of three sugar factories. Two of these, with a capacity of 1500 tons each, are for the Pattoki and Pasrur Sugar Mills in the Punjab, while the third, for Samundri Sugar Mills (also in the Punjab), will have a capacity of 2000 tons.

Mauritius sugar statistics[3]

	1975		1974	
	(*metric tons, raw value*)			
Initial stock		158,067		180,852
Production		496,164		737,966
Imports		12		24
Consumption		38,660		34,982
Exports:				
Afghanistan	22		0	
Botswana	8		0	
Burundi	0		31	
Canada	28,572		176,017	
Indonesia	0		5,559	
Iran	0		27,618	
Iraq	0		23,996	
Rwanda	635		0	
Seychelles	2,008		628	
Somalia	0		5,296	
Sudan	0		12,913	
UK	417,867		431,319	
USA	24,857		42,416	
		473,969		725,793
Final stocks		141,614		158,067

India sugar expansion incentives[4].—In order to ensure the economic viability of new sugar factories and of expansion projects, the Government of India has decided to provide incentives in the form of higher levy-free sugar quotas and of excise duty concessions. The quotas will apply at decreasing levy-free proportions over six years and will be greater for low-recovery area projects than for medium- and high-recovery areas. It is expected that sugar production will rise within a few years to 5 million tons, tel quel, as against 4·5 million tons in 1975/76 and 4·3–4·4 million tons estimated for 1976/77.

* * *

Guyana sugar production 1975.—A total of 3,474,596 long tons of cane were crushed during 1975 and yielded 300,350 tons of sugar of average 96·38 pol; this represented an appreciable fall from the 340,815 tons of 96·53 pol sugar produced from 4,099,176 crushed in 1974. Recovery was higher at 80·21% *vs.* 78·93% and the 96 pol sugar yield per acre greater at 2·90 tons as against 2·78 tons.

* * *

St. Kitts sugar production 1975.—According to the annual report of St. Kitts (London) Sugar Factory Ltd., 24,583 tons of sugar was made in the 1975 crop, equivalent to 25,103 tons of 96 pol sugar. The tonnage of cane crushed was slightly less than in 1974 and again well under the factory's capacity. The cane:sugar ratio remained good although slightly above the 1974 figure. Improved rainfall in the autumn of 1974 did not continue into 1975 and drought hit the island severely. During the year 15,564 tons were exported to the UK, the balance of exports going to the USA. Rainfall during the growth period of the 1976 crop showed considerable improvement over 1975 and the crop estimate is 30,000 tons.

* * *

New Philippines sugar factory plans[5].—A $55-million sugar factory and refinery is to be built at Maguiling, Piat, Cagayan, and managed by the Cagayan Sugar Corporation. Machinery is to be furnished by the Marubeni company of Japan and crushing capacity is to be 4000 t.c.d., with a refinery capacity of 250 tons of sugar per day. Construction was due to start in June 1976 but no date has been set for commencement of operations.

* * *

Philippines refinery expansion[6].—The Philippines National Bank is considering the investment of about six million dollars in order to double the daily capacity of the Dayad refinery from its present 250 tons. The capacity of the country's five refineries is hardly sufficient for its needs. Dayad provides about 8% of the total refining capacity of the Philippines.

[1] *I.S.O. Stat. Bull.*, 1976, **35**, (5), 34.
[2] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (13), 10.
[3] *I.S.O. Stat. Bull.*, 1976, **35**, (5), 74.
[4] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (16), 7–8.
[5] *Sugar News* (Philippines), 1976, **52**, 49.
[6] *Amerop Noticias*, 1976, (30), 12.

Holland sugar imports and exports[1]

	1975	1974
	(*metric tons, tel quel*)	
Imports		
Argentina	0	893
Brazil	4,573	0
Chile	0	174
Colombia	498	0
Cuba	113	94
Dominican Republic	0	289
France	499	1,167
Germany, West	2,130	1,015
Panama	749	0
Surinam	247	0
Trinidad	1,500	0
USA	8,197	0
Other countries	65	255
	18,571	3,887
Exports		
Germany, West	545	116
Ghana	0	1,660
Greece	3	24,740
Hungary	0	1,050
Iceland	317	0
Iraq	0	200
Ireland	0	400
Israel	3,438	45,334
Italy	1	5,841
Ivory Coast	500	0
Kuwait	1	5,400
Libya	0	10,500
Malta	0	7,400
Norway	1,724	1,555
Spain	1	4,826
Switzerland	0	14,829
Tunisia	0	540
UK	2,123	4,582
Other countries	56	265
	8,709	129,238

Caroni Ltd. nationalization bid[2].—Involving a total market capitalization of £5,300,000, Caroni (1975) Ltd., owned by the Government of Trinidad & Tobago, plans to buy all the ordinary and preference shares of Caroni Ltd., of which the Government currently possesses 24·4 million (55%) ordinary shares. Tate & Lyle Ltd. holds 5·13 million ordinary shares (11·6%) and 120,000 (20·7%) of the £1 preference shares, and has irrevocably agreed to accept the offer of 12½p per ordinary share and 55p for each preference share. The ordinary offer is conditional on acceptance for at least 90% of the ordinary shares or such lesser percentage as the bidders may decide at over 50%. The offers will lapse if either or both offers are referred to the Monopolies Commission. Given the Trinidad Government's nationalization policy, acquisition of Caroni Ltd. was to be expected and will include the four sugar factories and 74,000 acres of land, 52,000 acres of which is under cane.

* * *

Cuba-Japan sugar trade agreement[3].—Cuba has signed a four-year agreement with a group of 12 Japanese importers to sell a million metric tons of Cuban raw sugar over the period. The agreement emerged from prolonged talks with a Cuban sugar mission and involves supply of 100,000 tons in 1977 and 300,000 tons yearly in 1978-80. The sale will be linked to an average of the New York No. 11 Contract spot price during the month of shipment plus 120% of the Caribbean/UK freight rate, with a differential not exceeding £4. This is the first long-term deal arranged by Japan for Cuban sugar although Japan has already concluded similar contracts with Australia, Brazil, South Africa and Thailand. As a result, about 90% of Japan's raw sugar requirements are covered by long-term agreements. 1976 needs are estimated at about 2·4 million tons, below the normal level of 3 million tons per annum.

* * *

Cuba sugar production[4].—Sugar production in the 1974/75 season amounted to 6,432,058 metric tons, raw value, as against 6,043,742 tons tn the 1973/74 season.

Belgium/Luxembourg sugar imports and exports[5]

	1975	1974
	(*metric tons, tel quel*)	
Imports		
Brazil	920	0
Colombia	1,156	0
Cuba	0	113
France	9,957	681
Germany, East	963	0
Germany, West	1,062	311
Holland	3,247	1,169
Salvador	5,244	0
UK	455	104
USA	4,960	0
Other countries	57	139
	28,021	2,517
Exports		
Algeria	8,626	3,422
Burundi	0	1,302
Chad	100	5,851
Dahomey	1,424	1,500
France	1,062	2,694
French Pacific	504	1,850
Germany, West	34,131	38,561
Ghana	333	6,000
Greece	0	2,472
Holland	19,889	95,321
Iceland	250	853
Ireland	19,220	6,600
Israel	170	26,660
Italy	10,834	21,395
Ivory Coast	0	9,071
Kenya	0	3,975
Libya	0	2,184
Mauritania	495	3,508
Nigeria	200	1,732
Norway	1,413	1,428
Senegal	2,564	7,140
Spain	0	2,980
Syria	0	5,435
Tanzania	0	1,200
UK	100,142	35,193
Upper Volta	0	2,300
Zaire	0	4,507
Other countries	1,827	5,944
	203,184	301,078

Broom's Barn open day.—Broom's Barn Experimental Station near Bury St. Edmunds was open to invited guests on the 29th June to permit examination of the sugar beet research projects under way, and discussion of their work with research staff. Among the work exhibited were experiments on seedling emergence and establishment, soil conditions and growth, fertilizers —N, P, K, Na and Mg, irrigation, pests and disease control (especially virus yellows and powdery mildew).

* * *

International Photosynthesis Congress.—The 4th International Congress on Photosynthesis is to be held during the 4th–9th September 1977 at the University of Reading, in England, with accommodation in the University's halls of residence. Symposia will be held on the following subjects; light harvesting and reaction centres, photosynthesis in cells and tissues, organization of electron transport, photosynthesis and productivity, carbon metabolism, photosystem II and O_2 evolution, regulation and metabolism, development of photosynthetic systems, photo-phosphorylation, solar energy conversion in biology, and photosynthesis and food. The Congress will be sponsored by, among others, Booker McConnell Ltd., British Sugar Corporation Ltd. and Tate & Lyle Ltd. Further information and an application form for intending participants may be obtained from the local organizer, Dr. J. Coombs, Tate & Lyle Ltd., P.O. Box 68, Reading, England RG6 2BX.

[1] C. Czarnikow Ltd., *Sugar Review*, 1976, (1274), 40.
[2] *The Times*, 3rd July 1976.
[3] *Public Ledger*, 3rd July 1976.
[4] *I.S.O. Stat. Bull.*, 1976, **35**, (5), 33.
[5] C. Czarnikow Ltd., *Sugar Review*, 1976, (1276), 49.

Indian sugar exports[1]

	1975	1974	1973
	—metric tons, raw value—		
Afghanistan	10,848	0	0
Bangladesh	0	0	20,475
Egypt	184,116	12,529	0
Germany, West	12,554	0	0
Indonesia	48,401	80,458	50,617
Iran	416,435	141,598	22,401
Jordan	9,852	25,058	0
Kuwait	0	0	8,672
Malaysia	0	0	3,801
Maldive Republic	434	1,519	0
Morocco	0	24,407	0
Qatar	1,627	0	0
Southern Yemen	13,126	38,621	0
Sri Lanka	10,750	22,572	0
Sudan	84,370	71,422	0
Tunisia	12,366	0	0
UK	38,076	26,781	26,847
USA	178,365	78,794	75,892
Yemen	23,919	12,529	0
Total	1,045,239	536,288	208,705

New Surinam sugar factory[2].—Plans have been made for the construction of a sugar factory to be built in the Tibitie district. It will have an annual capacity of 45,000–50,000 metric tons of sugar for which 6000 hectares will need to be planted to cane. It is intended to mechanize the harvest completely. The factory is to be supplied by the Brazilian Dedini Group and will cost 40–50 million florins.

* * *

Pakistan sugar development plans[3].—Over the next five years projects are planned entailing an outlay of 3000 million US dollars by the State Enterprises; among the projects are a chain of sugar factories.

* * *

Sweden sugar imports[4].—Imports of sugar by Sweden in 1975 totalled 75,901 metric tons, raw value, as against 66,563 tons in 1974. As before, the major suppliers were Cuba with 32,565 tons (36,019 tons in 1974), Dominican Republic with 23,925 tons (22,912 tons) and Finland with 19,182 tons (4,318 tons).

* * *

Dominican Republic sugar production, 1975[5].—The Instituto Nacional Azucarero has reported sugar production in 1975 at 1·25 million tons and has forecast 1976 production at 1·33 million tons.

* * *

Polish sugar factory equipment exports[6].—During the current plan period (1976–80) Poland expects to export several complete sugar factories, some of which have already been sold to Canada, Mexico and Yugoslavia. The largest factory is currently being built near Kaba in Hungary[7] with a daily capacity of 6000 tons of beets. A similar factory has been ordered by East Germany, while the Soviet Union is interested in factories having a daily slice of 9000 tons. By contrast, the average slice of the factories operating in Poland is only 2000 tons, one of the lowest figures for Europe. As a consequence of the antiquated machinery, the last campaign lasted for 120 days whereas a campaign of 70–80 days is thought to be optimal. However, it is planned to erect several new sugar factories by 1980 with a daily capacity of 6000 tons.

* * *

Ivory Coast sugar project[8].—Redpath Industries Ltd. of Canada has announced that it has been awarded a contract valued at $155 million by the Government of the Ivory Coast to build a major agro-industrial sugar complex in the Ferkessedougou area. Redpath Sugars Ltd. will carry out the contract. The project will provide an annual output of 60,000 metric tons of raw sugar for the export market, and will include a turn-key sugar factory, development of a 14,000-acre sugar cane plantation, housing and roads development and provision for agricultural machinery.

* * *

Bagasse paper plant in Venezuela[9].—Guanare Papelera is to install a paper pulp plant at Guanare, at a cost of 376 million bolívares (about $90 million), which will use bagasse as raw material.

Taiwan sugar exports[10]

	1975	1974
	—metric tons, raw value—	
Guam	435	*
Hong Kong	1,927	1,700
Japan	96,657	169,882
Jordan	1,304	4,348
Korea, South	147,862	239,342
Lebanon	0	10,999
Malaysia	272	30,671
North Borneo	1,087	*
Qatar	0	2,174
Saudi Arabia	36,741	14,130
USA	127,691	66,152
Other countries	0	14,080
	413,976	553,478

* Exports, if any, included in "Other countries" figure.

Peru bagasse paper plant[11].—Elof Hansson, of Sweden, has been awarded a contract worth 75 million Swedish crowns to instal machinery for a 110,000-ton bagasse newsprint plant at Trupal. The machinery is on order from Valmet Oy. of Finland.

* * *

Austria sugar production 1975/76[12].—The sugar beet crop in 1975/76 was around 3,140,000 metric tons and yielded 465,000 tons, white value, of sugar. Overall sugar consumption is estimated at 300,000 tons, leaving an exportable surplus of some 160,000 tons. Export licences have already been given for 80,000 tons to Hungary and 21,000 tons to Switzerland, while export licences for the remainder will be given when the next beet crop is secured.

* * *

Bulk sugar terminal in Brazil[13].—During inter-Governmental talks during a state visit of the President of Brazil to France, one of the development programmes discussed included a sugar terminal at Santos.

* * *

US refinery to close[14].—Corn Products Company announced on 11th May that market conditions will compel it to close or sell its cane sugar refinery at Yonkers, NY, by 30th September. The Yonkers plant is primarily a producer of liquid cane sugar for industrial use and there has been a long-term decline in demand in the north-eastern US for this material, such that the refinery operates at less than two-thirds of capacity.

* * *

Honduras sugar expansion[15].—Total sugar output in 1974/75 amounted to 82,000 tons; present capacity is estimated at 88,000 tons and is expected to increase to 250,000 tons by 1979/80 as a result of an investment programme equivalent to $40–50 million during the next two years.

* * *

Colombia sugar factories[16].—A new $30-million sugar factory is to be built 450 km south of Bogotá and is to come on stream in 1978. Another factory is to be erected in Zulia, near the Venezuelan border, and is to come on stream in 1980 with an annual production of 12,900 tons, to be increased to 42,700 tons by 1985.

* * *

Paraguay cellulose and paper plant[17].—Bowater Paper Corporation of the UK is to set up a cellulose and paper plant in Paraguay, at a cost of $50 million, to use bagasse as raw material.

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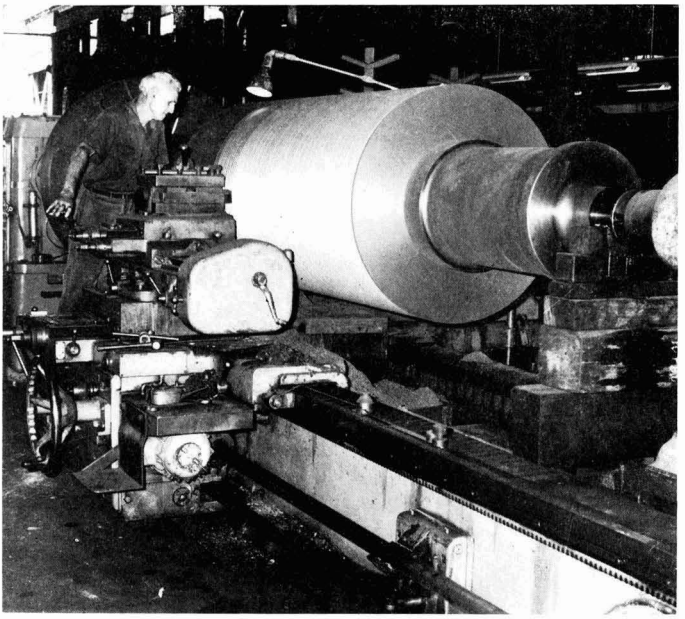
[1] *I.S.O. Stat. Bull.*, 1976, **35**, (3), 57.
[2] *Sucr. Belge*, 1976, **95**, 176.
[3] *Standard Chartered Review*, February 1976, 25.
[4] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (15), viii.
[5] *Bank of London & S. America Review*, 1976, **10**, 92.
[6] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (13), 6.
[7] *I.S.J.*, 1976, **78**, 192.
[8] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (15), 11.
[9] *Bank of London & S. America Review*, 1976, **10**, 289.
[10] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (14), xiii.
[11] *Bank of London & S. America Review*, 1976, **10**, 101.
[12] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (3), 7.
[13] *Bank of London & S. America Review*, 1976, **10**, 266.
[14] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (15), 9.
[15] *Bank of London & S. America Review*, 1976, **10**, 270.
[16] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (15), 10.
[17] *Bank of London & S. America Review*, 1976, **10**, 285.



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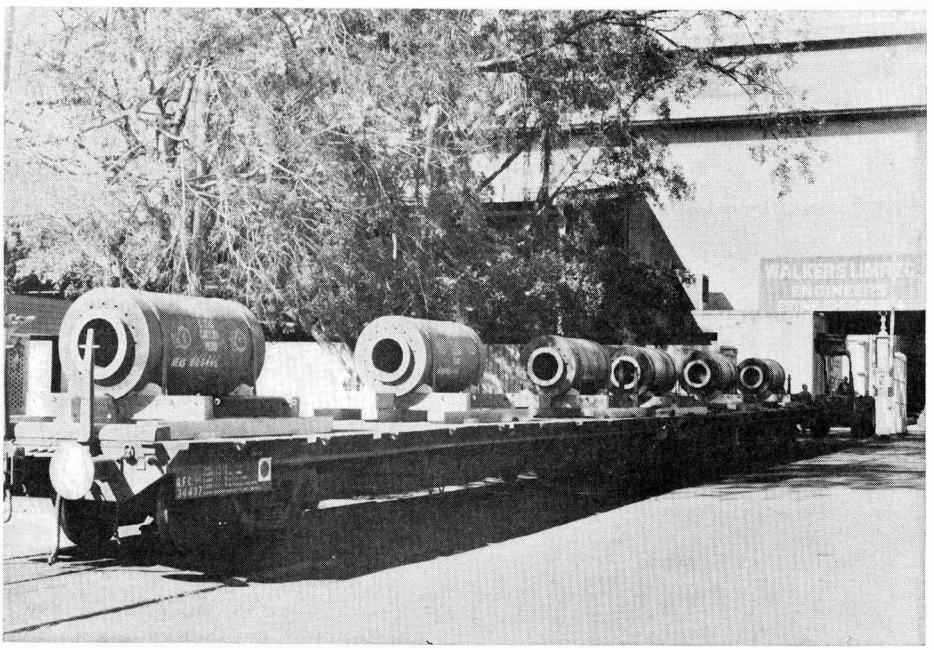

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