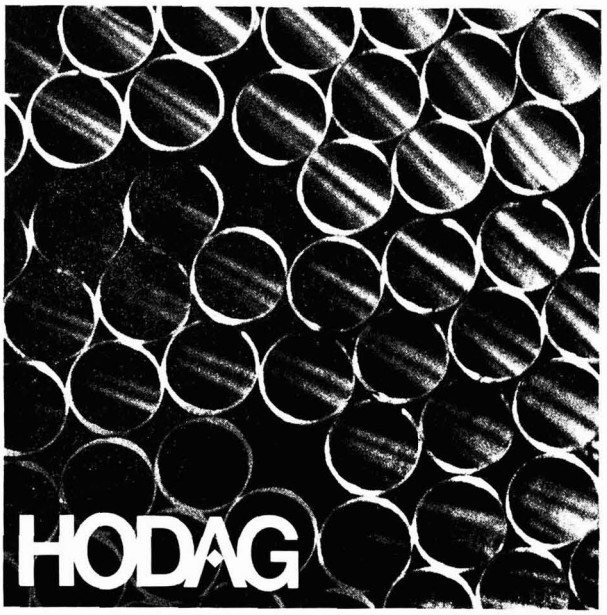
International Sugar Journal

OCTOBER 1976



Hodag PH-2 Removes Scale Thoroughly

Powerful . . . Non-Corrosive . . . Convenient

Hodag PH-2 Descaler, the safe granular acid cleaner, is the non-corrosive, non-destructive, yet most effective way to remove scale from evaporators, vacuum pans, and heat exchangers.

New PH-2 Descaler will not etch or corrode stainless steel, copper, or brass at normal use concentrations. Yet, PH-2 is more powerful than hydrochloric, sulfuric, and sulfamic acids.

Cleaning cycles are shortened. Time is saved. PH-2 Descaler solution quickly penetrates and thoroughly removes the toughest scale deposits. Metal surfaces are left clean and bright, restoring heat transfer efficiency.

Use no more than you need. Hodag PH-2 Descaler is bright pink in solution, but turns yellow after its cleaning power is spent. If after a boilout, the tubes are clean and the solution is still pink, less PH-2 can be used on subsequent cleanings until the optimum concentration and time of boil are determined.

Hodag PH-2 Descaler is dry and easy to handle—elminates the nuisance of carboys and the hazard of spilled acid—measures easily and dissolves in cold water without objectionable fumes.

Look into the complete Hodag cleaning program for sugar factory and refinery vessels:
Step 1—Alkaline cleaning with caustic soda and Rapisol Accelerator.
Step 2—Acid boiling with PH-2 Descaler.
Step 3—Inhibit scale formation with addition of VAP-99 to thin juice.

For further information or to arrange a trial, use the coupon below.

☐ Hodag PH-2 Descaler ☐ Hodag Rapisol ☐ Hodag VAP-99

☐ Please send complete information on products indicated.

☐ *Please have Hodag representative contact me for a trial.*

Name _____

Title _____

Company _____

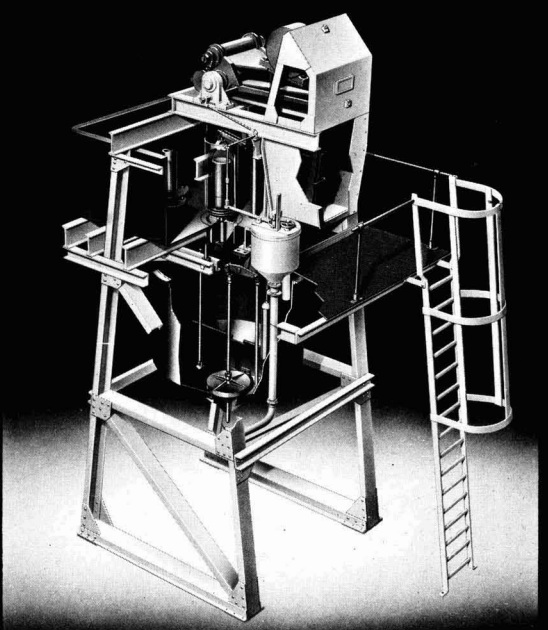
Address _____

City _____ State _____

Country _____

HODAG CHEMICAL CORPORATION / HODAG INTERNATIONAL S.A.
7247 North Central Park Ave., Skokie, Illinois 60076, U.S.A.
Cable Address: HODAG SKOKIEILL Telex: 72-4417

When you think of sugar machinery...



The Automatic Liquid Scale

TARE PRINCIPLE ENSURES MAXIMUM ACCURACY

SIMPLICITY OF DESIGN REDUCES MAINTENANCE COSTS

SELF ACTUATING

AUTOMATIC ADDITIVE DOSING

EXCISE SEALS EASILY FITTED

...think of FS

FS design and construct complete factories and refineries, and supply a fully comprehensive range of unit equipment and spares for the sugar industry

FS Fletcher and Stewart Limited

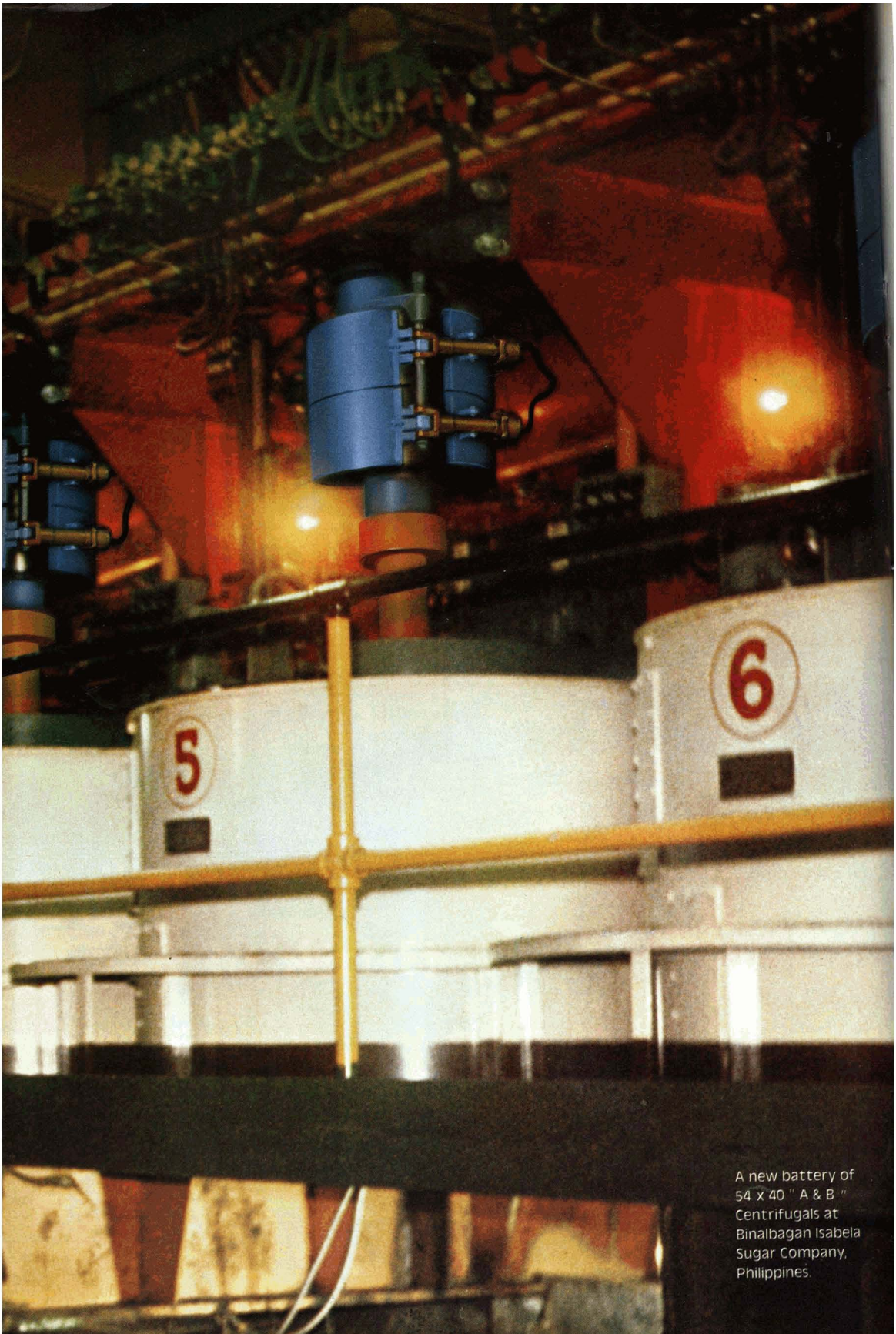
DERBY - ENGLAND - DE2 8AB

1966 1972

Telephone: Derby 40261 Telex: 37514 Telegrams: Amarilla Derby Telex

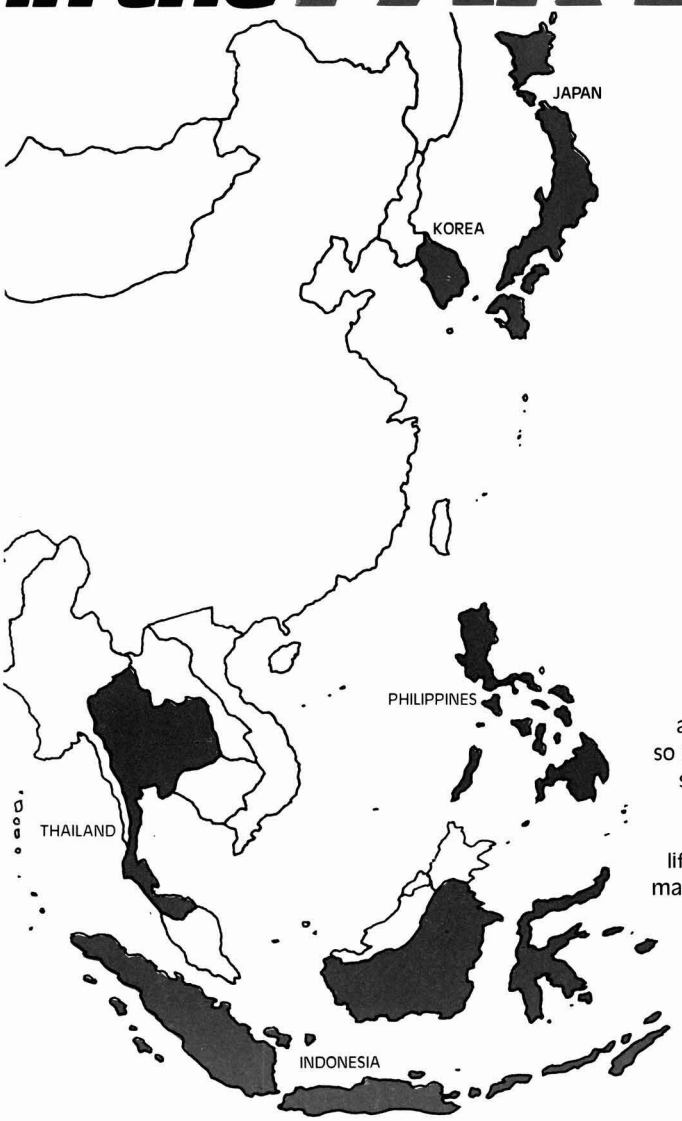
A Member of the Booker McConnell Group of Companies

H4



A new battery of 54 x 40 " A & B " Centrifugals at Binalbagan Isabela Sugar Company, Philippines.

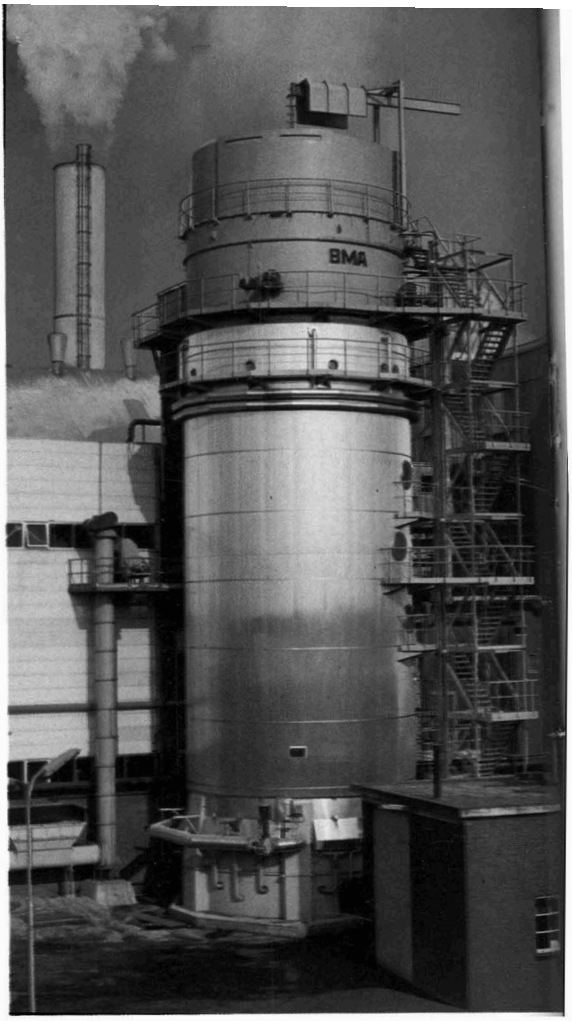
WESTERN STATES in the FAR EAST



Producing sugar at a profit is just as important in the Far East as it is anywhere. That's a major reason why so many Far East sugar companies have selected Western States centrifugals. High production, low maintenance costs, low operating costs and long life... backed by a team of experts, no matter where you're located, are major reasons why Western States centrifugals are so profitable. Want to talk profits? Contact your local Western States representative or Mr. James Coleman, General Sales Manager.

THE WESTERN STATES MACHINE COMPANY
Hamilton, Ohio 45012 U.S.A.
ROBERTS CENTRIFUGALS

BMA diffusion tower for 6,500 t beets/d
at CSM's Vierverlaten/Holland sugar factory



BMA
DIFFUSION TOWER

Raw-juice draft 110 – 120 % on beets
Sucrose in pulp 0.20 % on beets

Outdoor installation, small space requirements, therefore no expenses for

- **remodelling of main process building**
- **remodelling of structural steel**
- **relocation of existing equipment**

Unit sizes from 1,000 t to 6,500 t beets/d

High sucrose extraction, low raw-juice draft, low sucrose losses

Exclusion of air during extraction

Scalding & gentle handling of beet material, even with frozen beets in the cossette mixer

No steam jackets, no local overheating, no dead spaces, therefore highest possible sterility.

BMA extraction plants are

economical
energy-saving
pro-environmental

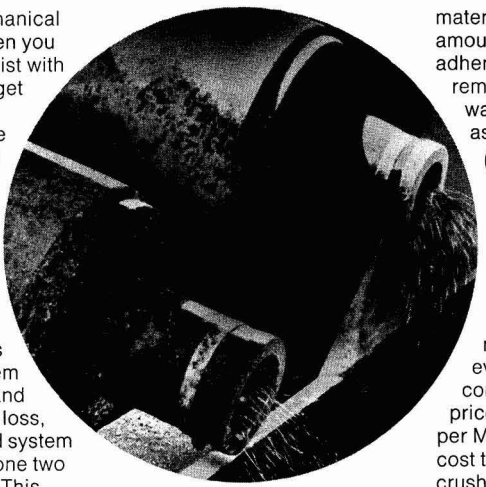
Braunschweigische Maschinenbauanstalt
P.O. Box 32 25 / D 33 Braunschweig / Germany
Tel.: 05 31 / 8 04-1 Telex: 9 52 456 a bema d

BMA Machinery & Equipment Corp.
4920 Oneida Street / Commerce City (Denver) / Colorado 8 00 22
Tel.: (303) 287-9653 TWX: 910 936 0859 Cable: bemaquip denver

BMA

Beware of sand.

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.



Dorr-Oliver DorrClone discharging sand.

DorrClone® The easy, effective answer.

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.

How the DorrClone cyclone works.

A vortex action is created inside the DorrClone separator by the tangential feed and pump pressure. Mineral particles in the feed are thrown against the walls and pass out through the bottom. Liquid overflow passes through the top.

Why a two-stage system?

Because it's twice as effective. After the first desanding stage, gritty material is washed with a small amount of washwater to recover the adhering sugar. The second stage removes the grit from the sweet wash water. The two-stage approach assures minimum sugar loss.

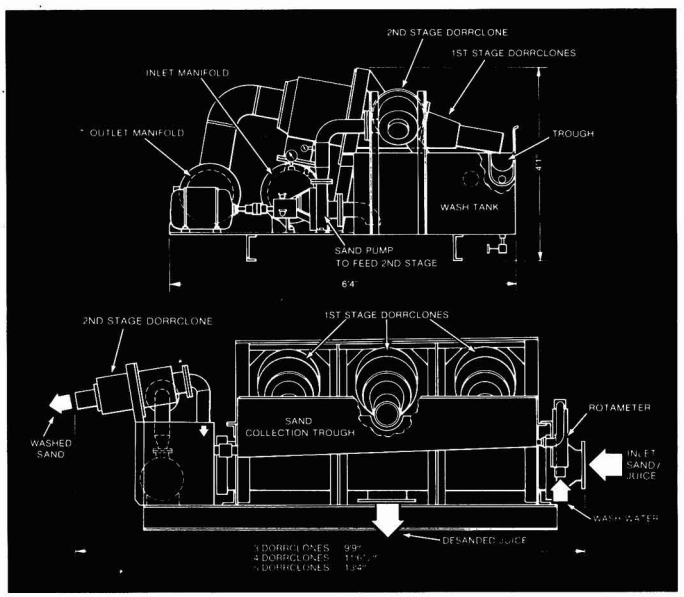
Compact package. Low initial cost.

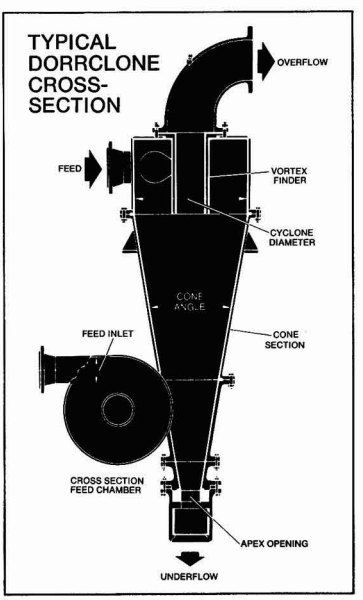
The compact packaged system can be located in any convenient area or elevation. And if you already have existing pumps, tanks or other machinery, your initial cost is even lower than if you buy the complete package. The package price is as little as $3-$6 (U.S.) per M.T.C.D., ex works. The actual cost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

DORR-OLIVER

A step ahead in process equipment.





When you think of sugar machinery...

The Super Squat Calandria Vacuum Pan

MAXIMUM HEAT TRANSFER

MINIMUM CIRCULATION RESISTANCE

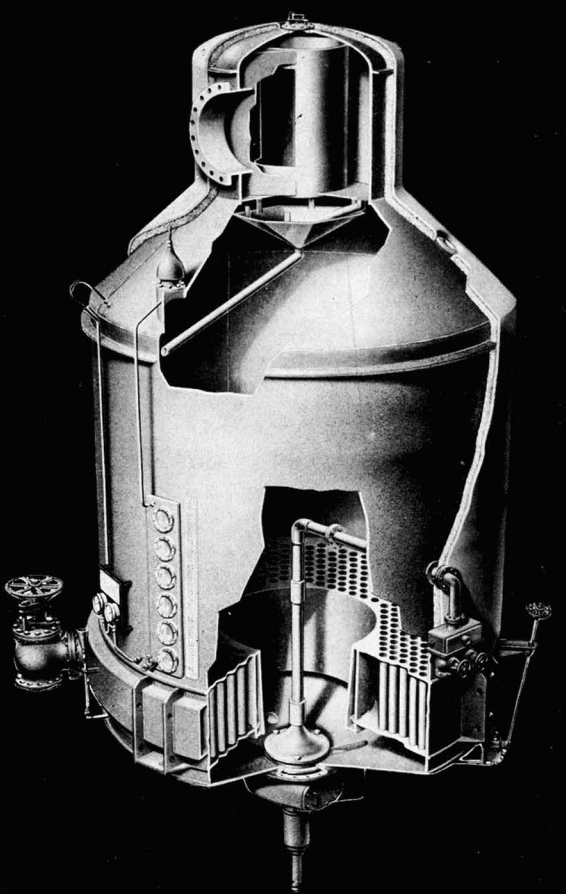
LOW HYDROSTATIC HEAD

IMPROVED STEAM FLOW

INDEPENDENT VENTING OF GASES

MULTIPLE CONDENSATE OUTLETS

REDUCED ENTRAINMENT



...think of FS

FS design and construct complete sugar factories and refineries, and supply a fully comprehensive range of unit equipment and spares for the sugar industry.

FS Fletcher and Stewart Limited

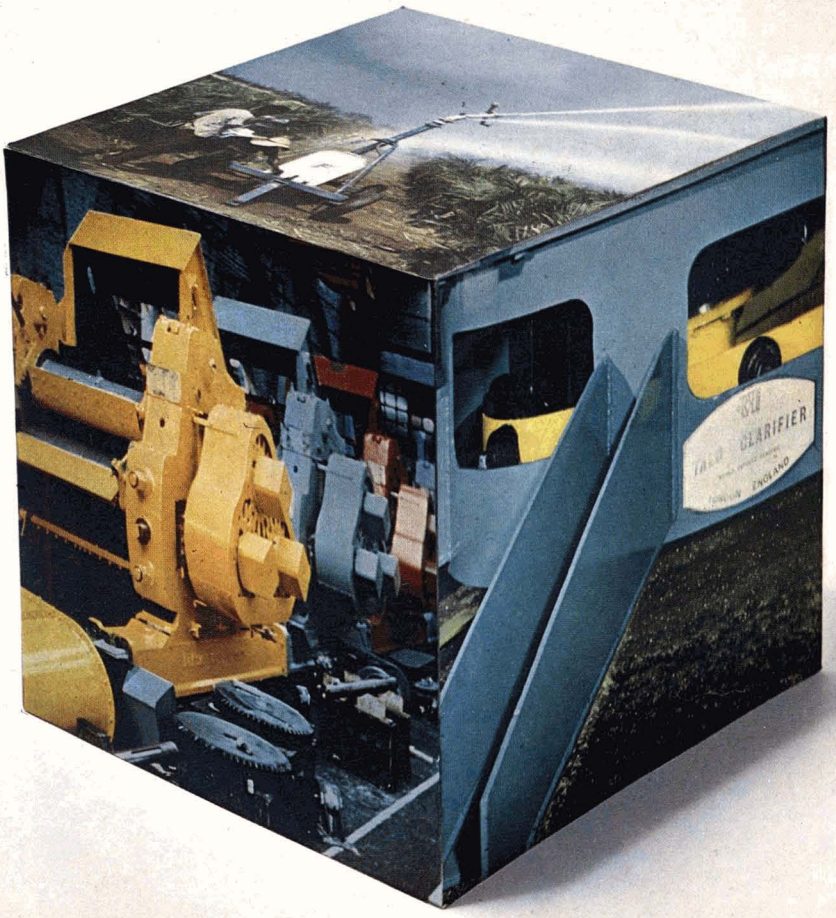
DERBY - ENGLAND - DE2 8AB

1966 1972

Telephone: Derby 40261 Telex: 35714 Telegrams: Amarilla Derby Telex

A Member of the Booker McConnell Group of Companies

H5



Tate & Lyle Engineering– the complete agro-industrial package.

Creating a complete new sugar project requires Tate & Lyle Engineering's unique agro-industrial package of skills, know-how and hardware.

Tate & Lyle Engineering can provide invaluable help at every single stage.

Preliminary surveys and feasibility studies. Cane cultivation, land clearance and irrigation. Civil engineering. Erection and commissioning of terminals, factories, refineries or distilleries. The manufacture and installation of plant. The provision and recruitment of management. The training of staff. Advanced products and electronic controls to maximise process efficiency. A continuing advisory service to monitor the project's technical and commercial progress. The promotion of loans and investments on your behalf. The supply of goods and services on medium/long-term credit at competitive rates of interest.

No other company has Tate & Lyle Engineering's experience. No other company has Tate & Lyle Engineering's complete package. You can use the total service or select those parts of it which you most need.

TATE & LYLE ENGINEERING LTD., Cosmos House, Bromley BR2 9NA, Kent, England. Telephone: 01-464 6556. Telex: 896368 TATELYLE BROMLY. Cables: TECSERVE Bromley.

TATE + LYLE Engineering

Published by
The International Sugar Journal Ltd.,
23a Easton Street, High Wycombe,
Bucks., England.
Telephone: High Wycombe 29408
Cable: Sugaphilos, High Wycombe
Telex: 21792 REF 869

International Sugar Journal

October 1976

Contents

* * *

Annual Subscription: $15.00 post free
Single Copies: $1.80 post free

* * *

UK ISSN 0020-8841

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Un examen des condensats et de leur contribution aux effluents des sucreries. 2ème partie. Etudes au sujet de l'élimination de l'éthanol des condensats. J. D. BLAKE, R. BROADFOOT et D. H. FOSTER. *p.* 291–295

Dans la 1ère partie de cet article il a été démontré que la fermentation par des microorganismes était la principale source de contamination des condensats et qu'une réduction significative de la DBO pourrait être obtenue en éliminant le composant éthanol. La 2ème partie traite d'études concernant la distribution de l'éthanol en sucrerie et de recherches concernant son élimination des condensats dans une colonne de rectification. Les résultats démontrent que la possibilité d'utilisation de la technique de la rectification est limitée par son incapacité apparente de ramener les niveaux de la DBO dans le résidu du condensat à une valeur à laquelle la décharge directe dans un fleuve ou dans un cours d'eau est permise en Australie, quoique la méthode pourrait être appliquée dans d'autres pays ou bien là où une certaine quantité d'eau relativement propre et stérile est requise pour les besoins de l'usine.

* * *

L'effet de certains produits chimiques sur la maturation de la canne à sucre. G. SINGH, K. SHARMA et R. S. KANWAR. *p.* 295–297

Des essais concernant l'application foliaire de certains produits chimiques avant la récolte, dans le but de faire mûrir la canne à sucre, sont décrits. Alors qu'on a constaté que quatre maturateurs commercialisés induisent une maturité précoce de la canne de la variété Co 1148, se traduisant par une teneur supérieure en sucre du jus et cela jusqu'à 6 semaines après l'application, le bore appliqué sous forme de borax n'avait pas d'effet. Aucun des produits chimiques n'a ni causé la brûlure du feuillage de la canne ni retardé la croissance.

* * *

Croissance et structure de l'industrie du sucre en Thaïlande. 2ème partie. P. ABDULBHAN et K. SUKSUPHA. *p.* 297–299

Le marché intérieur du sucre en Thaïlande et les exportations de sucre thaïlandais au cours de la période 1960–74 sont brièvement examinés; on donne des détails concernant la région thaïlandaise du Méklong, où il y a 14 sucreries ayant une capacité de broyage moyenne de 6.100 tonnes de canne par jour. Les effets de l'industrie sucrière sur l'environnement ainsi que sur les autres industries lelong du Méklong sont discutés.

Eine Untersuchung über Kondensat und seinen Beitrag zur Belastung des aus Zuckerrohrmühlen abzuführenden Abwassers. Teil II. Untersuchungen über die Entfernung von Äthylalkohol aus Kondensat. J. D. BLAKE, R. BROADFOOT und D. H. FOSTER. *S.* 291–295

Im ersten Teil dieser Arbeit wurde gezeigt, dass die durch Mikroorganismen hervorgerufenen Gärungserscheinungen die Hauptursache für die Verunreinigung des Kondensats sind und dass eine beträchtliche Verringerung des BSB-Wertes der Abwässer durch die Entfernung der Äthylalkohol-Komponente erreicht wird. Im zweiten Teil berichten die Verfasser über Untersuchungen zur Verteilung des Äthylalkohols in der Zuckerfabrik sowie zu seiner Entfernung aus dem Kondensat in einer Dampfdestillationsanlage. Die Ergebnisse haben gezeigt, dass die Verwendungsmöglichkeit der Destillationstechnik dadurch begrenzt ist, dass sie anscheinend nicht in der Lage ist, den BSB-Wert im Kondensatrückstand auf eine Höhe zu senken, bei der ein direktes Einleiten in einen Fluss oder einen Wasserlauf in Australien erlaubt ist. Die Methode dürfte jedoch in anderen Ländern oder dort zur Anwendung kommen können, wo eine bestimmte Menge relativ sauberen und keimfreien Wassers zur Verwendung in der Fabrik benötigt wird.

* * *

Der Einfluss von Chemikalien auf das Reifen von Zuckerrohr. G. SINGH, K. SHARMA und R. S. KANWAR. *S.* 295–297

Es wird über Versuche berichtet, bei denen zur Beschleunigung des Reifens von Zuckerrohr Chemikalien vor der Ernte auf das Blattwerk gegeben wurden. Während bei vier im Handel befindlichen Reifebeschleunigern festgestellt wurde, dass sie bei der Rohrsorte Co 1148 zur Frühreife führten, was sich bis zu sechs Wochen nach der Anwendung in einem höheren Zuckergehalt des Saftes auswirkte, zeigte als Borax appliziertes Bor keinen Effekt. Bei keiner der untersuchten Chemikalien wurde ein Verbrennen des Zuckerrohr-Blattwerks oder eine Wachstumsverzögerung beobachtet.

* * *

Ausbau und Struktur der Zuckerindustrie in Thailand. Teil II. P. ABDULBHAN und K. SUKSUPHA. *S.* 297–299

Die Verfasser analysieren kurz die Entwicklung des inländischen Zuckermarktes in Thailand sowie der thailändischen Exporte in den Jahren 1960 bis 1974. Nähere Einzelheiten finden sich in diesem Bericht über die Maeklong-River-Region in Thailand, in der es 14 Zuckerfabriken mit einer Mittelverarbeitung von 6100 t Rohr pro Tag gibt. Die Auswirkungen der Zuckerindustrie auf die Umgebung und auf andere Industriezweige am Maeklong River werden diskutiert.

Un investigación de aguas condensadas y su contribución al arreglo de efluentes de centrales azucareros. Parte II. Estudios sobre eliminación de etanol de aguas condensadas. J. D. BLAKE, R. BROADFOOD y D. H. FOSTER. *Pág.* 291–295

En el primer parte de este artículo se demostró que fermentación microbial estuvo el fuente mayor de impurezas en agua condensada y estuvo posible hacer un disminución significativa de la DBO (Demanda Biológica de Oxigeno) de efluentes por eliminación de su contenido en etanol. En parte II los autores describen sus estudios de la distribución de etanol en el central azucarero y investigaciones sobre su eliminación de agua condensada en un alambique calentado a vapor. La resultas demuestran que la utilidad de la técnica de eliminación con vapour es limitado por su incapacidad de reducir los niveles de DBO en los residuos de la agua condensada a un nivel tal que es permitido en Australia descargar directamente en un arroyo o río. Sin embargo, es posible que el método puede aplicarse en otros paises o donde una cantidad de agua, relativamente limpia y estéril, se requiere para uso en la fabrica.

* * *

Efectos de algunos produtos químicos sobre la maduramiento de caña de azúcar. G. SINGH, K. SHARMA y R. S. KANWAR. *Pág.* 295–297

Se hace un informe sobre experimentos en la maduramiento de caña por aplicación foliar de algunos produtos químicos antes de la cosecha. Cuatro produtos comerciales inducieron madurez temprana en caña de la variedad Co 1148, con la resulta de un más alto contenido de azúcar en el jugo hasta 6 semanas despues de la aplicación, pero boro, aplicado como bórax, no tuvo efecto. Ningúna de las produtos químicos quemó el follaje ni retardó desarrollo de la caña.

* * *

Desarrollo y estructura de la industria azucarera de Tailandia. Parte II. P. ABDULBHAN y K. SUKSUPHA. *Pág.* 297–299

El mercado doméstico en azúcar de Tailandia y exportes de azúcar del país en el período 1960–74 se examinan brevamente y se presenta detalles de la zona del Río Maeklong en Tailandia donde hay 14 centrales azucareros con un capacidad promedia de molienda de 6100 toneladas de caña por día. Los efectos de la industria azucarera sobre el ambiente y otras industrias a lo largo del Río Maeklong se discuten.

INTERNATIONAL SUGAR JOURNAL

VOL. LXXVIII OCTOBER 1976 No. 934

Notes & Comments

World sugar production, 1975/76[1]

F. O. Licht published their fourth estimate of world sugar production at the end of July and, although this was nearly at the end of the 1975/76 crop year, the total world production estimate was raised by no less than a million metric tons, raw value, compared with the third estimate made two months earlier[2]. The figures for Europe are generally unchanged except for Spain (increased by 32,000 tons), East Germany (reduced 20,000 tons) and Poland (increased 70,000 tons). Outside Europe the only beet sugar production estimate significantly altered is that for the USA, increased by 181,000 tons. The total beet sugar figure is set 265,000 tons higher at 32,862,270 tons which represents an increase of just over 3,000,000 tons compared with 1974/75.

Outside Europe major changes had to be made with respect to Cuba. Figures published by the International Sugar Organization revealed that most analysts had been too pessimistic concerning the 1974/75 Cuban crop which is now set at 6·4 million tons, while the 1975/76 crop is also set 400,000 tons higher at 5·8 million tons. The 1975/76 Brazilian crop estimate has also been raised by 230,000 tons while that for India has been reduced by 150,000 tons. The figure for Iraq has been corrected to 75,000 tons, while that for Pakistan is 100,000 tons higher. Production in Thailand proved greater than expected on a basis of early results and the total is set 134,000 tons higher, to give a 750,000-ton net increase in the world cane sugar estimate. Details of the estimate appear elsewhere in this issue.

* * *

World sugar prices

As E. D. & F. Man put it[3], the raw sugar market "finally collapsed in August under the weight of heavy selling from producers". From a level of £154 per ton at the start of the month, the London Daily Price fell to £127 by the end of August and declined further to £118 by the first week of September. The slide in prices was halted near the middle of the month with rumours of purchasing interest by the USSR but denials came promptly from Soviet officials and the broker alleged to have been concerned and the fall was resumed.

F. O. Licht's estimates of the world sugar balance indicated higher stocks than previously thought, and the results of European beet tests indicated that the effects of this year's drought were not so drastic as had been feared. Pressure from producers to sell and forecasts of increased world production in the 1976/77 season helped to push the price lower to a level not seen since December 1973. Man considers, however, that "the market needs to move lower to encourage a transfer of stocks to end users" while Sucres et Denrées S.A., after a survey in August of recent trends, believe that a number of factors could act as a brake on the price fall. First, the difference between raw sugar prices for prompt and later shipment is widening and if this continues would make more attractive anticipated purchases for US refiners who hedge themselves on the terminal market so as not to assume any market risks.

In addition, the fall in raw sugar prices will cause some countries to rebuild their stocks from present low levels and, although it is difficult to estimate the price level sought by importers, sooner or later this stock building will restrain the price fall. Consumption will also be affected since many countries curtailed domestic consumption because of high prices on the international market and a return to lower prices considered reasonable by importing countries will probably stimulate demand.

White sugar prices have fallen also during the period, the LDP(W) going from £188 at the beginning of August to £167 at the end of the month. The fall has been induced by pressure of sales of Brazilian white sugar and by the European beet test results, but the premium of whites over raw sugar has widened and is thought likely to remain so for the near future.

* * *

Brazil sugar export plans[4]

Commenting on market rumours that Brazil intends to export as much as 1,000,000 metric tons of sugar between July and the end of March 1977, the Export Director of the Sugar and Alcohol Institute stated that a maximum of 400,000 tons are earmarked for the world market this year. He was unable to say how much would be exported during the first quarter of next year, as this will depend on the new crop. Crop conditions in the first half of this year were normal but the danger of frosts would continue until the end of July at least. Exports during April–June 1976 were almost 100,000 tons, more than New York trade sources had suggested. Much of the current crop is already accounted for under long-term contracts and a long-term contract was recently signed with Finland to supply 40,000 tons of raws annually for three years on a price-fixing basis plus premium.

[1] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (21), 1–4.
[2] *I.S.J.*, 1976, **78**, 223.
[3] *The Sugar Situation*, 1976, (303).
[4] *Public Ledger*, 17th July 1976.

ISO Executive Director's views on a new International Sugar Agreement[1]

At a commodity conference in London in July sponsored by the *Financial Times* and the *Investors Chronicle*, Mr. ERNEST JONES-PARRY, Executive Director of the International Sugar Organization, referred to the aim of governments to negotiate a new and effective International Sugar Agreement in the spring of 1977. Mr. JONES-PARRY recalled that part of the UNCTAD IV declaration, made in May of this year, included an agreement to hold a negotiating conference to set up a common fund. He said that if a a common fund were to be established it was to be hoped that it would not be used solely to finance internationally owned buffer stocks but also, so far as sugar was concerned, to finance nationally owned stocks.

Mr. PARRY-JONES said that most members of the International Sugar Council, especially the exporters, believed that the costs involved in establishing an internationally owned stock would be so high as to make this unacceptable if it were to be the sole mechanism for price stabilization. On the other hand, it was believed that, if combined with quota arrangements, nationally held stocks might play an important role in ironing out price fluctuations.

Exporting countries, he said, especially those which are heavily dependent on sugar for their foreign exchange, would be loath to invest heavily in new undertakings unless there were the possibility of defending satisfactory minimum prices by international action.

Mr. JONES-PARRY said that production costs had gone up steeply in the past few years and in any new Agreement these would have to be reflected in the indicative prices. Furthermore it will be necessary for these prices to be reviewed from time to time, though it might be difficult to obtain the level of automaticity which developing exporters have sought.

He said that there was need for increased investment and technology in developing countries and went on to say that developed countries should not be allowed to encourage the view that they were being helpful in selling their surplus sugar to the poor countries of the world. If the poor countries are to prosper, he said, it is necessary for them to grow their own sugar and export it at satisfactory prices.

* * *

Financing of commodity buffer stocks[2]

At the meeting of UNCTAD IV held in Nairobi this year it was agreed to establish a common fund to finance buffer stocks within an integrated programme for commodities. In conformity with this decision a negotiating conference must take place no later than March 1977. The Secretary General of UNCTAD has therefore decided to convene the first preparatory meeting for this negotiating conference in November this year. Additional meetings will be convened as necessary prior to the full conference taking place.

A negotiating conference for a new International Sugar Agreement is at present provisionally scheduled to take place during April/May 1977 so that delegates will be able to take note of the decisions regarding the financing of buffer stocks when they consider the special problems relating to sugar.

* * *

World sugar balance 1975/76

F. O. Licht KG have recently published[3] their third estimate of the world sugar balance for the crop year September 1975–August 1976 and these figures are reproduced below, together with corresponding data from the previous two crop years.

	1975/76	1974/75	1973/74
	(*metric tons, raw value*)		
Initial stocks	17,989,000	15,843,000	16,018,000
Production	82,878,000	80,375,000	80,673,000
Imports	22,433,000	24,513,000	34,705,000
	123,300,000	120,731,000	121,396,000
Exports	22,505,000	24,590,000	24,685,000
Consumption	80,466,000	78,152,000	80,868,000
Final stocks	20,329,000	17,989,000	15,843,000
Production change	+2,503,000	—298,000	+3,324,000
,, ,, %	+3·11	—0·37	+4·30
Consumption change	+2,314,000	—2,716,000	+2,912,000
,, ,, %	+2·96	—3·36	+3·74
Final stocks % consumption	25·26	23·02	19·59

The earlier estimates have been brought up to date as more information has become available and this is of particular importance in the case of Cuba, the 1974/75 crop results having been published only in July and showing a considerable difference from what had been expected by market observers. With better records of production levels, stocks and consumption, the later sugar balance estimates become more reliable and the latest figures indicate a stock figure for August 1976 of 20·3 million tons against the 19 million tons anticipated in the first balance estimate of last February.

The increase in sugar production is set slightly higher than the increase in consumption, so that surplus of production over consumption similar to that of 1974/75 is estimated to have raised the stock figure over the year by 2·3 million tons or from 23 to 25% of annual consumption. This greater availability of sugar is the basic reason for the declining values on the world sugar market.

Discussing the crop year September 1976/August 1977, Licht writes that, although there will be poor crops in some European countries, 1976/77 world sugar production will certainly again exceed the 1975/76 production results owing to better prospects in several cane sugar producing countries. If 1976/77 world sugar demand were to show a similar rate of increase as in 1975/76 no increase of production would be needed to maintain the same level of final stocks. Consequently, since production is certain to be higher, world sugar stocks will rise further by August 1977 unless the rate of consumption increase is greater in the current crop year than in 1975/76.

C. Czarnikow Ltd.[4] point out that, if the direction of terminal market values can be taken as any indication, the market view is that prices will rise in the forthcoming months. "Certainly consumption shows signs of getting into its stride once again after a period of negligible growth".

---

[1] C. Czarnikow Ltd., *Sugar Review*, 1976, (1291), 109–110.
[2] *ibid.*, (1297), 135–136.
[3] *International Sugar Rpt.*, 1976, **108**, (23), 1–3.
[4] *Sugar Review*, 1976, (1297), 135.

An investigation of condensates and their contribution to effluent disposal from sugar mills

Part II. Studies on the removal of ethanol from condensates

By J. D. BLAKE, R. BROADFOOT and D. H. FOSTER
(Sugar Research Institute, Mackay, Queensland, Australia)

Introduction

In Part I[1], results were presented on the origin and nature of compounds contributing to the biological oxygen demand found in condensates obtained during sugar milling operations. It was concluded that fermentation by micro-organisms was the major source of contamination and consequently a significant reduction in the BOD of effluents would be achieved by removal of the ethanol component.

Further studies on the distribution of ethanol and the development of a method for its disposal were undertaken. In this respect a distillation technique evolved from laboratory-scale investigation to pilot plant operation. The results are reported in this paper.

Experimental and Results

Distribution of ethanol throughout the factory

Sample points were machined into vent lines in the evaporators at Racecourse Sugar Mill in the Mackay region. From these, vapours were drawn off using a rotary vacuum pump and condensed by passage through a copper coil immersed in an ice bath. Condensates so obtained were analysed using gas-liquid chromatography as described in Part I[1]. Results are tabulated in Table I.

Table I. The distribution of ethanol in the evaporators at Racecourse Mill, 7th December 1974

Sample origin		*Ethanol concentration (ppm)*
Condensate	No. 1 effect	100
Condensate	No. 2 effect*	200
Vent	No. 1 effect	2260
Vent	No. 2 effect	2050
Vent	No. 3 effect	1800
Vent	No. 4 effect	560

* Condensate of vapours carried from No. 1 effect and discharged from the calandrias of the second vessel.

A number of samples were also analysed at selected effluent discharge points at Isis factory. Condensate from No. 1 effect contained 80 ppm ethanol while 820 ppm were found in the condensate from the No. 2 vessel. The overflow from the boiler-feed tank which received condensates from Nos. 1 and 2 effects plus the pan stage carried 400 ppm ethanol, while the overflow from the maceration tank, fed by condensates from effects 3, 4 and 5, contained 280 ppm ethanol. Combined effluents in the final discharge to a storage dam contained 50 ppm ethanol.

Steam stripping of ethanol

Of the methods available for the removal of ethanol from sugar factory condensates, it appeared that the best type would be those based on the high volatility of ethanol relative to that of water in dilute solutions. Published data[2] indicate that ethanol has about ten times the volatility of water at low concentration levels. This means that, if a small fraction of the mixture was evaporated, the concentration of ethanol in the vapour phase would be about ten times that existing in the liquid phase. Calculations for a steam stripping operation using the graphical method of Treybal[3] indicated that a steam flow of 10% on condensate flow, using a column equivalent to nine theoretical transfer plates, could strip a condensate stream to an ethanol concentration of 10% of its original value. Known design data for packed columns suggest that column costs would be reasonable.

It was therefore decided to investigate stripping methods, initially on a laboratory scale and subsequently on a pilot plant scale if results proved encouraging.

(*i*) *Laboratory trials*

A laboratory-scale steam-stripping still was set up at the University of Queensland Chemical Engineering Department to study its efficiency under controlled conditions and to verify theoretical predictions. The system used is shown schematically in Fig. 1. The still consisted of a glass column 75 mm in diameter and packed to a height of 2·75 m with 10 mm Raschig rings. Samples of feed, distillate, and residue were analysed as the mass ratio of stripping steam to feed (G/L) was varied.

Results are shown in Table II.

Table II. Laboratory-scale trials for ethanol stripping studies on condensates from No. 2 vessel

Steam feed kg.hr^{-1}	*G/L %*	*Sample*	*Ethanol ppm*	*TOC* ppm*	*BOD_5 ppm*
8·0	16·0	Condensate feed	230	180	470
		Distillate	1980	1250	3550
		Residue	7	30	53
10·3	20·6	Condensate feed	164	127	330
		Distillate	1290	790	2250
		Residue	3	27	54

* TOC—Total organic carbon.

Throughout, the condensate feed was maintained at 50 kg.hr^{-1} and samples were taken 45 minutes after steady operation was achieved. The liquid flow loading during these tests was about 11,300 kg.hr^{-1} per square metre of packed cross-sectional area and the steam input varied from 0·15 to 0·2 on the liquid flow. An undetermined fraction of this steam was condensed in the column owing to heat losses so that the effective steam:liquid ratio was lower than the value actually measured.

For an equilibrium volatility ratio of 10·6 for ethanol-water, it can be calculated that column performance achieved about 5–6 theoretical plates. Significantly, ethanol concentrations were reduced to low levels and justified further studies on a pilot plant scale. The "height equivalent of a theoretical plate"

[1] Blake: *I.S.J.*, 1976, **78**, 131–137.
[2] Brown: "Unit Operations" (Wiley, New York) 1950, p. 582.
[3] "Mass Transfer Operations" (McGraw-Hill, New York). 1952, p. 252.

was thus about 0·45 m for the packing used, i.e. 10 mm Raschig rings. It was considered that it would be desirable to use a larger packing for industrial purposes and 25 mm Raschig rings were chosen. It was anticipated that this would result in a higher estimate of the "height equivalent" value and design was based on an approximation of 0·5 m.

(ii) Pilot-scale trials

A pilot unit as illustrated in Fig. 2 was installed at Pleystowe Sugar Mill in the Mackay region. It consisted of a 200 mm diameter steel pipe packed to a height of 2·14 m with 25 mm Raschig rings. This was thought sufficient to give about five "theoretical plate" stages. A 0·3 m liquid seal was set at the residue removal leg and the still was lagged with asbestos rope. Condensate from No. 2 effect was fed through a Mono metering pump with variable speed drive to reduce fluctuation in flow rate. Steam was taken from the 100 kPa process steam main and its flow was measured by pressure differential across an orifice plate. Sample points for both steam and condensate distillate and residue were set up. Analytical results for several runs are shown in Table III. It was found that a representative sample of distillate could not be collected reproducibly from the top of the still and evaluation of this parameter was abandoned.

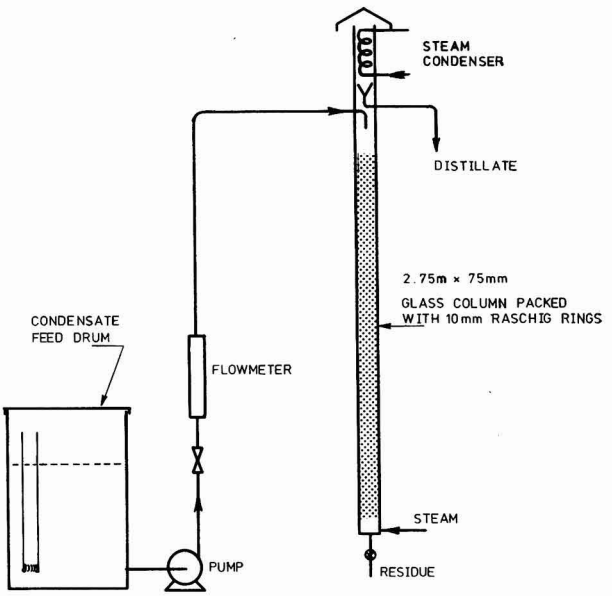


Fig. 1. The experimental steam-stripping still set up for preliminary investigation on the removal of ethanol from condensates

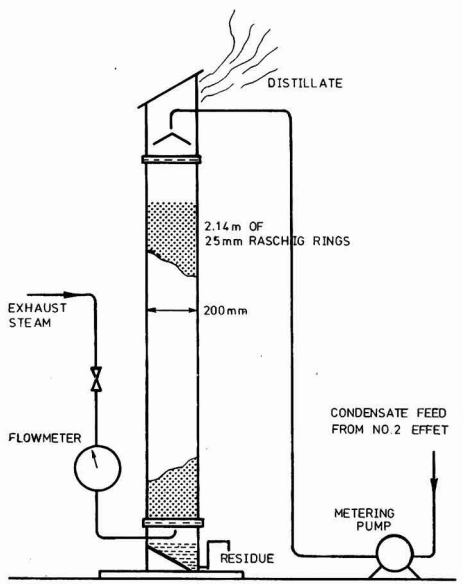


Fig. 2. The steam-stripping still used to study the removal of ethanol from condensate in pilot plant trials

From these initial observations it was evident that the final ethanol content attainable was limited by the ethanol carried in the exhaust steam. This in turn fluctuated as condensates of variable ethanol content were used for steam generation. An example of the fluctuation found during milling operation is shown graphically in Fig. 3.

The problem of ethanol contamination in the stripping steam was resolved by use of a reboiler whereby steam was generated from the condensate by heat exchange with the exhaust steam previously used. Exhaust steam was passed through 30 m of 13 mm copper tubing located in the base of a steel drum approximately 1 m high and 0·5 m in diameter. Because of the location of steam source in the factory, difficulties were experienced with its "wetness". This factor necessitated installation of a hot water trap in the line to the reboiler. Condensate feed was set at $6{\cdot}65 \pm 0{\cdot}4$ kg.min^{-1} and flashed from 105°C.

The results from seven tests using the reboiler facility are shown in Table IV.

From a theoretical treatment of the effects of a reboiler on the residue from a stripping still, the residual ethanol content of a condensate residue was calculated for a still containing six theoretical plates under varying conditions of the steam-to-feed ratio. Thus for the system illustrated in Fig. 4, the following results shown in Table V were calculated. These are compared graphically with those of Table IV in Fig. 5. The agreement is close and indicates that the column was indeed behaving as six theoretical plates.

In a separate analysis, using a steam-to-feed ratio of 0·164, an ethanol concentration of 1512 ppm was reduced to zero concentration. The residue obtained had a chemical oxygen demand (COD) of 88 ppm and BOD_5 of 40 ppm. Volatile nitrogen content changed from 33 to 3·4 ppm while concentration of

4·5 litres of residue to dryness established that there were 16 ppm dissolved solids remaining. Paper chromatography on an approximately one per cent solution of this residue failed to reveal any significant concentration of sucrose or its constituent sugars.

Discussion

Ethanol level in factory condensate

The alcohol observed in condensates produced during milling operations undoubtedly has its origin in fermentation by micro-organisms. Claims have been made concerning the influence of micro-organisms throughout the factory but evaluation of this contribution has proved difficult. This arises mainly because of the great fluctuation in ethanol concentrations occurring during normal operations within the mill and difficulties in setting up adeqate sampling points.

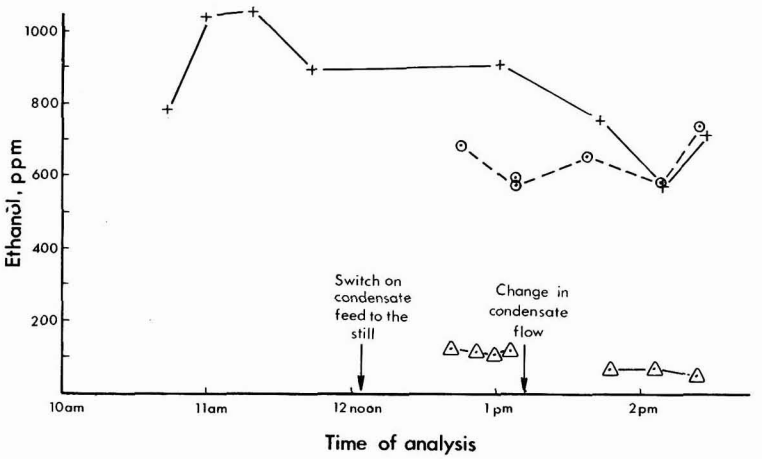


Fig. 3. An example of the fluctuation in ethanol concentration in condensate during milling operation
+ Stripping steam
⊙ Condensate feed
△ Stripped residue at two flow rates of condensate feed

It is felt that ethanol concentration levels arise primarily as a result of burning cane to remove trash. Thereafter any factors which prolong the period between burning and milling will influence the ultimate amount of ethanol found throughout the factory. As such, climate has a major influence, particularly with regard to rainfall which limits accessibility to cane land by mechanical harvesters. Temperature and humidity both before and after mechanical harvesting are further factors beyond control. Mill stoppage and harvesting features such as overburning, bruising and size of billets are other parameters over which some degree of control may be exercised.

From studies conducted at Racecourse Sugar Mill, it can be seen that condensate collected at the No. 2 effect is the major source of ethanol. This results from the initial evaporation of the juice in the first vessel and its carry-over in the vapour to the calandria of the second effect. Thereafter, the concentration is rapidly reduced as the juice moves through the remaining evaporators. The re-use of condensates throughout the milling operations enables a rapid distribution throughout the factory. This is evident in the results obtained in the Isis survey wherein it is also noteworthy that ultimate dilution of combined effluents to a storage dam reduced the ethanol level to 50 ppm.

It must be remembered that the milling operation is a dynamic one and ethanol levels fluctuate according to the condition of the incoming cane to the mill. It is this rapid distribution and the variation in condensate usage in different mills that provides problems in design for effluent treatment plants. The presence of varying quantities of ethanol creates significant and unpredictable biological oxygen demand loadings in

Table III. Steam-stripping efficiency for alcohol in condensate from No. 2 effect at Pleystowe Sugar Mill

Parameter	*Experiment No.* 1	2	3
Average steam feed rate	0·8 kg.min^{-1}	0·87 kg.min^{-1}	0·87 kg,min^{-1}
Average condensate feed rate	7·4 kg.min^{-1}	11·5 kg.min^{-1}	6·65 kg.min^{-1}
$\frac{G}{L} = \frac{\text{vapour feed}}{\text{condensate feed}}$	0·11	0·076	0·13
Condensate temperature	105°	104°	104°
Ethanol concentration (ppm) in:			
(*i*) steam	155	890	648
(*ii*) condensate feed	475	640	640
(*iii*) residue from the still	30*	110	60

* BOD_5 determination on this residue was found to be 90 ppm.

Table IV. Residual ethanol in the condensate residue after steam stripping from a reboiler, shown as a function of steam usage

$\frac{G}{L} = \frac{\text{Steam}}{\text{liquid feed}}$	*Condensate feed ethanol conc., ppm*	*Condensate residue, ppm* — *Ethanol*	*TOC*	*COD*	*BOD*	*% residual ethanol*
0	871	853	400	1698	1370	98
0·054	701	359	210	840	545	51·2
0·091	706	119	66	328	205	16·8
0·116	782	10	28	138	81	1·3
0·141	834	0		not analysed		0
0·165	857	0	23	102	68	0
0·186	700	0	30	138	82	0

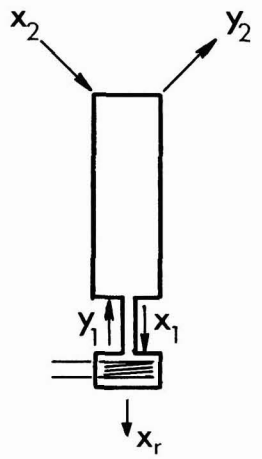


Fig. 4. Schematic model for the theoretical determination fo residual ethanol stripped from a still of six theoretical plates using a reboiler

x_2: ethanol concentration in feed.
x_1: ethanol concentration in residue prior to entering the reboiler.
x_r: ethanol concentration in the residue from the reboiler.
y_2: ethanol concentration in the distillate from the still.
y_1: ethanol concentration in the steam generated in the reboiler.

such plants and a preferable alternative for its removal is the use of its high volatility in a distillation unit.

The major variables influencing the efficiency in stripping ethanol by distillation may be summarized as follows:

(*i*) *Steam-to-feed ratio*

The cost factor of the steam used is a dominant consideration and the ratio chosen should depend upon the degree of removal of ethanol desired and the point in the factory at which it is deemed most desirable that it be removed.

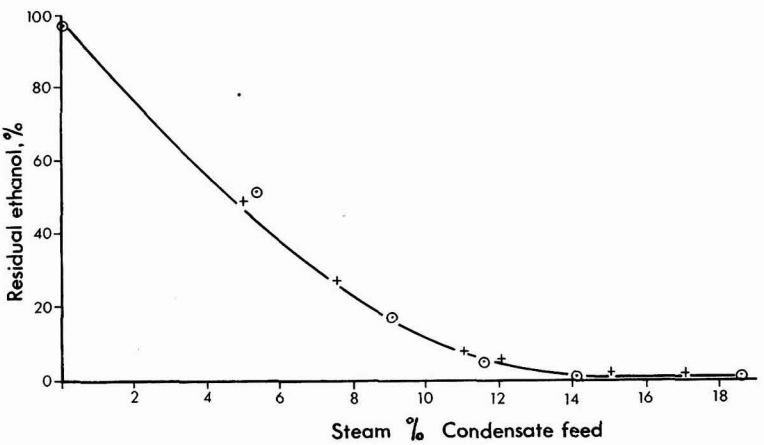


Fig. 5. Comparison of the predicted and actual concentration of ethanol after steam stripping from a reboiler, shown as a function of steam usage
⊙ Points obtained by experimental measurements.
\+ Theoretical considerations.

Condensate from No. 2 effect is richest in ethanol and stripping at this point would effectively reduce subsequent ethanol contamination in condensates throughout the mill system. An attempt to reduce ethanol levels in condensate at a final discharge point to comply with the requirements of legislation would be very much more expensive because of the heat requirements and the greater loading necessary on the still.

(*ii*) *Composition of condensate*

Fluctuation in the concentration of volatiles in a condensate is not a significant problem in their removal and will be in accordance with the performance limit set by the design of the still. The problem associated with composition of the condensate pertains to the concentration of non-volatiles and this can be limiting in that, while ethanol levels can be reduced to insignificance, the BOD contribution of non-volatiles may still prevent direct discharge if legislatory requirements are to be met.

Table V. Theoretical efficiency of a stripping still of six theoretical plates for the removal of ethanol as a function of steam to liquid feed

$\frac{G}{L} = \frac{\text{steam}}{\text{liquid feed}}$	*Ethanol concentration in still residue (ppm) for a feed supply containing 800 ppm ethanol*	% *residual ethanol*
0·17	6	0·75
0·16	9	1·1
0·15	13	1·6
0·12	43	4·2
0·11	62	5·4
0·10	89	11·2
0·075	213	26·6
0·05	396	49·5

Throughout these investigations, the lowest BOD_5 achieved in the residue was 40 ppm. Sucrose was insignificant in this residue and its concentration in practice reflects the efficiency of entrainment arrestors in the evaporators. Queensland legislation requires a maximum discharge BOD_5 of 20 ppm and thus further treatment is necessary before discharge.

(*iii*) *Temperature of condensates*

As mentioned above, choice of source of feed for a stripping still is an important cost factor because of the temperature of feed to be treated. In this sense, throughout these studies it was found that the temperature of condensate taken from No. 2 effect varied over the range 103–109° and so contributed an initial flash effect to the efficiency of the column.

Industrial significance of stripping methods

The usefulness of the stripping technique is limited by its apparent inability to reduce the BOD levels in

the condensate residue to the point where direct discharge can legally be made to a stream or watercourse in Queensland. The expense of the column and reboiler and the extra usage of steam may have been justifiable had it been able to meet the legislative requirements without any secondary treatment. It may, however, have application in other countries or in circumstances where a quantity of relatively clean and sterile water is required for some internal factory usage. In some cases, the stripping method might be justified as a means of reducing the loading on the normal effluent treatment system of the factory. Based on the pilot plant results presented here, a stripping process to treat 45 $m^3.hr^{-1}$ of condensate of BOD 0·500 $mg.cm^{-3}$ would require a column diameter of 2·0 m packed to 2·2 m height with 25 mm Raschig rings (6·9 m^3 packed volume or 0·153 m^3 per $m^3.hr^{-1}$ of condensate to be treated), and a reboiler of approximately 110 m^2 heat transfer surface using 5400 $kg.hr^{-1}$ of process steam at around 70 kPa gauge pressure. An approximate capital cost estimate for this arrangement would be about half that of the capital cost of equivalent aeration treatments to remove the same amount of BOD from the effluent[4]. However, the requirement for the stripping steam could result in a higher effective continuous cost.

ACKNOWLEDGMENTS

The authors wish to thank Professor E. T. WHITE, Department of Chemical Engineering, University of Queensland, and Dr. P. G. WRIGHT, Sugar Research Institute, for helpful advice and discussions during the course of this investigation.

The technical assistance of JOHN LITTLEMORE and ROSLYN THOMSON is gratefully acknowledged.

We also express our appreciation to the management of Pleystowe and Racecourse sugar mills for use of their facilities in the course of these studies.

[4] MCNEIL: *Private communication*, 1976.

Effect of some chemicals on the ripening of sugar cane

By GURBAKSH SINGH, KRISHNA SHARMA and R. S. KANWAR

(Punjab Agricultural University, Sugarcane Research Station, Jullundur, Punjab, India)

Introduction

RECENTLY a few chemicals have been tried as cane ripeners in Hawaii, Puerto Rico, Philippines and Queensland. Of these, "Polaris" (Monsanto Chemical CP 41845) has been found to be the best chemical for inducing ripening in sugar cane. In the sub-tropical climate of northern India, the cane crop is planted in spring (January–March) and harvested during winter (November–February) and spring (March–April). The main variety grown in this area is Co 1148 which gives good cane yield but ripens very late, i.e. in March and April. In the absence of early maturing varieties, Co 1148 is crushed during the months of November, December and January, as a result of which the sugar recovery during this period is very low. In order to induce early maturity in this variety for better sugar recovery during the earlier part of the crushing season, investigations were carried out at the Sugarcane Research Station, Jullundur, of Punjab Agricultural University, to study the effect of pre-harvest foliar application of some chemicals on ripening of sugar cane. The results of these studies are reported in this paper.

Material and methods

The experiments were conducted over two seasons: 1973–74 and 1974–75. A trial was laid out in a randomized block design with four replications and plot size of 50 m^2, planted to Co 1148. The chemicals tried were "Polaris" (N,N-bis-phosphonomethyl glycine), "Cycocel" (2-chloroethyltrimethyl ammonium chloride), Compounds C 9550, C 9551 and C 9552 and boron as H_3BO_3. There were six treatments during 1973–74 and ten during 1974–75. Compounds C 9550, C 9551 and C 9552 are chemical ripeners obtained from Indofil Co., Bombay. Foliar applications of the chemicals was made twice, on 20th September and 3rd November 1973, and on 20th October and 21st November 1974, before carrying out the juice analysis. The solutions of the chemicals were sprayed at 1250 litres of water per hectare on foliage with a manually operated sprayer. Three cane clumps from each plot were harvested on each date of analysis, the stalks crushed and juice analysed for sucrose content by polarimeter and reducing sugars by titration against Fehling's solution (A and B). Juice purity was calculated from total solids and sucrose content. The data were statistically analysed.

Results and discussion

The data are presented in Tables I and II. The data in Table I for 1973–74 show that "Polaris" at both the rates of application, viz. 2·15 and 4·30 $kg.ha^{-1}$, significantly improved the juice sucrose content when the samples were analysed on 14th November and 12th December 1973, i.e. 11 and 39 days after the second spraying. In the mid-December analysis, i.e. 39 days after second spraying, "Cycocel" at 2 and 4 $kg.ha^{-1}$ also significantly improved the sucrose content in juice. After the middle of December, however, the differences in sucrose content for cane treated with "Polaris" and "Cycocel" disappeared.

During 1974–75 "Polaris" and Compound C 9550 at both application rates (2·30 and 4·50 $kg.ha^{-1}$) and Compound C 9551 at 4·5 $kg.ha^{-1}$ showed significant increases in sucrose content when juice was analysed on 27th November 1974, i.e. one week after the second spraying. The beneficial effect of these chemicals on sucrose content was recorded till the end of

Table I. Effect of different chemical ripeners on sucrose % juice

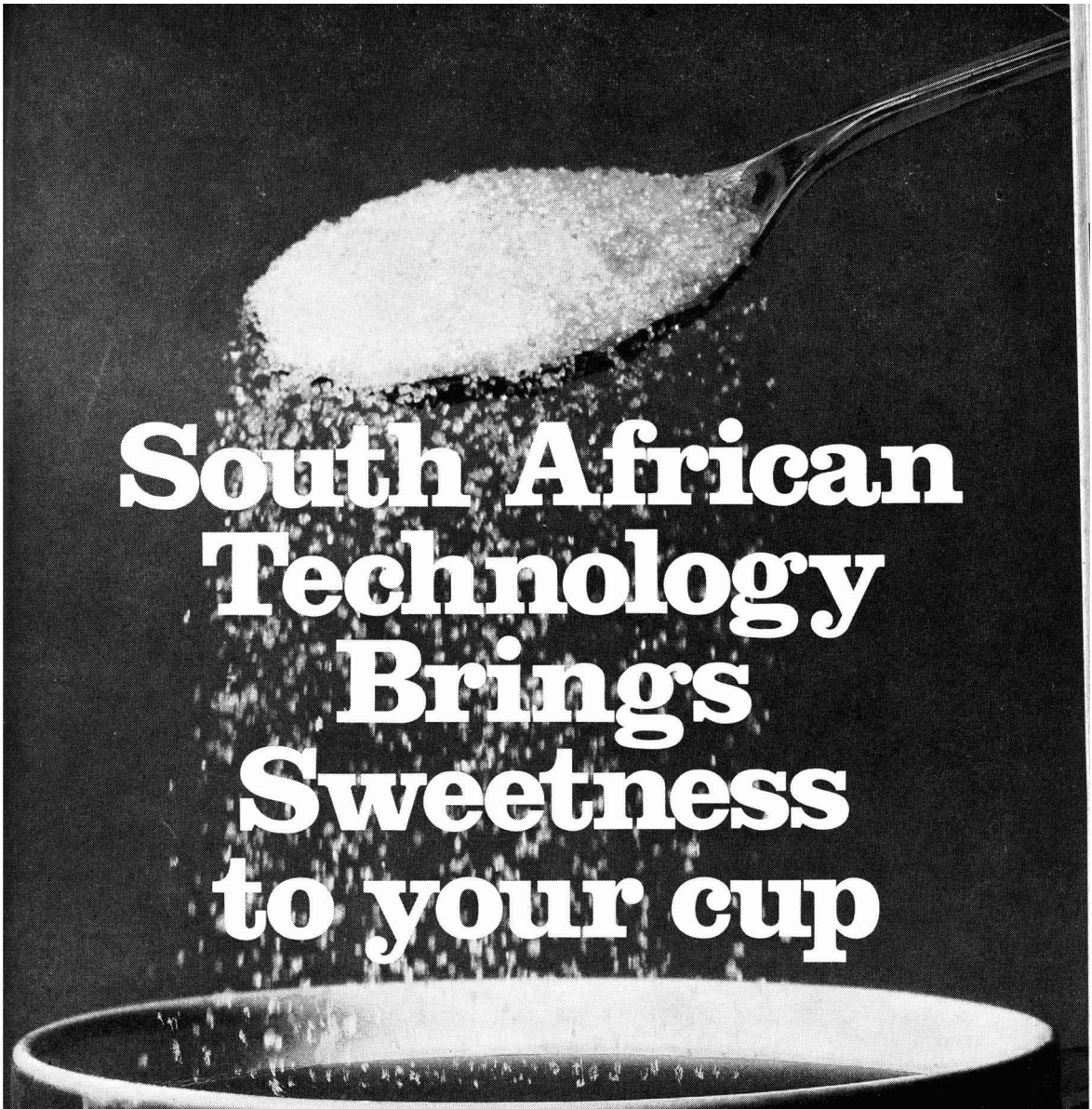
Chemical	*Rate, kg.ha*$^{-1}$	*Dates of analysis*					
		1973-74					
		27th Oct. 1973	*14th Nov.* 1973	*12th Dec.* 1973	*8th Jan.* 1974	*7th Feb.* 1974	*1st March* 1974
"Polaris"	2·15	12·31	13·68	15·14	15·04	15·82	17·45
"	4·30	12·30	13·77	15·41	15·08	16·01	17·77
"Cycocel"	2·00	11·96	12·66	14·81	14·90	16·03	17·94
"	4·00	11·70	13·09	15·09	14·25	15·99	18·32
Boron (H_3BO_3)	6·25	11·98	12·43	14·62	14·66	15·65	17·57
Control (water spray)	—	12·23	12·92	13·94	14·64	15·02	17·36
C.D. at 5%		N.S.	0·72	0·84	N.S.	N.S.	N.S.
		1974-75					
		27th Nov. 1974	*11th Dec.* 1974	*30th Dec.* 1974	*16th Jan.* 1975	*31st Jan.* 1975	*15th Feb.* 1975	*1st March* 1975
"Polaris"	2·15	12·53	12·81	14·36	14·99	15·37	15·63	16·76
"	4·30	12·80	13·34	14·30	15·05	15·28	16·36	17·11
Boron (H_3BO_3)	6·25	12·05	12·83	14·06	14·56	14·99	15·95	16·37
Compound C-9550..	2·30	12·77	13·13	14·55	15·38	15·81	16·51	16·32
" ..	4·50	12·81	13·39	13·98	14·54	15·37	14·62	16·68
CompoundC-9551 ..	4·50	13·12	13·64	14·49	15·44	15·95	15·66	16·13
Compound C-9552..	4·50	12·30	12·75	14·11	14·21	15·94	15·12	15·59
"Cycocel"	2·00	11·86	12·96	13·60	15·30	15·54	14·63	15·92
"	4·00	12·40	13·52	14·59	14·70	15·58	15·94	16·42
Control (water spray)	—	11·78	12·95	13·96	14·82	15·17	15·17	16·00
C.D. at 5%		0·81	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table II. Effect of different chemical ripeners on purity of juice

Chemical	*Rate, kg.ha*$^{-1}$	*Dates of analysis*					
		1973-74					
		27th Oct. 1973	*14th Nov.* 1973	*12th Dec.* 1973	*8th Jan.* 1974	*7th Feb.* 1974	*1st March* 1975
"Polaris"	2·15	68·0	73·9	77·9	79·1	79·7	84·2
"	4·30	69·3	73·5	77·5	79·6	79·9	85·2
"Cycocel"	2·00	68·4	71·0	76·3	80·1	80·6	86·2
"	4·00	69·8	71·9	77·8	78·9	79·2	87·6
Boron (H_3BO_3)	6·25	68·0	70·0	76·5	78·6	79·1	85·2
Control (water spray)	—	67·5	71·0	75·0	79·4	80·4	83·0
		1974-75					
		27th Nov. 1974	*11th Dec.* 1974	*30th Dec.* 1974	*16th Jan.* 1975	*31st Jan.* 1975	*15th Feb.* 1975	*1st March* 1975
"Polaris"	2·15	72·3	73·2	77·5	78·8	81·7	81·9	82·0
"	4·30	72·6	74·7	75·3	78·6	81·5	78·4	81·1
Boron (H_3BO_3)	6·25	71·8	72·7	76·3	77·4	79·6	83·3	81·8
Compound C-9550	2·30	73·5	73·9	77·6	79·0	82·9	85·1	82·8
"	4·50	74·0	74·0	76·2	77·5	81·0	78·2	81·6
Compound C-9551	4·50	75·0	75·3	77·0	79·4	84·2	80·5	80·8
Compound C-9552	4·50	73·0	72·9	76·2	77·2	84·2	80·5	81·5
"Cycocel"	2·00	70·9	74·5	74·9	79·6	81·7	77·3	81·7
"	4·00	73·3	73·3	76·5	77·8	80·8	82·1	81·5
Control (water spray)	—	70·9	72·3	74·5	78·3	79·2	81·7	81·1

Table III. Effect of different chemical ripeners on reducing sugars % juice

Chemical	*Rate, kg.ha*$^{-1}$	*Dates of analysis*					
		1973-74					
		27th Oct. 1973	*14th Nov.* 1973	*12th Dec.* 1973	*8th Jan.* 1974	*7th Feb.* 1974	*1st March* 1974
"Polaris"	2·15	1·85	1·44	1·10	0·96	0·50	0·52
"	4·30	1·75	1·39	1·12	0·75	0·58	0·55
"Cycocel"	2·00	1·80	1·68	1·02	0·82	0·47	0·51
"	4·00	1·86	1·73	0·89	0·83	0·42	0·39
Boron (H_3BO_3)	6·25	2·10	1·76	1·12	1·03	0·57	0·56
Control (water spray)	—	1·90	1·58	1·17	0·90	0·54	0·53
C.D. at 5%		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
		1974-75					
		17th Nov. 1974	*11th Dec.* 1974	*30th Dec.* 1974	*16th Jan.* 1975	*31st Jan.* 1975	*15th Feb.* 1975	*1st March* 1975
"Polaris"	2·15	1·16	1·29	0·59	0·62	0·60	0·52	0·46
"	4·30	1·18	1·39	0·52	0·66	0·64	0·61	0·35
Boron (H_3BO_3)	6·25	1·41	1·51	0·76	0·70	0·55	0·48	0·45
Compound C-9550	2·30	1·14	1·33	0·54	0·84	0·46	0·43	0·29
"	4·50	1·12	1·26	0·84	0·82	0·64	0·39	0·31
Compound C-9551	4·50	1·16	1·36	0·56	0·71	0·58	0·55	0·30
Compound C-9552	4·50	1·16	1·30	0·45	0·72	0·67	0·51	0·28
"Cycocel"	2·00	1·08	1·30	0·55	0·75	0·66	0·46	0·31
"	4·00	1·02	1·25	0·63	0·70	0·70	0·34	0·35
Control (water spray)	—	1·14	1·29	0·46	0·75	0·66	0·48	0·31
C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.



South African Technology Brings Sweetness to your cup

EDWARD L. BATEMAN LIMITED, a leading South African design and project engineering company, in association with the best South African sugar technologists, offer you the following services for New Sugar Factories and Modernisation and Extension of Existing Factories.

FEASIBILITY STUDIES (INCLUDING AGRONOMIC STUDIES)

DESIGN AND ENGINEERING

INCORPORATION OF EQUIPMENT OF YOUR CHOICE

PROJECT MANAGEMENT

COMMISSIONING AND INITIAL OPERATION OF FACTORY

TURNKEY PROJECTS

ATTRACTIVE SOUTH AFRICAN PRICES

ADEQUATE CREDIT FACILITIES

TRAINING OF STAFF

ELB

EDWARD L. BATEMAN LIMITED

Bartlett Road
Boksburg North
Transvaal
South Africa Tel: 892-2020

P.O. Box 565
Boksburg. 1460
Telegrams "Founders"
Telex: SA 8-7880

R. STON

December also, but the differences in sucrose content were statistically non-significant. On subsequent dates of analysis, the positive effects of the chemicals disappeared as in 1973–74. The reducing sugars and purity were not influenced by the ripeners.

The above results show that the improvement in sucrose content due to "Polaris", "Cycocel", Compound C 9550 and Compound C 9551 was found up to six weeks after the second application, after which the differences among the various treatments were non-significant. None of the chemicals showed any burning or retarding effect on crop growth, though "Polaris" and "Cycocel" have both been reported to have a retarding effect on growth and burning of foliage. With spraying of these chemicals, however, the crop did not attain the peak maturity as shown by the data in Tables I and II. Results obtained by other workers[1] indicated that "Polaris", 6 to 8 weeks before harvesting, gave the best results. PARTER & EHLRICKS[2] have reported that application of "Polaris" at the rate of 2 to 6 kg.ha^{-1}, four to thirteen weeks before harvesting, increased the sucrose content in juice of plant cane as well as in the ratoon crop. SRIVASTAVA *et al.*[3] evaluated the effects of "Cycocel" for cane ripening under tropical conditions in South India and reported its beneficial effect on ripening of cane. The results of the present investigation indicate the usefulness of "Polaris", "Cycocel", Compound C 9550 and Compound C 9551 in inducing early maturity in variety Co 1148. Further investigations are necessary to work out the best rate and time of application of these chemicals.

Summary

An experiment was conducted during 1973–74 and 1974–75 at the Sugarcane Research Station of the Punjab Agricultural University, Jullundur, to study the effect of foliar application of some chemicals on ripening of Co 1148, a high-yielding, late-maturing cane variety. The results showed that "Polaris" at 2·15 kg.ha^{-1}, Compound C 9550 at 2·3 kg.ha^{-1}, Compound C 9551 at 4·5 kg.ha^{-1} and "Cycocel" at 4 kg.ha^{-1} induced early maturity in Co 1148, resulting in higher sucrose content in juice up to 6 weeks after application of the chemicals. Boron did not show any effect.

[1] NICKELL & TANIMOTO: *Rpts. Hawaiian Sugar Tech.*, 1971, 73–82.
[2] *ibid.*, 71–72.
[3] *Proc. 4th Joint Conv. India Sugar Tech. Assoc.*, 1971, A.1–A.7.

Growth and structure of the sugar industry in Thailand

By Dr. PAKORN ABDULBHAN and Mr. KHUBBOL SUKSUPHA

(Industrial Engineering Management Division,
Asian Institute of Technology, Bangkok, Thailand)

PART II

Sugar markets

Domestic Market

The domestic price is unstable as a result of speculation and stock piling as well as sugar availability changes dependent on weather and cane supply to the sugar factories. Usually the sugar price varies seasonally. In December, the beginning of the production season, the price usually falls as the stocks are released together with the new sugar production. Then it gradually rises until a high point is reached in a period of two or three months prior to the next production season—that is, in October or September.

Exports

Prior to the 1960's, Thailand was unable to supply the domestic market with sufficient sugar and imports were needed. Since then the industry has been developed for import substitution and even has surplus sugar available for export.

In the first period of export (1960-1968), owing to the surplus of supply and the depressed price of sugar in the world market, the Government had to formulate the 1961 Sugar Act in order to support the exporter and alleviate the over-production problem, by charging the producers an amount of money proportional to the volume of production in order to subsidize cane growers, industrial research and, in particular, exporters.

This support proved unsuccessful because the charges to the producers discouraged them from improving the efficiency of their plants or the quality of their products. Since they got less profit per unit output, they merely increased their productions and this caused a crisis in 1965. The country's surplus of sugar was so big that the 1961 Act had to be abolished and a policy of limiting sugar production to the level of domestic demand was announced. Exports after 1966 fell steadily and disappeared in 1968.

Since 1970, owing to the increasing demand and rising price of sugar on the world market, the sugar industry has been expanded and exports have risen from 56,248 tons in 1970 to 420,241 tons in 1974. The value of exports has risen from 93 million Bahts in 1970 to 3500 million Bahts in 1974 (see Table VII).

The pattern of production in the period 1970-1974 changed from one of producing plantation white sugar for domestic consumption with the surplus exported, to one of producing plantation white sugar to maintain the domestic price, while raw sugar has been produced specifically for export.

Maeklong River sugar region

Parts of Kanchanaburi and of Rajburi Provinces along the Maeklong River form an important zone for sugar production in Thailand. This sugar region extends from below the Vachiralongkorn Dam in

Table VII. Exports of sugar, 1960–74

Year	*Quantity (tons)*	*FOB value (Bahts)*
1960	5,723·2	8,056,170
1961	1,536·6	2,689,270
1962	42,973·3	45,915,480
1963	52,823·9	121,812,720
1964	48,907·6	211,100,310
1965	83,834·4	100,465,100
1966	54,858·1	81,636,800
1967	15,012·8	36,965,170
1968	—	—
1969	16,101·8	46,983,790
1970	56,248·5	93,727,050
1971	145,010·6	381,613,600
1972	426,808·0	1,264,293,540
1973	258,294·0	1,160,990,020
1974	420,241·5	3,531,549,860

Kanchanaburi District of Kanchanaburi Province, to the Ban Pong District of Rajburi Province (see Fig. 3). It covers a distance of 45 kilometres along the Maeklong River. The region possesses the following characteristics:

(1) Fourteen sugar plants are clustered along the banks of the river. Their individual production capacities are high, and the total capacity of the existing plants is about 55% of the national total (or 89,500 tons per day). Thus, this region is the most important sugar production region in Thailand.

(2) The transportation of cane from plantations to the factories is quite convenient. Transportation of sugar from the factories to Bangkok, the main market and terminal for export, is by way of the Petchkasem Highway or the Southern Railway with the distance about 90 kilometres.

(3) The power used in production is provided by three large substations of the Provincial Electricity Authority in Kanchanaburi and Ban Pong Districts. Moreover, the Kwae Yai Dam Project of EGAT (Electricity Generating Authority of Thailand), now under construction, is expected to provide both irrigation and electric power, and will thus be able to support general industrial expansion in the region.

(4) The region is suited to the cultivation of cane; the soil is fertile and annual rainfall is sufficient. The region is part of the irrigation area of Vachiralongkorn Dam and the projected Kwae Yai Dam. These factors permit the cane yield to be relatively high by national standards.

Because the Maeklong River region is fertile and well-irrigated, the cane production area has expanded rapidly from 46,381 rais in the 1962–63 crop season to 943,500 rais in 1974–75, about 49% of that of the whole country (see Table VIII and Fig. 4). Cane production in the Maeklong River region increased from 305,852 tons in the 1962–63 season to 7,300,000 tons in the 1973–74 season. The higher rate of growth of cane production compared with cane production area growth rate appears to imply improved yield per unit area.

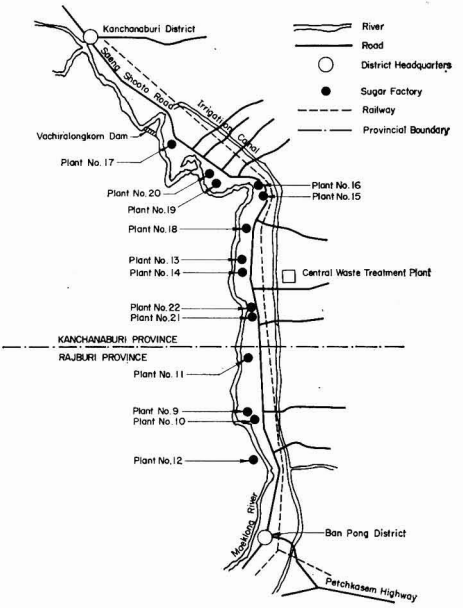


Fig. 3. Maeklong River sugar industry region

The production of sugar in this zone increased from 21,817 tons in 1962-63 to 579,188 tons in the 1973–74 production year at the average growth rate of 36·5% (see Table VIII and Fig. 4). At present the number of plants is 14, compared with 3 in 1962. The sugar plants in the region have an average capacity of 6,100 tons cane crushed per day, which is significantly higher than the national average of 3800 tons per day.

Employment generation

Sugar manufacture, being an agriculture-based processing industry, is a major employer of labour both in the agricultural and non-agricultural sectors.

For processing of 85,500 tons of cane per day at 14 sugar mills in the Maeklong River region, the labour required is about 11,125 persons, or about

Table VIII. Comparison of cane and sugar production in the Maeklong River system with that of the whole country

Year	*Maeklong River area*		*Cane production*		*Average cane production,*	*Sugar production*	
	rais	*% of total*	*tons*	*% of total*	*tons/rai*	*tons*	*% of total*
1962–63	46,381	13·4	305,852	18·1	6·50	21,817	17·6
1963–64	104,000	23·0	623,827	26·1	5·998	45,000	26·8
1964–65	140,000	26·3	1,290,540	33·0	9·218	85,916	26·9
1965–66	133,500	25·5	1,041,946	34·2	7·805	72,991	27·1
1966–67	115,400	27·9	1,074,318	37·9	9·310	70,164	30·2
1967–68	155,032	34·2	1,000,580	35·0	6·454	68,459	30·2
1968–69	265,207	37·9	2,000,202	43·0	7·542	113,761	29·3
1969–70	332,982	41·6	2,266,920	41·5	6·808	177,361	38·2
1970–71	385,825	44·8	3,840,110	58·3	9·953	296,534	55·7
1971–72	467,200	53·6	3,372,923	56·9	7·219	272,615	54·3
1972–73	473,792	41·8	5,817,797	61·2	12·279	365,007	56·3
1973–74	918,858	56·9	7,515,064	59·2	8·179	519,188	56·3
1974–75	943,500	48·8	7,300,000	50·3	7·737	511,000	50·3
Average growth rate (%)	33·9	—	38·1	—	7·1	36·5	—

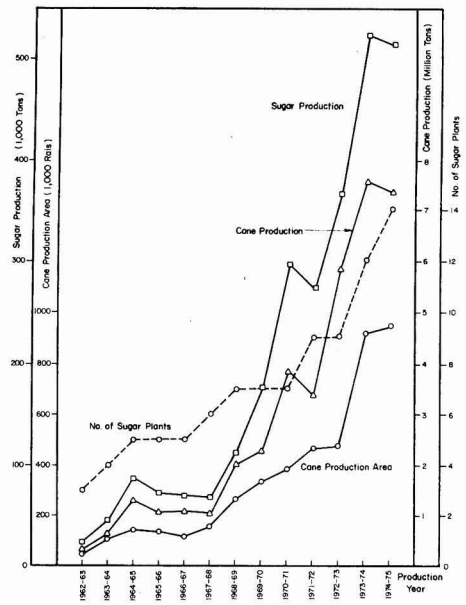


Fig. 4. Cane and sugar production in the Maeklong River region

77% of total labour employed in manufacturing in the Rajburi and Kanchanaburi Provinces (14,500 persons).

Moreover, agricultural manpower used for planting and harvesting sugar cane, raw material of the sugar industry, is significant particularly for the agricultural base of the Thai economy. UNIDO estimates that 15·94 man-hours are needed for producing and harvesting each ton of cane. Thus, for the estimated weight of 7·3 million tons of cane crushed in the last production season (1974–75), 116·36 million man-hours are needed. Thus if one assumes 200 working days a year and 9 working hours per day, the approximate agriculture manpower requirement in cane production would then be about 64,645 persons, or 72·6% of total labour in the agriculture sector of the Maeklong region (89,000 persons).

Environmental impact

Along the Maeklong River, in the region shown in Fig. 3, are a series of cane sugar plants, plus additional plants. Quantities of waste discharged from these plants are enormous, sufficient to kill the fish and harmful to the people in the region over the past several years. Recent studies by the Environmental Division, Ministry of Public Health, indicate that 92% of total pollution load discharged to the Maeklong River is sugar industry waste. Moreover, the cane sugar industry, one of Thailand's major export earners, is expanding, causing continuing intensification of the problem. Since rivers in Thailand are used for fishing, irrigation, drinking, bathing, transportation, etc., this problem has serious socio-economic effects. The problem has become critical, particularly since 1970, when the waste from sugar mills in the region polluted the water all along the river. Costs of damage at that time has been recorded as follows:

1. *Fishery.* The Thai Department of Fishery has estimated the direct damage cost to fish, lobster and other aquatic life in the Maeklong River to be 2–3 million Bahts and the damage to oyster farms in the estuarine zone in the range of 8–10 million Bahts.

2. *Potable water.* The livelihood of most of the residents along the Maeklong Rivers mainly depends on the condition of the river. The water treatment plant which normally drew the water from the river for purification had to be closed after 1970 and the Environmental Planning Office of the National Economic and Social Development Board has estimated the damage cost to be 500,000 Bahts.

3. *Agriculture.* From the data of the preliminary report prepared by Maeklong River Basin Development Project, annual vegetable and fruit production is about 90 million Bahts. In the year 1971 production decreased about 5 million Bahts and it is believed that the major cause was the polluted water in the river.

The total direct damage cost is about 15–19 million Bahts, which is small by comparison with cane growers' income or plants' profit. However, the livelihood of the residents along the river which has been ruined cannot be calculated in monetary terms. The point that should be emphasized is that cleaning up the river is neither a technical nor economic, but a political problem—that of enforcing the public responsibilities on industry.

The Government, through the Ministry of Industry, has had to construct a central waste treatment plant. The Government financed it initially, and charges the individual plants in proportion to their effluent volume. This action has alleviated the problem considerably but not yet completely.

Conclusions

The sugar industry in Thailand appears to be a relevant example of industry which began as an import substitution operation. After succeeding in such purpose, it has gone on to become a major export industry. It generates significant employment not only in the manufacturing plants but also in the agricultural field. It has grown significantly in many aspects as discussed earlier in this paper. With the exception of the environmental aspects of the Maeklong River region which is being minimized, the sugar industry has made an important contribution to the development of Thailand, in general, and the industrialization of the country, in particular.

Summary

The paper analyses the sugar industry of Thailand during the 1960–75 period. An attempt is first made to determine the structure and growth of the industry from the following aspects: cane production; sugar production; sugar consumption; export performance. The Maeklong River sugar industrial region whose combined capacity accounts for 55% of the Thailand industry is then examined. Its characteristics are then compared with those of the whole industry.

BIBLIOGRAPHY

[1] *Board of Investment Rpt.*, Bangkok, 1968.
[2] Department of Customs: "Foreign Trade Statistics of Thailand 1960–1975" (Bangkok, Thailand), 1974.
[3] Manpower Planning Division, National Economic and Social Development Board: "Fact Book on Manpower in Thailand" (Bangkok, Thailand), 1974.
[4] Ministry of Commerce: "Thai Manufactured Products".
[5] The Sugar Institute: "Reports of Thailand Sugar Industry" (Ministry of Industry, Bangkok) 1973.

Sugar cane agriculture

Pesticide use and hazards in Mauritian agriculture. C. RICAUD. *Rev. Agric. Sucr. Maurice*, 1975, **54**, 143–148. Care needed in applying pesticides and herbicides as used in Mauritian agriculture, including cane crops, is discussed and possible hazards are indicated.

* * *

Influence of Left Bank Canal closure during hot months on the quantity and quality of cane in the Tungabhadra Ayacut area. M. V. RAO and S. H. RAO. *Sugar News* (India), 1975, **7**, (6), 12–14.—Cane growing along the Left Bank Canal of Tungabhadra Reservoir has been found to suffer in yield and quality as a result of closure of the canal for 17–30 days in May and consequent moisture stress. Cane of the same variety growing along the Right Bank Canal performs better, since the canal is closed in December.

* * *

Response of sugar cane crop to potassium. G. K. ZENDE. *Sugar News* (India), 1975, **7**, (6), 18–27.—A review is given of the literature on cane response to K, covering: the role of K in crop growth, factors affecting K availability in soils, the K status of Indian cane soils, K uptake by cane, determination of K requirements, the effect of K on juice quality, and the influence of K on shoot borer resistance.

* * *

"Sevidol" granules for the control of the sugar cane shoot borer *Chilo infuscatellus* Snell. M. D. PADMANABHAN, G. VARDHARAJAN and K. SAIVARAJ. *Indian Sugar*, 1975, **25**, 555–559.—Of six granular and three spray insecticides tested against the shoot borer in two seasons, the most effective was "Sevidol" granules applied at the rate of 11·2 kg.ha^{-1} 35 days after cane planting. One application was almost as effective as two applications. Best results were a yield of 118·7 tons.ha^{-1} against 84·6 tons.ha^{-1} with untreated cane.

* * *

Insect pests of sugar cane and their control. S. N. BANERJEE and D. K. BUTANI. *Indian Sugar*, 1975, **25**, 415–416, 561–571.—A survey is presented of the literature on cane insect pests and their control in India.

* * *

Companion cropping of sugar cane and wheat. The pest problem and how to tackle it. A. N. KALRA, A. VARMA and T. N. SRIVASTAVA. *Sugar News* (India), 1975, **7**, (7), 11–12.—Intercropping of wheat and cane has been found to increase the chances of large infestations of pests common to both crops, probably because of increased survival resulting from adequate food and shelter. Two major pests observed are the pink borer (*Sesamia inferens*) and the army worm (*Pseudaletia separata*); the former can be controlled with γ-BHC or "Heptachlor" at 1 kg a.i. per ha, while the latter can be controlled with 10% BHC dust at 20–25 kg.ha^{-1}, the chemicals being applied immediately after harvesting of the wheat. Also mentioned as a pest of cane and wheat is the termite, which can be controlled by frequent irrigation and proper attention to the crops.

* * *

Note on white fly incidence in relation to foliar application of urea. A. N. KALRA and M. C. GUPTA. *Sugar News* (India), 1975, **7**, (7), 13.—Brief mention is made of a trial in 1965–66 which confirmed earlier findings that foliar spraying with urea at the rate of 28 kg N per ha helped reduce the incidence of white fly (*Aleurolobus barodensis*) compared with unsprayed controls. Doubling the urea application rate reduced the pest incidence further but only by an insignificant amount compared with the lower rate.

* * *

Increasing cane production by intercropping. K. S. RATHI. *Sugar News* (India), 1975, **7**, (7), 14–16.—The advantages of cane intercropping are discussed and various factors to be considered before adopting it are examined.

* * *

Correlation study of quality and yield contributing characteristics in early maturing sugar cane cultivars. B. K. SAHI and K. A. PATEL. *Indian Sugar*, 1975, **25**, 621–624, 641.—Studies of 40 early-maturing cane varieties grown under both tropical and sub-tropical conditions demonstrated a high correlation between cane yield and (1) c.c.s. per plot and (2) cane sugar content. The correlation between yield and weight was also good, but less so than the other correlations mentioned.

* * *

Importance of soil analysis for improving the sugar cane yield. M. L. AGARWAL, B. SINGH and A. C. SHUKLA. *Sugar News* (India), 1975, **7**, (8), 16–18. Methods of soil analysis for the more important nutrients are listed and the micro-nutrient requirements of cane indicated. Correction of soil nutrient deficiencies is discussed and methods of fertilizer application to cane outlined.

* * *

Erosion control in sugar cane. R. P. HUMBERT. *World Farming*, 1976, **18**, (2), 24–26.—Soil erosion by rain in cane fields is briefly discussed with the aid of illustrations, two of which clearly show the splashing of soil and water under the effect of raindrop impact. It is stressed that rain is particularly harmful to young cane which has no leaf canopy to protect it. Means of preventing erosion are indicated.

* * *

Apparatus for the lower cutting of cane stalks in the harvesters. V. ABLIKOV and G. B. RIVAS. *ATAC*, 1975, (Nov./Dec.), 22–30.—The four types of base-cutter used for cane harvesting are discussed, viz.

bulldozer blades, discs, inclined blades and combined cutters. Disc and blade cutters are considered to have more scope for development, and an investigation is proposed into study of the best shape and arrangement of the cutting elements and mechanism.

* * *

Preliminary study on irrigation efficiencies in the Peruvian sugar industry. A. HOEKSTRA. *Bol. Técn. Divn. Técn. Inst. Central Invest. Azuc.*, 1974, **3**, (4), 1–101.—A detailed study has been made on the effects of factors including gradient, flow, furrow length, etc., on irrigation in Peru with different soil types and at various locations, and a multiple statistical examination of measurements made; calculated infiltration values showed no significant interrelationships. It is considered that irrigation efficiency in Peru can be improved by adjusting the relationships between length and gradient of furrows, and requirements and flows of water. With open furrows, the gradients may be in the range 2–6% but they should be minimal with closed furrows (less than 1·5%), while the closed furrow length can give efficient irrigation with a length of 80–160 metres. With open furrows, the time of irrigation is of greatest importance as regards efficiency; for application up to 150 mm, the maximum time should be 380 minutes. Field design should be carefully considered in providing for irrigation; irrigation engineers should be employed, and meters and controls should be installed, if best use is to be made of a limited supply of water.

* * *

The quality of irrigation water. I. RISSEEUW. *Bol. Técn. Divn. Técn. Inst. Central Invest. Azuc.*, 1974, **3**, (4), 102–116.—The most important characteristics which determine irrigation water quality are discussed, viz. salinity, pH and material in suspension, and methods are mentioned for alleviating the consequences of the temporary use of low-quality water. Investigations which have been made into the quality of irrigation water used by Peruvian sugar cooperatives are described.

* * *

Post-graduate research studies on sugar cane in Tamil Nadu. T. R. SRINIVASAN and Y. B. MORACHAN. *Indian Sugar*, 1975, **25**, 675–679.—Nine studies undertaken by post-graduates at Tamil Nadu Agricultural University, Coimbatore, from 1963 to 1973 are summarized. Most of the studies concerned cane fertilization.

* * *

Response of sugar cane to green manuring. N. KUMARAPERUMAL *et al. Indian Sugar*, 1975, **25**, 681–684. The effect of ammonium sulphate application in two doses of 140 kg.ha^{-1} 45 and 100 days after cane planting was compared (as control) with that of the earlier application plus incorporation of a green manure (grown as intercrop) 100 days after planting, N being applied to make up to the equivalent of 140 kg N per ha. In the cases of three different green manures, cane sugar content and cane and sugar yield were lower than with the control; only *Gliricidia maculata* leaves plus 70 kg.ha^{-1} N (both applied as the second dose) increased cane yield, but sugar content and yield were still lower than with the control. Juice quality was not affected by the form of fertilizer. All the green manure crops were sown 45 days after cane planting.

The designs and installation of the tile drains system at Victorias. A. A. MACTAL. *Sugarland* (Philippines), 1975, **12**, (4), 6–8, 35.—The design and installation of tile drains and the sub-surface system installed on a cane farm owned by Victorias Milling Co. Inc. are described, and the economics assessed.

* * *

Report on a visit to Japan. G. D. THOMPSON and P. G. C. BRETT. *S. African Sugar J.*, 1976, **60**, 61–66. A brief survey is presented of Japanese sugar cane agriculture and of six experiment stations and agricultural institutes visited by the authors.

* * *

Control of the sugar cane stalk borer (*Chilo auricilius* Ddgn.) by newer insecticides. H. N. YADAV and S. P. SHARMA. *Indian Sugar*, 1975, **25**, 729–730.—In comparative trials, "Monocrotophos" ("Nuvacron") gave best results in reducing borer incidence to 2·0%, followed by "Fenitrothion" (2·6%), "Endosulfan" (3·6%), "Endrin" (3·7%) and "Thiometon" (4·0%). All proved better than no treatment (7·1%). Each insecticide was applied at 1·25 kg a.i. per ha four times at 20-day intervals.

* * *

Plant protection for enhanced juice quality of sugar cane. T. SOMU, R. N. SEETHARAMAN and K. RAJU. *Indian Sugar*, 1975, **25**, 731–733.—Pests and diseases affecting cane in India are discussed and means of controlling them indicated.

* * *

Relative toxicity of insecticides to *Icerya pilosa* Green on sugar cane in Uttar Pradesh. R. A. SINGH, B. N. PANDEY and A. SINGH. *Sugar News* (India), 1976, **7**, (9), 6–7.—Tests with 25 insecticides applied to single cane leaves to control this minor cane pest showed that none completely eliminated it at the maximum dosage of 0·1%, although most achieved at least 90% and many nearly 98% mortality after 7 days, compared with an increase of 68% in incidence of the pest on untreated control leaves.

* * *

Herbicides for sugar cane. D. J. C. SINGH and K. M. GUPTA. *Sugar News* (India), 1976, **7**, (9), 17–20. The performances of various herbicides in different cane-growing countries are summarized, and results of trials at two locations in India during 1971-74 are tabulated. "Lasso" and "Atrataf" proved particularly effective in increasing cane yield over that obtained with hand weeding.

* * *

Nitrogen: basic food for cane. M. A. C. DOS SANTOS. *Brasil Açuc.*, 1976, **87**, 14–18.—The author discusses theoretical aspects of N fertilization such as origin, function in plants, sources and aspects to be taken into account in choosing N fertilizers, as well as the time and methods of application.

* * *

Effect of organic matter on the solubilization of phosphates in the soil. III. Effects of distillery residues (vinasse). N. A. DA GLÓRIA and M. E. MATTIAZZO. *Brasil Açuc.*, 1976, **87**, 55–62.—Examination of the effect of vinasse on phosphate solubilization in two different soils after an incubation period was made by the modified NEUBAUER method, but no favourable effect was found.

Massive rearing of *Diatraea saccharalis* (F.1794) in the laboratory on rice (*Oriza sativa* L.). N. MACEDO, A. DE C. MENDES, P. S. M. BOTELHO and O. NAKANO. *Brasil Açuc.*, 1976, **87**, 65–67.—A comparison is made between larvae of *D. saccharalis* raised on germinated rice in an evironment of 70% humidity and 25–30°C and larvae raised on the artificial wheat germ diet of HENSLEY & HAMMOND[1]; the rice-raised larvae were better developed and the technique is easier and less costly, while further studies are under way to make it more efficient and economical.

* * *

An inexpensive mechanical harvesting system that works. A. G. DE BEER. *S. African Sugar J.*, 1976, **60**, 111–112.—Illustrations and a description are given of a cane loader and trailer which a grower in the Malelane area created out of two old loaders when faced with a sudden labour shortage in the 1974/75 harvesting season. The system has functioned to the fullest satisfaction in two seasons, the cane being push-piled and loaded at the rate of 6 tons in 25–30 minutes.

* * *

An evaluation of various types of cultivators for weed control in sugar cane. E. MEYER and A. G. DE BEER. *S. African Sugar J.*, 1976, **60**, 114–119.—See *I.S.J.*, 1976, **78**, 174.

* * *

Time and intensity of flowering as influenced by certain temperature and photoperiod treatments. P. G. C. BRETT, R. HARDING and J. G. PAXTON. *S. African Sugar J.*, 1976, **60**, 121–129.—See *I.S.J.*, 1976, **78**, 175.

* * *

Further studies on the preventive measure to arrest the deterioration of harvested sugar cane in storage. S. BOSE, K. C. GUPTA and S. MUKHERJEE. *Sharkara*, 1974, **13**, 47–53.—Spraying the ends of cut cane with formalin in varying concentrations reduced the purity loss and reducing sugars formation compared with untreated controls up to 384 hours after the cane had been cut. Tabulated data refer to trials at four Indian sugar factories. A 1% concentration (the minimum tested) gave the best results.

* * *

Sugar cane cultivation. P. H. NELSON and E. ZILLICH. *Die Zuckerrübe*, 1976, **25**, (3), 28–29.—A brief survey is presented of cane agriculture and processing.

* * *

Effect of sugar cane burning on milling and juice qualities and sugar recovery. S. EL-N. A. HEMAIDA, G. EL-K. SAYED, M. A. HUSSEIN and A. A. EL-BADAWI. *Res. Bull. Egyptian Sugar and Distillation Co., Sugar Cane Dept.*, 1975, (52), 32 pp; through *S.I.A.*, 1976, **38**, Abs. 76-435.—Burned and unburned harvested cane was stored in the field, and samples of this cane and of burned standing cane were analysed after 2, 4, 6 and 8 days. Juice extracted per ton of cane and % cane, sugar extracted per ton of cane and % cane, sugar losses in bagasse, and mixed juice Brix, sucrose content, purity and glucose ratio are shown in graphs. The theoretical sugar yield % cane was greatest in burned harvested cane and lowest in burned standing cane, but this was partly due to the weight losses in harvested cane; the yield in tons per feddan (1·038 acre) decreased by 0·1, 0·44 and 1·64 in 8 days in burned standing, burned harvested and unburned harvested cane, respectively. It is therefore recommended that burned cane be left standing in the field if milling delays are expected.

* * *

Fertilizer and soil fertility practices for sugar cane production in Louisiana, 1976. ANON. *Sugar Bull.*, 1976, **54**, (10), 8–9.—Recommended N, P and K application rates in the three main cane areas of Louisiana are given for plant, ratoon and seed cane, and advice is also given regarding lime and filter cake application.

* * *

Studies on clonal selection of sugar cane at different levels of nitrogen fertilization. J. A. MARIOTTI and O. GIMÉNEZ L. *Rev. Ind. Agríc. Tucumán*, 1974, **51**, (2), 41–51.—A study was made of the effect of different levels of N fertilization on the effectiveness of clonal selection of sugar cane. 100 hybrid clones from 5 biparental progenies were taken at random with no previous selection and grown with 0, 60 or 120 kg N per ha. Genotypes were controlled for several yield and quality components and data from the first ratoon crop analysed in a variance-covariance scheme. Estimations were made for repeatabilities, heritabilities and phenotypic and genotypic correlations as well as the theoretical efficiency of cross-selection from a control environment. Results indicate that the bulk of the population investigated tended to have a response to N which is similar to that observed in highly selected commercial varieties. N levels did not greatly affect the estimates of repeatability or heritability for most traits; at the 120 $kg.ha^{-1}$ level, however, some higher estimates were observed of heritability for various traits. The 60 $kg.ha^{-1}$ level affected estimates of sugar yield, while associations among most characters were non-significant at that level. Genetic mechanisms which are responsible for the phenotypic expression of traits appear to be very similar in the three N levels investigated in the experiment. Further research is to examine the effects of different and variable soil and moisture conditions.

* * *

Methodology applied in the Tucumán Agricultural Experiment Station for obtaining new sugar cane varieties. O. GIMÉNEZ L. and E. PÉREZ A. *Publ. Misc. Estac. Exp. Agríc. Tucumán*, 1975, (52), 16 pp. Details are presented of the methods used to obtain crosses, using photoperiod and temperature control to induce flowering, greenhouse propagation of seedlings, multiplication and planting in the fields, and comparative regional trials, in which important characteristics tested include resistance to mosaic, smut and leaf scald diseases, as well as resistance to frost, high sugar yield and juice quality, adaptability to different soils, etc., erectness, resistance to borers, etc.

* * *

Economic study of three systems of sugar cane cultivation in the Department of Burruyacu (Tucumán). R. P. COSSIO and J. M. HINOJO. *Rev. Ind. Agric. Tucumán*, 1975, **52**, (1), 1–10.—An economic study was made in the comparison of the conventional cultivation practice with manual weeding, total chemical control of weeds in both row and inter-row, and a chemical-mechanical system in which the cane

[1] *J. Econ. Entomol.*, 1968, **61**, 1742–1743.

row was kept clear of weeds with herbicide but the inter-row was weeded manually. The last of these gave the highest return which had the lowest cost, while the sucrose content of the cane was unaffected by the method used.

* * *

Economic study of three systems of sugar cane cultivation in the Department of Famailla (Tucumán). R. P. COSSIO, J. M. HINOJO and R. BARCUDI. *Rev. Ind. Agric. Tucumán*, 1975, **52,** (1), 11–27.—The three systems of weed control (cf. previous abstract) were compared in Famailla and the highest return obtained using complete chemical control of weeds, which gave the highest yield of cane as a direct result of increased tillering.

* * *

Effect of lodging on sugar cane quality. F. A. FOGLIATA and D. M. MORIN. *Rev. Ind. Agric. Tucumán*, 1975, **52,** (1), 39–48.—Analysis of juices showed that, during the normal crop period, lodged cane had a lower yield, purity and sugar content but a higher content of reducing sugars.

* * *

The industrial quality of flowering sugar cane. F. A. FOGLIATA and D. M. MORIN. *Rev. Ind. Agric. Tucumán*, 1975, **52,** (1), 49–60.—During the normal crop period, flowering cane showed a higher juice purity, sucrose % cane and yield than non-flowering cane; however, after November the juice quality decreased seriously.

* * *

Cold tolerance in sugar cane relatives. J. D. MILLER. *Sugar y Azúcar*, 1976, **71,** (3), 24–25.—Pot-grown clones of *Saccharum spontaneum*, *S. sinense* and *S. officinarum*, two commercial varieties (CP 43-33 and CP 67-432) known to be frost-tolerant, and one natural hybrid were placed in a cold chamber for 4 hours at —3·5°C, after which they were removed and placed in a constant-temperature room at 20°C for at least 16 hours. Determination of the percentage of dead leaf tissue and live terminal buds showed that, while the commercial varieties were the fourth and sixth most tolerant of the clones investigated, the three clones of *S. spontaneum* were the best, while one clone of *S. sinense* came fifth (although others of this species were highly susceptible to frost). However, back-crossing of frost-tolerant F_1 clones from crosses between *S. spontaneum* and commercial varieties has given only low frequency of frost-tolerant clones which resembled the *S. spontaneum* clones from which they originated, so that the possible availability of frost-tolerant cane varieties is considered a long way off.

* * *

Field mechanization. ANON. *Sugar y Azúcar*, 1976, **71,** (3), 47–52.—Illustrated information is given on cane planters demonstrated in Florida, particularly a two-row machine developed by the United States Sugar Corp. for skip planting (designed to maintain high ratoon crop yields by reducing the frequency of ploughing-out and planting). A hot water treatment plant for the seed cane used in skip planting is briefly described; it is stressed that the treatment is intended to increase germination speed but not to prevent RSD. Cane harvesters are also described; it is pointed out that, for certain technical and agricultural reasons, development of mechanical harvesting in Florida has not been easy.

The control of Johnson grass and other weeds in Louisiana sugar cane, spring 1976. ANON. *Sugar Bull.*, 1976, **54,** (11), 10–16.—Recommendations are given on chemical control of Johnson grass, Raoul (itch) grass and Bermuda grass in plant and ratoon cane.

* * *

The recurring problem of smut. ANON. *S. African Sugar J.*, 1976, **60,** 161–163.—Although smut has been largely restricted to the northern, irrigated areas of South Africa and Swaziland, it had previously been a serious disease over a much wider area, and a recent outbreak has demonstrated its potential to be a problem outside the areas mentioned. It has been found to be well established in a number of crops of N:Co 382 and N 55/805, although losses have not yet reached the economic level. The article is intended to familarize growers with smut symptoms and measures for its control, while brief mention is made of the work being done on the production of new smut-resistant varieties, of which N 52/219 is one that has recently been released in the north.

* * *

Release of the variety J 59/3. ANON. *S. African Sugar J.*, 1976, **60,** 163.—Information is given on this variety which in most trials has had a sugar content as high as that of N:Co 310, although there is some indication that it may be less tolerant of bad drainage than most varieties. Its male parent is B 4223, while its female parent was derived from N:Co 310 and two wild forms of cane found in Burma.

* * *

Implementation of field layout for mechanization and surface water control. O. P. LANDREY, J. P. FOURIE and N. A. JOHNSTON. *S. African Sugar J.*, 1976, **60,** 165–175.—See *I.S.J.*, 1976, **78,** 174.

* * *

The importance of current entomological investigations in view of the improvement of sugar cane in Brazil. G. M. AZZI. *Brasil Açuc.*, 1976, **87,** 224–228.—The author stresses the importance of breeding for resistance to the moth borer. In the past four years Brazil has lost more than $355 million through the combined effects of borer attack, red rot and *Fusarium* stem rot. The Brazilian sugar cane improvement programme (PLANALSUCAR) strategy is to breed for resistance to these diseases and the mass rearing of borer parasites and their liberation in the most heavily infested cane areas. In 1976 a new project is to test, under local conditions, varieties which have been reported in the literature as borer-resistant. Morphological traits will be studied in correlation with resistance. Progeny tests will be carried out to assess heritability and resistant material will be selected.

* * *

The sugar cane borer and its behaviour in the sugar cane region. H. D. DE SOUZA and M. F. DA SILVA. *Brasil Açuc.*, 1976, **87,** 229–237.—A study is reported on the borer in the state of Bahia. Of the 14 species found by Box in Brazil, only two are found in Bahia, the *Diatraea saccharalis* in small numbers and *D. flavipennella* the major pest. Natural enemies include *Metagonistylum minense*, *Ipobracon* spp. and *Apanteles flavipes*, all of which occur in Bahia, but the programme for identifying the heaviest infected areas and times will permit the most effective breeding and release of predators to reduee borer damage most economically.

Sugar beet agriculture

Effect of different rates of nitrogen on yield and quality of sugar beet. D. S. DEOL and R. S. KANWAR. *Sugar News* (India), 1975, **7**, (6), 28–29.—N trials during 1972/73 and 1973/74 are reported in which 120 kg.ha^{-1} was found to be optimum for the Punjab as regards root yield, but an adverse effect of N on pol was established.

* * *

Late-developing weed. N. V. TURNER. *British Sugar Beet Rev.*, 1976, **44**, 11–12.—Field trials conducted at 14 locations in 1974 and at 8 locations in 1975 are reported in which a residual pre-emergence herbicide was applied either alone or in combination with one or more post-emergence herbicides, two tests also involving post-emergence treatment only without residual pre-emergence herbicide. Eight treatments were compared at each site and the percentage early and late weed control determined. While the residual herbicide on its own gave poor results, its omission caused post-herbicide treatments to give poorer results than when it was included. Hence, best results were given by residual herbicide plus "Betanal E" plus another post-emergence herbicide or herbicide mixture (possibly including "Betanal E"). It is pointed out that the most economical and effective weed control programme for any one farm can only be established locally, but that, for consistent results year after year, a programme must be planned and adhered to. Some reasons for first herbicide treatments failing to prevent late-developing weeds are listed, including the obvious one of late emergence. Treatment for control of late-developing weeds is discussed, "Betanal E" being recommended for most cases, although "Treflan" is also suggested as a suitable herbicide for such purposes. Black nightshade, a notorious late-emerging weed which can be a problem in beet fields, can be effectively controlled with a "Betanal E"/"Pyramin" mixture. Brief mention is made of two new promising herbicides, "Nortron" and "Goltix", which could offer an effective means against late-developing weeds. The use of underleaf spraying is recommended when the beet plants reach the 4–6 leaf stage.

* * *

Good beet drilling. J. CROW. *British Sugar Beet Rev.*, 1976, **44**, 17–20.—Good seed bed preparation, essential for good seed drilling, is discussed, after which the author considers important factors in preparation of the seed drill and in drilling. Tables are reproduced which give the seed application in weight and number per acre for a given spacing and row width.

* * *

Problems in the chemical control of aphids and yellows. R. A. DUNNING and G. H. WINDER. *British Sugar Beet Rev.*, 1976, **44**, 21, 30.—While aphicides were applied more frequently to beet during the 1975 season more than ever before in the UK, by the end of August nearly 40% of the beet plants were infected with yellows, this being the fourth highest incidence in 30 years during which records have been kept. Reasons for this and how better control can be obtained are discussed. Recommended measures for 1976, based on trials in 1974 and 1975, are discussed. Of granular chemicals, "Temik" controls early aphid and virus attacks as well as Docking disorder, but its regular use can only be justified economically in areas at greatest risk, assuming that it will also improve seedling establishment and vigour. In 1975, "Dacamox" proved more effective than "Temik" in controlling aphids and yellows. Of spray materials, the most effective was "Aphox" (a non-organophosphorus compound), which reduced aphid incidence by 84% and virus yellows incidence by 32% while increasing sugar yield by 7·1% compared with untreated controls. The time, method and frequency of foliar application are examined. Even with high aphid and yellows incidence, a maximum of two sprayings has been found to give the best monetary return in terms of increased yield. In one trial, six sprayings gave no greater yield than did one.

* * *

Chemical weed control in beet in the West Midlands. M. EDDOWES. *British Sugar Beet Rev.*, 1976, **44**, 28–30.—Herbicide trials conducted in 1973–75 on light-to-medium sandy loam soils typically used for beet growing in the West Midlands area of the UK showed that best control of annual weeds was generally given by a combination of a pre- with a post-emergence herbicide or by a mixture of two post-emergence herbicides. While there was little difference between yields as a result of treatment in 1974 (as well as little difference in yields between treated and untreated crops), in 1975 marked differences occurred, and all treatments increased yield considerably compared with the untreated controls. Highest yield was given by "Lenacil" pre-emergence plus "Phenmedipham" post-emergence herbicide.

* * *

Drill modifications. K. J. THOMPSON. *British Sugar Beet Rev.*, 1976, **44**, 33.—Modifications to beet seed drills necessitated by abnormal climatic and soil conditions in 1975 are described.

* * *

Approved chemical products for beet. N. B. DAVIS. *British Sugar Beet Rev.*, 1976, **44**, 38.—An up-to-date list is presented of fungicides, herbicides and pesticides approved by the UK Ministry of Agriculture, Fisheries & Food for use in beet crops.

* * *

Sub-soil compactness and hardpan. P. LEFEVRE. *Hautes Etudes Betterav. Agric.*, 1976, **8**, (33), 9–17.—Symptoms of hardpan which occur in the four seasons of the year are described as they occur

in both the soil surface and in various crops, including sugar beet. Causes of hardpan are listed, and the effects of the disorder indicated. Detection of hardpan and remedial measures are then discussed.

* * *

Powdery mildew. J. E. HULL. *Sugarbeet*, 1976, (81), 8–9.—Trials on control of beet powdery mildew have shown that 40 lb 85% sulphur dust per acre in July completely prevented occurrence of the disease at harvest; treatment increased yield and sugar content but also K and nitrate-N content, while reducing amino-N, Na and purity. Application of 4 pints of a 52% flowable sulphur in 30 gal water per acre was not as effective as sulphur dust, since some areas contained beets having infected lower leaves about a month before harvest, although the disease did not spread to the upper leaves, and beet yield and sugar content did not seem to be significantly affected.

* * *

Factors that influence the effectiveness of your herbicides. D. TRAVELLER and J. E. HULL. *Sugarbeet*, 1976, (81), 16–17.—The factors affecting herbicide efficiency which are discussed are: temperature and soil moisture, texture and organic matter. High temperatures at the time of application of soil-active herbicides usually cause more rapid loss or shorter herbicide life through increased microbial activity, greater volatilization and increased radiation. Warmth and other conditions conducive to growth are necessary for best results with contact herbicides applied directly to growing weeds. Excessive soil moisture causes poor incorporation and inadequate weed control, since the moisture adheres to individual soil particles and thus fills absorptive sites, leaving the herbicide essentially loose in the free water or soil solution. Herbicides adhere readily to dry, fine-textured soils, so that their incorporation and activity are enhanced. On the other hand, adequate soil moisture is important for contact herbicides, since this ensures that the weeds are growing actively and are thus more susceptible to the effects of herbicides. The finer the soil particles, the greater will be the amount of surface area available for herbicide adherence. High organic matter contents (4–5%) tend to tie up herbicides through absorption of the herbicide molecule, so that application rates must be adjusted to compensate for this. The characteristics of a number of well-known herbicides are tabulated.

* * *

Root maggot—still a problem for sugar beet growers. A. KELLER and J. D. STALLINGS. *Sugarbeet*, 1976, (81), 18–19.—A description is given of the root maggot adult fly and of the life cycle and feeding characteristics of the root maggot, incidence of which has been rapidly increasing in beet fields of Idaho. A list is given of five insecticides which are effective against the pest. While their performances vary somewhat with the year, and the one which gives the best maggot control is not necessarily the same one which will give the highest beet yield, systemic insecticides usually give greatest yield, possibly because they control other pests as well.

* * *

Let's not forget the cultivator. C. KESTER and F. KIRK. *Sugarbeet*, 1976, (81), 21.—The advantages of the cultivator for both weed control (after pre-emergence herbicide application) and soil aeration are discussed.

New seed coating helps improve efficiency of precision planting. ANON. *Sugarbeet*, 1976, (81), 22.—The benefits of a new high-porosity seed coating described include faster emergence and a more uniform stand. The coating is a product of the Filcoat Pelleted Seed Division of Germain's Inc.

* * *

Ten steps to a good beet stand. J. E. HULL. *Sugarbeet*, 1976, (81), 23.—Recommended measures for a good stand of beet which can be mechanically harvested include: provision of an adequate seedbed moisture content; preparation of the seedbed in the autumn; proper maintenance of the drill, ensuring that the seed is of the right size for it; checking the seed spacing; calibrating herbicide application equipment to prevent excessive doses; taking care over planting depth and drilling speed; breaking soil crusts; and cultivating at the right time.

* * *

Regularity of sowing and soil profiles. II. C. DE ZANCHE and G. BARALDI. *Ind. Sacc. Ital.*, 1976, **69**, 11–14.—Laboratory experiments are reported in which the effects of soil profile on beet and maize seed drilling at forward speeds of 3–8 kph were determined. Irregularities in the soil surface were simulated by means of wedges placed in pairs to form triangular sections of varying length and height. Results indicated that these irregularities had a noticeable effect on drilling only at speeds above 5 kph, but that at normal speeds slight irregularities had a negligible effect.

* * *

Studies on the effect of different levels of nitrogen on the yield and quality of sugar beet. S. N. L. SRIVASTAVA, O. P. SINGH and L. K. BISHNOI. *Sugar News* (India), 1976, **7**, (9), 14–15.—N-P-K trials conducted in 1972–73 and 1973–74 at Haryana Agricultural University Research Farm, Hissar, are reported in which 120 kg N per ha at a 3:2:2 N:P:K ratio was found to be optimum for sugar yield.

* * *

Around the 1976 S.I.M.A. ANON. *Le Betteravier Franç.*, 1976, **46**, (293), 15–18.—Illustrations and brief descriptions are given of beet agricultural machinery on show at an exhibition held in March 1976. Virtually every beet mechanization process is covered.

* * *

Varietal trials with sugar beet seed in 1975. L. SCHMIDT, D. MRAČKOVÁ and J. JAROŠ. *Listy Cukr.*, 1976, **92**, 49–57.—Tests conducted on 19 varieties at the Sugar Industry Research Institute in Prague during 1971–75 are reported, and comparison is made between the results and those obtained at Šemcice Research Institute (also in Czechoslovakia) as well as in Austria, France and Hungary in different years. In 1975 Dobrovická A proved the best in terms of white sugar rendement, although a slight fall in processing quality occurred where the seed was segmented as opposed to abraded. Similarly, better results were obtained with unpelleted compared with pelleted seed.

* * *

Secondary effects of herbicides used in sugar beet agriculture on black leg in young sugar beet. H. BÖTGER and C. WINNER. *Zucker*, 1976, **29**, 161–172. Field trials and pot experiments with naturally infected soil and with soil inoculated with *Aphanomyces*

cochlioides were carried out to establish if various herbicides widely used in beet had a secondary effect on soil fungi (*A. cochlioides*, *Pythium* spp., *Fusarium* spp., *Rhizoctonia* spp. and *Alternaria* spp.). Results showed that infected plants in the field tests were only slightly affected by the herbicides, but the number of diseased beet remained about the same. In the pot tests, under otherwise identical conditions, the loss in young seedlings as a result of herbicide application was greater than in the field tests, but the number of plants infected with fungal diseases fell slightly. The tests with *A. cochlioides*-infected soil showed a drop in the number of infected beets under the effect of "Avadex" ("Diallat"). Hence, under normal conditions, herbicides have no real effect on soil fungi.

* * *

Planning your weed spray programme. C. KESTER. *Sugar Beet J.*, 1976, **39,** (2), 2–4.—The author cites the experiences of five farmers in pre- and post-emergence herbicide application to beet in Michigan. It is demonstrated that planning of a weed control programme well in advance is necessary, particularly in the case of post-emergence herbicides which should be applied as soon as the beet plants are sufficiently large to withstand the effects of a spray.

* * *

Towards 100% weed control. ANON. *Sugar Beet J.*, 1976, **39,** (2), 7–8.—Advice is given on pre- and post-emergence herbicide application for control of annual and perennial weeds, and illustrations are given of post-emergence spray appliances.

* * *

Seedbed preparation for sugar beets. L. S. ROBERTSON and D. M. VAN DOREN. *Sugar Beet J.*, 1976, **39,** (2), 9–10.—Advice is given on how to obtain an ideal seedbed (which should be level, have a fine soil particle size, contain moist soil at the planting depth, and offer protection against temporary standing water) according to type of soil. The authors do not advocate spring tillage of the clay soils typical of Ohio and Michigan but recommend tillage in the autumn or in the winter after autumn ploughing.

* * *

Sugar beet diseases and their control. C. L. SCHNEIDER. *Sugar Beet J.*, 1976, **39,** (2), 11–12.—Guidance is given on control of blackroot, crown rot and leaf spot by modifications to normal cultural practices, by use of disease-resistant varieties and by fungicide application.

* * *

Tests to establish the effect of temperature and rainfall on the function of beet invertase during the 1974/75 campaign. I. JANUSZEWICZ, K. MOSSAKOWSKA, E. KOROLCZUK and K. ZELAZNY. *Gaz. Cukr.*, 1976, **84,** 59–61.—Increased inversion losses in beet diffusion in 1974/75 were attributed to a higher invertase content and activity in the beet as a result of marked fluctuation in temperature and abnormally high rainfall.

* * *

The effect of ambient moisture on germination of pelleted sugar beet seed. P. KOLAGO. *Gaz. Cukr.*, 1976, **84,** 64–67.—Laboratory tests were conducted on three beet varieties to establish the effects of moisture in the range 10–60% on germination. While results generally indicated minimum germination with the highest moisture content and maximum germination at the lowest, results for the intermediate moisture contents depended on the variety, as did the absolute percentages obtained.

The struggle against yellows. E. SEUTIN and L. VAN STEYVOORT. *Le Betteravier*, 1976, **10,** (97), 11. Treatment for virus yellows control includes application of a granular insecticide, e.g. "Temik 10 G" or "Curater 5 G", at sowing; in the absence of such treatment, the farmer should spray the beets with a systemic insecticide or a non-systemic aphicide based on "Pirimicarb" at 12-day intervals up to about the second half of June. Brief notes are given on various suitable systemic insecticides.

* * *

Post-emergence treatment—continuation and conclusion of a weed control system. J. M. BELIEN and F. J. SALEMBIER. *Le Betteravier*, 1976, **10,** (97), 12–13. The most frequent weeds which remain to be destroyed by post-emergence control are listed, and advice is given on a combined system of mechanical cultivation and chemical control with mixtures of "Betanal" and "Pyramin".

* * *

What is PRB 200? ANON. *Le Betteravier*, 1976, **10,** (97), 14.—Information is given on PRB 200 growth regulator and means of applying it to beet.

* * *

Comparative study on the use of liquid and farmyard manure in beet agriculture. L. TRUYENS, R. VANSTALLEN and K. VLASSAK. *Publ. Trimest. Inst. Belge Amél. Betterave*, 1975, **43,** 149–162.—Analysis of soil and beet were aimed at determining the effect of regular applications of liquid manure on beet quality and yield by comparison with beet receiving only farmyard manure. It was concluded that the liquid manure applications not only resulted in a marked accumulation of N in the soil profile but also increased the soil P and K. While root yield was about the same for beets receiving liquid and farmyard manure, the sugar content was considerably lower after liquid than after farmyard manure treatment and repeated applications of liquid manure were found to have an adverse effect on processing quality.

* * *

Developments in connexion with the problem of wild beet. A. VIGOUREUX. *Publ. Trimest. Inst. Belge Amél. Betterave*, 1975, **43,** 163–179.—Details and illustrations are given of four groups of machinery developed to deal with the problem of wild beet: cutters, lifters, chemical spray applicators and machines for applying non-selective contact herbicides. Advice is given on the most suitable herbicides for the task.

* * *

Machinery for sugar beet agriculture. W. C. VON KESSEL. *Die Zuckerrübe*, 1976, **25,** (3), 10–14. Requirements of modern beet machinery, the various types available in any one category and factors governing the choice are discussed in reference to a mobile exhibition which takes place in West Germany every two years and which in 1976 was held in Munich.

* * *

A small weed population is not harmful. H. NEURURER. *Die Zuckerrübe*, 1976, **25,** (3), 14–15.—It is pointed out that much money can be spent on keeping beet fields clear of weeds throughout the period from emergence of the beets to harvest without increasing yield or improving harvesting operations. While many growers consider a completely weed-free field to be necessary, the author states that beet plants are most sensitive to weeds from 4 to 6 weeks after emergence, and it is only during this period that

complete weed eradication is necessary. The extent to which later weeds affect yield and/or harvesting depends on the type of weed, soil conditions, weather and competition with the beets. A list is given of thirteen weeds and the numbers required per 10 m^2 to cause a 5% drop in yield and a 5% loss of time in harvesting. In most cases, a specific weed adversely affects yield or harvesting but not both. A table also shows the number of each type of weed per 10 m^2 which can be tolerated—control is economically justified only when the population exceeds the tabulated value. In addition to the effects on yield and harvesting, certain weeds can influence beet processing. Particularly harmful in this respect are *Atriplex* spp. and black nightshade, both of which become very fibrous and disrupt beet slicer operation.

* * *

Late weed control and spraying methods. ANON. *Die Zuckerrübe*, 1976, **25**, (3), 15.—Advice is given on late weed control which, in northern Germany, is needed in the case of only a few species. A warning is given against excessive use of mechanical hoes, which should definitely not be used after the final spraying. A combination of a soil herbicide such as "Pyramin", "Venzar" or "Tramat" with "Betanal" is recommended, but it is emphasized that none of these combinations is effective against all weeds. Hints are given on application.

* * *

New soil investigation techniques for phosphorus and potassium in the Hannover Agricultural Board area. W. KÖSTER. *Die Zuckerrübe*, 1976, **25**, (3), 16–17. A new method for determination of soil P involves use of water, which extracts only those phosphates which are readily soluble under normal soil conditions. These constitute that portion of the soil P supply which can meet the very high, but usually only short-lived, P requirements of the plant. K is determined by extraction with calcium chloride solution, which eliminates the effects of clay and humus on K availability without the need for additional time-consuming and costly tests. Comparison of the results with reference standards, which have also been changed, is explained, and advice is given on fertilization levels.

* * *

Fertilizer recommendations. ANON. *Die Zuckerrübe*, 1976, **25**, (3), 18–20.—Recommendations are given on P, K, Ca, Mg, Na, Mn, Cu and B application rates for the different soil types in West Germany on the basis of soil analyses by stated methods, including the new P and K methods cited in the preceding abstract. The average amounts of P, K, Ca and Mg provided by cattle, pig and poultry manure and removed at harvest per unit weight of crop (including sugar beet) are indicated.

* * *

Field spray equipment should be purpose-built. W. GARBURG. *Die Zuckerrübe*, 1976, **25**, (3), 21–22. Apart from greater care in spraying fields, there is need for closer attention to the construction of spray equipment, and the author considers it essential that all such equipment, particularly pumps, should be built to official standard specifications and operate within fixed tolerances. A particular problem is posed by underleaf spraying, but it is hoped that eventually the conventional means of lifting the leaves will be replaced with a torpedo-type device.

Virus yellows infection of sugar beet. W. R. SCHÄUFELE. *Die Zuckerrübe*, 1976, **25**, (3), 24–25.—Causal agents and vectors of beet virus yellows, disease symptoms, prediction of the degree of incidence and losses which result, and means of combating the disease are all discussed. It is emphasized that the viruses cannot be directly controlled, so that means must be used against the vectors as well as certain measures which are complementary to chemical treatment, e.g. prompt removal of growing beet crowns from clamps, eradication of over-wintering weeds, early drilling and avoidance of gappy stands.

* * *

Wild beet. J. KRZYWON. *Die Zuckerrübe*, 1976, **25**, (3), 26–27.—The occurrence and effects of bolting beet and means of eliminating them are discussed with special reference to work in France and Belgium, where the problem has had to be tackled on a large scale.

* * *

Nitrogen fertilizer for sugar beet. ANON. *Current Topics* (Min. Agric., Fisheries & Food), 1976, (Apr. 26th).—While the amount of N applied to beet fields in the UK has fallen considerably in recent years and is now closer to recommended levels, most farmers still use more than the recommended amount of 125 $kg.ha^{-1}$, and a further reduction is considered advisable. In 1975, 28% of the UK beet fields received farmyard manure, which reduced still further the amount of N fertilizer needed in other forms. The situation is regarded as unsatisfactory because of the waste and because of the drop in sugar content and juice purity which results from rates greater than 75 $kg.ha^{-1}$. Factors which may influence the amount of N required are discussed, including soil type, previous cropping and manuring, length of growing season, irrigation and utilization of beet tops as fodder.

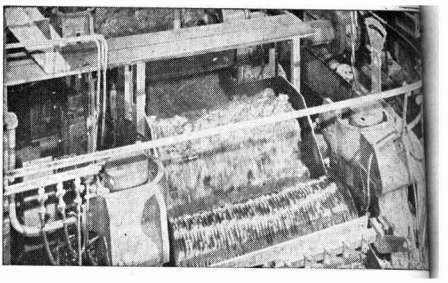
* * *

Interspecific hybrids between *Beta vulgaris* L. and the wild species of *Beta*. G. H. COONS. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 281–306.—Work conducted by the author and others on hybridization of *Beta vulgaris* with wild species of beet in the sections Vulgares, Corollinae and Patellares is reviewed with 91 references to the literature.

* * *

A weather index method and temperature distribution applied to sugar beet yields and sugar percentage. G. K. RYSER. *J. Amer. Soc. Sugar Beet Tech.*, 1975, **18**, 312–331.—Application of a weather index method (as used with certain other crops) to beet to evaluate the trends in yield under the effect of weather was tested and preliminary findings are reported. It was found that the minimum daily temperature had greater effect on yield and sugar content than did the daily maximum temperature or daily temperature distribution. The daily difference (a function of daily maximum and minimum temperatures) showed promise as an indicator of temperature effect on crops. Orthogonal polynomial distribution coefficients of 54 five-day periods over 20 and 25 years showed that sugar content depended more on temperature distribution than on root yield, although it was not possible to establish a mathematical correlation between sugar content and a 1° rise in temperature.

Cane sugar manufacture



Semi-automatic and remote control system for pan evaporation valves. E. BATULE and A. RODRIGUEZ. *ATAC*, 1975, (Nov./Dec.), 12–13.—When a number of pans are connected to a single central condenser, large valves are interposed in the vapour pipe and, to disconnect the pan for discharge, etc., this valve has to be closed, which is a task requiring two men and considerable time. The system described utilizes a reversible motor which operates the valve through a chain drive and sprockets, under the action of a control panel on the pan floor.

* * *

Sugar factory effluents. A. C. CHATTERJEE, B. M. DUTT, S. R. KALSWAD, B. R. MATH and V. K. KELKAR. *Indian Sugar*, 1975, **25**, 351–360.—Detailed analyses are tabulated for 19 samples of factory effluent, and methods of waste water treatment are briefly described. At Walchandnagar, use of aerators to produce rapid oxidation, and treatment with mesophilic and anaerobic bacteria, have helped to reduce the BOD from 1000 to 3000 ppm. The need to prevent leakage of intermediate products in the factory is stressed as a means of helping to reduce effluent BOD.

* * *

A practical approach to better sugar quality at low cost. G. S. JAIN. *Indian Sugar*, 1975, **25**, 363–365. Information is given on the low-cost modifications to equipment and processes at the author's sulphitation factory whereby white sugar colour and crystal size were improved. The distribution of sugar grades at this and another factory, where similar modifications were made, are tabulated.

* * *

Periods of difficult mud settling. P. P. CHATURVEDI. *Indian Sugar*, 1975, **25**, 367–370.—Abnormally high mud levels in clarification were reduced by raising the juice temperature and pH (to about 7); on the other hand, addition of settling aid ("Flocal LT 26/50") had no beneficial effect.

* * *

Potentiality of inter-firm comparison for performance evaluation in the sugar industry. R. L. SRIVASTAVA. *Sugar News* (India), 1975, **7**, (6), 6–11.—The application of inter-firm comparison (IFC) to evaluation of sugar factory performance is demonstrated by comparison of data for two factories, covering technical efficiency, utilization of plant capacity, unit conversion cost and the price paid for the raw material as well as a number of factors bearing on factory operation and finance.

* * *

Purity fall observed from clear juice to unsulphured syrup in spite of neutral pH of the clear juice. K. N. PAUL. *Sugar News* (India), 1975, **7**, (6), 15–17.—The literature concerning possible causes of sucrose inversion, reducing sugar destruction and colorant formation in evaporation is reviewed, including the effect of pH on the behaviour of the juice.

Profitability of raw *vs.* white sugar. A. C. CHATTERGEE. *Sugar News* (India), 1975, **7**, (7), 4–7.—The author considers Indian raw sugar to have a wider export market than white sugar, which is better produced in modern factories, and cites the example of Australia to support his argument. The economics of production are examined, and possible improvements that can be made to increase profitability are discussed. Bulk handling of raw sugar is briefly described.

* * *

Factors that contributed to the production of sparkling white sugar. C. R. SRIRAMULU, S. N. GUPTHA and P. S. KRISHNAMIRTHAM. *Sugar News* (India), 1975, **7**, (7), 9–10.—A description is given of the boiling scheme used at Sakthi Sugars Ltd. which has permitted production of white sugar having a colour of I.S.S. 30.

* * *

Sugar technology for the busy executive—milling. G. RAMACHANDRAN. *Sugar News* (India), 1975, **7**, (8), 10–12.—The fundamentals of cane milling and its efficiency assessment are explained.

* * *

Factors affecting sugar losses. II. Presence of cane trash with sugar cane during milling. S. EL-N. A. HEMAIDA, G. EL-K. SAYED, M. A. HUSSEIN and A. A. EL-BADAWI. *Res. Bull. Egyptian Sugar and Distillation Co., Sugar Cane Dept.*, 1975, (51), 20 pp; through *S.I.A.*, 1976, **38**, Abs. 76-436.—The effects of adding 2·5, 5·0 or 7·5% green or dry trash to clean cane were investigated. Dry trash, but not green trash, decreased mixed juice % cane and sucrose extraction. Sugar losses in bagasse increased with the percentage of either type of trash. Mixed juice purity was reduced by either type of trash, but only dry trash significantly increased mixed juice Brix, sucrose content and glucose ratio. Sugar losses in molasses were increased by dry trash and to a lesser extent by green trash. It is estimated that total sugar losses would increase by 1 kg for each 13·4 kg dry trash or 36·9 kg green trash milled with 1 ton of net cane.

* * *

Brazilian experience with the disposal of waste water from the cane sugar and alcohol industry. C. E. MONTEIRO. *Process Biochem.*, 1975, **10**, (9), 33–34, 36–38, 40–41; through *S.I.A.*, 1976, **38**, Abs. 76-574. Processes used in sugar manufacture and in alcohol production from molasses in Brazil are outlined, and the properties of the main types of liquid wastes produced are tabulated. Condenser water can be aerated and recirculated; the pollution load of condensate can be decreased by installing efficient entrainment separators, and the condensate can be re-used, e.g. as imbibition water, boiler feed water, or filter or centrifugal wash water. Cane wash water, which contains considerable quantities of sugar when cane has been burned, may be treated in aerated lagoons; if mechanical harvesting is introduced, washing can probably be eliminated. Spent mash

sugar-centrifugal screens

all over the world continuous sugar-centrifugals of all types are equipped with Veco pure nickel chromeplated perforated sheets

technical data:

material nickel; also obtainable with chromium plating (900 DPN).

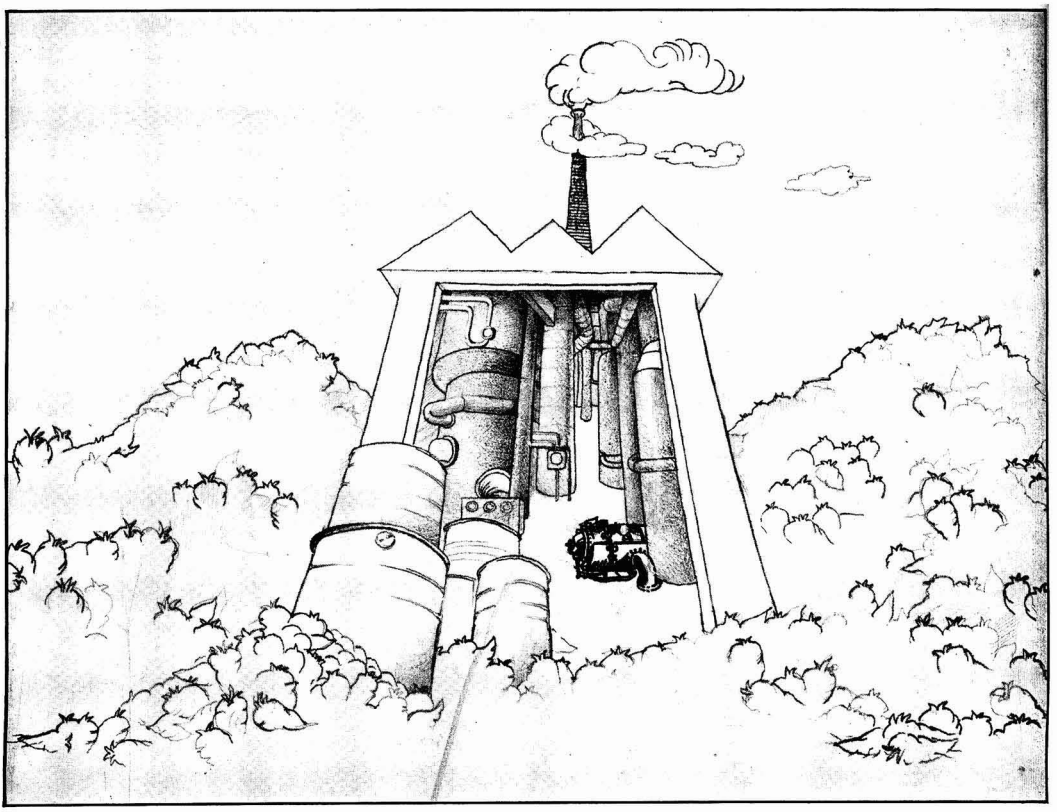
mirror smooth face

conical perforation, which means that Veco-segments feature a high discharge efficiency.

dimensions in accordance with specifications of centrifugal manufacturers.

veco

veco zeefplatenfabriek b.v. eerbeek-holland · phone 08338-9100 · telex 45415



«Hydro» pumps you through

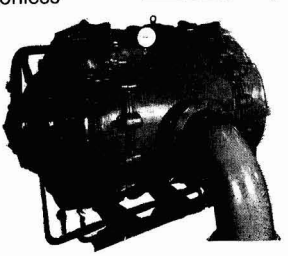
It took them ages finding the "Hydro" when the men from B Mill came across and asked to see it ("... hear it's the most dependable vacuum and gas pump available... apparently works round the clock, 100 days on end"). They'd have been quicker if they'd found Joe. He'd installed it years ago and nobody had thought of it since. Joe said afterwards : "No point in sticking it right out there in the middle. I only need to get at it every 2 or 3 years to clean it up."

Sugar factories the world over have their "Hydros" and "Hydro" Joes. This is simply because "Hydros" cut costs. Frictionless water-ring, low rpm, simple design, and wear-resistant, sturdy construction all this means low power requirements and practically no maintenance. And none of that downtime with cane or beet rotting in the yard and profits evaporating. "Hydros" pump you right through the harvest. The're quiet too.

Your new "Hydro" catalogue is available from :

ALSTHOM
GROUPE CGE

NEYRPIC
Département pompes à vide
rue Gal Mangin . 38100 Grenoble/France
tél. (76) 96.48.30 . télex 320 750 F



Synthèse FI-78

from alcohol distillation has a very high BOD; evaporation or incineration is usually uneconomical, but direct disposal on land improves soil properties and causes no serious problems. Wash water from the fermentation vats can be mixed with it.

* * *

Roller bearings. S. E. CARVER. *Sugar J.*, 1976, **38**, (9), 24–28.—Advice is given on care and maintenance of roller bearings and on their removal and installation. Examination of bearings for damage and results of faulty mounting and vibration are also discussed with the aid of illustrations.

* * *

Evaluation of flocculating agents in cane juice clarification. A. C. CHATTERJEE, S. R. KALASWAD, B. R. MATH and V. B. TAWARE. *Indian Sugar*, 1975, **25**, 723–727.—Laboratory experiments on ten flocculants used to treat cane juice collected from a heater are reported. All increased clarity compared with the untreated control when added at the rate of 2, 5 and 7 ppm, but at 10 ppm a number gave only the same results as non-treatment.

* * *

Uniform grains for low-grade massecuite. P. MARIMUTHU. *Sugar News* (India), 1976, **7**, (9), 9–10. Tests showed that a seed slurry purity of 72 was optimum as regards graining low-grade massecuite, giving uniform and fine grain compared with unsatisfactory results achieved with higher purity slurry. It is pointed out, however, that use of a pan conductivity meter will help obtain satisfactory results even with lower purity seed material.

* * *

A problem area of clarification. S. NARAIN. *Sugar News* (India), 1976, **7**, (9), 11–13.—The problem of a high solids content in Oliver filtrate is discussed and means of overcoming the consequent recirculation of non-sugars, high molasses yield and poor clarification of filtrate plus mixed juice are described.

* * *

Factory trials of a newly-developed continuous carbonatation process for making plantation white sugar from cane juice. S. L. SANG, C. H. CHEN and J. F. TONG. *Taiwan Sugar*, 1976, **23**, 7–12.—Factory trials on a continuous carbonatation system are reported in which the operation was smoother and simpler, requiring less labour, and permitted smoother running of the filter, sulphitation and evaporation stations. No significant difference was found in juice colour and filtrability or sugar colour as produced by batch and continuous carbonatation, although the latter system used more lime.

* * *

BMA cane diffusers (Egyptian system). ANON. *BMA Information*, 1975, (14), 3–4.—Information is given on the BMA diffuser at Malelane in South Africa.

* * *

Electric power factor in the cane sugar factory. K. S. ARNOLD. *Sugar J.*, 1976, **38**, (10), 37–49.—See *I.S.J.*, 1972, **74**, 311.

* * *

Causes of colour formation at the clarification station and influence of bagacillo in raw juice on resulting crystal colour. N. L. C. SUZOR. *Sugar y Azúcar*, 1976, **71**, (3), 42–46.—High raw sugar colour at Honokaa, Hawaii, was attributed to high non-sugars recirculation with *C*-melt and to clarification problems. Reduction of non-sugars recirculation to below 15% on *C*-massecuite achieved some colour reduction, while use of a surface-active agent in boiling increased yield as well as reducing the colour, although addition to raw juice before liming is considered preferable because of the considerable reduction in turbidity which results. Use of lime and magnesium oxide proved better, as regards clarification efficiency, than did lime alone, while hot liming was better than the cold process and gave faster settling rates, greater phosphate removal, improved turbidity, lower mud volume and better juice colour. Modifications to the clarified juice withdrawal system gave some improvements in juice quality. The major cause of high juice colour and turbidity was, however, found to be a combination of lime, bagacillo and heat, and two DSM screens are used to subject the raw juice from the mills to a coarse filtration. The adverse effect of bagacillo has been confirmed by the HSPA and at other Hawaiian factories.

* * *

Cooperative sugar factories—by-product utilization and diversification. G. K. CHETTY. *Sugar News* (India), 1976, **7**, (10), 9–10.—Cooperative factories in India draw much of their cane from small farmers who transport the cane on bullock carts. The use of the bullock dung for manufacture of methane is suggested. Because of their high N content, cane tops used to bind the bundles of cane can create problems in clarification and should be removed before crushing. Their potential use for composting or as animal fodder is suggested. Factory by-products utilization is also discussed, and mention is made of diversification into various agricultural activities.

* * *

Role of milling loss in milling performance indicators. P. F. JAIN. *Sugar News* (India), 1976, **7**, (10), 11–14, 23–26, 8.—Formulae for assessing cane mill performance are surveyed and data for three seasons are tabulated to demonstrate the value of the various indicators. It is concluded that the NOËL DEERR formula is the most suitable of those investigated.

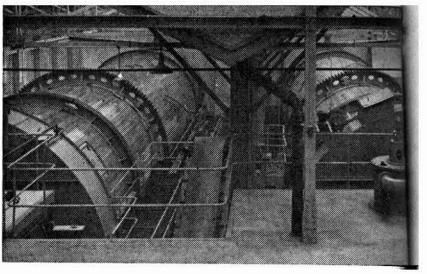
* * *

Establishment of a materials balance for the "Saturne" cane diffuser at Ferkessedougou (Ivory Coast). J. PALACI. *Ind. Alim. Agric.*, 1976, **93**, 321–325.—A materials and sugar balance for the milling-cum-diffusion system at Ferkessedougou was drawn up from analyses of juice, cane and final bagasse, knowledge of the imbibition rate and determination of the bagasse moisture before and after the second dewatering mill. A diagrammatic representation of the scheme of calculations is explained.

* * *

Barometric condensers—good and bad. J. G. ZIEGLER. *Sugar J.*, 1976, **38**, (11), 39–41.—Reasons for inefficient water removal from condensers and consequent irregular vacuum in pans are examined. Means of overcoming problems in the short term are briefly described; but it is stressed that it is important for designers of barometric condensers to concentrate more on smooth water withdrawal and less on internal baffling arrangements. As a contribution to greater efficiency, the author advocates increase in the condensing area, use of large-diameter, straight vertical leg lines and incorporation of steep accelerating cones.

Beet sugar manufacture



Simulation and regulation of continuous sugar beet diffusion. N. MARIGNETTI, G. MANTOVANI and S. LANDI. *Zucker*, 1976, **29**, 108–112.—See *I.S.J.*, 1976, **78**, 25.

* * *

Protection of concrete with plastic coatings. F. M. DEPKE. *Zucker*, 1976, **29**, 115–120.—The protection of concrete against aggressive media and against water and impurities generally (since concrete is porous) is discussed and the various types of surface protection and methods of application are described. Properties of specific binding agents are indicated, and advice is given on the particular requirements which protective coatings must meet in the sugar industry.

* * *

Guidelines for damage prevention in the sugar industry. G. T. DIRKX. *Zucker*, 1976, **29**, 132–134.—New guidelines on prevention of damage by fire or explosion in sugar factories have been published in West Germany, and the implications of these are discussed, with particular attention to those pieces of equipment and areas of a factory which offer greatest risk. While sugar milling and storage are particularly associated with explosion hazards, the author considers the most potentially dangerous (as regards fire) to be the pulp drying and storage section. Means of preventing fire or explosion (or at least reducing its intensity) are described.

* * *

Device for maintaining (water) level in leaf catchers. F. HRUŠKA. *Listy Cukr.*, 1976, **92**, 46–47.—Diagrams and a brief description are given of a system of single or double gates which open under pressure from the beets and thus release more water into the leaf catcher section of the flume so as to maintain a constant beet-water mixture and thus permit more efficient operation of the leaf catcher.

* * *

Causes of obstruction of process water feedlines at Eskisehir sugar factory and the removal of manganese causing it. N. TAYGUN. *Seker*, 1976, **26**, (98), 2–10. Scaling of process water feedlines by manganese, present at 0·2–0·3 mg.litre^{-1}, led to investigations of methods for treatment of the water to reduce the problem. Seven different methods, including a biological technique, are described, and details are given of a zeolite process especially developed to tackle the problem. The adsorbent is regenerated with sodium hypochlorite.

* * *

The beet slicer. I. ERGÜN. *Seker*, 1976, **26**, (98), 20–24.—The theory of beet slicer feed hopper level control is treated mathematically and some worked examples are presented for calculation of hold-up as a function of slicer parameters for four different slicing rates.

Possibility of using ammoniacal condensates as nitrogen nutrient complement in RT-Lefrançois biological treatment. A. SIMONART, J. P. DUBOIS and R. PIECK. *Sucr. Belge*, 1976, **95**, 97–108.—See *I.S.J.*, 1976, **78**, 56.

* * *

Protection of scroll-type diffusers from corrosion. V. F. RAFAL'SKII, N. P. ROMENSKII and S. M. KHELEMSKII. *Sakhar. Prom.*, 1976, (3), 10–13.—Protection of the inner surfaces of scroll-type beet diffusers with epoxy resin (possibly after aluminizing) is discussed, and methods of application of the protective coating are explained. Comparison between (1) blast cleaning followed by spray application of the resin, and (2) sand blasting or manual cleaning with use of rust converter followed by brush application showed that, after one campaign, 85–90% of the coating remained on the scroll and trough wall after treatment (1), while only 60–65% normally remained after treatment (2).

* * *

Creation of the non-effluent sugar factory. I. G. CHUGUNOV. *Sakhar. Prom.*, 1976, (3), 17–19.—From the normal quantities of water lost in a sugar factory, the author deducts that amount of water in beet which is liberated during processing, and calculates that, for a factory having no accumulation of effluent, the fresh water intake should not exceed 10% on weight of beet. However, water balances for a modern factory system have shown that the main processes and water recycle systems will function only at a fresh water intake of at least 150% on weight of beet. On the other hand, by using only evaporator condensate as boiler feedwater, segregating steam and power generation effluent from the overall factory effluent, and removing filter cake and flume-wash water mud in a closed circuit, it is considered possible to reduce fresh water requirements to 35% on beet. Nevertheless, this still leaves the question of water pollution by waste products and intermediate products, and it is pointed out that the presence of merely 0·02–0·03% sugar in fresh water will bring it to the same level of pollution as town sewage. While there is need for means of totally eliminating pollution, new processes such as ion exchange and the greater use of chemical descaling of evaporators have created new sources of pollution.

* * *

Re-use of process waste waters in sugar factories. A. N. SAKUN. *Sakhar. Prom.*, 1976, (3), 20–21. Effluent from steam and power generation usually has a temperature of 100°C, which is far greater than it should be for treatment together with other factory effluent, so that a considerable quantity of fresh water is needed to cool it. At Starokonstantinov factory, the effluent from steam and power generation is cooled by mixing it with cold untreated factory waste and the mixture subsequently treated as normally, or

it is cooled by contact with a part of the treated flume-wash water recycled to the beet yard.

* * *

Beet piler sprayer for mass treatment of sugar beet piles. A. M. ELAGIN, S. N. RYAZANTSEV and B. P. MIROSHNICHENKO. *Sakhar. Prom.*, 1976, (3), 27–32. Milk-of-lime has been found during three years of trials to reduce beet sugar and weight losses in piles by disinfecting to minimize the occurrence of *Botrytis cinerea* and by reducing the temperature and increasing the moisture content. Details are given of a sprayer mounted on the base of a beet piler which has proved of value in applying the lime.

* * *

A milk-of-lime control valve. M. P. KLEPAL'CHENKO. *Sakhar. Prom.*, 1976, (3), 33–34.—Brief details are given of a control valve for regulating milk-of-lime feed to defeco-saturation at the author's factory.

* * *

Device for determining scale thickness in a heat exchanger without shut-down. I. V. KOSMINSKII, V. S. LIPSMAN, V. N. GOROKH and F. T. TIMOSHENKO. *Sakhar. Prom.*, 1976, (3), 39–41.—A system is described which is linked to the overflow tube of a heat exchanger (e.g. raw juice heater) and which gives the thickness of scale (after suitable mathematical calculation) by means of the difference in level of the water in the measuring vessel placed slightly above the level of the top of the heater. The vessel is linked to the overflow tube by a pulse tube consisting of a horizontal copper section and a vertical glass section.

* * *

Effect of the specific heating surface of an evaporator on heat energy input for process purposes in a beet sugar factory. A. A. KNYAZEV and V. N. GOROKH. *Sakhar. Prom.*, 1976, (3), 41–43.—From analysis of experimental data and mathematical calculations of evaporator efficiency it is shown that use of vessels having heating surfaces which are smaller or greater than the optimum for a given evaporation rate will merely cause a reduction in the rate through inadequacy of the heating surface area or through inadequacy of the steam input needed for the larger heating surface. The result will be either a protracted thick juice retention period or a syrup leaving the last effect at too low a Brix.

* * *

Optimum performance of the vacuum condenser plant in a beet sugar factory. N. YU. TOBILEVICH, B. A. MATVIENKO and V. I. PAVELKO. *Sakhar. Prom.*, 1976, (3), 44–48.—It is shown, by means of worked examples in which the water input for given condensation parameters is calculated, that for a rise in condenser water temperature and reduction in the cold water input it is preferable to have a separate condenser for the evaporator and vacuum pans. If the condensers are then linked by a steam line and connected to a common vacuum pump, the temperature in the last evaporator effect must be regulated by installing a valve between the condensers. If each condenser is connected to its own pump, the valve may be installed after the final effect. Linking two condensers by a steam line without separation of the flow streams from the evaporator and vacuum pans will increase water input, by comparison with one common condenser, without raising the temperature of the condenser water. Heat losses can be reduced by lowering the temperature fall in the steam line from the last evaporator effect and in the steam line from the vacuum pans to the condenser, as well as by automatic control of the condenser plant.

* * *

Optimization of the performance of vacuum condenser units at sugar factories. K. N. SAVCHUK. *Sakhar. Prom.*, 1976, (3), 48–52.—A modular system is described in which two condensers are linked by a steam line but are connected, individually, to the evaporator and pan station. Full details are given of the dimensions and operational parameters of the system for factories having daily slicing capacities ranging from 1000 to 5000 metric tons of beet. The system is intended to provide ample heat for all types of diffusers and to assure a vacuum of 680–700 mm Hg in the vacuum pans for treatment of all massecuites with vapours from 2nd and 3rd evaporator effects.

* * *

Tests on various means of moistening ventilation air in the beet yard of Merke sugar factory. M. Z. KHELEMSKII *et al. Sakhar. Prom.*, 1976, (3), 53–56. A system in which air is blown through a duct and wetted from a spray jet installed on the suction side of the blower fan has proved effective in reducing weight and daily sugar losses in stored beet compared with untreated beet. A simple system using the wetting chambers of normal conditioners was equally effective.

* * *

White sugar storage in silos. M. BRAECKMAN. *Proc. 34th Meeting Sugar Ind. Tech.*, 1975, 108–116.—The ABR white sugar silo as erected at Wanze in Belgium is described with the aid of photographs and a diagram[1].

* * *

The use of ammoniacal waters for RT-Lefrançois biological waste water treatment. A. SIMONART, J. P. DUBOIS and R. PIECK. *Zeitsch. Zuckerind.*, 1976, **101**, 189–194.—See *I.S.J.*, 1976, **78**, 56.

* * *

The "Rhecrymat" programme cycle of the rheometer automatic boiling system. H. KEMTER. *Zeitsch. Zuckerind.*, 1976, **101**, 195–206.—Information is given on the Fischer & Porter automatic boiling control system. Diagrams and illustrations demonstrate the control steps involved and the switchgear used. Mention is made of a process simulator available at the Göttingen works of Fischer & Porter for training of personnel from factories installing the system.

* * *

The SSA system for cube sugar manufacture. A. BIRCH-IENSEN. *Zeitsch. Zuckerind.*, 1976, **101**, 206–210.—See *I.S.J.*, 1976, **78**, 232–234.

* * *

Fundamentals of a boiling scheme evaluation by means of a balance using computers. J. BURIÁNEK and M. KMÍNEK. *Listy Cukr.*, 1976, **92**, 58–66.—As an introduction to computerized evaluation of beet sugar factory processes, the authors explain the fundamentals of a mathematical model and demonstrate its value in assessing the process stages from thin juice treatment to raw sugar production from a 2-massecuite scheme. The system is based on 15

[1] *I.S.J.*, 1974, **76**, 26, 286.

relationships, with each intermediate product being allotted an index number in the range 0–18. The programme is written in FORTRAN language.

* * *

A laboratory investigation of a continuous blade-type centrifugal. V. OPLT and J. PŘIDAL. *Listy Cukr.*, 1976, **92**, 67–71.—The principle of a blade-type continuous centrifugal is explained and laboratory tests with low-grade massecuite and an artificial massecuite reported. The machine incorporates two curvilinear blades on opposite sides of the central shaft; they act as filter screens and extend to the perimeter of the basket. The aim is to create a greater filtration surface than in a conventional basket of the same volume, and so prolong the massecuite retention time and reduce the crystal velocity across the basket, thus decreasing crystal breakage. The separation process is divided into two stages: (1) in which the liquid phase is ejected from the massecuite, and (2) in which the massecuite itself travels along the blade towards its outer edge. The molasses falls into the lower section of the basket while the sugar crystals are thrown sideways into the upper section (separated from the molasses space by suitable means). Results of the tests in a 300-mm basket showed that stable conditions were achieved very shortly after start-up and that fluctuations in massecuite temperature and concentration had little effect on performance. The desired sugar parameters were achieved at 2000–3000 *g* according to crystal size and molasses viscosity. Reduction in viscosity and increase in crystal size favoured separation, while massecuite concentration within the range 40–50% and filtration surface area had a secondary effect on separation.

* * *

Thoughts on continuous sugar crystallization. H. G. KÖPPEN. *Zucker*, 1976, **29**, 173–178.—The question of crystal growth rate in relation to the mother-liquor weight:crystal surface ratio in boiling is examined, from which it is concluded that at a suitable value of $< 0{\cdot}4$ (kg:m^2) the syrup needs to be pre-concentrated to 77% dry solids. To achieve this and other desirable boiling variables, the author proposes a continuous tubular crystal generator 32 m long and having an initial diameter of 0·3 m and a final diameter of 1·82 m. The tube houses vertical, slightly sloping heating surfaces. For a throughput of 30 tons.hr^{-1}, the heating surface is calculated at 135 m^2. Advantages of the system would be reduction in steam usage for white sugar boiling, a considerably narrower range of grain sizes, avoidance of excessive supersaturation and hence conglomeration, and a more uniform vapour bleed. Tabulated values are given for the various continuous boiling parameters at a throughput of 30 tons.hr^{-1} and a crystallization rate of 6000 and 6500 mg.m^{-2}.min^{-1}.

* * *

Surface protection in sugar factories. E. KOLMERER. *Zucker*, 1976, **29**, 179–186.—Protection of metal and concrete surfaces in general is discussed, and more specific references made to the process equipment and plant in the sugar industry. The various types of protective coating, their methods of application and means of under-surface treatment to give maximum results are described.

* * *

Pipelines of thermo- and thermosetting plastics for industrial building and plant construction. K. H. RUTTERT. *Zucker*, 1976, **29**, 186–190.—Advantages of plastic piping are discussed and details given of available standard piping for given working pressures up to 16 bar and temperatures up to 150°C, plus information on its resistance to particular media and means of installation.

* * *

Diagnostic tests on noise and vibration from sugar machinery. T. BOGUMIL, W. KUROWSKI and J. MOTYLEWSKI. *Gaz. Cukr.*, 1976, **84**, 54–59.—Tests are reported in which noise and vibrations emanating from sugar factory machinery were determined. At 89–110 decibels, factory noise was found to be well outside the permitted range, while vibrations transferred from machinery to bearing surfaces, e.g. centrifugal and slicer station floor elements and roofing frames, were particularly noticeable. Remedial measures to be taken are discussed and an integrated test programme outlined.

* * *

Theory of (beet) diffusion. The hypothesis of Silin. G. V. GENIE. *Sucr. Franç.*, 1976, **117**, 159–163.—The author, referring to the article by GIORGI & RICHARD[1], analyses SILIN's theory on beet diffusion and reveals a number of flaws in his argument. While praising SILIN for his work at a time when very little had been done in the field of diffusion theory, the author considers that insufficient note has been taken of work carried out by others, particularly SMET, in the same field. He concludes that SILIN's theory must be used with caution and limited to those cases where cylindrical cossettes are used.

* * *

The present largest beet sugar factory: Connantre. ANON. *Ind. Alim. Agric.*, 1976, **93**, 47–63, 187–205. Details, with a large number of photographs and diagrams, are given on Connantre sugar factory which has a daily slice of 14,000 tons of beet and an annual sugar output of 160,000 tons. Its equipment includes two RT4 diffusers, each of 7400 tons per day rated capacity.

* * *

Application of EDP techniques in the design and construction of equipment. ANON. *BMA Information*, 1975, (14), 5–13.—The application of electronic data processing to machinery design and construction is described and exemplified by mass and heat balances for beet diffusion and juice purification, a boiling scheme and a quadruple-effect evaporator system, while a programme for control of a boiling pan is explained.

* * *

Start-up of two beet sugar factories constructed by BMA in the Red River Valley. ANON. *BMA Information*, 1975, (14), 14–23.—Details and illustrations are given of Hillsboro and Wahpeton sugar factories in North Dakota, USA.

* * *

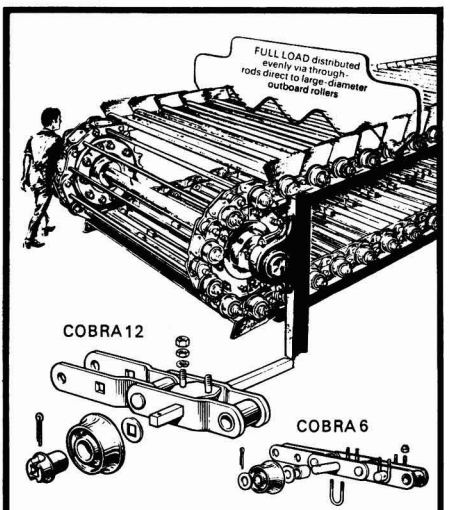
Screens for continuous centrifugals. ANON. *BMA Information*, 1975, (14), 26–29.—The processes used in the manufacture of centrifugal screens are described, with particular reference to Balco nickel screens for continuous machines.

* * *

Investigation of beet piling in factory yards. N. A. EMEL'YANOV, N. M. KICHIGIN, V. S. YATSENKO and R. K. KAZIMIROV. *Pishch. Prom.*, 1975, **21**, 3–6.—The authors criticize the system used in the USSR where

[1] *I.S.J.*, 1976, **78**, 247.

Ewart Cobra cuts cane handling costs



"EWART 'COBRA' HEAVY DUTY OVERLAPPING APRON CARRIER"

EWART COBRA – Carrier OutBoard Roller Assemblies – heavy-duty overlapping apron conveyors.

GENERAL DESIGN FEATURES

1. More robust construction – proven longer and trouble-free life.
2. Load carrying outboard rollers on both carrying and return runs leave chains for power transmission only.
3. Simplified carrier structure.
4. Lower operating costs and power requirements – due to the larger-diameter outboard rollers. Simpler maintenance on all components.

TRAYS

1. Overlapping trays eliminate spillage on to moving parts – providing added protection against wear.
2. Box section stiffeners give greater beam rigidity.
3. Easy removal of slats without disturbance of chain or of through-bar assembly.
4. Support shoes on underside of trays avoid deflection at load points and under cutting knives – giving better cutting efficiency.

CHAIN

1. Design of through-bar and superior method of locking apron to chain distributes load evenly to each strand of chain.
2. Chain and outboard roller assemblies are easily accessible for lubrication – no centre strand of chain to worry about.
3. Larger-diameter chain pins for longer life.
4. Chain rollers and outboard rollers specially hardened to give increased wear-resistance – longer life.
5. Twin strand COBRA obtainable in strengths ranging from 120,000 lb. to 460,000 lb. UTS – equivalent to triple-strand conventional carrier chains.

AVAILABLE ALTERNATIVES:

* *Pressure lubrication.*
* *Stainless articulating parts.*
* *Sealed outboard roller bearings.*

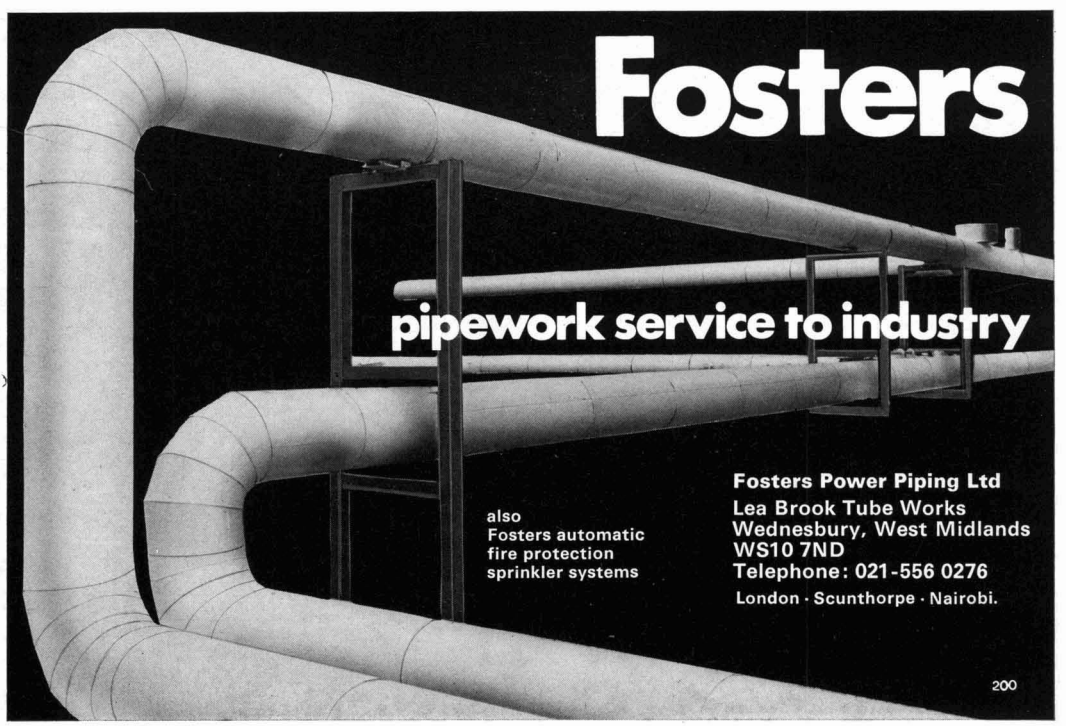
GREATER BEARING AREAS MEAN LONGER LIFE

Full details – including section drawings, tables and illustrations – are given in catalogue No. 400. Send for a copy NOW.

EWART CHAINBELT CO. LTD
DERBY DE3 8LX, ENGLAND

Telephone: Derby (0332) 45451
Telex: 37575 Leysewart Derby
Cables: Chainbelt Derby

EWART



beets are piled for long periods before processing, in contrast to the West European approach, so that storage losses are high and the processing quality reduced. Moreover, beets are not handled on a "first come, first served" basis, so that it is suggested that the piles be placed alongside flumes which would allow beets to be extracted from different parts of the pile or from different piles for priority processing. The use of wet unloading of beet, as used in some other beet countries, is also recommended. Beets could also be stored under solid roofs at special points near the factory, with modern means of loss reduction being used.

* * *

Calculation of natural circulation in massecuite vacuum pans. V. I. PAVELKO and V. T. GARYAZHA. *Pishch. Prom.*, 1975, **21**, 9–12.—A series of theoretical equations is given for calculation of boiling parameters where such calculation is not limited to conditions which have been the subject of investigation but is applicable universally for vertical pans. Comparison between experimental and calculated values of circulation rate, height at which ebullition starts and pressure drop for massecuite at given Brix, level and heat flux shows close agreement.

* * *

Sensors for measurement of the thickness and velocity of a moving layer of massecuite on a sloping heating surface. B. G. DIDUSHKO and V. T. GARYAZHA. *Pishch. Prom.*, 1975, **21**, 22–25.—Electronic systems for measuring massecuite layer thickness and flow velocity during boiling are described.

* * *

Conductimetric control of electrodialysis treatment of beet sugar factory intermediate products. L. D. BOBROVNIK, V. V. DUTCHAK, L. A. FEDORENCHENKO and N. S. FEDOROVA. *Pishch. Prom.*, 1975, **21**, 25–28. By the method of least squares, the authors have statistically evaluated the conductimetric method of checking molasses electrodialysis efficiency and have derived equations from which nomograms have been plotted.

* * *

Extraction of sugar and non-sugars. Optimization of the draft and sugar loss parameters. J. BLOK and P. W. VAN DER POEL. *Sucr. Belge*, 1976, **95**, 131–141. See *I.S.J.*, 1976, **78**, 26.

* * *

On the use of electrodialysis in the sugar industry. J. HOUSSIAU and R. PIECK. *Sucr. Belge*, 1976, **95**, 143–155.—The principle of electrodialysis is explained and experiments are reported in which *B*-syrup was treated by one of three methods: (1) continuous single-pass treatment in an Ionics Inc. unit containing five pairs of cells separated alternately by cationic and anionic membranes, (2) a "feed-and-bleed" process in which the raw feed was mixed with some recirculated dialysate and treated in a Stork-Werkspoor unit of eight pairs of cells, and (3) a batch recirculation process in which the syrup was passed repeatedly through a Model SPFP-130 "Aqualyzer" (manufactured by Société de Recherches Techniques et Industrielles) until the required demineralization was obtained. All test solutions (including beet and cane molasses treated with the "Aqualyzer") had an initial Brix of 30°. Details of the results, given in graph and tabular form, showed that process (1) removed 7·5–11·5% of the ash, process (2) removed 44–69%, while process (3) removed 28·5–64·0%. Process (1) was characterized by rapid and practically irreversible fouling of the membranes by the colouring matter in the syrup, process (2) required syrup pre-treatment with decolorizing resins, while process (3) permitted syrup treatment without any preliminary treatment other than careful filtration. This last process was also tested on a factory scale and gave a 3–6 unit rise in purity. Discussion of the economic aspects of electrodialysis shows that the SRTI process could be profitably used to increase white sugar output by 3½ tons a day using a 48-minute cycle.

* * *

Problems concerning technical equipment in the Bulgarian sugar industry. D. BABEW. *Die Lebensmittelind.*, 1976, **23**, 180–182.—Information is given on process equipment in Bulgarian sugar factories, indications being given of the need for more modern or larger-capacity types in certain cases.

* * *

Experience in the operation of scroll-type diffusers. G. I. STASEEV. *Sakhar. Prom.*, 1976, (4), 12–16.—It is stated that, while scroll-type diffusers have a number of advantages over other continuous systems, they are somewhat more complicated and place greater demands on the skills of personnel. Aspects of their operation are discussed, and recommendations are given on the basis of experiences at a number of Soviet factories. The article covers scroll rotary speed, juice level in the first section, causes of bottlenecks, diffuser assembly, lubrication, formalin dosing and level of juice-cossette mixture relative to the scroll diameter.

* * *

More on the performance of tower diffusers. A. P. PARKHOD'KO. *Sakhar. Prom.*, 1976, (4), 23–26.—The author complains that, despite numerous breakdowns of KDA-30-66 tower diffusers manufactured by one particular enterprise in the USSR, the manufacturers remain complacent and continue to produce faulty diffusers. Trouble spots in the diffuser are mentioned and recommended remedial measures discussed. While most of the problems are of a mechanical nature, mention is also made of marked discrepancies between actual and rated juice retention times.

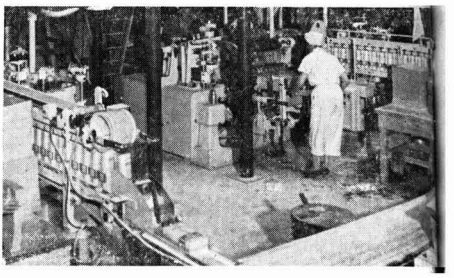
* * *

Automation of disc filter operation. L. S. TARANENKO, A. G. SHINGUR, L. A. FILIPCHUK and T. S. TARANENKO. *Sakhar. Prom.*, 1976, (4), 38–41.—A description is given of a control scheme for disc filters handling 1st and 2nd carbonatation juice; tests showed that the system permitted a 10–15% greater throughput per unit time than with non-automatic filters, while cloth replacement frequency was reduced and juice filtration improved.

* * *

Sugar yield and calculation of unknown sugar losses in manufacture. G. F. TYAZHELOVA. *Sakhar. Prom.*, 1976, (4), 46–50.—The level and calculation of unknown losses in beet diffusion are discussed and tabulated values given for Ramon factory. Means of reducing unknown losses are briefly indicated, and the importance of strict control on such losses is underlined.

Sugar refining



The action of polymers in the fabrication of refined sugar. J. A. DUENAS. *Proc.* 1974 *Meetings Amer. Soc. Sugar Cane Tech.*, 77.—The benefits of polymer flocculants in clarification of refinery liquor are briefly discussed. While the major advantage lies in the easing of the load on the filters and their considerably increased capacity and a reduction in steam and water consumption for filtration while giving a high quality liquor, a secondary benefit occurs in the form of the mud itself; this contains phosphates and flocculant, so that when recycled to the raw sugar factory it is of great advantage in the clarification of juice.

* * *

Affination of crop sugars in sugar refining. S. A. BRENMAN, I. L. ZDANOVICH, F. P. ALEKSEENKO, L. V. OGORODNIICHUK and K. V. UKRAINETS. *Sakhar. Prom.*, 1975, (9), 19–22.—The distribution of non-sugars in washed and unwashed 1st, 2nd and 3rd crop sugars from three refineries was investigated. Affination of unwashed crop sugars with saturated syrup at 40°C for 15 minutes was also tested, from which optimum syrup quantities were found to be 40% for 1st crop sugar and 50% for 2nd crop sugar (without washing of affined sugar with water), while for 3rd crop sugar the optimum was 40%, assuming affined sugar washing with water at 40°C at the rate of 1% on weight of massecuite. The increase in sugar recovery that can be expected by crop sugar affination is calculated.

* * *

Obtaining white sugar from raw. I. GALBÁN. *Cuba-Azúcar*, 1975, (Oct./Dec.), 3–7.—The production of white sugar from raws in a sugar factory during the inter-crop is discussed. Two methods are compared: affination and liming followed by single carbonatation and sulphitation, and affination and liming followed by double sulphitation. The colour removal is about the same but the second method uses less lime; even if the same amount of lime is used, decolorization is not improved. A third scheme has been proposed[1] in which affined sugar liquor is subjected to simultaneous liming and gassing, heated, filtered and the liquor limed and sulphited followed by further filtration. The purification obtained is greater than with either separate defeco-saturation or defeco-sulphitation using the same amount of lime.

* * *

Sugar refining. A. ROSSI. *Ind. Sacc. Ital.*, 1975, **68**, 27–40, 61–69, 94–103, 129–136, 160–169.—A summary is provided of lectures delivered by the author to students of the Serafino Cevasco sugar school in the University of Ferrara. It covers aspects of sugar refining which include world production of refined sugar; characteristics of raw beet and cane sugar; raw cane sugar manufacture and quality; storage; affination; syrup preparation and purification by phosphate flotation and by carbonatation; filtration; decolorization by bone char, active carbon and ion exchange resins; demineralization; boiling; centrifugation; refining of raw beet sugar; refining of cane raws during the campaign in a beet sugar factory; drying, cooling, screening, storage and conditioning of refined sugar; the various types of silo; packing of the various kinds of sugar; special products including tablet, lump and loaf sugar; liquid sugar; heat energy requirements; chemical control and losses.

* * *

Starch: its occurrence, importance and removal in sugar manufacture. J. B. ALEXANDER and M. MATIC. *Proc.* 1974 *Tech. Session Cane Sugar Refining Research*, 13–28.—The literature on the occurrence, influence and removal of cane starch in raw sugar manufacture and refining is surveyed (with 48 references). It is stressed that the starch (or amylose) content in raw sugar is of far greater significance than raw sugar filtrability. Whereas in refining most attention has been directed at understanding the mechanism of starch interference in carbonatation, preliminary experimental work has shown that starch also plays a role in the phosphatation-flotation process by affecting the rate of calcium phosphate floc formation, the rate of subsequent flotation and the physical properties of the floc. In a brief appraisal of methods for starch determination, mention is made of an amperometric titration method which requires no standard but suffers from inadequate sensitivity in its present form. Four methods of starch removal are considered: mechanical removal of starch granules from cold raw juice; cold flocculation and removal of starch granules with the floc; adsorption of starch on adsorbents such as active carbon; and degradation of starch molecules to smaller and innocuous molecules. Of these, the last is the one which has shown most promise, although success in evaporator syrup starch reduction achieved with bacterial enzymes in the raw sugar factory has not been repeated in the refinery, since the starch in raw sugar melt does not respond to enzymatic hydrolysis as readily as that in factory syrup, and enzymes are not highly efficient at Brix values greater than 60°.

* * *

Effect of phosphate constituents on the sugar refining process. C. C. CHOU. *Proc.* 1974 *Tech. Session Cane Sugar Refining Research*, 29–38.—In a study of constituents in washed and unwashed raw sugar, relatively high correlation was established between phosphate and alcohol insolubles in washed raw sugar on the one hand and filtrability on the other, compared with slight correlation between polysaccharides and filtrability and no correlation between filtrability and silicate, starch and protein in washed

[1] DAISHEV *et al.*: *Sakhar. Prom.*, 1971, **45**, (2), 10–12; *I.S.J.*, 1971, **73**, 344.

raw sugar. On the other hand, some correlation was found between filtrability and the quantity of starch removed by filtration, suggesting that the type and not the quantity of starch influences filtrability. Phosphate removal with regenerated filter earth washed with acid increased filtrability by 35% in the pH range 6–9, best results being achieved when NaOH was used for pH adjustment, while use of phosphate reduced filtrability. Tricalcium phosphate in refinery liquor retained by bone char was the main cause of increase in the char bulk density; the tendency of bone char to retain it is attributed partly to the fact that char is about 80% calcium phosphate in hydroxyapatite form which may serve as the nucleus for the crystallization of calcium phosphate adsorbed from the liquor, and partly to the very low solubility of Ca phosphate in aqueous solution, so that removal by char washing is not easy. This low solubility also promotes adsorption of the phosphate in the presence of calcium + magnesium; the DH of the char (Ca + Mg concentration in aqueous extract expressed in millinormal units), drastically reduced by phosphate adsorption, was found to be inversely proportional to the concentration of sodium phosphate solution used in the investigations, this being ascribed to precipitation of phosphate ions with the available Ca + Mg in the char. Because a sharp fall in decolorization was probably due to Ca deficiency (at a reduction in DH from 2·2 to 0·24), it is important to maintain an optimum Ca level in the liquor on char to facilitate colour removal. As a rule hydrophobic (non-polar) molecules are attracted to hydrophobic surfaces such as that of bone char. Anionic colorant can react with the Ca ion to form a non-ionic colorant, causing an increase in the hydrophobic nature of the colorant and thus increasing decolorization, while the pairing of Ca ion and ionic colorant also helps decolorization. Generally, however, the likelihood of ionic colorant adsorption from aqueous solution onto a hydrophobic surface is reduced by the high degree of hydration of the ionic centre by the water molecules. Lowering the pH of the liquor leads to conversion of anionic colorants to electrically neutral molecules, which accounts for the general observation that decolorization performance increases with fall in pH of the liquor.

* * *

Clarification of sugar refinery syrups by TsM-A2 cellulosic anion exchange resin. M. Yu. Mazov, M. A. Kop'ev, M. A. Tyuganova and H. S. Pavlenko. *Sakhar. Prom.*, 1976, (2), 15–17.—TsM-A2 is a resin produced by graft copolymerization of cellulose with poly-2-methyl-5-vinylpyridine after the latter's alkylation with epichlorohydrin. Available in the USSR for research purposes only, it was used in investigations on refinery syrup treatment, in which colour reduction was in the range 80–100%. Even after 8–9 cycles (an average of 30 tons of syrup per cycle), the flow rate through the resin was little different from that in the initial cycle and the colour was reduced to 1·5–1·8°St at a Brix of 64–65°. The resin is regenerated with salt.

* * *

Sucrose adsorption by anion exchange resins. G. A. Chikin and V. F. Selemenev. *Sakhar. Prom.*, 1976, (2), 18–19.—Investigations of sucrose adsorption by three Soviet resins in OH^- and Cl^- form are described. Among factors having possible effect on the adsorption, the decisive one is considered to be dissolution of the sucrose in the phase water of the resin as influenced by the properties of the water's structure in the resin capillaries and pores. Since resins contain ions of opposing charges (with the electrolytes endeavouring to surround themselves with solvate envelopes), only a part of the water in the capillaries is in a free state and capable of dissolving a non-electrolyte; hence, all factors promoting increase in the proportion of free solvent will favour sucrose adsorption. Tabulated data show the differences in this behaviour for the different resins. Sucrose adsorbed by resin has been found to be easily removable by elution with water, so that risk of increased losses is minimal.

* * *

A decolorizing carbon fron paddy husk. B. G. Krishnamurti. *Indian Sugar*, 1975, **25**, 669–672.—Details are given of a process for producing decolorizing carbon from paddy husk which was charred and subsequently boiled with NaOH and then with HCl. Laboratory-scale tests with palmyrah jaggery showed that the decolorizing efficiency of the carbon was up to 96%. Revivification by heating for 1 hour in a steam bath reduced the quantity of carbon and its decolorizing efficiency.

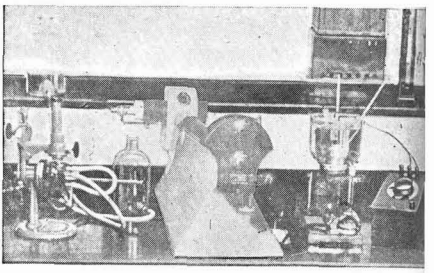
* * *

Flocculation technology in sugar manufacture. M. C. Bennett. *Proc. 34th Meeting Sugar Ind. Tech.*, 1975, 22–32.—Reasons for the stability of the particle suspension found in raw juice and refinery liquor are stated and three methods of destabilizing and flocculating such suspension are described, of which introduction of a bridging mechanism is the basic one used for all current flocculation processes in the sugar industry. The use of polymer flocculants based on acrylic acid and acrylamide to effect primary and secondary flocculation (primary flocculation involving aggregation of single particles into clusters, while secondary flocculation promotes still further increase in floc size) is explained, and four factors are listed which determine the activity of a polyacrylamide flocculant in juice or liquor, viz. monomer ratio, distribution of the monomer units, molecular weight and the occurrence of cross-linking during polymerization. The effect of inorganic electrolytes on the configuration of a polyacrylamide molecule is demonstrated, and the care to be taken in the preparation and handling of a flocculant solution, so as to ensure that the essential structure is not ruptured and its activity not markedly reduced, is discussed. Applications of polyacrylamide flocculants in the sugar industry include clarification of juice, liquor and syrup, and refinery clarifier mud sweetening-off by flotation (which necessitates only secondary flocculation).

* * *

The melt house computer installation at C and H Sugar Company. A. O. Maylott and J. W. deCelis. *Proc. 34th Meeting Sugar Ind. Tech.*, 1975, 133–142.—Details are given of the mini-computer system used to control various process parameters in the melt house. The scheme incorporates automatic control of magma consistency in the mingler and of magma level in the mixer fed from the mingler; the time of start-up of the automatic Western States centrifugals and their washing and drying times; raw sugar liquor Brix; and pre-melter steam feed.

Laboratory methods & Chemical reports



Effect of crystal content in a sugar solution on the crystallization rate. J. MALCZEWSKI. *Gaz. Cukr.*, 1976, **84**, 1–3.—A method for determination of crystallization rate is described in which weighed samples of known crystal content are fed into small cylinders having perforated walls which are then placed inside a large vertical glass cylinder (containing a solution of known supersaturation), the outer surface of which is heated at constant temperature. The large cylinder is then rotated at 1·4 rpm for 12–15 minutes, after which the perforated cylinders are removed and placed in heated test-tubes containing benzene for centrifuging at 5000 rpm. By this means, the syrup is removed from the crystals, which are then analysed after drying. For comparison, one of the perforated cylinders contained only a single crystal in tests, which involved two crystal weight fractions: 9·6–11·3 mg and 33–39 mg. Results indicated that the value of the coefficient relating crystal growth in solution to that of the single crystals fell rapidly for the smaller fraction as the mass ratio between the single crystal and crystal-solution mixture increased. However, at the same supersaturation and temperature, the fall in value of the coefficient was about the same for both fractions as a function of total surface area per unit volume of crystal-solution mixture.

* * *

Rapid method of determining the colour of sugar factory products. A. YA. ZAGORUL'KO and L. A. KOROBEINIKOVA. *Sakhar. Prom.*, 1976, (1), 56–58.—For rapid removal of turbidity from sugar house samples the authors have found use of a stainless funnel plugged with cellulose to be most suitable. The solution is passed through three layers of cambric into the funnel and thence into a Bunsen flask for photometric measurement. The method has accelerated the overall colour measuring process compared with the conventional method, while the analytical error with dark solutions has been reduced. Results are given for white sugar solution measured at 420 and 720 nm and remelt liquor measured at 560 nm.

* * *

The "Betalyser"—a computerized system for sugar beet quality analysis. W. KERNCHEN. *Zeitsch. Zuckerind.*, 1976, **101**, 135–138.—Details are given of the "Betalyser" beet tarehouse laboratory system, such as installed at Lehrte sugar factory (West Germany), which incorporates sucrose determination by polarization, Na and K determination by flame photometry and α-amino-N determination by photometry.

* * *

Rapid method of analysis for high-density sugar products. A. YA. ZAGORUL'KO *et al. Sakhar. Prom.*, 1976, (2), 32–35.—Details are given of an integrated line for determination of Brix and sugar content of sugar house intermediate products such as massecuite, run-off, molasses and low-grade sugar. Central to the arrangement is a 1:1 dilution device which bases the amount of distilled water on the weight of the product.

* * *

Adsorption of juice colorants on calcium carbonate. K. VUKOV. *Zucker*, 1976, **29**, 49–53.—See *I.S.J.*, 1976, **78**, 26.

* * *

The density and refractive indices of aqueous solutions of sucrose + KCl. M. I. DAISHEV and N. V. ORLOVA. *Izv. Vuzov, Pishch. Tekh.*, 1975, (6), 108–112.—KCl added to aqueous solution of sucrose will form a concentrated aqueous salt solution in the space between the molecules of hydrated sucrose, and the nature of the changes occurring under the effect of the sucrose molecules can be determined by comparing the specific volume of the salt solution component V_{ns} and of pure KCl solution V_{np}, for which equations are presented. Because of extreme similarity between calculated and experimental values of V_{np} at a given concentration, extrapolation was considered valid for the sake of comparison with values of V_{ns}, which were found to be generally greater than V_{np} as concentration increased. Further investigations were carried out into reasons for this, and showed that the degree of dissociation of KCl was greater in the sucrose solution than in pure solution. An explanation is offered for this phenomenon. The specific volume of the dissociated portion of the KCl rises in proportion to the sucrose concentration, which would explain the considerable differences in configuration of the hydrated sucrose molecules and the KCl ions. Similar calculations were made of the refractive index of the sucrose-KCl solution and the values compared with experimental results, showing close agreement.

* * *

The system sucrose-glucose-water. V. I. BURAVLEVA, A. V. ZUBCHENKO and A. YA. OLEINIKOVA. *Izv. Vuzov, Pishch. Tekh.*, 1975, (6), 119–121.—The solubilities of sucrose and glucose in prepared aqueous mixtures of the two sugars were determined at 30–70°C. Isotherms were plotted, and from values of coefficients a and b in the equation $y = ax + b$, where y and x are sucrose and glucose concentration (%), respectively, the displacement of sucrose by glucose and *vice versa* was calculated. Results indicated that glucose displaces sucrose to a greater extent than sucrose displaces glucose in the temperature range studied; this is attributed to the greater tendency to hydration of the glucose molecule. The displacement by both sugars fell with temperature rise as a result of collapse of the water structure and fall in hydration of glucose and sucrose when the kinetic energy of the molecules increased. By means of linear equations, the glucose content at the eutectic points increased, as did the total sugar content, with

reader inquiry service

If you wish to receive further information on the products and services mentioned in the advertisements please fill in the inquiry section of this card and post it to us.

reader inquiry service

Please arrange for me to receive without obligation further details of the products referred to below which are advertised in your ..... 19..... issue.

Advertiser	Product	Page

Signature .....

Block Letters

NAME ..... Date .....

Position .....

Firm .....

Address .....

photocopy service

We are able to supply one photocopy, for research or private study purposes, of most of the original papers abstracted in this journal. It should be noted that these are *not* translations but are in the original language of publication, which may not be English. The charge of 20 cents or 10p per page includes surface mail; airmail costs extra and depends on weight and destination.

photocopy service

Please supply one photocopy of each of the following original papers, abstracts of which appeared in your ..... 19..... issue.

Page	Author(s)	Title

Air Mail/Sea Mail

Signature .....

Block Letters

NAME ..... Date .....

Position .....

Firm .....

Address .....

additional subscriptions

To receive additional copies of *The International Sugar Journal* all you need do is to complete the card with details of the subscription required, and return it with your remittance of U.S. $15.00 for supply by surface mail.

additional subscription order

Please send a further copy of your journal each month to the address below, starting with the issue

..... 19.....

Block Letters

.....

.....

.....

.....

.....

Signature .....

Date .....

I enclose cheque/draft/M.O./P.O. for $15.00

Reader Inquiry Service,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks.
England.

Photocopies Dept.,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks,
England.

Subscriptions Dept.,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks.,
England.

rise in temperature, while that of sucrose fell. Empirical equations relating the composition of the eutectic mixture to glucose content and temperature were found to give results in close agreement with experimental data.

* * *

Determination of sucrose crystal growth parameters. V. M. KHARIN and A. L. ZHARKOV. *Izv. Vuzov, Pishch. Tekh.*, 1975, (6), 145–146.—Calculation of the sucrose crystallization rate during mass crystallization requires knowledge of the value of the dimensionless parameter ψ_o ($= k_r/\beta_o$), where k_r is the reaction rate coefficient at the surface of the crystal, and β_o is the coefficient of mass transfer during free fall of a single crystal. For crystallization in pure sucrose solution, ψ_o is a function of concentration and temperature and can be calculated from experimental data. Calculated results were plotted and showed that, in the metastable zone between supersaturations of 1·0 and 1·1, ψ_o was independent of concentration while, in terms of temperature, it is approximately given as $0{\cdot}0133 \times 10^{0{\cdot}0526\,t}$ (where t is in °C).

* * *

The concentration of reaction products in melanoidin formation and sugars decomposition in molasses. V. N. SHVETS, T. P. SLYUSARENKO and E. I. KNOGOTKOVA. *Pishch. Prom.*, 1975, **20**, 3–5.—The reaction products determined in 10 molasses samples by spectrophotometry were invert sugar alkaline decomposition products, melanoidins, caramelan and furfural. Refractometric Brix, sucrose, total fermentable sugars, pH, acidity and alkalinity, total N and volatile organic acids were also determined, and data are tabulated. It was not possible to establish any relationship between change in the concentration of the individual colorant groups and furfural on the one hand and the physico-chemical properties of the molasses on the other.

* * *

New sugar standards. A. C. CHATTERJEE. *Indian Sugar*, 1975, **25**, 615–619.—The International Codex standards for white sugar are indicated and their introduction in India recommended. The Indian standard for refined sugar is shown, and details are given of the defeco-melt phosflotation process. The advantages of this over the sulphitation process are listed, and the economics of producing sugar of given grain size and colour are discussed.

* * *

Applications of chromatography in the sugar industry with special reference to gas-liquid chromatography (GLC). M. KIELY and M. O'SULLIVAN. *Sucr. Belge*, 1976, **95**, 83–94.—Chromatographic techniques used by the Irish Sugar Co. Ltd. and results obtained with them are discussed. Lactic and volatile acids in juices and molasses are determined by GLC using the method of KIELY & O'DRISCEOIL[1], which has also been applied to effluent and wash water. (Mention is also made of the GLC method of OLDFIELD *et al.*[2] which is considered more time-consuming than the KIELY & O'DRISCEOIL method, while the thin-layer chromatographic method of OLDFIELD *et al.*[3] for lactic acid determination in juices and molasses is considered of value for use in control laboratories because of its rapidity and lack of need for sophisticated instrumentation.) The NELSON modification of SOMOGYI's arsenomolybdate method[4] is a paper chromatographic technique which has been used for analysis of juices, molasses and syrups but which is used nowadays only to confirm GLC results, while checking is more usually done by enzymatic methods. Whereas close agreement was found in 1973 between GLC results and the values obtained by the enzymatic method applied to raflnose determination in beet, in 1974 agreement was poor and the enzymatic method, which is described, gave variable results. Organo-chlorine pesticide residues in sugar are determined by GLC using an electron capture detector. Results in 1974–75 showed a considerable reduction in the contents of four pesticides compared with values obtained in 1970–71.

* * *

Polarimetry of mixtures of optically-active substances, especially carbohydrates. J. SAGEL. *Pharmaceutisch Weekblad*, 1974, **109**, 285–290; through *S.I.A.*, 1976, **38**, Abs. 76-371.—Sucrose in pure solutions was determined by the Clerget method, and the constants in the Clerget formula for use at wavelengths 546 and 578 nm were calculated. Binary mixtures of sucrose-invert sugar or sucrose-glucose can be analysed with the aid of diagrams showing the rotation due to each component over a given concentration range at various wavelengths; results obtained for solutions of known compositions are tabulated.

* * *

Increasing the sensitivity of the anthrone method for carbohydrate. M. A. JERMYN. *Anal. Biochem.*, 1975, **68**, 332–335; through *S.I.A.*, 1976, **38**, Abs. 76-372. The above method has the disadvantage that the rate of colour formation at a given temperature and the sensitivity are lower for aldoses than for ketoses. The optical density obtained with glucose can be more than doubled by treating a 1-ml sample with 1 ml conc. HCl and 0·1 ml 90% formic acid before adding 8 ml anthrone reagent. Under these conditions, glucose, fructose, galactose, xylose, arabinose and a half-molar quantity of sucrose gave approx. equal colour yields after 12 minutes' heating in a boiling water bath.

* * *

Enzymatic determination of glucose: applications of the "Enzymax Glucose Analyzer". J. P. SULLIVAN, K. PATEL and J. C. WASILEWSKI. *Proc. 34th Meeting Sugar Ind. Tech.*, 1975, 33–39.—After a brief review of enzymatic methods for glucose determination, the authors give details of the Leeds & Northrup "Enzymax Glucose Analyzer" in which the glucose in a flowing stream reacts with oxygen in a buffer solution in the presence of glucose oxidase to form hydrogen peroxide and gluconic acid. (The glucose oxidase is immobilized on the surfaces of glass beads in the enzyme column through which the filtered solution is pumped.) The solution is then heated to 35°C in a heat exchanger, after which it flows through an amperometric detector where the H_2O_2 is converted to oxygen and water at an electrode; electrons released by the reaction are detected and amplified to a digital display of the current which is directly proportional to the quantity of glucose in the stream, or read-out can be made with a 100-mV recorder. It has been found possible to send a solution directly from the filter to the detector in order to measure substances oxidizable at the carbon anode.

[1] *I.S.J.*, 1971, **73**, 135–139, 196–197.
[2] *ibid.*, 1973, **75**, 3–6, 44–46.
[3] *ibid.*, 1974, **76**, 305.
[4] *J. Biol. Chem.*, 1944, **153**, 375.

An evaluation of an automatic polarimeter. C. C. CHOU and K. R. HANSON. *Proc. 34th Meeting Sugar Ind. Tech.*, 1975, 40–45.—Tests to evaluate automatic polarimeters are described in which it has been found that the instruments generally eliminate visual instrument error due to operator and to cover-glass strain created by excessive tightening of end caps. Reproducibility of an automatic instrument was also found to be good. Studies were also conducted on the effects on polarimeter readings of impurities having partial molar volumes greater than zero. Applying Euler's theorem on homogeneous functions to volume in a thermodynamic system, the authors show that the total volume of a sucrose solution is the sum of the partial molar volumes of its separate components; hence, if the sucrose concentration is defined as weight per fixed volume, the presence of non-sugars in this fixed volume will reduce the amount of dilution water to be added by an amount which is proportional to their partial molar volumes. Thus, tests in which carbon tetrachloride, aluminium weights and lead were individually added to sucrose solutions caused polarimeter readings to be higher than the true sucrose polarization.

* * *

Solid colour of white sugar by transluminescence. J. C. P. CHEN. *Proc. 34th Meeting Sugar Ind. Tech.*, 1965, 46–56.—The various instruments used in the sugar industry to measure white sugar colour in terms of reflectance and methods used to grade sugar visually are summarized. Mention is then made of electronic colour sorting of various products; while this has proved highly efficient in the case of rice and beans, it has been found to be unpractical for crystal sugar for reasons which are given. Transluminescence, in which light is passed through the sample, diffused and re-emitted, is briefly explained; reference is made to tests conducted on sugar in 1972/73, in which the correlation between transluminescence and the BRBU of the Bottler's Standard was found to be greater than that between BRBU and reflectance. Advantages of measuring solid sugar colour by measurement of its transluminescence are listed.

* * *

The influence of gel material on sugar colorant separation. V. PREY and H. ANDRES. *Zeitsch. Zuckerind.*, 1976, **101**, 211–214.—Investigations were conducted on the colorant separation properties of "Sephadex G-25" and of two Bio-Rad polyacrylamide gels, "P2" and "P6", through which prepared solutions of glucose alkaline decomposition products and molasses colorants were passed. The columns were eluted with chloroform-saturated water and the extinction values of the collected fractions measured at 420 nm. U.V. spectra are reproduced and results tabulated, showing for each gel a high- and a low-molecular component obtained from the glucose alkaline decomposition product; the high-molecular fraction had a M.W. which varied with the exclusion limit, while the low-molecular fraction (representing the major part of the eluate or being more highly coloured) had a M.W. of about 3000. Only with "Sephadex G-25" was further sub-fractionation of the low-molecular fraction possible. Fractionation of the molasses colorants into lead acetate-precipitable and non-precipitable was much more difficult and revealed marked scatter with the lead acetate-precipitable components, so that no precise information on M.W. was possible and only orders of magnitude could be established. The problems were attributed to differences in the chemical nature of the molasses components. Hence, while gel chromatography is useful as a rapid method of browning product separation, it has its limitations as an analytical method.

* * *

A new exhaustibility relationship for Hawaiian final molasses. T. MORITSUGU, B. J. SOMERA and G. E. SLOANE. *Sugar J.*, 1976, **38**, (9), 10–15.—See *I.S.J.*, 1975, **77**, 123.

* * *

Comparison of micro-distillation and potentiometric methods for determination of nitrogen in sugar cane leaves. V. C. BITTENCOURT, J. O. FILHO, E. A. G. ZAGATTO and E. ZAMBELLO. *Brasil Açuc.*, 1976, **87**, 45–54.—A comparison has been made between the two methods, micro-distillation[1] involving digestion with sulphuric acid in the presence of catalysts, and distillation of the extract with NaOH so that NH_3 is evolved, to be trapped in a solution of H_3BO_3 which is then titrated. The newer potentiometric method[2], which employs a new Radiometer "Air Gap Electrode", was found to give higher N values statistically significant at the 5% level and this attributed to the recovery of more N than with the micro-distillation method since measurement of coefficients of variation showed that both methods had similar precision (1·88% *vs.* 1·76%).

* * *

Study of some factors affecting the exhaustibility of Egyptian cane molasses. M. A. MOHAMED, S. H. ABOU-EL-HAWA and K. A. HAMMADI. *S. African Sugar J.*, 1976, **60**, 137–139.—Analysis of molasses samples from Egyptian sugar factories revealed differences in the composition and poor exhaustion compared with molasses from other countries. Statistical analysis of the results showed that molasses colour and ash % non-sugars were the most significant of factors studied which affected molasses exhaustibility, and a regression formula has been derived for correlation of the three parameters.

* * *

Diffusion in the system sucrose-heavy water. M. N. DADENKOVA, L. P. ZHMYRYA, V. M. DANILEIKO and R. S. BURDUKOVA. *Pishch. Prom.*, 1975, **21**, 13–15. The coefficients of diffusion D were measured by an optical diffraction method at a concentration of 3–52% and a temperature of 25–70°C, and values of the concentration and temperature-D correlations as well as other correlations and parameters were compared with those for normal aqueous solutions of sucrose.

* * *

The hydration number of glucose in diluted aqueous solutions. L. P. ZHMYRYA, M. N. DADENKOVA, V. M. DANILEIKO, R. S. BURDUKOVA and V. M. LYSYANSKII. *Pishch. Prom.*, 1975, **21**, 15–17.—Investigations of auto-diffusion coefficients at 25, 40 and 60°C showed that the hydration number fell appreciably with rise in temperature at constant concentration.

---

[1] MA & ZUAZUAGA: *Ind. Eng. Chem., Anal. Ed.*, 1942, **14**, 280–282.

[2] GILBERT & CLAY; *Anal. Chem.*, 1973, **45**, 1757–1759; EAGAN & DUBOIS: *Anal. Chim. Acta*, 1974, **70**, 157–167.

World sugar production estimates 1975/76[1]

BEET SUGAR	1975/76	1974/75	1973/74
EUROPE	——(*metric tons, ráw vâlue*)——		
Belgium/Luxembourg	732,000	620,000	797,000
Denmark	432,000	424,444	376,000
France	3,302,000	3,013,000	3,240,000
Germany, West	2,590,440	2,493,205	2,509,566
Holland	937,000	795,127	850,589
Ireland	206,944	148,598	196,101
Italy	1,474,000	1,034,000	1,156,000
United Kingdom	641,400	613,864	1,068,778
Total EEC	*10,315,784*	*9,142,238*	*10,194,034*
Austria	523,180	402,660	371,096
Finland	90,256	84,173	82,789
Greece	313,343	191,113	161,927
Spain	938,000	584,400	805,126
Sweden	283,333	312,222	270,000
Switzerland	66,041	73,873	79,531
Turkey	1,022,000	852,181	752,330
Yugoslavia	493,333	568,451	468,751
Total West Europe	*14,045,270*	*12,211,311*	*13,185,584*
Albania	18,000	16,000	19,000
Bulgaria	218,000	200,000	240,000
Czechoslovakia	780,000	750,000	730,000
Germany, East	680,000	670,000	560,000
Hungary	338,000	345,692	326,022
Poland	1,900,000	1,588,900	1,817,114
Rumania	600,000	620,000	580,000
USSR	7,700,000	8,000,000	9,750,000
Total East Europe	*12,234,000*	*12,190,592*	*14,022,136*
Total Europe	26,279,270	24,401,903	27,207,720
OTHER CONTINENTS			
Afghanistan	10,000	9,000	8,259
Algeria	25,000	14,100	3,400
Azores	7,000	7,000	6,500
Canada	136,000	103,500	119,300
Chile	322,000	224,856	129,432
China	980,000	950,000	900,000
Iran	590,000	585,000	570,000
Iraq	75,000	50,000	50,000
Israel	38,000	31,700	13,200
Japan	249,000	286,170	408,889
Lebanon	18,000	8,800	11,584
Morocco	255,000	272,830	226,875
Pakistan	28,000	24,717	9,800
Syria	26,000	19,000	18,432
Tunisia	9,000	6,880	5,100
United States	3,719,000	2,726,000	2,917,000
Uruguay	96,000	84,650	57,203
Total Other Continents	6,583,000	5,404,203	5,454,974
TOTAL BEET SUGAR	32,862,270	29,806,106	32,662,694

CANE SUGAR	1975/76	1974/75	1973/74
EUROPE			
Spain	30,000	29,800	29,377
NORTH & CENTRAL AMERICA			
Belize	62,000	84,832	91,028
Costa Rica	191,000	177,990	164,020
Cuba	5,800,000	6,432,058	6,044,000
Dominican Republic	1,179,000	1,141,913	1,194,104
Guadeloupe	105,000	87,500	97,471
Guatemala	515,000	381,300	325,257
Haiti	69,000	71,000	68,503
Honduras	95,000	90,387	80,640
Martinique	12,000	15,000	14,231
Mexico	2,750,000	2,713,256	2,837,372
Nicaragua	248,500	198,300	160,040
Panama	149,000	136,346	108,860
Puerto Rico	268,000	271,284	260,607
El Salvador	274,000	273,446	232,227
USA—Mainland	1,650,000	1,334,000	1,288,626
Hawaii	970,000	1,004,229	944,151
West Indies—Barbados	107,000	100,517	112,687
Jamaica	375,000	366,441	373,445
St. Kitts	35,000	25,855	26,732
Trinidad	205,000	163,040	186,815
Total N. & C. America	15,059,500	15,069,594	14,611,176
SOUTH AMERICA			
Argentina	1,378,855	1,532,136	1,641,837
Bolivia	213,000	165,199	188,613
Brazil	6,180,239	7,220,981	6,933,354
Colombia	990,000	969,701	894,820
Ecuador	311,000	290,058	283,493
Guyana	371,000	310,859	352,740
Paraguay	57,000	78,214	76,278
Peru	996,000	1,005,000	1,020,816
Surinam	12,000	10,362	7,910
Uruguay	29,000	22,655	23,047
Venezuela	500,000	526,816	586,777
Total South America	11,038,094	12,131,981	12,009,685
AFRICA			
Angola	40,000	48,800	60,310
Cameroun	30,000	29,000	21,400
Congo (Brazzaville)	31,550	29,423	37,492
Egypt	639,000	581,994	611,000
Ethiopia	150,000	142,933	134,072
Ghana	18,000	12,607	8,784
Kenya	177,000	183,000	176,854
Madeira	1,900	2,606	2,778
Malagasy Republic	128,000	122,984	106,700
Malawi	69,000	53,347	52,000
Mali	10,000	10,000	10,000
Mauritius	496,164	737,966	760,782
Morocco	4,070	0	0
Mozambique	256,000	300,891	265,546
Nigeria	35,260	38,310	30,277
Réunion	225,594	227,949	239,210
Rhodesia	260,000	250,000	248,000
Somalia	27,175	32,983	35,000
South Africa	1,896,726	1,983,195	1,831,575
Sudan	189,000	142,946	134,413
Swaziland	214,000	198,000	172,651
Tanzania	121,000	113,000	117,889
Uganda	22,000	34,700	60,310
Zaire	63,330	62,591	63,000
Zambia	85,058	64,550	58,000
Total Africa	5,211,827	5,408,675	5,238,043
ASIA			
Bangladesh	112,000	111,162	99,793
Burma	75,000	72,000	70,000
China	2,800,000	2,600,000	2,550,000
India, excl. khandsari	4,700,000	5,375,000	4,375,000
Indonesia	1,290,000	1,137,000	936,628
Iran	85,000	83,000	98,300
Iraq	75,000	72,000	70,000
Japan	223,163	192,450	247,000
Malaysia	70,000	50,000	16,000
Nepal	4,426	6,091	8,778
Pakistan	662,000	525,896	612,273
Philippines	2,735,000	2,471,304	2,534,584
Sri Lanka	24,320	20,285	21,650
Taiwan	816,000	751,094	892,066
Thailand	1,664,470	1,215,750	926,312
Total Asia	15,336,379	14,661,032	13,438,384
OCEANIA			
Australia	2,933,000	2,921,000	2,593,000
Fiji	272,407	273,490	319,000
Total Oceania	3,205,407	3,194,490	2,912,000
TOTAL CANE SUGAR	49,881,207	50,495,572	48,238,665
TOTAL BEET SUGAR	32,862,270	29,806,106	32,662,694
TOTAL SUGAR PRODUCTION	82,743,477	80,301,678	80,901,359

[1] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (21), 1–4.

South Africa sugar statistics[1]

	1975		1974	
	(*metric tons, raw value*)			
Initial stocks		564,645		559,981
Production		1,968,441		1,970,104
Imports		540		1,097
		2,533,626		2,531,182
Consumption		1,215,102		1,139,555
Exports:				
Canada	281,894		167,552	
Finland	0		13,278	
Israel	2,155		14,964	
Japan	372,110		528,278	
Jordan	0		2,174	
Portugal	0		28,067	
Seychelles	0		976	
UK	13,222		24,799	
USA	129,838		42,368	
Other countries	9,141		4,526	
		808,360		826,982
Final stocks		510,164		564,645

"Technology for sugar refinery workers".—This classic textbook by the late Sir OLIVER LYLE had been thought to be out of print and unavailable. A source has now been found of copies of the third edition, reprinted in 1970, and these are now available through our Sugar Book Department, at a price of $25.00 U.S. currency, including surface mail, or $34—$36 by airmail, depending on destination.

* * *

Tongaat Group Ltd., 1976 report.—During the 1975/76 season the Tongaat sugar factory crushed 1,694,364 metric tons of cane to make 179,896 tons of sugar, a little less than the 184,803 tons of sugar made from 1,658,305 tons of cane in the previous season. The factory's expansion programme is proceeding according to plan and on schedule, with a new evaporator brought into operation and installation of a new 240 t.c.h. diffuser, a continuous *C*-pan, a 120 tons.hr^{-1} steam boiler and two 7·4 kW turbo-alternators being planned to avoid significant disruption of milling. The pan was to be in operation by 1st July 1976 and the other equipment ready for commissioning at the beginning of the 1977/78 season. The Company's own plantations yielded 750,395 tons of cane, at an average of 62·2 tons per hectare. Capital expenditure during the year was approximately R 5,380,000.

* * *

Bagasse paper and cellulose piant for Iraq[2].—The Ministry of Industry and Mines in Iraq recently signed an agreement with a German-Swiss consortium under the leadership of Sulzer AG. The contract, for a value of 502 million marks (US$ 198 million) will cover the turn-key constructions of a paper and cellulose factory in Amarah, beside the Tigris, and will by August 1978 cover domestic demands of about 39,000 tons of cellulose, 35,000 tons of wrapping paper, 22,000 tons of board and 33 million egg-boxes. The raw material will be bagasse from the nearby sugar factory.

* * *

New Indian sugar factories[3].—A sugar factory at Kurungulam, near Thanjavur in Tamil Nadu State, is to start production in 1977 while another is to be set up in the Mayuram-Siskali area. A factory at Eraiyur in Tiruchi district is likely to start production in July 1977, while licences have been issued for three more plants. Two sugar factories are to be built at Shahbad and Palwal, in Haryana State[4].

* * *

Bagasse board plant in Malaysia[5].—A board factory is to be built in Mergong, in the Alor Setar industrial zone in the state of Kedah. It will produce 20,000 tons of board per year using bagasse, waste paper and rice straw as raw material.

* * *

New Philippines sugar cane varieties[6].—The Philippines Sugar Institute has developed five high-yielding cane varieties, of which four—Phil 6421, 6425, 6429 and 6553—are resistant to downy mildew and leaf scorch, and one—Phil 6559—is resistant to fungus disease.

USSR sugar imports and exports[7]

	1975	1974	1973
	(*metric tons, raw value*)		
Imports			
Argentina	0	0	15,877
Australia	51,475	0	75,933
Brazil	95,494	0	458,451
Colombia	0	0	60,611
Costa Rica	0	0	15,600
Cuba	2,963,721	1,855,571	1,603,326
Czechoslovakia	1,081	0	21,740
Dominican Republic	0	0	99,962
Guatemala	0	0	27,461
Guyana	20,320	0	0
Mauritius	0	0	12,259
Nicaragua	0	0	10,297
Peru	104,985	0	96,834
Poland	0	0	108,698
Salvador	0	0	23,706
	3,237,076	1,855,571	2,630,755
Exports			
Afghanistan	21,826	54,079	10,999
Finland	0	30,024	0
Mali	2,109	0	0
Mongolia	24,603	18,860	24,462
Vietnam, North	8,651	8,652	10,875
Yemen	2,130	5,408	0
	59,319	117,023	46,336

Rhodesia sugar expansion[8].—Hippo Valley Estates is to invest more than $24 million during the next five years in expanding its factory capacity, developing its associated plantations, and expanding plantations which it owns on an equally-shared basis, with Triangle Ltd. Recently Triangle announced a £12-million expansion programme for itself.

* * *

Belize sugar production, 1975[9].—Sugar production in 1975 fell by 6·8% from the 1974 record level, to 82,874 tons, largely because the 1975 crop was affected by hot and dry weather during harvesting. However, favourable prices last year assured an increase of 27·5% in revenues. The 1976 crop is expected to be around 60,000 tons but the price will be much less favourable to producers.

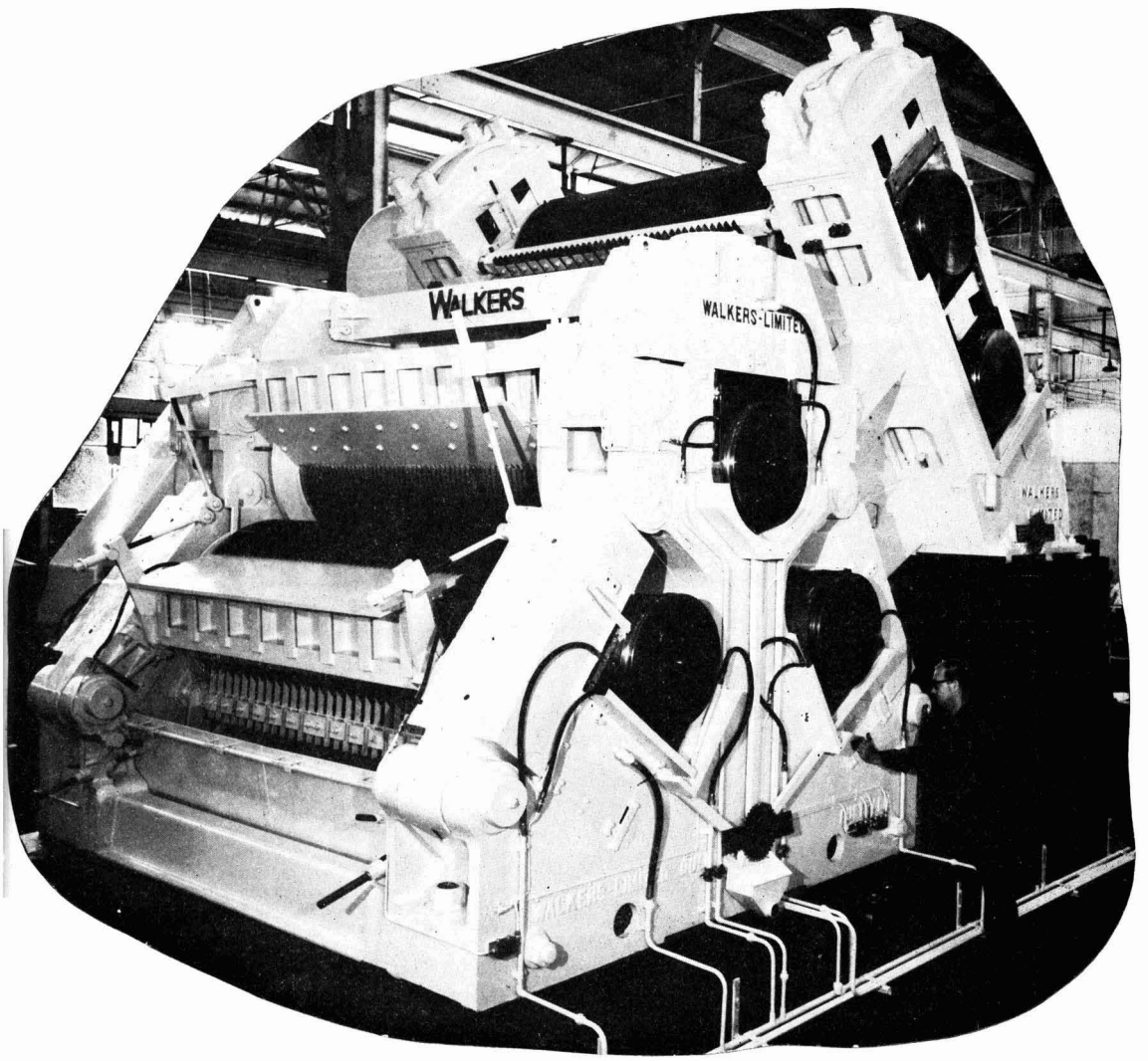
* * *

USDA cane variety improvement programme.—Scientists at the U.S. Department of Agriculture (USDA) Sugarcane Field Station at Canal Point, Florida, will conduct a sugar cane variety improvement programme under a trust fund cooperative agreement with the Florida Sugar Cane League, Inc. The League will provide the USDA Agricultural Research Service (ARS) with $5000 initially and additional funds as necessary for continuing research. The variety improvement programme will include crossing, screening for resistance to pests and environmental stress and testing for high yielding ability. Scientists will also conduct research to develop improved methods of disease and insect control. In addition to providing 15 acres of land contiguous with the U.S. Sugarcane Field Station, the League expects to provide other plots of land dispersed throughout the growing area for evaluation of advanced cane selections. Through its members, the League also plans to provide implements and labour for planting, cultivation, sampling and harvesting. Dr. N. I. JAMES, agronomist at the Sugarcane Field Station, Canal Point, is the ARS representative for the cooperative research. Dr. J. ORSENIGO, director of research, is the Florida Sugar Cane League representative at Clewiston, Fla.

[1] *I.S.O. Stat. Bull.*, 1976, **35**, (4), 94–95.
[2] *Amerop Noticias*, 1976, (32), 4.
[3] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (20), 12.
[4] *Indian Sugar*, 1976, **26**, 4.
[5] *Amerop Noticias*, 1976, (32), 5.
[6] *Reuter's Sugar Rpt.*, 11th May 1976.
[7] F. O. Licht, *International Sugar Rpt.*, 1976, **108**, (20), vii.
[8] *Amerop Noticias*, 1976, (32), 5.
[9] *Barclays Country Rpts.*, (FE1), 28th June 1976.

WALKERS FIVE ROLL MILL

FOR CONVENTIONAL MILLING
OR DIFFUSER BAGASSE DEWATERING



ALL ROLLS 84" x 42" DELIVERY AND TOP HYDRAULICS
TURBINE DRIVE COMPLETE WITH HIGH AND LOW SPEED GEARING
LET US SOLVE *your* MILLING AND DIFFUSER DEWATERING PROBLEM

WALKERS LIMITED

CONSULTANTS
DESIGNERS
ENGINEERS

P.O. BOX 211, MARYBOROUGH, QUEENSLAND, AUSTRALIA

Telex: 49718

Index to Advertisers

Printed by JOHN ROBERTS & SONS, Salford, Manchester; and published by the Proprietors, THE INTERNATIONAL SUGAR JOURNAL LTD., at 23a Easton Street, High Wycombe, Bucks. Entered at the New York Post Office as Second-Class Matter.

PRINTED IN GREAT BRITAIN.