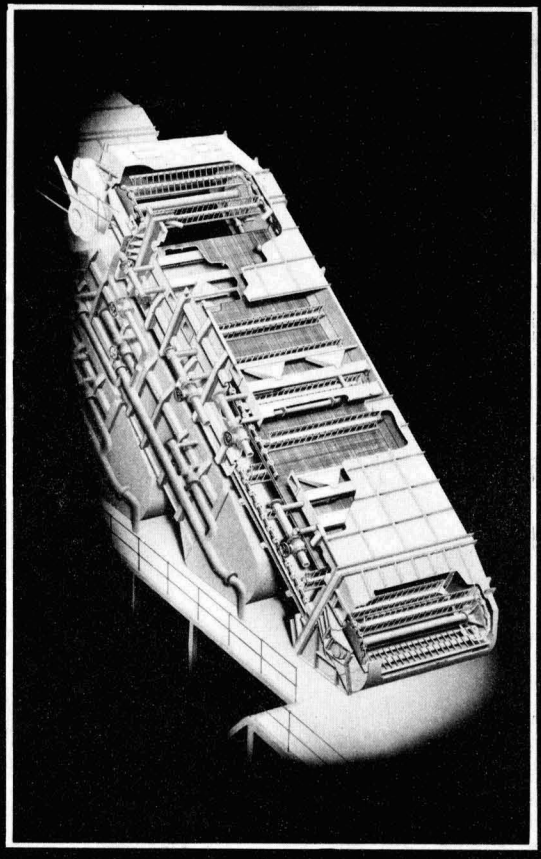
THE International Sugar Journal

JUNE 1975

When you think of sugar machinery...



Diffuser

(VAN HENGEL SYSTEM)

ACCEPTS MAXIMUM CANE PREPARATION

HIGH JUICE RECIRCULATION

FLOODING ELIMINATED

CONSTANT LOW JUICE AND BAGASSE RETENTION TIMES

PRESSWATER TREATMENT ELIMINATED

MODULAR CONSTRUCTION - READILY EXTENDABLE

...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

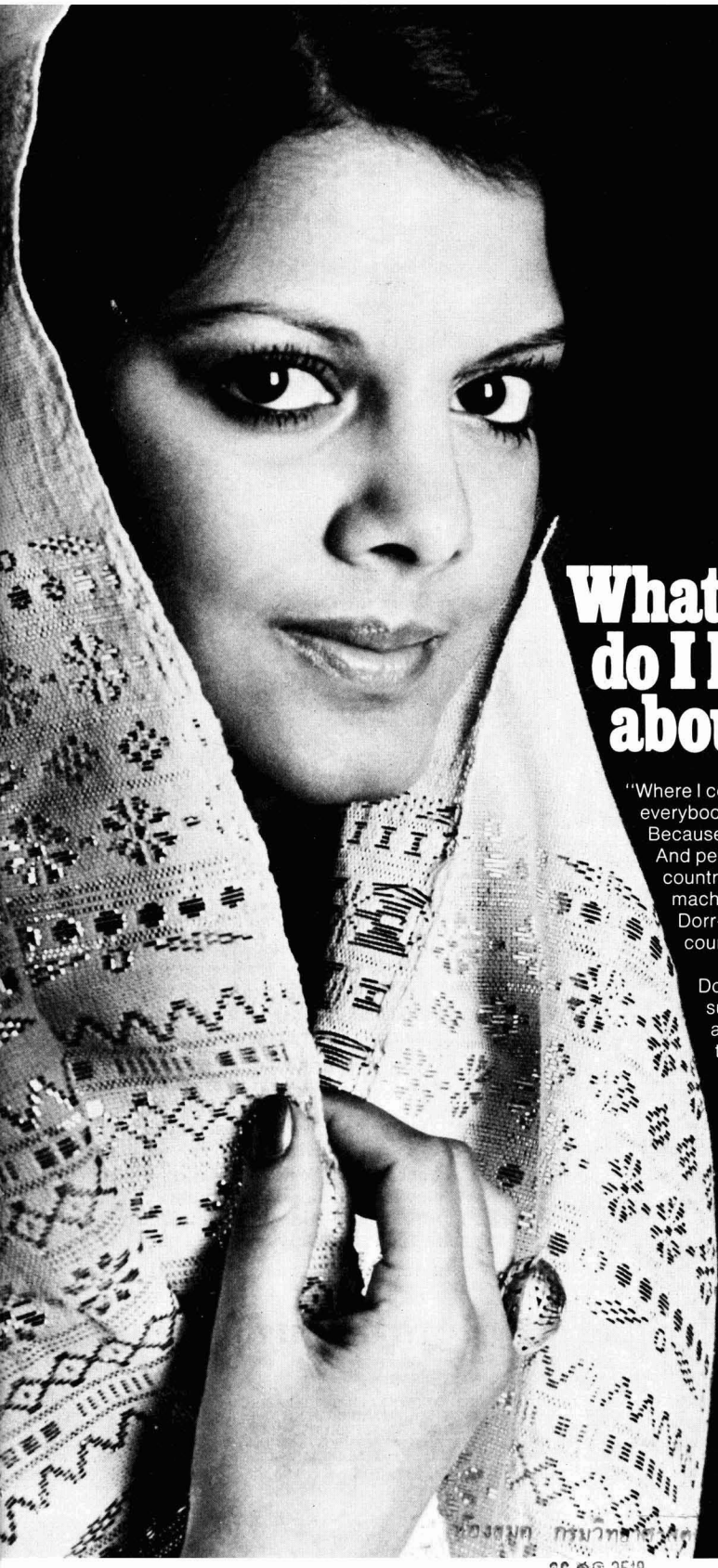
Fletcher and Stewart Limited

DERBY - ENGLAND - DE2 8AB

1966 1972

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

A Member of the Booker McConnell Group of Companies



What do I know about sugar?

"Where I come from, sugar is something everybody knows something about. Because it's such an important business. And people in the sugar business in my country say that when it comes to machinery and equipment for their mills, Dorr-Oliver is a company they can count on."

All around the sugar belt of the world, Dorr-Oliver has proven its ability to supply top quality process equipment and the technology and engineering to assure maximum efficiency. For cane mud filters, cane juice clarifiers, DSM®screens, desanders, or complete systems, Dorr-Oliver offers quality equipment and dependability of service.

In many countries, pollution control has become increasingly important in most industrial operations. Dorr-Oliver is equally capable in waste water treatment, and related technologies.

Get all the facts. Write, Larry Engel, Sugar Division, Dorr-Oliver Incorporated, 77 Havemeyer Lane, Stamford Connecticut 06904, U.S.A.

DORR-OLIVER

A step ahead in process equipment.

Pan Boiling bottlenecks?

Visc-Aid prevents them...

and helps recover 10 to 20% more sugar from molasses

Pan boiling bottlenecks are a recurring problem to sugar processing plants around the world. But dozens of factories now use Fabcon Visc-Aid* to effectively prevent this problem. In fact, every factory trial program so far, using Visc-Aid, has shown such dramatic improvement in massecuite processing that the customer decided to use Visc-Aid regularly. These demonstrations prove that with Visc-Aid, non-sugar recirculation is decreased by 50%, thus off-loading the boiling house and preventing bottlenecks.

Visc-Aid increases crystal content.

With Visc-Aid added to all pans as recommended, sugar factories can now brix A, B and C pans 1° to 2° brix higher. Pan drops are therefore increased.

Centrifuging is dramatically improved.

Typically, when Visc-Aid is used as prescribed, centrifugal capacity jumps up as much as 25%. Sugar purities increase and molasses purity is reduced because removal of molasses from around the sugar crystals is more complete. The need for reheating is often eliminated.

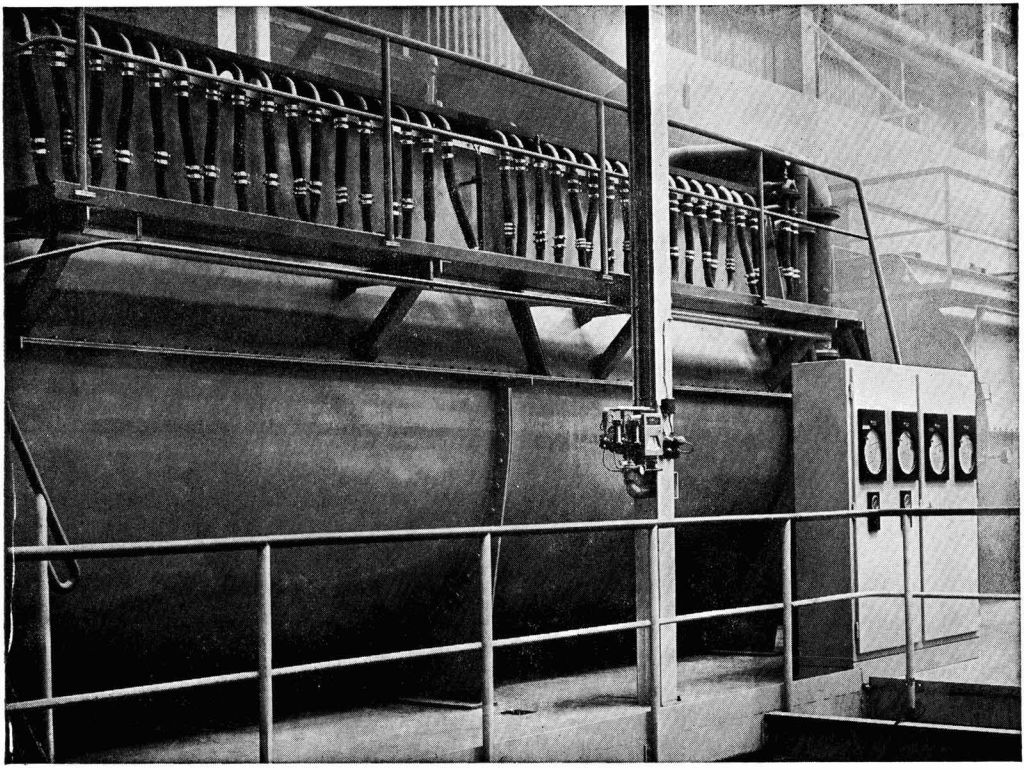
For these reasons final molasses purity and volume are reduced, providing a 10% to 20% increase in sugar recovery from molasses when Visc-Aid is used regularly.

Your Fabcon Service Engineer will call on you soon with evidence of the benefits obtainable with Visc-Aid, Pan-Aid and Quite; all effective crystallization aids. Only from Fabcon.

*South Africa Pat. No. 71/5754. U.S. and other foreign patents pending.

Fabcon: a world of service to the sugar industry

UNITED STATES-CANADA: DAVID TAY/**LOUISIANA:** DR. WILMER GRAYSON/**FABCHEM (PTY.) LTD. SOUTH AFRICA:** NORLAND SUZOR, JEAN-PIERRE HAREL/**LATIN CARIBBEAN-FLORIDA:** TONY VELIDANES/**FABCON DO BRAZIL-SOUTH AMERICA:** JOSE PIRES, JOSE VILLAMIL/**FABCON LATIN AMERICA-CENTRAL AMERICA:** ENRIQUE VILLAMIL, JORGE BALLARDO DIAZ, JUAN CARLOS SOLEY, MANUEL YABAR-DAVILA/**COLOMBIA:** GUILLERMO GARCIA/**QUIMICA DEL VALLE, MEXICO:** ENRIQUE VILLAMIL, C. CAMPOS/**FABCON CARIBBEAN LTD, JAMAICA:** DERYCK CORSBIE/**FABCON PHILIPPINES INC.:** REY NAVARRO/**INDONESIA:** B. HASLIM/**EUROPE-INDIAN OCEAN:** NORLAND SUZOR, JEAN-PIERRE HAREL/**MIDDLE EAST:** ANJUM BILGRAMI.



Continuous... rapid

Consider the advantages of the Werkspoor Rapid Crystallizer and you will understand why we are proud of our invention.

Over 700 units operate all over the world in cane- and beetsugar factories, as well as refineries. They have not only proven to be outstanding for low-grade massecuites, but equally for high and intermediate strikes.

Recently, we adapted the design of the Werkspoor Rapid Crystallizer to the latest technological developments. Results are even better now.

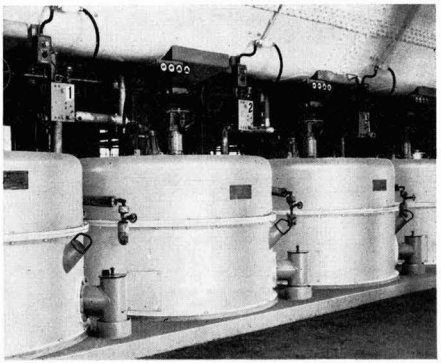
This uncrowned king of crystallizers brings more sugar in the bag, reduces investments and operating costs, saves a lot of space and lowers steam consumption.
Let us show you how!

STORK-WERKSPOOR SUGAR

sugar industry engineers
P.O. Box 147 Hengelo (O) - the Netherlands

Member of VMF/Stork-Werkspoor
Cables: Stowesugar Telex: 44485 Tel.: 05400 - 54321

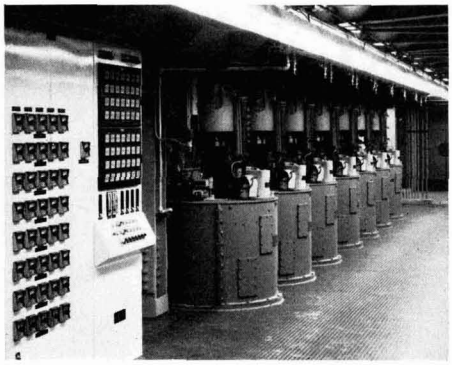
think CENTRIFUGALS



Think continuous centrifugals . . . think Western States. Hundreds of sugar processors did and now, several years later, performance as forecast is a reality . . . minimum maintenance and maximum return on investment.

Think Western States . . . and we'll think with you. Our engineers will help you fit our centrifugals into your new or existing facilities.

..think Western States



Think batch type centrifugals . . . think Western States. They are renowned for high production and minimum downtime over long periods (in some cases 30 years or more) . . . a real contribution to cost reduction.

Think productivity . . . durability . . . low maintenance . . . long life . . . engineering know-how . . . lower labor costs. . . ruggedness . . . profits . . . high return on investment . . . then, we think you will think Western States.

Over the years Western States' batch and continuous type centrifugals have earned a highly favorable reputation in all of these areas. It didn't just happen . . . our people made it happen. Our accumulated expertise is available to you. You can start the ball rolling by contacting Mr. James Coleman, General Sales Manager.

THE WESTERN STATES MACHINE COMPANY
Roberts Centrifugals
Hamilton, Ohio, 45012, U.S.A.

FOUNDED 1838

Discerning people choose good company

When buyers within an industry return again and again to the same supplier for their requirements, it is logical to assume that this supplier is serving them extremely well.

Especially is this true of a company like Fletcher and Stewart which has served one single industry – Sugar – for nearly 140 years.

Time then becomes a measure of success, for no company could possibly survive such a span unless succeeding generations of buyers were convinced of its ability to serve them well.

Over the years, the name Fletcher and Stewart has become a byword in the Sugar Industry for its unique brand of personal service, integrity and technical skill in designing and manufacturing specialised plant.

No wonder its reputation is coveted throughout the World.
No wonder discerning people choose good Company.

Fletcher and Stewart Limited
DERBY - ENGLAND

at all stages of sugar manufacture

- 150 years of experience in the construction of sugar machinery
- a large number of complete plants (cane and beet) installed in the whole world
- machinery whose sturdiness has acquired a world wide fame
- technological back-up of an important Research Centre

fcb FIVES-CAIL BABCOCK

AGENTS THROUGHOUT THE WORLD
7, rue Montalivet, 75 - PARIS 8e
Phone : 265.22.01 and 742.21.19
Telex : FIVCAIL 65 328

Ewart Cobra cuts cane handling costs

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.

ALL THIS EQUALS LOWER OPERATING AND MAINTENANCE COSTS

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.

ALL THIS EQUALS CLEANER AND MORE EFFECTIVE MATERIALS HANDLING

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

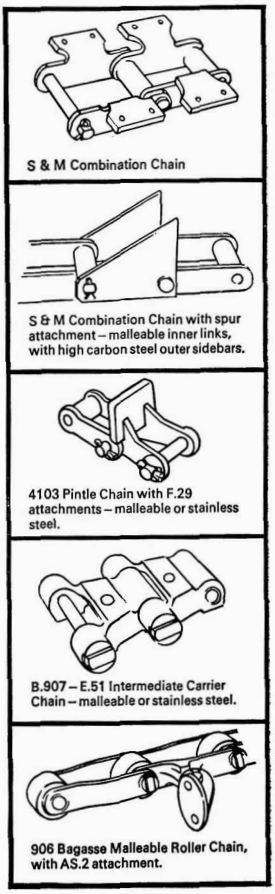
Full details – including section drawings, tables and illustrations – are given in catalogue No. 400. Send for a copy NOW.

EWART

EWART CHAINBELT CO. LTD
DERBY DE3 8LX, ENGLAND

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

The conventional SS.600 cane carrier link, inset in the circle, is drawn to the same scale and emphasises the size and strength of the COBRA.



S & M Combination Chain

S & M Combination Chain with spur attachment – malleable inner links, with high carbon steel outer sidebars.

4103 Pintle Chain with F.29 attachments – malleable or stainless steel.

B.907 – E.51 Intermediate Carrier Chain – malleable or stainless steel.

906 Bagasse Malleable Roller Chain, with AS.2 attachment.

I.S.J.
SUGAR BOOK DEPARTMENT

Most books reviewed in this *Journal* may be obtained through our Sugar Book Department. Where no inclusive price is quoted in our review, 50p should be added to cover the cost of packing and postage. Prices given below are approximate and subject to alteration without notice owing to fluctuations in currency exchange rates.

★ *Check your personal library against the list of basic books given below :*

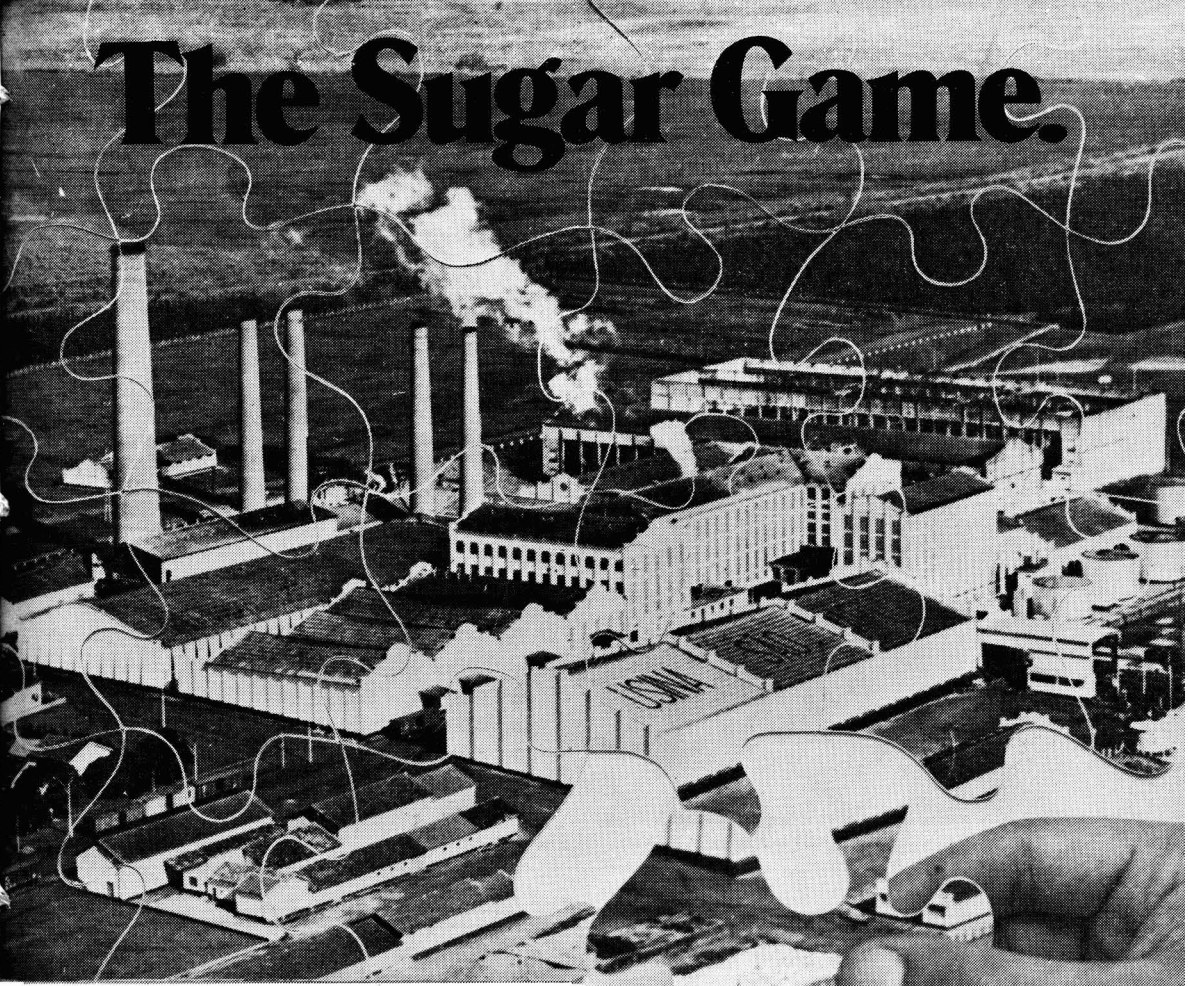
AUSTRALIAN SUGAR YEARBOOK 1975	(1975)	£5.00
THE SUGAR CANE (2nd ed.): *Barnes*	(1974)	£11.50
MANUFACTURE OF SUGAR FROM SUGAR CANE: *Perk*	(1974)	£3.85
SUGAR CANE PHYSIOLOGY: *Alexander*	(1973)	£35.15
LICHT'S INTERNATIONAL SUGAR ECONOMIC YEAR-BOOK & DIRECTORY	(1974)	£13.00
SUGAR BEET NUTRITION: *Draycott*	(1972)	£7.50
HANDBOOK OF CANE SUGAR ENGINEERING: *Hugot* transl. *Jenkins*	(1972)	£53.15
BEET SUGAR TECHNOLOGY (2nd ed.): *McGinnis*	(1971)	£11.30
SYSTEM OF CANE SUGAR FACTORY CONTROL (3rd ed.) *International Society of Sugar Cane Technologists*	(1971)	£2.10
PROCEEDINGS 15TH SESSION ICUMSA	(1970)	£4.50
ANALYTICAL METHODS USED IN SUGAR REFINING: *Plews*	(1970)	£7.50
SUCROSE CHEMICALS: *Kollonitsch*	(1970)	£6.00
LABORATORY MANUAL FOR QUEENSLAND SUGAR MILLS (5th ed.): *Bureau of Sugar Experiment Stations*	(1970)	£3.85
PESTS OF SUGAR CANE: *Williams, Metcalfe, Mungomery & Mathes*	(1969)	£19.80
BY-PRODUCTS OF THE CANE SUGAR INDUSTRY *Paturau*	(1969)	£16.30
SUGAR CANE FACTORY ANALYTICAL CONTROL: *Payne*	(1968)	£11.90
THE GROWING OF SUGAR CANE: *Humbert*	(1968)	£28.60
THE MECHANICS OF CRUSHING SUGAR CANE: *Murry and Holt*	(1967)	£9.30
MANUFACTURE AND REFINING OF RAW CANE SUGAR: *Balkow*	(1967)	£17.20
INTRODUCTION TO CANE SUGAR TECHNOLOGY: *Jenkins*	(1966)	£16.30
GENETICS AND BREEDING OF SUGAR CANE: *Stevenson*	(1965)	£5.25
MANUAL OF CANE GROWING: *King, Mungomery and Hughes*	(1965)	£13.65
CANE SUGAR HANDBOOK (9th ed.): *Meade*	(1963)	£16.45
SUGAR CANE DISEASES OF THE WORLD (Vol. I): *Martin, Abbott and Hughes*	(1961)	£18.05
(Vol. II): *Hughes, Abbott and Wismer*	(1964)	£13.65
BASIC CALCULATIONS FOR THE CANE SUGAR FACTORY: *Eisner*	(1958)	£0.50

The above prices include postage and packing.
Terms are strictly cash in advance.

Our Bankers are: Barclays Bank Ltd., 3 Great Tower Street, London E.C.3.

SUGAR BOOK DEPARTMENT, International Sugar Journal Ltd.
23a Easton Street, High Wycombe, Bucks., England

The Sugar Game.



Dedini knows how to solve it.

The construction of a sugar plant is so intricated it resembles a jigsaw puzzle.
Make things easier for yourself.
Count on Dedini's first hand experience.
The only industry to put out the whole sugar plant.
Part by part.
Turn-key delivery system.
Brazil is the world's largest sugar cane producing country.
And 80% of its production goes through the processing equipment manufactured by Dedini.
Sugar plants throughly manufactured by Dedini are in full operation in many countries.
These statements vouch for Dedini's quality and international standard in equipment and complete set-ups for the sugar cane processing. If your worry is sugar, contact whoever manufactures each and every part.
Contact Dedini.

M. DEDINI S.A. METALÚRGICA
Equipment and plants made to order

General office and plant:
Av. Mario Dedini, 201 - Phone 3-1122 - Cable: DEDINI
13400 Piracicaba, SP - Brazil.
Offices: Rua 7 de Abril, 277 - 9th floor - Phones: 35-7997 - 36-5019 - 36-6659 - 37-7639 - Cable: EMEDEDINI
01043 - São Paulo, SP - Brazil.
Av. Presidente Vargas, 542 - 22 nd floor. - Phone: 223-9949
20000 Rio de Janeiro, GB - Brazil.

GD GRUPO DEDINI

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

* * *

Annual Subscription: £5.00 or $15.00 post free
Single Copies: 60p or $1.80 post free

* * *

UK ISSN 0020-8841

International Sugar Journal

June 1975

Contents

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Analyse directe et évaluation de la canne à sucre. E. HUGOT. *p.* 163–168

Les méthodes d'évaluation de la canne sont discutées sous deux titres: celles qui sont basées sur l'analyse du jus primaire et celles basées sur l'analyse directe d'un échantillon prélevé dans la canne. Les méthodes sont comparées et certains avantages de l'analyse directe sont avancés. On souligne la nécessité de tenir compte du contenu en fibre, bien que les fibres ont un effet plus important dans le moulin que dans la presse. On donne une description d'une analyse directe qui tient compte de la teneur en fibre; la formule d'estimation du sucre extractible *RS* qui y est donnée est la suivante: $RS = k\,(1 - 1{,}45f)\,(S - 0{,}3B)$, dans laquelle k = "coefficient de travail", f = fraction de fibre dans la canne, S = polarisation du jus primaire et B = brix du jus primaire. Le coefficient 1,45 est valable lorsqu'on utilise une pression de 400 bar, mais doit être augmenté ou réduit suivant que la pression utilisée est respectivement plus faible ou plus élevée. Comme cette formule est basée sur le concept d'efficience idéale, elle est d'une application générale et universelle et peut donc être utilisée pour comparer différentes usines et même différentes régions.

* * *

Réduction des pertes en sucre dans une raffinerie de canne. J. A. WATSON. *p.* 168–170

L'auteur examine l'origine des différentes pertes connues ou indéterminées que l'on peut rencontrer dans une raffinerie de canne et montre qu'il est possible de les diminuer, principalement en réduisant les pertes indéterminées. Bien que le niveau auquel les pertes peuvent être maintenues dépend d'un nombre de facteurs (lieu de raffinage, âge de l'installation, principe de travail, nature de produits, etc.), il est admis comme possible de maintenir une perte ne dépassant pas 0,75% des matières sèches entrées.

* * *

La floraison de la canne à sucre au Soudan. H. A. TALBALLA. *p.* 170–172

On décrit der expériences de floraison de canne au Soudan. Dans chaque cas on a considéré un grand nombre de variétés. Les dates de début et de fin de floraison sont données pour chaque variété. Les résultats font apparaître qu'à Malakal, site le plus au sud des quatre sites étudiés, on obtient les meilleurs résultats du point de vue production de semence.

Direkte Untersuching und Bewertung von Zuckerrohr. E. HUGOT. *S.* 163–168

Die Methoden zur Bewertung von Zuckerrohr werden unter zwei Gesichtspunkten diskutiert: diejenigen, die auf einer Untersuchung des Primärsaftes beruhen, und die direkte Analyse einer Probe, die der angelieferten Zuckerrohrladung entnommen wird. Die Methoden werden miteinander verglichen, wobei einige Vorteile der direkten Analyse aufgezeigt werden. Es wird besonders darauf hingewiesen, dass der Fibergehalt eine Rolle spielt, obwohl dieser in der Mühle einer grösseren Einfluss ausübt als in der Presse. Der Autor beschreibt eine Methode zur Direktanalyse, bei welcher der Fibergehalt berücksichtigt wird. Zur Berechnung des gewinnbaren Zuckers (*RS*) wird folgende Gleichung angegeben: $RS = k\,(1 - 1{,}45f)\,(S - 0{,}3B)$; k = sog. Arbeitskoeffizient; f = Fiberanteil im Rohr; S = Polarisation des Primärsaftes; B = Trockensubstanzgehalt des Primärsaftes. Der Koeffizient 1,45 entspricht einem Druck von 400 bar; er muss für niedrigere Drücke vergrössert und für höhere Drücke verkleinert werden. Da die Gleichung auf der Annahme des idealen Wirkungsgrades basiert, kann sie allgemein Anwendung finden. Daher lässt sie sich zum Vergleich verschiedener Fabriken und sogar verschiedener Länder benutzen.

* * *

Die Verringerung der Zuckerverluste en einer Rohrzuckerraffinerie. J. A. WATSON. *S.* 168–170

Der Autor untersucht die verschiedenen Ursachen für bekannte und unbekannte Zuckerverluste in einer Rohrzuckerraffinerie und zeigt Wege zur Verringerung dieser Verluste auf. Der Hauptanteil des zu erzielenden finanziellen Gewinns ergibt sich aus einer Erniedrigung der unbekannten Verluste. Die Höhe, auf der die Verluste gehalten werden können, wird durch eine Anzahl von Faktoren bestimmt (Lage der Raffinerie, Alter der Anlage, angewandtes Verfahren, Natur der Produkte usw.). Der Autor hält es trotzdem für möglich, diese Verluste auf höchstens 0,75% der eingeführten Feststoffe zu beschränken.

* * *

Das Blühen der Zuckerrohrpflanze im Sudan. H. A. TALBALLA. *S.* 170–172

Der Verfasser berichtet Einzelheiten über Versuche die sich auf das Blühen von Zuckerrohrpflanzen beziehen. Für jedes Anbaugebiet wurde eine grosse Zahl von Sorten untersucht, für die der Zeitpunkt des Aufganges und das Ausmass der Blüte angegeben werden. Die Versuche zeigten für Malakal, das im äussersten Süden gelegene Anbaugebiet, die besten Resultate hinsichtlich der Samenerzeugung.

Analisis directo y valoración de caña de azúcar. E. HUGOT. *Pág.* 163–168

Métodos de valoración de caña se discuten abajo de dos títulos: ellos basado sobre análisis de jugo primario y métodos de análisis directo, usando muestras tomado del consignación de caña. Los métodos se comparan y algunos ventajes de análisis directo se indican. La necesidad de dar cuenta del contenido de fibra se recalca, si bien la fibra tiene un efecto más grande en el molino que en la prensa. Se presenta una descripción de un método de análasis directo que da cuenta del contenido de fibra; la fórmula para estimar el azúcar recuperable (*RS*) es $RS = k\,(1 - 1{,}45f)\,(S - 0{,}3B)$ donde k es un llamado "coeficiente de trabajo", f es la fracción de fibra en la caña, y S y B son la polarización y el Brix del jugo promario. El coeficiente 1,45 corresponde a una presión aplicada de 400 bar, pero debe aumentarse para presiones más bajo y reducirse para presiones más grande. Porque la fórmula se base sobre el concepto de eficiencia ideal, es de aplicación general y universal y puede usarse para comparación entre diferentes fábricas y aun paises.

* * *

Disminución de pérdida de azúcar en una refinería de azúcar de caña. J. A. WATSON. *Pág.* 168–170

El autor examina los varios origenes de pérdidas conocidas y no-conocidas de azúcar en una refinería de azúcar de caña y enseña como se pueden reducirse, siendo el fuente del mayor parte de los ahorros la disminución de pérdida no-conocida. Mientras que el nivel de pérdida que puede mantenerse es gobernado por algunos factores (sitio de la refinería, edad de la planta, proceso empleado, natureza de los productos, etcétera) se considera posible mantener una pérdida no más que 0,75% sobre sólidos entrados.

* * *

Floración de caña en el Sudán. H. A. TALBALLA. *Pág.* 170–172

Se presentan detalles de experimentos sobre floración de caña en el Sudán. En cada sitio se meten muchas variedades y se presentan detalles de las fechas de aparición para cada una. Las resultas demuestran que Malakal, el más lejano hacia el sur de los cuatro sitios, proveió las mejores resultas con respecto a producción de semilla.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXVII JUNE 1975 No. 918

Notes & Comments

USSR sugar statistics

Figures concerning imports and exports of sugar by the USSR have recently been published by C. Czarnikow Ltd.[1] and appear below. After two years of large-scale imports from the free market, it seems that in 1974 there was a partial return to more normal trading patterns; Cuba has returned to her former position of being the sole foreign supplier to the USSR, deliveries at 1·85 million tons being the highest since 1970.

Soviet exports of sugar remained somewhat limited in 1974, both in quantity and in the number of destinations involved. The total of 117,000 tons compares with 46,000 tons in 1973 and 64,000 tons in 1972; in 1971, a total of 1·4 million tons was exported to a wide selection of outlets throughout the world.

Czarnikow notes: "At present it seems doubtful that there will be a swift return to a volume of exports of this order, although such is the scale of Soviet production that only a minor change in percentage yields can have a sizeable effect upon the final tonnage produced".

	1974	1973	1972
Imports	——(*metric tons, raw value*)——		
Argentina	0	15,877	0
Australia	0	75,933	119,564
Brazil	0	458,451	299,755
Colombia	0	60,611	10,000
Costa Rica	0	15,600	0
Cuba	1,855,571	1,603,326	1,101,379
Czechoslovakia	0	21,740	21,740
Dominican Republic	0	99,962	23,152
Ecuador	0	0	10,617
France	0	0	53,738
Germany, East	0	0	81,525
Guatemala	0	27,461	0
Holland	0	0	10,870
Mauritius	0	12,259	25,187
Nicaragua	0	10,297	0
Peru	0	96,834	0
Poland	0	108,698	108,700
Salvador	0	23,706	24,196
Venezuela	0	0	34,019
	1,855,571	2,630,755	1,924,442
Exports			
Afghanistan	54,075	10,999	18,446
Finland	30,024	0	188
Iran	0	0	5,870
Korea, North	0	0	5,452
Mongolia	18,967	24,462	23,484
Vietnam, North	8,640	10,875	10,747
Yemen	5,408	0	0
	117,114	46,336	64,187

Spanish sugar requirements

It was announced recently in an official bulletin[2] that Spain will have to import about 300,000 metric tons of sugar this year to offset a shortfall in domestic production and meet an annual consumption estimated at over one million tons. This compares with imports of 78,777 tons in 1973 and 57,467 tons in 1972[3]. Meanwhile the retail price of sugar has been raised from 22 to 52·50 pesetas per kilo, which may have an inhibitory effect on the country's sugar consumption. The move follows a recent price rise to domestic beet producers aimed at stimulating production.

* * *

World sugar production

F. O. Licht K.G. have recently published[4] their third estimate of world sugar production for the crop year September 1974/August 1975. A further reduction in overall production is forecast by comparison with the second estimate[5], and this is now set at 79,503,080 metric tons, raw value, as against 79,924,850 tons earlier, and a 1973/74 figure of 80,755,523 tons.

The cane sugar figure is almost identical with the second estimate, at 49,473,320 tons, while the beet sugar estimate is now 30,029,760 tons instead of 30,458,000 tons. The slight difference in cane sugar production hides the self-cancelling effects of large changes in individual countries, Cuban production being reduced by 800,000 tons owing to the effect of drought. This is offset by a 400,000-ton increase in the Brazilian estimate which, at 7,600,000 tons, places Brazil well above the next cane sugar producer and less than a million tons behind the USSR which remains the largest beet sugar producer at 8,500,000 tons.

Colombia's production is set 150,000 tons higher than the earlier estimate, while the Philippines crop is down by 200,000 tons. The Indian figure is raised substantially, however, by 350,000 tons to bring it to 4,500,000 tons.

The beet sugar crops in almost all countries were completed when the third estimate was published, at the beginning of February, and, apart from the USSR, most of the larger crops were known with a

[1] *Sugar Review*, 1975, (1224), 53, 55.
[2] *Public Ledger*, 29th March 1975.
[3] *I.S.O. Stat. Bull.*, 1975, **34**, (2), 95.
[4] *International Sugar Rpt.*, 1975, **107**, (5), 1–4.
[5] *I.S.J.*, 1975, **77**, 63.

more or less high degree of accuracy; the reduction in the beet sugar production estimate thus reflects the adjustment to earlier assessments made before the end of the campaign.

* * *

UK refiners cut output

As sugar stocks pile up, output from UK refineries has dropped, a 40% reduction in the April figure being indicated[1]. Tate & Lyle were reported to have 70,000 tons of refined sugar in stock, which is more than four times the normal quantity for late April. While the company said that they were not anticipating having to dismiss workers at the time, overtime had been cut, although it was hoped that the period of low demand would be a short one. The company also admitted that it had been responsible for importing refined and packed sugar from the EEC when it had no raw sugar to refine. But now EEC white sugar "has been sucked into the vacuum left by last year's shortage".

* * *

Europe beet area, 1975

F. O. Licht K.G. have recently published[2] revised estimates of European beet areas for 1975. The figures are as follows:

	1975	1974
	hectares	
Belgium	110,000	104,426
Denmark	85,000	68,000
France	550,000	504,000
Germany, West	428,000	374,289
Holland	130,000	115,648
Ireland	33,300	25,600
Italy	235,000	190,000
UK	198,300	182,342
Total EEC	1,769,600	1,564,384
Austria	59,785	53,666
Finland	23,500	22,319
Greece	42,100	27,000
Spain	160,000	127,918
Sweden	52,300	46,500
Switzerland	11,400	10,417
Turkey	205,500	184,959
Yugoslavia	117,000	100,443
Total Western Europe	2,441,185	2,137,617
Albania	6,000	6,000
Bulgaria	62,700	58,000
Czechoslovakia	200,000	190,000
Germany, East	266,000	236,000
Hungary	129,000	98,338
Poland	500,000	440,000
Rumania	275,000	250,000
USSR	3,690,000	3,579,000
Total Eastern Europe	5,128,700	4,857,338
Total Europe	7,569,885	6,994,955

Commenting on the new figures, C. Czarnikow Ltd. point out[3] that it is "well known that several countries in Europe expect to expand the areas sown to beet this year. High world market prices for sugar, coupled with the element of economic nationalism which has been engendered by the downturn in world trade, have been a sufficient spur for countries to endeavour to seek self-sufficiency or to enter the world market as sellers while such a good return can be achieved. Nevertheless . . . it has come as something of a surprise that the revised figures are even higher (than the first estimates[4], already considered by some to be on the high side), although the adjustment is only 18,000 hectares."

A prime factor in the prospects for the next campaign is, of course, the weather. There has been some improvement in conditions during the few days up to the time of writing, sufficient to lend an air of optimism in certain quarters, so that the world sugar price has shown quite a sharp fall. Nevertheless, up to the third week of April, doubts were being expressed about the possibility of farmers fulling their targets in view of the waterlogged conditions in a number of Western European countries.

* * *

West Indies Sugar Association 1974 report

The adverse weather conditions which afflicted the sugar industries during the 1970–73 period continued into the growing period for the 1974 crop. In Barbados, where the 1974 crop was 12,000 tons below the previous 3-year average and about 22,000 tons below the previous 5-year average, rainfall in 1973 averaged 11·5 inches below the 126-year average, and distribution was poor. The number of smallholders delivering cane fell alarmingly despite increased prices paid for cane; the figure in 1974 was 11,000 compared with 18,000 in 1972.

In Guyana, excessive rain affected the autumn crop severely, and harvesting was markedly hampered, resulting in a considerable amount of cane carried over to the spring crop of 1974, which ended in late June and achieved an all-time record production of 163,095 tons of sugar.

Weather conditions were also an upsetting factor in Jamaica; although the total annual rainfall was only slightly below average, the pattern was one of drought followed by heavy rain, except on the north coast where good rainfalls prevailed throughout the year. Lack of rain also had a detrimental effect on cane in St. Kitts and in Trinidad.

* * *

Beet sugar industry proposal for north-eastern US

It is reported[5] that a group of businessmen in the state of New Jersey are interested in the development of a beet sugar industry in the southern part of that state. Their newly formed company, Nordic Sugar Corporation, has expressed a wish to purchase the long-idle sugar beet factory at Easton, Maine. While the state authorities of Maine, owners of the factory, have indicated in the past that they would sell the factory only if it could be operated where it is, they have suggested that, if they failed to receive a satisfactory offer for operation of the factory in Maine, they would reluctantly consider bids which call for it to be moved out of the state. While a large number of farmers are willing to support a beet sugar scheme in New Jersey, there is a sizeable opposition from others, including some who fear that so much of the already-limited farm land would be taken for beet agriculture that present major crops would suffer.

---

[1] *The Times*, 22nd April 1975.
[2] *International Sugar Rpt.*, 1975, **107**, (13), 1.
[3] *Sugar Review*, 1975, (1228), 69.
[4] *I.S.J.*, 1975, **77**, 130.
[5] *Sugar y Azúcar*, 1975, **70**, (4), 18.

Direct analysis and evaluation of sugar cane

By E. HUGOT

(Sucreries de Bourbon, Réunion)

Paper presented to the 15th Congr. ISSCT, 1974

Introduction

IN cane sugar manufacture, one has constantly to determine the quality, or sugar producing value, of the cane delivered to the factory. This is usually cane from growers, who are paid according to the percentage of sucrose or of recoverable sugar in their cane. But the sugar factory also needs to know the sugar value of the cane grown on its own estates in order to compare different varieties grown, and to determine the influence of the soil, the effect of harvesting time in relation to the season, the age of the cane, the quantity or kind of fertilizer used, etc., upon the sucrose % cane. With the same object, experiments are generally systematically carried out, either by the factory itself or by Experiment Stations, to compare the cane from various plots of an experiment.

METHODS

There are several processes for the analysis of sugar cane and they can be classified under two headings:

(*a*) The methods using the *primary juice*, i.e. the first extracted juice or the first mill juice from a sample of cane passing through this first mill.

(*b*) The so-called *direct analysis* methods, using a sample taken from the cane consignment to be analysed, the analysis being made in a laboratory.

Methods using the primary juice

The methods dealing with the first mill juice have some advantages:

(*a*) The sample may be made of almost the total consignment of cane. The juice may be sampled either by hand or automatically the whole time during which the consignment is passing through the first mill. If a consignment is, for instance, of 10 tons of cane and if the factory grinds 120 tch, the juice obtained is sampled during the 5 minutes taken by these 10 tons passing through the mill. No sampling is done during the first few seconds, in order to ensure that the juice of the preceding consignment has been completely washed out; sampling ceases in the last few seconds of the process to avoid any risk of mixing with the next consignment. At the same time, samples of cane coming from the sets of knives or the shredder are continuously taken for fibre determination.

(*b*) Such a method ensures an analysis bearing on the actual proportions of clean cane, trash, tops, etc. of the consignment.

On the other hand, there are serious drawbacks to these methods:

(*a*) It is not easy to sample the cane so that the sample is representative, because the fan-effect of the knives and of the shredder involves a differential sedimentation of the pieces in the layer on the carrier from the knives. The later and heavier pieces sink first to the bottom while the lighter ones, including green and dry leaves and dry stems, fall last onto the upper part of the layer. These light pieces are of very high fibre percentage. Therefore, the sample must include in their right proportion all the strata of the bed, as otherwise the fibre value found is either erratic or systematically wrong. This difficulty has been overcome by sampling on the rising section of a rake conveyor running over a trap-door which opens to engulf, on its whole width, the whole length of the heap of cane pieces being pushed between two rakes.

(*b*) The Brix and purity of the primary juice depend on the percentage of juice extracted by the mill[1]. This percentage depends on the setting of the mill, on the amount of pressure applied and principally on the immediate volume of cane gripped by the mill, the upper roller of which may lift or keep still. It follows therefore that, for the same cane, Brix and purity vary from factory to factory, and also in the same factory, from moment to moment.

This is why some countries have given up first extracted juice analysis for primary juice analysis, that is to say whole dry pressure juice (first mill juice, or crusher + first mill juice in tandems with a crusher). First extracted juice is much more dependent on the above factors (setting, pressure, ratio between feed and delivery work openings, immediate volume of feed) than primary juice; it contains only about 40 to 50% of the absolute juice sucrose, against 60 to 75% for the primary juice. It is plain that the nearer one comes to 100%, the less is the influence of the error and the inaccuracy factors. This influence would of course fall to zero at 100%, but this maximum is unfortunately out of reach of a mill.

Methods by direct analysis

Lack of comparability and the variations mentioned have prompted some factories and countries to give up even the primary juice analysis method. As far as cane payment on a quality basis is concerned, the obvious drawback for the growers was the discrepancy between the results of various factories, particularly obvious in the case of a grower dividing his canes between two factories. The growers' associations have requested an analytical method not dependent on the factory machines and able to supply comparable results for all factories in a country.

These countries therefore decided on direct analysis, which eliminates some of the difficulties but has others, namely:

(*a*) It allows only very small samples, compared to the total weight of the consignment, with possibilities of error particularly if the consignment is heterogeneous or mixed.

(*b*) It requires special equipment, i.e. a laboratory mill or a hydraulic press.

The hydraulic press is to be preferred, because the laboratory mill does not allow for accurate control of the pressure and the general conditions of juice extraction, therefore reproducing the same drawbacks as the big mills. The sample must be thoroughly prepared and always in the same uniform way, for

[1] HUGOT: "Handbook of cane sugar engineering", 2nd Edn. (Elsevier, Amsterdam.) 1972, pp. 335–338.

instance by a "Jeffco" cutter-grinder. The press must have a fixed pressure, a fixed time for reaching that pressure, a fixed time for keeping the sample under pressure, and a fixed diameter and capacity of the press pot in order to obtain comparable results. One may for instance adopt a pressure-rising time of 20 seconds, a pressure-retaining time of 90 seconds, a pressure of 400 bar and a pot diameter of 145 mm. The pot must be pierced with numerous holes and samples must be of fixed weight. The rise in pressure is carried out by a pump which is automatically stopped at the fixed pressure, this pressure being also automatically broken at the fixed moment by a clockwork switch.

The direct analysis offers some advantages:

(*a*) It is more speedy and thus allows for a greater number of analyses. It is even possible to analyse all consignments.

(*b*) The analyses can be made even when the mill is idle.

(*c*) The cane arriving during daytime and stored for the factory night work can be analysed on arrival.

(*d*) The results are comparable between factories and all along the crop for every factory.

(*e*) The fibre may be determined by weighing the cake coming out of the press, since a correlation may be worked out between its weight and the fibre of the cane sampled, leading to a formula of a very straightforward type, $f = mb$, b being the weight of the cake of press bagasse % cane. This correlation is not perfect, but it is sufficient on account of the great number of analyses made for every grower, and it provides a neat solution to the difficult problem of fibre determination.

Process

Here is a direct analysis process. Let us assume we are dealing with a grower's cane payment and that the cane is sent to the factory by truck, trailer or rail truck. Just after the weighbridge, a core-sampler is placed on rails along the path of the trucks or trailers. There are several types of samplers: the Hawaiian or American core-sampler, the French FAPMO, or the moving sampler-fitted tractor. The sampling probe is a 150 or 200 mm diameter tube which can revolve at 450 or 600 rpm while moving forward, with the mouth fitted with a saw all around its edge. The driver, sitting on the seat and driving the sampler, can move it along the rails which are 6 or 8 metres long; he can also lift or lower the tube. He places the sampler where he wants on the rails, sets the tube in motion and takes four samples: one up at the rear, one low nearer the middle, one up further forwards, and one low at the front, taking care not to sample either end of the cane stems, when they are stowed in orderly bundles, but preferably towards the middle, upper or lower third of their length. A piston, set in motion by a push-button or a lever, extracts the core sample from the tube and drops it in a bucket which is taken to the laboratory with a tag giving the analysis weighbridge number. The sample is thoroughly mixed and passed through the "Jeffco" cutter-grinder. A certain quantity, for instance 1000 g, is weighed and transferred to the press pot. The piston of the press is set in motion, the pressure reaches 400 bar, remains 90 seconds at this pressure, and the pressure is broken. The juice extracted is collected in two 200 ml settling tubes, one of which is kept only for possible checking; the Brix (preferably refractometric) is measured and, after defecation by Horne's dry basic lead acetate and filtration, the pol is read on an electronic automatic saccharimeter. The press cake is removed from the pot and weighed. From this are obtained: the fibre, given by the correlation scale or formula; the pol; the Brix and thus the purity. These are the factors which will make possible the calculation of the percentage of recoverable sugar.

Recoverable Sugar Formulae

It is not the sugar % which gauges cane quality, but the quantity of sugar the cane will permit an efficient factory to recover. This quantity, reckoned as a percentage, is referred to as RS = recoverable sugar.

The recoverable sugar may be calculated by means of various formulae from the factors given by the analysis.

Ideal or average efficiency

The formulae that we are going to study may be derived according to two different hypotheses: it may be decided either to compare the factory efficiency to an ideal efficiency matching the best results obtained in the world or to compare it with the average results recorded in the country.

As a matter of fact, the choice is not as important as it might appear at first sight, because these formulae are made up of two independent components: (*a*) the body of the formula including the three quality factors (f, B and S or P); (*b*) a numerical coefficient bringing this body to the selected value which may be chosen to correspond to the practical level in the country. It is thus possible to arrive at this practical level either with an ideal efficiency formula admitting a low coefficient, or with an average efficiency formula with a higher coefficient. The discrepancies between these two systems are of little importance and the formulae based on an ideal efficiency offer advantages: (1) The determination errors, chiefly those concerning fibre or purity, bear less incidence on the exactitude of the results. (2) Being derived from ideal bases, these formulae may be put into general and universal use, making possible comparisons between countries. We strongly recommend these ideal efficiency formulae and it is these formulae that we shall study; we will merely quote the average efficiency.

Primary juice analysis

Before studying direct analysis, it is useful and interesting to recall the mill juice analysis formulae.

The derivation of the best formula to apply in this case has already been given[1]. It is based on the following hypotheses:

(*a*) That it is the RS which is sought.

(*b*) That ideal efficiency is adopted, measured by:

Reduced extraction = 97·5%.
No loss in the filter cake; no undetermined losses.
Final molasses exhausted to about 29 purity.

(*c*) That the factory efficiency is measured by the k coefficient which compares the factory efficiency with the above ideal efficiency.

The formula reads[1] (see Appendix 1):

$$RS = k\,(1 - 1{\cdot}65f)\,(S - 0{\cdot}3B) \qquad (1)$$

where RS = recoverable sugar to be obtained. It

may be reckoned at 94°, at 96°, at 98° or as white sugar, according to the official regulations or to the stipulations between growers and manufacturers. f = fibre fraction in the cane (0·14 for instance); S = pol of the primary juice; and B = Brix of the primary juice.

According to the standard sugar agreed on and to the factory efficiency, the coefficient k varies (as a rule between 1·32 and 1·40, for 98° sugar).

We must state that the coefficient 1·65 which applies to factor f in formula (1) is specific to mill analysis; this formula can apply to direct analysis only provided that a lower coefficient be substituted for 1·65.

Average efficiency formula.—If the following conditions were substituted for the above ideal ones:

Reduced extraction = 95%.
Final molasses exhausted to about 39 purity.
Losses in cake and undetermined losses kept at zero, to be merely included in the k efficiency coefficient,

the formula would become (see appendix 3):

$$RS = k(1 - 1{\cdot}8f)(S - 0{\cdot}4B) \quad \ldots\ldots\ldots\ldots (1')$$

k then varies between 1·65 and 1·75.

Formulae (1) and (1′) show the great influence of the fibre in the mill analyses. This results, as shown by HOARAU[2], from the important lowering effect of the fibre on the ratio of sucrose % absolute juice to pol of primary juice. This means that if a mill grinds two canes of the same juice but of different fibre, all other things being equal, the pol of the extracted juice of the high fibre cane will be positively higher than that of the low fibre cane, and not the same, as is often believed. Formulae (1), (1′) show how much the fibre must be penalized to counterbalance this effect.

As noted for 1·65 of formula (1), the coefficient 1·8 of formula (1′) is specific to mill juice analysis.

Direct analysis

Having regard to the condition that the coefficient 1·65 must be changed, formula (1) may also be applied to direct analysis. The fibre lowering effect was denoted in the mill formula by the factor $(1 - 0{\cdot}57f)$[1]. In the 400-bar press, it is denoted by the factor $(1 - 0{\cdot}33f)$. Proceeding as for formula (1) (see Appendix 1), we have:

$$ES = K_2S(1 - 0{\cdot}33f)(1 - f)(1 - 0{\cdot}2f)$$
$$= K_2S(1 - 1{\cdot}53f + 0{\cdot}596f^2 - 0{\cdot}066f^2).$$

The term: $n = (1 - 0{\cdot}33f)(1 - f)$ may be found by direct determination: $n = 1 - 1{\cdot}285f$. The polynomial in f may be replaced, for normal values of f, by $(1 - 1{\cdot}45f)$ and the formula becomes:

$$RS = k(1 - 1{\cdot}45f)(S - 0{\cdot}3B) \quad \ldots\ldots\ldots\ldots (2)$$

with an approximation of the same order as that of formula (1).

We strongly recommend formula (2) and the 400-bar press. However, there is another type of formula. The idea is to determine the sucrose % cane and to deduct the normal losses to be expected.

The sucrose % cane R is easily obtained, thanks to HOARAU's experiments. Let:

E_J = weight of juice extracted by the press % juice in cane,
E_S = weight of sucrose extracted by the press % sucrose in cane,
S_A = sucrose % absolute juice, and
S_E = sucrose % extracted juice.

Let:

$$C = \frac{S_A}{S_E}$$

We have by definition:

$$Es = \frac{E_J \,.\, S_E}{1 \,.\, S_A}$$

whence: $C = \dfrac{S_A}{S_E} = \dfrac{E_J}{E_S}$

This formula, or HOARAU's formula, is very important in direct analysis. It reads: *the ratio of sucrose % absolute juice to sucrose % extracted juice is equal to the ratio of juice extraction to sucrose extraction.* This simple and almost plain relationship had, as far as we know, never been stated nor used. Ignoring or neglecting it has led many technologists to assume $C = 1$, an approximation which, in direct analysis, involves a serious error and underestimates the penalty that should be imposed on fibre.

Direct analysis is then quite straightforward and easy: the pol S_E of the extracted juice is read on the saccharimeter and we have:

$$R = C(1 - f)\,S_E.$$

Putting: $C(1 - f) = n \qquad R = n.S_E.$

For the 400-bar press, n_{400} is given with good approximation by:

$$n_{400} = 1 - 1{\cdot}285f$$

whence:

$$R = (1 - 1{\cdot}285f)\,S_E.$$

For the 100-bar press, we would have had: $n_{100} = 1 - 1{\cdot}375f$.

Once the sugar % cane, R, is thus known, we must now find out the recoverable sugar RS. To this end, we shall split up the manufacturing losses into their components:

(*a*) *Sucrose lost in bagasse.* The only factor pertaining to cane in the extraction process is the fibre f. All other factors are related to the mill, to imbibition, pressure, setting, etc. . . . leaving only fibre to characterize the sucrose extractability of the cane. (It is unfortunately true that two varieties of the same fibre may sometimes not have the same extractability, but it is not easy to take this property into account). As for the standard extraction to choose, the maximum may be selected, as in formula (1), i.e. 0·975; or 0·95 as in (1′). For reasons already explained, we shall choose the first, whence the loss in bagasse will be set at $2{\cdot}5f$.

(*b*) *Sucrose lost in cake, molasses and undetermined losses.* Admitting the above assumption, the sucrose obtained after the milling plant is: $R - 2{\cdot}5f$. If we assume a sugar purity of 99°, final molasses of 30° purity, and a difference of 3 units between the purity of the press extracted juice and the purity of the mixed juice, we have, owing to the loss in final molasses:

$$(R - 2{\cdot}5f)\,\frac{99\,(P - 3 - 30)}{(P - 3)\,(99 - 30)}$$
$$= 1{\cdot}435\,(R - 2{\cdot}5f)\left(1 - \frac{30}{P - 3}\right)$$

[2] *I.S.J.*, 1969, **71**, 330-331.

Assuming the sucrose lost in the cake and in the undetermined losses to be 2·4%, we finally have:

$$RS = 1{\cdot}435\,(R - 2{\cdot}5f)\,0{\cdot}976\,(1 - \frac{30}{P-3})$$

$$= 1{\cdot}4\,(R - 2{\cdot}5f)\,(1 - \frac{30}{P-3})$$

or:

$$RS = 1{\cdot}4\,[(1 - 1{\cdot}285f)\,S - 2{\cdot}5f]\,(1 - \frac{30}{P-3}).$$

The efficiency being assumed maximum, this result will generally have to be reduced by a "coefficient of work" k:

$$RS = 1{\cdot}4\,k\,[(1 - 1{\cdot}285f)\,S - 2{\cdot}5f]\,(1 - \frac{30}{P-3}) \quad \ldots\ldots\ldots(3)$$

With average efficiency, we would have found:

$$RS = 1{\cdot}63\,k\,[(1 - 1{\cdot}285f)\,S - 5f]\,(1 - \frac{40}{P-3}) \quad \ldots\ldots\ldots(3')$$

the coefficient of work being higher in this case (and eventually $\geqslant 1$).

The systematic errors introduced by the possible but unfortunately frequent shortcomings of the sampling (for instance manual sampling) and/or analysis process sometimes lead to a substitute for S, a term αS, α being a coefficient which can be of the order of magnitude of 0·9 and even lower, to be accurately determined by practical tests.

Remark. An empirical simplified formula might be substituted for formula (3'):

$$RS = [(1 - 1{\cdot}285f)\,S - 5f]\,\frac{P-2}{100} \quad \ldots\ldots(3'')$$

It is easy to verify that:

$$y_1 = 1{\cdot}63\,(1 - \frac{40}{P-3})$$

gives values quite close to those of:

$$y_2 = \frac{P-2}{100}.$$

Precision. The theoretical approximations we accepted introduce only a maximum error of 0·25%, even with P values as extreme as 80 or 92. But the main drawback of this type of formula comes from the fact that it is liable to a bigger error on extraction loss than is formula (1). This is why we recommend the latter.

Conclusion

The formula to be recommended in direct analysis is:

$$RS = k\,(1 - 1{\cdot}45f)\,(S - 0{\cdot}3\,B)$$

the coefficient 1·45 applying to the 400-bar press. It must be modified for other pressures, i.e. higher for lower pressures and lower for higher pressures.

APPENDIX 1

Primary Juice Analysis—Formula

Let:

R = sucrose % of the cane under consideration.
S_A = sucrose % absolute juice of this cane.
f = fibre per unit of this cane.
X = sugar recoverable from this cane (or: "RS").
B = Brix of primary juice furnished by the first mill (or by the combination of crusher and first mill).
S = pol % primary juice.
P = apparent purity of primary juice = 100 S/B.
P' = Clerget purity of mixed juice obtained from this cane.
M = Clerget purity of the final molasses.

The sucrose entering the factory, % on cane, is: $R = S_A\,(1 - f)$.

Being unable to extract the absolute juice, we must be content to deal with the extracted juice, i.e. the primary juice. We may therefore write:

$$R = k_1 S\,(1 - f) \quad \text{where} \quad k_1 = \frac{S_A}{S}$$

The losses in mud and the undetermined losses are small. Besides, we have some discrepancies resulting from the use of pol instead of sucrose, of Brix instead of dry substance, of apparent and Clerget purity instead of true purity, and, in the final result, of sugar instead of sucrose. We shall include those losses and those discrepancies together in a second coefficient k_2. To obtain the recoverable sugar, it remains to calculate the two major losses: loss in bagasse and loss in molasses.

(1) *Loss in bagasse.* Let:

β = sucrose lost in bagasse % cane.
σ = sucrose % bagasse.
f' = fibre per unit of bagasse.

We have:

$$\beta = \sigma \cdot \frac{f}{f'}.$$

We must fix the standard efficiency to set as a basis. If the loss in bagasse must correspond to a standard extraction e_o for a standard fibre f_o, we shall have:

$$\frac{\beta}{R} = \frac{f}{f'} \cdot \frac{\sigma}{R} = 1 - e \text{ whence: } \frac{\sigma}{R} = \frac{f'(1-e)}{f}$$

and we require:

$$\frac{\sigma}{R} = \frac{f'(1-e_o)}{f_o}$$

The following must then hold:

$$\frac{\beta}{R} = \frac{f}{f'} \cdot \frac{f'(1-e_o)}{f_o} = \frac{(1-e_o)f}{f_o}$$

The sugar obtained after the milling plant will be:

$$ES = k_1 k_2 S\,(1-f)\,[1 - \frac{(1-e_o)f}{f_o}]$$

We must now fix the standard values for f_o and e_o. The classical and standard figure for standard fibre is: $f_o = 0{\cdot}125$. For e_o, following the above rule (see "Ideal or average efficiency"), we shall choose: $e_o = 0{\cdot}975$ since there are tandems exceeding 97% and since diffusion makes such extractions readily attainable.

Hoarau[2] has shown that k_1 is a function of f and he has given the range of variation for all the Réunion factories. The good correlation between the graph obtained and the individual value found for widely different tandems and factories (see Fig. 1 and Appendix 2) allows the results to be generalized and expressed with good precision by the formula: $k_1 = 1 - 0{\cdot}57f$.

Substituting the values of k_1, f_o and e_o in the above ES equation, we have:

$$ES = k_2 S(1 - 0{\cdot}57f)(1 - f)(1 - 0{\cdot}2f)$$

or:

$$ES = k_2 S(1 - 1{\cdot}77f + 0{\cdot}884f^2 - 0{\cdot}114f^3)$$

f being small, the terms in f^2 and f^3 are still smaller and have little effect compared with the term in f. If we retain only the latter and modify it to give it the same value as the whole polynomial in f would have for a mean value of f, for instance: $f = 0{\cdot}135$, the sucrose obtained after the milling plant becomes:

$$ES = k_2 S(1 - 1{\cdot}65f)$$

and it is readily shown that the approximation thus adopted involves an error not exceeding 0·4% (say: 4 parts per 1000) for extreme values of f such as 0·10 and 0·16.

(2) *Loss in molasses.* If we take a standard purity M for the final molasses, the final quantity of sugar recovered from the cane under test will be:

$$X = k_2 S(1 - 1{\cdot}65f)\frac{100(P' - M)}{P'(100 - M)}$$

or:

$$X = k_2 \cdot \frac{100}{100 - M} \cdot S(1 - 1{\cdot}65f)\frac{P' - M}{P'}$$

but:

$$S = \frac{BP}{100}$$

hence:

$$X = k_2 \cdot \frac{B}{100 - M}(1 - 1{\cdot}65f)\,P \cdot \frac{P' - M}{P'}$$

Now:

$$P \cdot \frac{P' - M}{P'} = P - \frac{P}{P'}M.$$

If, following the same rule, we choose a standard purity of molasses M such that:

$$M\frac{P}{P'} = 30$$

which corresponds closely to: $M = 29$, a value close to the classical figure $M = 28{\cdot}57$, we shall have:

$$X = k_2 \cdot \frac{100}{100 - M} B(1 - 1{\cdot}65f)\frac{P - 30}{100}.$$

Putting:

$$k_2 \cdot \frac{100}{100 - M} = k$$

and commenting that:

$$B\frac{P - 30}{100} = S - 0{\cdot}3B$$

we finally have:

$$X = RS = k(1 - 1{\cdot}65f)(S - 0{\cdot}3B).$$

APPENDIX 2

Formula $(1 - 0{\cdot}57f)$

HOARAU[2] made a great number of press experiments at a pressure of 100 kg.cm^{-2} and arranged the various fibres found in the following series:

Fibres between 0·0975 and 0·1024 = series 0·100
Fibres between 0·1025 and 0·1074 = series 0·105
Fibres between 0·1075 and 0·1124 = series 0·110

and calculated by the regression formula the value of the C coefficient for each series. These values are given in columns 2 and 3 of Table I. He compared the values thus obtained with those given by the chemical control of the 12 factories of the island and established that the sucrose % of the factories

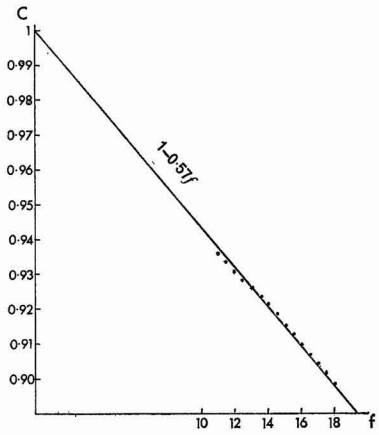


Fig. 1. Relation between coefficient C and fibre f (%) as determined by HOARAU.

tallied quite well with the B, S, f values of the control, provided that the C coefficient used is the one found for the press reduced by 1·85%; the correlation was equally good with the weekly figures of the various factories.

Table I gives in column 4 the C_f values $= 0{\cdot}9815\,C_p$, and we added column 5 giving the values of $(1 - 0{\cdot}57f)$ and showing the high correlation with column 4.

Table I

1	2	3	4	5
Fibre % cane	*Cp*		*Cf*	
f	*calculated*	*observed*	(=0·9815*Cp*)	(1—0·57*f*)
0·100	0·959	—	0·941	0·943
0·105	0·956	0·956	0·938	0·940
0·110	0·954	0·955	0·936	0·937
0·115	0·952	0·952	0·934	0·934
0·120	0·949	0·950	0·931	0·932
0·125	0·947	0·944	0·929	0·929
0·130	0·944	0·942	0·927	0·926
0·135	0·942	0·942	0·925	0·923
0·140	0·939	0·937	0·922	0·920
0·145	0·936	0·934	0·919	0·917
0·150	0·933	0·931	0·916	0·915
0·155	0·930	0·932	0·913	0·911
0·160	0·927	0·925	0·910	0·909
0·165	0·924	0·925	0·907	0·906
0·170	0·921	0·922	0·904	0·903
0·175	0·918	—	0·901	0·900
0·180	0·915	—	0·898	0·897

APPENDIX 3

Primary Juice Analysis—Average Efficiency Formula

We follow the same procedure as in Appendix 1, with the only difference that we substitute extraction $e_o' = 0{\cdot}95$ for standard extraction $e_o = 0{\cdot}975$ and final molasses purity M_1 for M, such that:

$$M_1 \cdot \frac{P}{P'} = 40.$$

It becomes:

$$1 - \frac{(1 - e_o)f}{f_o} = 1 - 0{\cdot}4f$$

and:

$$(1 - 0{\cdot}57f)(1 - f)(1 - 0{\cdot}4f) = 1 - 1{\cdot}97f + 1{\cdot}198f^2 - 0{\cdot}228f^3$$

which, for mean value of $f = 0{\cdot}135$, gives the same result as: $1 - 1{\cdot}8f$, this latter expression not departing from the polynomial in f^2 and f^3 by more than 0·8% for the extreme values: $f = 0{\cdot}10$ and $f = 0{\cdot}17$.

Taking: $M_1 \cdot \frac{P}{P'} = 40$, we finally have:

$$X = RS = k(1 - 1{\cdot}8f)(S - 0{\cdot}4B)$$

Summary

Formulae are given to be used for estimating the recoverable sugar of a consignment of cane. Direct analysis is compared with analysis by means of the factory first mill juice and attention is drawn to the necessity of taking into account the effect of the fibre in both cases, an effect which is more important in the mill than in the press.

The reduction of sugar loss in a cane sugar refinery

By J. A. WATSON*

THE shortage of sugar and its current high price make the minimizing of loss during processing a matter of most urgent importance. The world production of raw cane sugar during recent years has averaged just over 50,000,000 tons. An optimistic level of 1·0% average loss would mean that the refineries are destroying 500,000 tons per year valued at around £150–£200,000,000 at current world prices. The actual level is probably very much higher and may well reach 1,000,000 tons at a world price value up to £400,000,000. The size of these figures indicates the size of the problem. It is not suggested that all the sugar could be saved; the nature of the refining process is such that some loss is inevitable. It is, however, suggested that there is a lot that could be done in most refineries towards bringing about worthwhile savings with benefits both to the world food supply and to company finances. This paper is presented in the hope that it will provide some help towards making this possible.

The first and most elementary precaution is to be aware of the problem, of its size and its importance. It is a useful discipline to think of all aspects of refinery operations and efficiency in terms of money; it is possible then to assess their relative effects on the well-being of the company. This habit, seemingly so basic, is very often ignored, with the result that changes made for good in one department or operation may actually cause more money to be wasted than is saved because of countervailing effects elsewhere.

Second, an efficient accounting system is an essential so that the level of the loss can be measured correctly. This means not only accurate weighing of the sugar entering the refinery and of all products leaving it, but also a reliable means of measuring sugar stock in process, that is, sugar that has entered the refinery and is in various stages of the refining process and has thus not yet been officially counted as packed. This means that all tanks, pan receivers etc., must be accurately calibrated so that their contents may be measured, which is perhaps most conveniently done by the dry dip method, that is, by measuring the distance between the top of the tank and the level of the material it holds. There must also be provided a means for obtaining a good average sample of the vessel's contents. What one should measure as a criterion of the loss level is a matter of some difference of opinion but the author believes that it is simplest and most basic to estimate the weight of input solids lost. This can later be broken down into any other factors desired, sucrose loss, invert gain, etc. Loss figures quoted in this paper are expressed on a solids basis. How frequently the level of loss should be determined is also a matter of choice. It is suggested that it should be accurately measured at intervals of not more than six months and more frequently is desirable. About six times a year is probably a useful compromise between too rarely and too frequently, but anything less frequent may mean a fault going undetected for some time.

The mechanics of carrying out the loss measurement are simple. The result will be tied to the refinery accounting period which may be a year but more probably will be six months. It is not possible simply to subtract the tons solids output from the tons solids input because of a probable stock-in-process difference. To correct for this the tons solids input into the refinery from the start of the current accounting period are added to the tons solids stock-in-process also measured at the start of the accounting period. From the total is subtracted the sum of the tons solids output for the period to date and the tons solids stock-in-process at the same time. The difference between the two is the tons solids loss in the current accounting period and this can be expressed as a percentage of the input. For example, if the loss is being measured at six monthly intervals, say the end of September and the end of March, then:—

Tons refinery input September–March = A
Tons stock-in-process at September = B
Tons refinery output September–March = C
Tons stock-in-process at March = D
Then (A + B) — (C + D) = Tons loss

It is important to remember that the refinery input consists not only of raw sugar but input from all sources; for example, sugar returned from customers for remelting must be added.

What is an achievable level of loss will depend on many factors; the site of the refinery, the age of the plant, the process employed, the nature of the products, etc. The author believes that in a well-run refinery under good conditions and without any complicating factors (such as the manufacture of inverted table syrup) a level as low as 0·75% on input solids can be achieved and maintained.

The control of sugar loss is usually nominally the charge of the technical department or more particularly the laboratory personnel. They will probably only be acting in an advisory capacity but it is important that the advice be accepted and acted on by those

* Former Chief Chemist, Tate & Lyle Refineries Ltd., Liverpool.

ASEA-WEIBULL

Fully automatic centrifugals with thyristor controlled d.c. motor drives

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

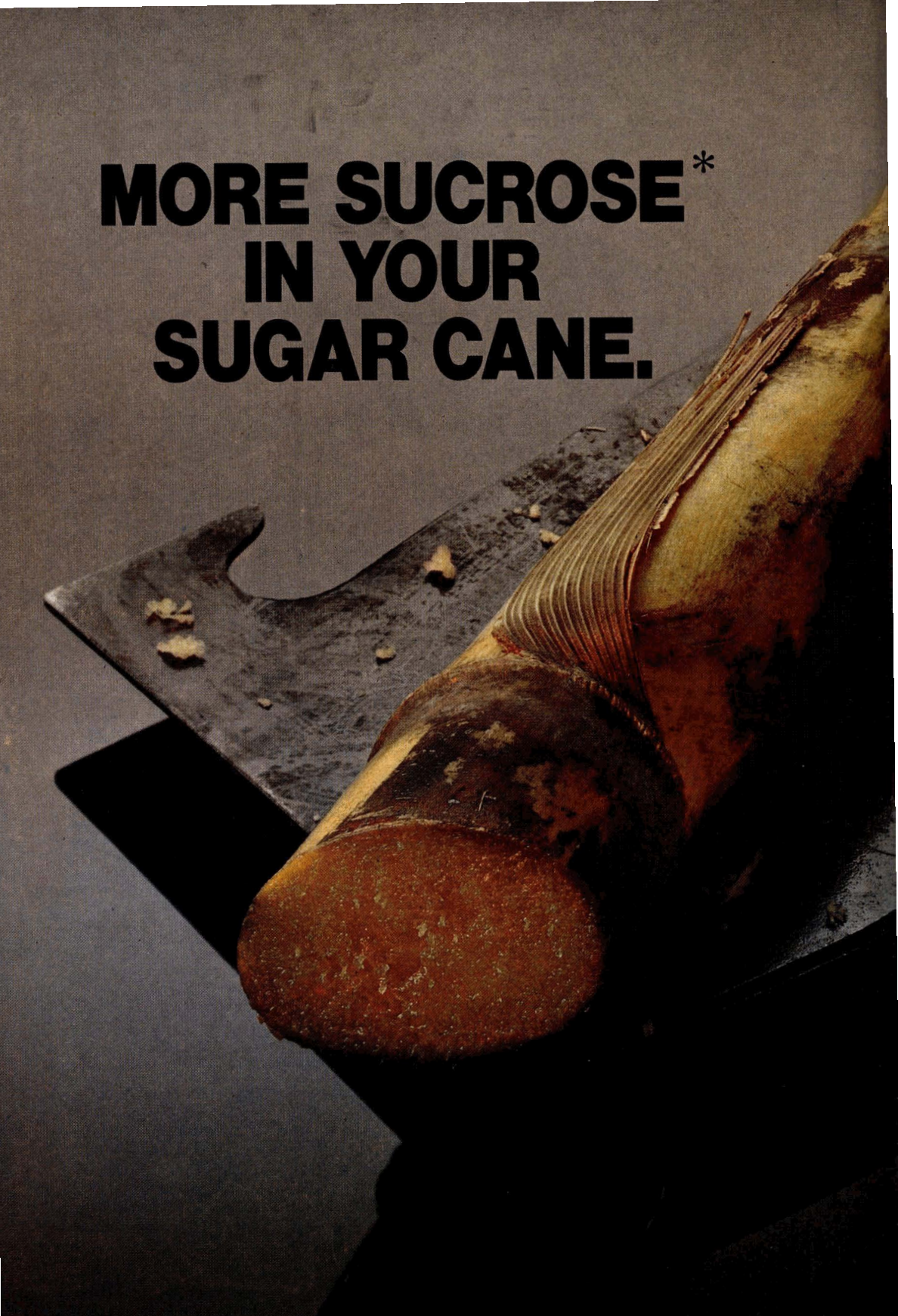
The outstanding ASEA thyristor controlled d.c. motor drive offers many advantages, such as variable speeds and acceleration rates, absence of current peaks and minimum power consumption.

ASEA-WEIBULL sugar centrifugals have built up a reputation for high quality of material and superb workmanship, giving reliable operation and making for a long life and low maintenance costs. Since 1956 more than 900 centrifugals have been delivered to beet and cane sugar factories and refineries throughout the world. The illustration shows a battery of seven 48″×42″ centrifugals for raw sugar affination installed at Arlöv Sugar Refinery, Sweden.

If you want to know more – Ask us!

ASEA
Industrial Department
S-721 83 Västerås, Sweden
Telex 407 20 ASEAVA S

ASEA


MORE SUCROSE*
IN YOUR
SUGAR CANE.

Introducing Polaris®. It can help you produce up to 15%* more millable sucrose from every ton of cane.

The world's first commercial sugar cane ripener, Polaris® plant growth regulator by Monsanto helps growers generate higher sucrose levels, in spite of most poor harvest ripening conditions.

What does Polaris do?

Polaris works in the following ways. First, it hastens ripening and increases sucrose levels during the ripening period when sucrose levels are normally rising. Secondly, Polaris minimizes declines in sucrose levels caused by rainfall during the ripening period.

How does Polaris help growers?

Poor weather conditions for natural cane ripening have always been a grower's major harvesting problem. Now, with Polaris, weather can be less of a factor. Because Polaris sugar cane ripener is at its best when conditions for natural ripening are at their worst — such as high constant temperatures; rain at ripening time; and excessive fertility. With Polaris, cane growers can obtain increased millable sucrose levels from their sugar cane —in spite of these poor ripening conditions.

How is Polaris applied?

Polaris should be applied by airplane early in the ripening and harvest periods.

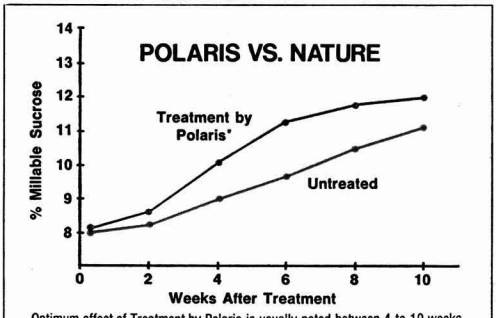
How do I know it will work?

Prove to yourself that Polaris works — leave a part of your field untreated, and compare with the Polaris treated cane at harvest time. This product is the result of 6 years research on more than 20,000 acres of sugar cane test plots in the United States and around the world. This research has shown that Polaris is effective on most major varieties of cane — either plant or rattoon.

Check with your local sugar cane specialist or with Monsanto (see coupon below) to determine recommended varieties and responses.

**The average varies between 0-15% more; depending primarily on the variety, time of application and climatic factors during the ripening period.*

Polaris doesn't increase or decrease the amount of millable tons of can per acre. Instead, **Polaris acts to increase the sucrose and purity levels,** primarily in the upper third of the cane stalk. Another frequent effect with Polaris can be the noticeable yellowing and drying of upper leaves. So, you not only get greater sucrose recovery, but can have less trash and improved trash burning at harvest.

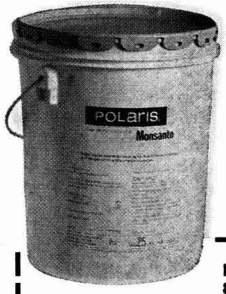


Optimum effect of Treatment by Polaris is usually noted between 4 to 10 weeks after application depending on geographical area. (Generalized response curve.)

Polaris is a major breakthrough in sugar cane management.

Monsanto would like you to know more about how Polaris sugar cane ripener can help you get more sucrose in your sugar cane. Clip the coupon below and send it to us for the full Polaris story. We'll send information on how you can put Polaris to work in your sugar cane fields this year including the EPA label for Polaris®

The world's first commercial sugar cane ripener:



POLaris®

PLANT GROWTH REGULATOR BY Monsanto

The Polaris label: As with all agricultural chemicals, please read and follow the Polaris label instructions carefully.

Monsanto Agricultural Products Company
800 North Lindbergh Boulevard C3NC
St. Louis, Missouri 63166

Please send me more information on Polaris® sugar cane ripener.

NAME_____

ADDRESS_____

TOWN_____STATE_____ZIP_____

SIEMENS

Central supervision and control of the crystallising process

To bring automation to sugar crystallisation, we have developed the viscosity/consistency transmitter and the relevant standardised automatic control and regulating equipment.

The transmitter is flanged to the pan. Its control panel can be set up separately or combined with others in a central control room, as shown.

The advantages of automation

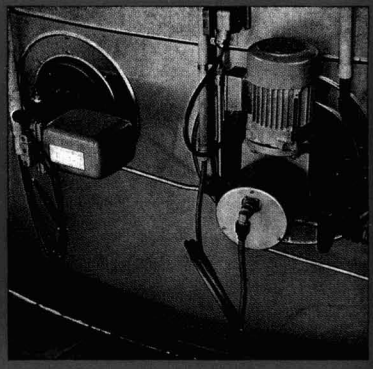
■ precise and reproducible measurement of the degree of supersaturation and of the crystal content enables exact determination of the seed point.

■ production of crystals of determined size and good quality gives consistently favourable massecuite for easier spinning and maximum output of crystals.

■ increased boiling-house production through smaller reboiling batches due to a lower proportion of false crystals and dust.

■ well-defined boiling time through preselection of process (set according to pilot strike).

For detailed information, write for our publications to:
Siemens Aktiengesellschaft, ZVW 13,
D 852 Erlangen 2, Postfach 3240.



Siemens automates crystallisation

responsible for refinery operations. Too often, for example, the correct level of refinery throughput and the correct level of refinery efficiency are considered incompatible. It is best if all aspects of loss are under the direction of one person who should be given sufficient authority to enable his recommendations and requests to have some force. It is suggested that he organize and run a course, or series of courses, where the importance of minimizing sugar loss can be represented to those responsible for refinery operations. The necessary precautions to be taken against loss should be explained and it should be pointed out that the benefits to be gained are not only monetary but aesthetic. It is more pleasurable to work in and better work is done in a clean and well-maintained refinery.

Refining loss can be split into two portions, known and unknown. The former consists of that portion which can be accounted for, for example char washing water to drain and overweights given away in packing. The remainder is the unknown portion and consists of the sugar which is destroyed during the refining process, or is lost mechanically without knowledge, or otherwise disappears without trace. It is not suggested that we have no knowledge of where all this sugar is going; the refining process is such that loss takes place during every operation, but we have no means of being able to quantify the loss at each stage.

It will be appreciated that the major portion of the savings which can be looked for will be obtainable from the unknown portion of the loss. It should be an urgent task to make a complete survey of the refinery to ensure that there are no places where sugar is going into the ground or into drains without knowledge. As re-arrangement of pipe flows and installation of new plant are a continuing process in most refineries it is necessary that such a survey be carried out at regular (but not of necessity frequent) intervals. Each pipe running into a drain should be clearly labelled with its function; any unlabelled pipe will thus become an object of suspicion. It must be appreciated also that such loss will not only take place through pipes; tiling or other floor covering in bad repair on the ground floors of buildings or in sumps can allow a surprisingly large quantity of liquid to drain through into the ground. The cost of making good such floors may often be paid for out of the savings made. Another source of unchecked loss might be any dust collectors used on the white sugar plant. These might be of either the wet or dry variety and though it is unlikely that any collector used in a refinery is 100% efficient they should be nearly so and the vents leading to the atmosphere should be checked occasionally to measure the level of dust loss.

Concerning refinery operations the nature of the process makes it impossible to operate without destroying sugar. The objective is to minimize the destruction. The reaction proceeds in two stages: first, inversion of the sucrose and then destruction of the invert, the governing factors being temperature, time and pH. Thus we should always follow two of the basic principles of good sugar refining practice, i.e. to work cool and keep liquid stocks low. These should be at the minimum required for process working; tanks should be considered things to empty, not to fill, but too often the exact opposite happens. The pH of high quality liquid stocks should be maintained at or above 7·0 or at least should not be allowed to fall much below this. A guide to the level of sucrose inversion and invert destruction likely in a refinery can be gained by making use of formulae devised by STADLER and published in *The International Sugar Journal*[1]. Reference may also be made to pages 132–133 of the Circular C440 of the American National Bureau of Standards.

Bacterial losses, particularly in sweet water circuits, can be high and formation of dextran can also materially affect, for the worse, the efficiency of some of the refinery processes. Very often these circuits are in an ideal condition for alcoholic fermentation to occur. The problem is best tackled at source, that is, by reducing the amount of water made. That which is made should be disposed of immediately. Leaking pipes, and glands leading to constant and needless cleaning-up, are a prolific source of water; good maintenance is an essential if sugar loss is to be minimized. Untreated low-Brix dirty sweet water, should never be stored for any length of time and particularly during refinery stoppages. Acid fermentation can be prevented by liming to a pH of 7·0+, but preferably the water should be thickened up to around 65°Brix or boiled into massecuite. Tanks used for sweet water should be regularly cleaned and treated either by steaming or spraying with a bactericide. The sides of the tanks can also, with advantage, be regularly treated by brushing and coating with freshly slaked milk-of-lime. In all these treatments the refinery floor drains should not be omitted.

Among the sources of unknown sugar loss must also be considered the possibility of theft on a large scale; it is very well worthwhile reviewing security arrangements against this possibility.

Turning to known sources of loss, it is necessary first to determine an acceptable level for each item and then to ensure that these levels are not exceeded. Char washing water is run to drain because the cost of evaporating it to recover the sugar it contains is greater than the value of the sugar and also because as washing proceeds so the purity of the effluent falls and it is bad refining practice to send for recovery low-Brix water containing solid material lower than molasses purity. If this is done the solids can only leave the refinery as molasses taking with them sugar which would otherwise have been in a white sugar bag. The right point at which to turn to drain and the amount to be sent must be calculated with these factors in mind. The water sent to drain must, of course, be sampled and analysed to make sure that all is well.

The level of loss in overweights will depend on the tolerance allowed by local legislation, the care with which packing machines are maintained and the correctness of the check weighing system employed. If reliance is placed on packing machine operators for this, then it is worthwhile calling on the technical department to make a statistically based check from time to time. Such a check has before now revealed that far more sugar was in fact being given away than the overweight returns showed; though such sugar is not strictly lost its value is nevertheless lost to the refiner and this is bad commercial practice.

All refinery sewers should be sampled and tested regularly. It is best to sample continuously or at least to take a sample at frequent intervals and this is best done mechanically, though hand sampling by laboratory staff is acceptable. The rate of flow through each sewer should also be estimated so that the actual

[1] *I.S.J.*, 1932, **34**, 273.

sugar solids in the sewers can be compared with what should be there.

Inversion of sucrose should be minimized; much is likely to occur in the recovery house circuits where the pH of the sugar syrups may be only a little above 5·0. It is desirable to bring this figure up to a level around 6·0 by adding to the raw sugar mingler lime or sodium carbonate, the latter being preferable because it is less melassigenic.

Some sources of loss may be known but unacceptable, such as losses through heating surfaces or by spillages at points where the spilled material goes down the drain. It is a useful discipline to ensure that all such occurrences are reported individually by the refinery supervisors on a separate report which lists the nature of the occurrence, the cause, the action taken and, if appropriate, suggestions for avoiding a recurrence.

As much as possible must be done to reduce to an absolute minimum the production in the refinery of sugar which will need for any purpose to be remelted; any sugar remelted incurs a second loss at the same overall level as the original raw sugar.

Finally, there should be no direct connexion anywhere in the refinery between a vessel holding sugar liquor and a drain to sewer whilst that vessel is under operating conditions. Pans, for example, where the heating surfaces may need periodical chemical treatment, may be installed with permanent connexions to drain to enable the cleaning materials to be readily discharged. This direct connexion must be broken when the pan is in normal use. A closed valve, even a locked closed valve, is not sufficient safeguard. There should be a removable distance piece which is only placed in position when the vessel is under treatment; the refinery supervisor on duty at the time should authorize this and also personally ensure that it is removed when the treatment is finished.

When examining loss figures it is worthwhile considering whether some of the loss is only apparent. Under-declaration of overweights might be considered under this heading; another source might be faulty analysis. It is particularly necessary to ensure that there is no drying-out of samples taken to represent the input of raw sugar into the refinery. If drying-out occurs then the figure calculated for the tons solids input into the refinery will be in error, and it is, of course, essential that the machines used for weighing refinery input be regularly checked for accuracy.

To finish this survey there are a few general observations which are worth making. Changes in plant and processes may increase loss and their performances should be costed with this in mind. It is not enough just to assume that because a new piece of equipment costs less or takes less labour it must save money. Too much labour saving in general can increase loss by reducing efficiency. High quality and sufficient supervision is essential and everybody must be made loss-conscious. It is the technical department's responsibility to make sure that all those responsible for refinery operations are aware of what the current level of loss is and what it should be. It is probable that a worthwhile reduction in loss is the biggest single financial prize available to sugar refiners; it is worthwhile giving some thought and time to its attainment.

Flowering of sugar cane in the Sudan

By H. A. TALBALLA

(Guneid Research Substation, Guneid, Sudan)

Introduction

IN the early stages of sugar cane breeding, and aside from building, expanding and maintaining genetic stock, a breeder must have adequate knowledge about true seed production in the country. Sugar cane is classified as a short-day intermediate plant[1,2]. Night interruption was found to inhibit flowering and a precise nyctiperiod, 11 hr 50 min to 12 hr 40 min, is required to induce flowering[3]. To be able to accept the stimulus the plant has to be well advanced in age and has to come through a period of vigorous vegetative growth[4]. Low night temperature is unfavourable for induction and below 58°F no flowering occurs[3]. Low temperatures also affect flower development adversely and reduce pollen fertility. High moisture tension during inductive nights is also unfavourable and low atmospheric humidity suppresses pollen fertility and impairs seed development. The difference between maximum and minimum temperature is considered by some workers as critical, a wide range being unfavourable for flowering[5].

Sugar cane varieties studied are complex polyploid species hybrids with a variety of environmental requirements for flowering. Their flowering is seasonal and determined by the latitude of the site considered. The Sudan is a large country extending from near the equator to a few degrees south of the tropic of Cancer. In the extreme south, where the photoperiod is always slightly inductive, sugar cane is expected to flower throughout the year provided other factors are also favourable (C. G. HANSFORD as reported by COLEMAN[6]). Going northward, flowering becomes

[1] ALLARD: *J. Agric. Research*, 1938, **57**, 775–789.
[2] BURR: *Rpts. Hawaiian Sugar Tech.*, 1950, 47–49.
[3] CLEMENTS & AWADA: *Proc. 12th Congr. ISSCT*, 1965, 796–812.
[4] ARCENEAUX: *ibid.*, 780–784.
[5] RAO *et al.*: *I.S.J.*, 1973, **75**, 241–244.
[6] *Proc. 13th Congr. ISSCT*, 1968, 992–1000.

Table I. Climatological normals (provisional) for the three sites, Malakal, Sennar and Wad Medani, average of 30 years

Month	*Air temperature max./min., °C*						*Rainfall, mm*			*Relative humidity at 12.00 hrs*		
	Malakal		*Sennar*		*Wad Medani*		*Malakal*	*Sennar*	*Wad Medani*	*Malakal*	*Sennar*	*Wad Medani*
June	32·9	22·1	38·9	23·6	39·6	24·6	115	47	31	54	29	22
July	30·9	21·6	34·9	21·8	35·6	22·8	153	146	122	62	44	38
August	30·6	21·5	32·8	21·2	33·1	21·9	167	170	129	65	53	50
September	31·8	21·8	34·7	21·0	35·2	21·8	144	63	55	61	47	41
October	33·6	21·8	38·0	21·4	35·0	21·6	75	21	16	52	37	25
November	35·5	19·6	37·6	19·3	36·7	17·8	6	TR	1	28	32	17
December	35·3	18·3	35·1	16·1	34·1	14·6	1	0	0	20	27	18

seasonal as the length of the inductive period becomes shorter. The effect of geographical position on the natural day length is also accompanied by other marked differences in climatic factors. The amount and duration of rainfall, maximum and minimum temperatures and relative humidity follow a definite pattern, becoming less favourable in the north.

Materials and Methods

Meteorological data at the sites studied:

(1) Malakal (Lat. 09° 33′N).

Table I gives the average monthly rainfall, maximum and minimum temperatures and relative humidity for 30 years. At this site the first date of emergence, extent of flowering and seed viability tests for 19 varieties were recorded (Tables II, III).

(2) Sennar (Lat. 13° 33′N).

Table I gives the average monthly rainfall, maximum and minimum temperatures and relative humidity for 30 years. At this site 43 varieties were planted in 1969, and the first date of emergence of those varieties that flowered, as well as the seed viability tests, were recorded (Tables II, III).

(3) Wad Medani (Lat. 14° 24′N).

Table I gives climatological normals as at the previous sites. The data recorded (Table II) were obtained from a previous agricultural research annual report[7]. Seed testing could not be done. Climatological normals at this site are included as a substitute for those of the Guneid area, as the data for the latter are not available.

(4) Guneid (Lat. 14° 52′N).

Climatological normals for the same period as at previous sites could not be obtained, but are expected to be similar to Wad Medani. At this site 43 varieties were planted for three seasons (1969–70–71). The data given in Tables II and III include first date of emergence, extent of flowering, pollen amount, percent fertility and degree of seed viability.

At all the sites, unreplicated plots of 5 to 7 rows, 14 metres in length, were used as observation plots. The earliest date of emergence was recorded.

Results and Discussion

Throughout the country adequate numbers of days with sufficient night length to trigger the stimulus for flowering in sugar cane varieties, occur at some time during the year. Hence failure to flower must be attributed to some other limiting factor. The meteorological data presented show that marked differences in the amount and duration of rainfall, maximum and minimum temperatures and relative humidity exist between Malakal and the three other sites. Soil

[7] EVELYN: *Agric. Research Corp. Ann. Rpt.*, 1963/64.

Table II. First date of emergence* and extent of flowering† at the different sites studied

Variety	*Guneid*		*Wad Medani*		*Sennar*		*Malakal*	
	Date	*Extent*	*Date*	*Extent*	*Date*	*Extent*	*Date*	*Extent*
Co 205	3 Nov.	3	28 Oct.		8 Nov.		12 Oct.	3
Co 281	—	0	—		—		12 Oct.	3
Co 413	—	0	—		—		N.P.	—
Co 417	13 Nov.	1	—		15 Nov.		15 Oct.	3
Co 419	—	0	—		—		N.P.	—
Co 421	5 Dec.	1	—		15 Nov.		9 Oct.	3
Co 432	—	0	—		—		10 Oct.	3
Co 453	20 Nov.	1	—		—		N.P.	—
Co 464	3 Nov.	3	28 Oct.		6 Nov.		12 Oct.	3
Co 475	—	0	—		—		N.P.	—
Co 527	5 Dec.	1	—		2 Dec.		N.P.	—
N:Co 291	30 Dec.	1	20 Dec.		10 Dec.		10 Oct.	3
N:Co 293	2 Dec.	1	19 Nov.		14 Nov.		N.P.	—
N:Co 301	18 Dec.	2	9 Dec.		4 Dec.		10 Oct.	3
N:Co 310	3 Nov.	3	28 Oct.		31 Oct.		9 Oct.	3
N:Co 339	—	0	—		—		10 Oct.	3
N:Co 349	9 Nov.	1	2 Dec.		10 Nov.		9 Oct.	3
N:Co 376	3 Nov.	2	N.P.		—		N.P.	—
CP 29/116	29 Nov.	1	9 Dec.		18 Nov.		14 Oct.	3
CP 34/120	19 Nov.	1	N.P.		7 Dec.		N.P.	—
CP 36/105	5 Nov.	3	13 Nov.		2 Nov.		13 Oct.	3
CP 43/47	—	0	—		—		N.P.	—
CP 44/101	—	0	—		—		10 Oct.	3
CP 44/101SH	—	0	—		—		N.P.	—
CP 44/155	5 Dec.	1	9 Dec.		—		N.P.	—
CP 34/79	—	0	—		—		N.P.	—
CP 48/103	19 Nov.	2	13 Nov.		14 Nov.		N.P.	—
CP 52/68	6 Dec.	3	N.P.		5 Nov.		N.P.	—
B 37/72	—	0	N.P.		—		N.P.	—
B 43/62	—	0	19 Nov.		—		N.P.	—
CB 40/77	—	0	N.P.		—		N.P.	—
CB 41/34	—	0	N.P.		—		N.P.	—
POJ 27/4	25 Nov.	1	—		—		11 Oct.	3
POJ 2961	—	0	—		—		13 Oct.	3
POJ 3016	—	0	—		—		N.P.	—
POJ 3067	—	0	N.P.		—		N.P.	—
PR/980	—	0	N.P.		—		N.P.	—
PR 1000	13 Dec.	3	20 Dec.		20 Nov.		N.P.	—
M 165/38	20 Dec.	3	—		12 Nov.		N.P.	—
Q 56	—	0	—		—		N.P.	—
Red Cane	—	0	N.P.		—		13 Oct.	3
Pindar	—	0	N.P.		—		N.P.	—
Black Cheribon	3 Nov.	1	—		—		N.P.	—

KEY: *Malakal three seasons, Sennar one season, Wad Medani one season and Guneid three seasons.
†Flowering extent. 0 = No flowering. 1 = Few flowers. 2 = ±50% of stalks flowered. 3 = More than 50%.
N.P. = Not planted.
— Indicates no flowering occurred; at Sennar data for Co 453 and CP 44/155 not recorded.

Table III. Germination test, pollen amount and % fertility

Variety	No. of seedlings/g			Guneid Pollen*	
	Malakal	Sennar	Guneid	Amount	% fertility
Co 205	15	13	17	3	23
Co 281	10	—	—	—	—
Co 290	0	N.P.	N.P.	—	—
Co 413	N.P.	—	1	1	8
Co 417	4	0	0	1	20
Co 421	3	0	0	1	33
Co 432	5	—	—	—	—
Co 464	10	0	0	1	20
Co 527	N.P.	0	0	1	10
N:Co 291	14	2	1	1	7
N:Co 293	N.P.	0	1	2	18
N:Co 301	15	4	2	1	47
N:Co 310	16	1	1	1	29
N:Co 339	14	—	—	—	—
N:Co 349	19	0	0	1	14
N:Co 376	N.P.	—	0	1	27
N:Co 453	N.P.	6	1	1	40
CP 29/116	2	0	0	1	12
CP 36/105	22	11	8	3	31
CP 34/120	N.P.	0	0	1	18
CP 44/101	0	—	—	1	30
CP 44/155	N.P.	—	2	1	37
CP 48/103	N.P.	0	1	2	30
CP 52/68	N.P.	10	6	2	15
POJ 2714	0	—	0	1	12
POJ 2878	20	N.P.	N.P.	—	—
POJ 2961	1	—	—	—	—
PR 1000	N.P.	0	0	1	15
Black Cheribon	N.P.	—	—	—	—
Red Cane	18	—	—	—	—
M 165/38	N.P.	3	0	1	12

* Amount of pollen 1 = few pollen grains
2 = moderate amount of pollen grains
3 = many pollen grains

N.P. = Not planted
— Indicates data not recorded

moisture is expected to be higher in the north. The occurrence of these factors or some of them during an inductive night may nullify its effect.

All the varieties grown at Malakal flowered during the month of October and could not be separated into early- and late-flowering categories. Under Guneid conditions this categorization was well defined. Sennar and Wad Medani showed somewhat intermediate situations. Moreover, some of the varieties that failed to flower in the north were found to be free bloomers in Malakal.

Seed set was much better at Malakal than at all the other sites. Pollen amount and % fertility were determined under Guneid conditions only, and no comparison in this respect can be made; nevertheless seed tests results gave some indications of what might be expected. The three sites Sennar, Wad Medani and Guneid were comparable and gave similar results.

Sugar cane flowering is divided into five stages[8]: Stage 1, induction; Stage 2, differentiation and initiation; Stage 3, growth and development of the rachis; Stage 4, emergence; Stage 5, opening of mature flowers. CLEMENTS[8] found that stage 1 is very sensitive to night temperature. It is also affected by the range between maximum and minimum temperature, the nutritional status of the plant, relative humidity and soil moisture tension. Since this stage occurs in the July-August period, effects of low night temperatures could be ruled out; however, other factors could be limiting in the north and might lead to failure of induction.

Stage 2 is less sensitive to night temperature[3], and complete reversion of the meristem could occur till about the middle of this stage. It was observed, under Guneid conditions, that reversion was frequent and "witches broom" and bunchy tops were very common in late-planted canes. This could possibly be related to the fact that late inductive nights occur a short time before the winter; hence, by the time the induction was complete, the conditions had become unfavourable for the plant to give a fully developed inflorescence.

The duration of stage 3 under normal conditions is about one month. Low night temperatures will extend this duration up to two months. In this stage and also in stage 5 low night temperatures affect pollen fertility and seed development adversely. This could account for inferior seed production in the north[9].

Varieties are known to have different requirements for flowering and their reactions to adverse conditions differ. In the Malakal area conditions were so optimal that all the varieties planted flowered very early and the majority gave very healthy seed. When these varieties were planted in the north they were exposed to adverse conditions, namely wide ranges in temperatures, low air humidity, and high moisture tension. In the north, varieties could be divided into three classes. Class 1: Completely failed to flower; Class 2: Bloomed late and with low intensity; Class 3: Bloomed early and intensively. Differences between classes could possibly be attributed to the reaction of varieties to different limiting factors.

Conclusion

Superior seed production in Malakal area indicated the possibility of utilizing that area as a seed production centre in future planning. The seed produced according to planned crosses can be shipped to production areas to be germinated in glasshouses and subjected to selection under the prevailing natural conditions. This practice is followed in many countries throughout the world.

True seed can also be obtained in other areas from varieties that produce viable seed under natural conditions. In addition, reluctant varieties can be induced to give flowers and viable seed by subjecting them to minor changes in environmental conditions. The two most important factors that need to be corrected are low night temperature and low air humidity. Fortunately these can easily be modified in glasshouses. In this connexion it might be noteworthy to point out the fact that the breeding season in the north is much longer than in the south. Flowering in the Guneid area extends from November to February.

Acknowledgement

I would like to thank the Director, Agricultural Research Corporation, Wad Medani, Sudan, for permission to publish this paper. Meteorological data included in this paper were kindly received from the Sudan Meteorological Department, Khartoum, Sudan. I would like to thank Mr. M. A. SIDDIG, Agricultural Research Corporation, Wad Medani, for advice and help in preparing the text.

[8] GEORGE & LALOUETTE: *Proc. 11th Congr. ISSCT*, 1962, 516–527.

[9] DUNCKELMAN: *Proc. 12th Congr. ISSCT*, 1965, 823–828.

Sugar cane agriculture

Cane diseases in Mauritius. ANON. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1973, 39–44.—The incidence of gumming disease in Mauritius has decreased (owing to weather unfavourable for its spread) to such an extent that the ban on M 377/56, a susceptible, comparatively new variety, has been lifted, thereby increasing the amount of inoculum available for combating the disease. Investigations on hot water treatment of setts with systemic infection showed that the bacterium was not killed at temperatures below 50°C even at 120 minutes' exposure, and experiments have begun on treatment with hot water containing penicillin and with hot water after penicillin treatment. Very wet conditions at the beginning of the season were conducive to widespread outbreaks of wilt or root disease, two varieties being particularly infected. Tests with "Benomyl" ("Benlate") have shown that the fungicide remained active in the bath used for sett treatment for at least 10 days, and germination was comparable to that of setts treated successively with hot water and an organo-mercurial dip. A combined hot water-fungicide treatment would be an economical method of controlling pineapple disease and is likely to be adopted commercially provided results so far obtained are confirmed by later tests. Yellow spot incidence has been found to occur early as a result of early heavy rainfall, but subsides halfway through the season, after which it disappears. The disease affects cane yield more than it does sugar content, and a 10–15% drop in yield of a highly susceptible variety is cited. A diagram is given showing the scheme used to test the reactions of new varieties to disease at various stages in the selection programme, and findings relating to a number of diseases are given.

* * *

Cane pests in Mauritius. ANON. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1973, 44–46.—Work on biological control of the scale insect *Aulacaspis tegalensis* has continued with releases of three species of imported Aphelinid parasites, *Metaphycus* sp. from Tanzania, *Physcus* sp. nr. *nitricalus* from Australia, and *Aphytis* sp. from Australia. Data on the relative incidence of recorded parasites and hyperparasites of the scale insect were obtained by sampling at a few selected sites. While *Adelencyrtus myiarai* had been found earlier to be the only common primary parasite but was very much subject to attack by the secondary parasite *Tetrastichus* sp., the latest investigations have shown that *Physcus seminotus*, introduced from Uganda, is now often the dominant parasite, outnumbering all others put together. At one site it was the commonest parasite throughout the season and was the only one recovered from samples taken after harvest in September–November when scale insect populations were minimal. Damage to cane by the spotted borer *Chilo sacchariphagus* at one site studied (60% of the canes bored) was found to occur almost exclusively during a limited and comparatively short period of crop growth; larval populations increased sharply and decreased equally sharply during this period. At another site, environmental conditions and the borer problem were different, white borer *Argyroploce schistaceana* being found in abundance together with *C. sacchariphagus* at certain times.

* * *

Weed control in Mauritius. ANON. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1973, 46–49.—Used as a post-emergence spray, "Mon 2139" ("Roundup") gave spectacular results in trials on control of weeds, its performance comparing favourably with that of DCMU. In trials against specific weeds, it gave complete control of *Paspalidium geminatum* at a minimum dosage rate of 4·30 kg a.e. per ha, reduced *Cyperus rotundus* growth to about 2% after two sprayings at one site and three sprayings at another (because of rainfall) at 0·5 kg a.e. per ha (while "Actril-D", 2,4-D and "Gesapax H" had little or no effect), gave a complete kill of *Paspalum paniculatum*, *P. urvillei* and *P. conjugatum* at a minimum dosage of 0·54 kg a.e. per ha, completely controlled *Kyllinga monocephala* at 0·54 kg a.e. per ha and gave 50% control at lower rates than this, while results with *Cynodon dactylon* were inconsistent: nearly 100% control of one biotype at a minimum dosage of 4·30 kg a.e. per ha with only slight regrowth 6 months after spraying, while in the case of another biotype regrowth was complete, indicating the possibility of resistance differences between the two biotypes. In trials against *Colocasia antiquorum*, "Mon 2139" gave total kill of all leafy parts; 12 weeks after spraying, regrowth of the weed ranged from 12 to 23% depending on dosage rates, which ranged from 1·08 to 5·38 kg a.e. per ha, compared with regrowth of 48% and 55% with application of "Actril-D" and MCPA, respectively. However, 13 weeks after a repeated spraying with "Mon 2139" there was no regrowth of the weed, irrespective of dosage rates, while 10% regrowth with emergence of many young plants occurred when the other two chemicals were applied. "Mon 2139" was also highly effective against *Leersia hexandra*, *Digitaria horizontalis*, *Setaria barbata* and *Coix lachryma-jobi*.

* * *

Sugar cane research in Africa. ANON. *Agron. Tropicale*, 1974, **29**, 517–530.—Details are given of cane research conducted during 1972 by Institut de Recherches Agronomiques Tropicales (IRAT) in the Malagasy Republic, Réunion, Ivory Coast, Upper Volta and the Niger Republic.

* * *

Potassic fertilizers in the control of the sugar cane shoot borer. S. SITHANANTHAM, R. N. SEETHARAMAN and S. LETCHOUMANANE. *Sugar News* (India), 1974, **5**, (12), 5–6.—The literature on application of potassium fertilizers together with pesticides sprays to control *Chilo infuscatellus* is briefly surveyed.

Harvesting—methods, problems and the economics of various methods. M. T. ROBENIOL and M. T. ILAGA. *Sugar News* (Philippines), 1974, **50**, 181–186.—The performances of a Toft "Hydroload" cane loader and of a Don Mizzi chopper-harvester (DMH6) at Hacienda Luisita are discussed and the relative economics of manual harvesting, manual or mechanized loading and mechanized harvesting discussed.

* * *

Comparative study of nine sugar cane varieties with three levels of nitrogen. E. SÁNCHEZ F. *Centro Rev. Cient. Univ. Central Las Villas, Serie: Azúcar*, 1973, **1**, (1), 3–18.—Varietal × nitrogen trials carried out in 1968 are summarized, based on split plots with four replications, and using 96 m^2 plots and standard P and K dosages. Significant differences were found between varietal yields and nitrogen levels as well as interactions between the two variables. Of the N levels (80, 120 and 160 $kg.ha^{-1}$), optimum dosage for plant cane was 120 $kg.ha^{-1}$, while there was no difference for first ratoons. Highest yields of plant cane were obtained with B 4362, My 54108 and CG 12745 varieties; highest yields of first ratoons were obtained with CG 12745, My 53108 and My 5369.

* * *

Ratoon stunting disease in relation to shipment of sugar cane cuttings from Canal Point, Florida. J. L. DEAN. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 7.—A warning is given that shipments of cane from Canal Point may contain RSD-infected cuttings, since inspection for internal vascular discoloration in the lowest one or two nodes will not eliminate those cuttings which are infected but show poor or no symptoms. Moreover, a routine knife sterilization system to prevent further spread of the disease is time- and labour-consuming as well as being of doubtful value. It is therefore considered advisable for agencies receiving foreign shipments of cane to place the cane in quarantine and heat-treat the progeny from such cane before releasing it for unrestricted use.

* * *

Harvest practice and smut levels. G. L. JAMES. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 8.—Although trash mulching at harvest is of benefit as regards soil moisture retention, the practice does help spread cane smut by incorporating smut whips, populations of which per hectare have been found to be much greater by the 5th ratoon than in the case of cane burning.

* * *

Pathology programme of Planalsucar, IAA, in Brazil. C. A. WISMER. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 9–10.—The author outlines the programme of work established under the national programme for sugar cane improvement set up by Instituto de Açucar e Alcool in Brazil in 1971. Under the programme, new varieties are being developed and the parent varieties and new seedlings tested for reaction to local diseases. Pathology laboratories have been set up at Maceió (Alagoas) and Araras (São Paulo), and quarantine houses are under construction at Maceió and Anhembi (São Paulo). The incidence of local diseases is being studied, while rules and regulations have been proposed to control the movement of cane varieties within Brazil.

Further studies on the role of sugar cane borers in the spread of red rot infection. P. APPALANARASIAH. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 11.—Studies, in which a suspension of the red rot organism *Physalospora tucumanensis* was introduced by hypodermic syringe into borer holes in cane of Co 419 variety, showed that there was no spread of the disease after 4 month' growth of the fungus, whereas cane inoculated with the fungus but not displaying borer holes became infected with the disease, which caused some of the samples to die. The lack of spread of red rot in the borer-damaged canes is attributed to the lining of the borer tunnels by dead tissue.

* * *

Pathology files. G. HUGHES. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 12–13.—A brief explanation is given of the system used by the Pathology Division of the Bureau of Sugar Experiment Stations in Queensland to file information on disease research, control and identification.

* * *

Association of a bacterium with R.S.D. D. S. TEAKLE, P. M. SMITH and D. R. L. STEINDL. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 13.—An electron photomicrograph is reproduced showing two cells of a coryneform bacterium found in fibrovascular sap from cane infected with ratoon stunting disease. The bacterium is permeable to phosphotungstate negative staining, which reveals a thin cell wall surrounding a cytoplasmic membrane and coiled mesosomes.

* * *

Predators on the vector of grassy shoot disease. T. N. SRIVASTAVA and B. PANT. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 14.—*Xanthogramma scutellare* and *Paragrus serratus* have been identified as flies, the maggots from which act as predators of the aphid *Longiunguis indosacchari*, the most important vector of grassy shoot in India. *Aphelinus* sp. has also been found parasitizing the aphid, although its occurrence is not as frequent as that of another parasite, *Lysiphlebus* sp., found earlier.

* * *

Varietal susceptibility to brown spot disease (*Cercospora longipes* Butler) of sugar cane. S. MUTHUSAMY and S. SITHANANTHAM. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 15–17.—Results are given of tests on the susceptibility to brown spot of seven cane varieties. The three varieties which were susceptible also had high leaf sheath moisture contents, although two resistant varieties had the same sheath moisture content as did one of the susceptible varieties. Of six fungicides tested for control of the disease, only one, "Miltox-0·1%", was effective in preventing any increase one month after spraying.

* * *

Aphid vectors of sugar cane mosaic virus recorded from Japan. Y. OHTSU and E. MANABE. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 17.—Aphids found on cane and on plants in the vicinity of cane fields at the sugar cane seed station at Kagoshima in Japan are noted. Eight of the species named are among the thirteen aphids known to be vectors of cane mosaic virus.

A diagnostic method for ratoon stunting disease. A. G. GILLASPIE, R. E. DAVIS and J. F. WORLEY. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 18.—See *I.S.J.*, 1974, **76**, 369.

* * *

Pathogenic potentialities of midrib isolates of *Colletotrichum falcatum* in inciting stalk rot of sugar cane. V. P. AGNIHOTRI and T. R. BUDHRAJA. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 19–21.—Tests are reported in which cane stalks were inoculated with isolates of *C. falcatum* (red rot) taken from cane midribs and the spread of the fungus in the tissue recorded after 2½ months. In no case did the infection spread beyond the inoculated internode, indicating that the midrib isolates were only weakly pathogenic. Hence, it is concluded that the races which cause midrib lesions are markedly different from those which cause stalk rot.

* * *

Mixed viral infections on sugar cane and other grasses could be mistaken for new strains. A. G. GILLASPIE and H. KOIKE. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 22.—Johnson grass, itching grass and cane were inoculated with one or more strains of cane mosaic virus before, during or ofter inoculation with maize dwarf mosaic virus; inoculum from one of the two grasses was subsequently repeatedly passed through the other grass and sweet sorghum. The result was that the symptoms on the sweet sorghum approached those of one or other of the diseases according to the plant through which the inoculum had been passed. It is pointed out, therefore, that mixed infections could give symptoms which differed from those of the individual component diseases and could be mistaken for new strains of maize dwarf mosaic virus, which readily infects both sweet sorghum and Johnson grass. Mixed infections could persist in individual cane plants for over a year.

* * *

Sugar cane white leaf disease in Thailand and Taiwan. C. T. CHEN. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 23.—White leaf disease has been found in almost all of the major cane areas of Thailand; the leafhopper *Matsumuratettix hiroglyphicus*, vector of the disease in Taiwan, has also been found in all Thailand cane areas. No differences have been found between the disease symptoms in Thailand and Taiwan.

* * *

Involvement of *Acremonium* species in wilt syndrome of sugar cane. K. SINGH and R. P. SINGH. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 24–25.—Because of lack of knowledge on the identity of the wilt disease pathogen, studies were undertaken in which numerous isolates were taken from infected canes. Besides *Fusarium moniliforme*, the isolates yielded *Acremonium furcatum* and *A. terricola* which, when injected into seven varieties of cane, produced typical wilt symptoms. *A. terricola* appeared to be more virulent than *A. furcatum*.

* * *

Interception of sugar cane culmicolous smut at a quarantine nursery in Taiwan. L. S. LEU, Y. P. TSAI and S. C. YAN. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 26.—Reference is made to the discovery of culmicolous smut on a stool of Phil 59 at Hsichi quarantine nursery. The only previous case of smut in Taiwan was also found on a Philippine cane variety.

* * *

Screening sugar cane varieties for resistance to root-knot nematode, *Meloidogyne* spp. C. P. MADAMBA, J. N. ESPINA and L. T. EMPIG. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 27–31.—Forty cane varieties were tested for resistance to *Meloidogyne javanica* and *M. incognita*. Details are given of the results, in which the gradings were based on the number of root galls formed.

* * *

Hot water treatment of single buds for ratoon stunting disease control. W. M. DA SILVA. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 32–33.—A method which has resulted in complete control of RSD consists of hot water treatment for 2 hours at 51°C, the single-bud setts (2 cm long) being cut with a specially devised machine. The water bath, of 100 litres capacity, can accommodate 4000 setts per treatment. After treatment, the setts are planted in sand; when they reach a height of 20 cm, they are removed and transplanted in the field where 12 months is adequate for establishment of sufficiently well developed stools for replanting in a secondary nursery.

* * *

Current status of diseases and pests of sugar cane in West Malaysia. G. S. LAN. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 33.—A list is given of fungal diseases with their causal organisms, viral diseases and species of stem borers and mealy bugs associated with cane in West Malaysia. Most of the nematodes found on cane elsewhere also occur in West Malaysia.

* * *

Sugar cane disease observations in Pakistan. J. L. DEAN. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 34.—A brief account is given of diseases encountered by the author while on a visit to Pakistan as a member of a mission sponsored by FAO. While cane mosaic virus was found on practically all commercial cane, the existence of the disease in Pakistan was denied by local growers, factory staff and ministry officials. The symptoms are mild and apparently generally accepted as normal for cane.

* * *

Nematodes at Kalibagor. S. HATMOSOEWARNO. *Sugarcane Pathologists' Newsletter*, 1974, (11/12), 35–37. Investigations in Java were aimed at determining the nematode populations in different types of soil in which two POJ cane varieties were growing. The results are tabulated and discussed.

* * *

Leaf scald threat to Burdekin. O. W. STURGESS. *Producers' Rev.*, 1974, **65**, (5), 3.—The possible accidental introduction of leaf scald into the Burdekin area of Queensland, where more than 1¼ million metric tons of the annual cane crop is represented by Q 63, which is highly susceptible to the disease, is considered a grave threat to the industry. By "accidental" the author means the careless dumping by tourists of cane which they have casually picked up in fields. The author, Director of the Bureau of Sugar Experiment Stations, also emphasizes that he will no longer approve new cane varieties which are suscept-

ible to the disease, regardless of other good properties they may have. Another disease discussed is yellow spot, which has spread from north Queensland and could, given the combination of susceptible varieties and adverse weather conditions, reach epidemic proportions.

* * *

Cane growers must drop N:Co 310 variety. O. W. STURGESS. *Producers' Rev.*, 1974, **65**, (5), 7.—Because of its high susceptibility to Fiji disease, N:Co 310 cane should not be grown but should be replaced with suitable alternatives less susceptible to the disease. The reluctance of growers to abandon the variety is due to its high yielding and strong ratooning properties, intensive care not being necessary to obtain high yields from it. While it is possible that a point has been reached where the disease is being contained during the first year of the major control programme, continuation to grow N:Co 310 is regarded as a threat to the programme, and a deterioration in the situation is regarded as a possibility. The difficulty of diagnosing the disease is mentioned. The occurrence of a severe drought would help fight the disease, since the author feels certain that Fiji disease-infected cane would be the first to suffer from moisture stress.

* * *

Agronomic characteristics of 15 varieties of sugar cane. Preliminary results for plant cane. C. CRUCCIANI, A. I. BASSINELLO, E. R. DE OLIVEIRA and D. BARBIN. *Brasil Açuc.*, 1974, **83**, 496–502.—Comparative trials have been made to determine the yields in metric tons per hectare, number of stalks per metre, and weight of stalks for plant cane of 15 CB and IAC varieties. The highest yield was given by CB 49-260 but this was not statistically significant.

* * *

Comparative efficiency of different weedicides for sugar cane under Canlubang conditions. A. R. APACIBLE. *Sugarland* (Philippines), 1974, **11**, (1), 8–10, 48–50. Comparative trials conducted with a number of herbicides during 1963–64 (*sic*) are reported.

* * *

The "Waletz" cane planter. ANON. *S. African Sugar J.*, 1974, **58**, 345.—Information is given on a cane planter which has been designed by two cane growers (W. REDINGER and E. NUSS) which is considered sufficiently inexpensive to be of interest to the small farmer. It is a simple, self-contained unit which can be attached to any make of tractor, is very manoeuvrable (ensuring maximum land usage, especially on difficult terrain), and can be used to plant single or double stalks, trashed or untrashed seed cane without any adjustments, whole stalks being cut into 18-inch setts with 3-inch overlaps at each end. Up to 700 yards can be planted with trashed cane without need to refill the carrier baskets, while 100 acres can be planted in a month. Addresses are given to which to apply for details of the planter.

* * *

How to get the best work and value out of your "Rotavator". D. ROSS. *S. African Sugar J.*, 1974, **58**, 346–347.—Advice is given on operation and maintenance of the "Rotavator" rotary hoe in seedbed preparation, cane stool eradication, incorporation of cane trash, filter cake and fertilizers as well as inter-row cultivation.

The first sugar cane crop harvested by the new sugar factory in Texas. J. NELSON. *Sugar J.*, 1974, **37**, (2), 8–11.—Details and illustrations are given of the operations and equipment involved in the harvesting and factory handling of cane grown in the Rio Grande Valley, Texas, for processing at Cowley factory.

* * *

Borreria—a rapidly spreading weed pest of the Innisfail-Tully area. I. J. STEWART. *Cane Growers' Quarterly Bull.*, 1974, **38**, 4–6.—Reference is made to a weed which is similar to *B. hispida* but has yet to be identified, although local names in the Innisfail area include "square weed" and "Borreria". It has a vigorous root system and growth habit which permit it to recover from most chemical sprayings, and it can cause poor cane yields by using up moisture and nutrients. It seeds profusely, is able to germinate all the year round, and is undeterred by poor light. The only successful treatment, which destroys top growth and gives reasonable pre-emergence control, is 4·5 kg of "Diuron" + 0·7 litres of "Gramoxone" per hectare; while this is expensive, the outlay is considered justified.

* * *

Yellow spot attacks again. B. T. EGAN *et al. Cane Growers' Quarterly Bull.*, 1974, **38**, 7–14.—A severe yellow spot outbreak in northern Queensland is discussed. Causes of its spread, some of the more important susceptible cane varieties, possible losses and future prospects are covered, and accounts are given of the situation in the various districts affected.

* * *

Over the row. C. D. JONES. *Cane Growers' Quarterly Bull.*, 1974, **38**, 15–16.—A description and illustrations are given of a tractor modified so as to give a high-clearance boom spray outfit for weed control work or, with further modification, for fertilizer application.

* * *

After hot water treatment—plant clean cane, keep it clean. M. A. HETHERINGTON. *Cane Growers' Quarterly Bull.*, 1974, **38**, 21–22.—The author briefly discusses the control of disease through hot water sterilization and the planting of uninfected cane, as well as eradication of weeds which could act as alternative hosts. Rat control is also considered important, since the pest may be capable of transmitting ratoon stunting disease from infected to healthy stools.

* * *

Methods used in the identification of ratoon stunting disease. D. R. L. STEINDL. *Cane Growers' Quarterly Bull.*, 1974, **38**, 23–25.—See STEINDL & TEAKLE: *I.S.J.*, 1975, **77**, 50.

* * *

Recommended method for grub control at Maryborough. J. WRIGHT. *Cane Growers' Quarterly Bull.*, 1974, **38**, 29–31.—Recommendations are given on application of BHC dust to control *Lepidiota frenchi, L. mungomeryi* and *Antitrogus mussoni.* The advantages of the drill method over broadcast application are briefly discussed.

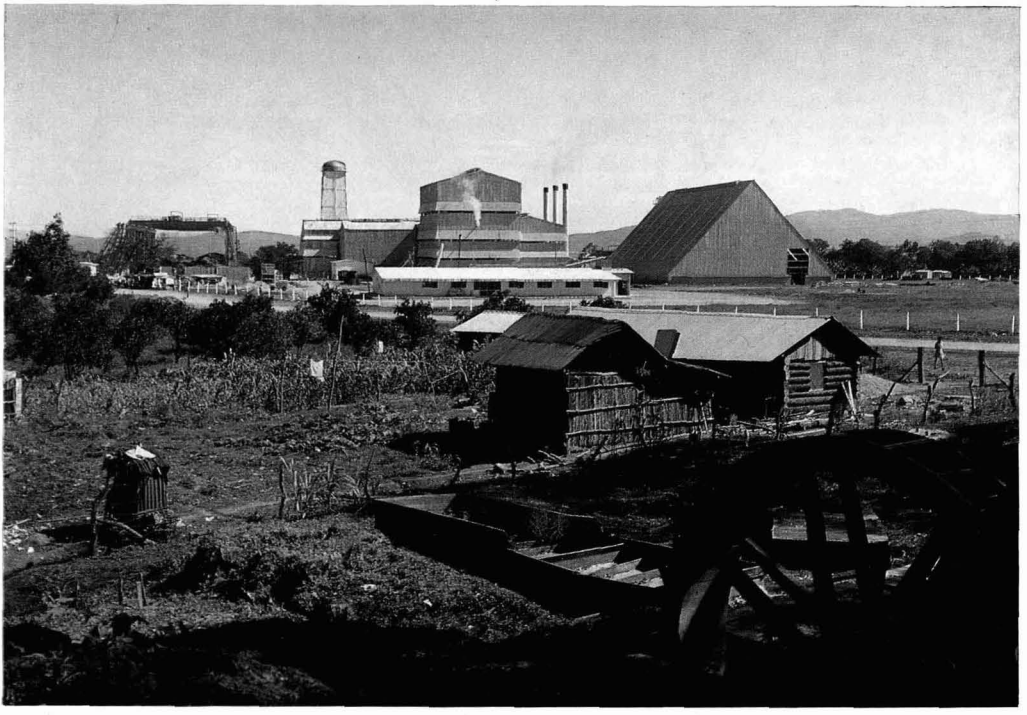
* * *

"Paraquat"—a useful herbicide. L. G. W. TILLEY. *Cane Growers' Quarterly Bull.*, 1974, **38**, 32–33. Advantages of "Paraquat" ("Gramoxone"), recommended methods of application, and precautions to take when applying it are discussed.

SMITH MIRRLEES

IN

MEXICO



Tambaca (Alianza Popular) Factory

We are pleased to report that this factory went into production in January after trials in December and is now being operated by the personnel of "Operadora Nacional de Ingenios" of Mexico.
The factory is designed to crush 4,000 tonnes cane per day and produce 96° Pol raw sugar and was supplied on a "Turnkey Basis" in collaboration with F.Y.M.I.S.A. our Associate Company in Mexico.

A & W Smith & Co Ltd

Cable Address: SUGRENGINE, BROMLEY, KENT

The Mirrlees Watson Co Ltd

Cable Address: MIRWAT, BROMLEY, KENT

SUGAR FACTORY AND REFINERY ENGINEERS

No. 1 COSMOS HOUSE, BROMLEY COMMON, BROMLEY

BR2 9NA, GREAT BRITAIN

Telex No. 2-2404

Works: Cook Street, Glasgow G5 8JW

COMPANIES IN THE TATE & LYLE GROUP

Standover cane. C. MCALEESE. *Australian Sugar J.*, 1974, **66**, 143–145.—Tests on standover cane in northern Queensland, where the conditions at the end of the 1973 season were so wet that field operations became impossible, showed that certain varieties remained quite healthy and maintained "reasonable" sugar contents when stood over. Generally, the sugar contents dropped between February and March, but subsequently rose again to reach, early in May, the level they had been at in February. On the other hand, the number of suckers in May was more than four times the number in February, and this would have had a significant effect on the ultimate sugar yield. Successful harvesting of standover cane also depends on the cane processing quality, weather conditions for some time before harvesting, and on the skill of the harvester operators; but the most important factor determining the success of the harvest is the pre-harvest burn, which must produce enough heat to eliminate dead and rotten stalks. The harvesters must be operated at a lower speed than for normal cane. Standover cane should be harvested as soon as weather conditions permit in order to prevent further deterioration and damage by rats.

* * *

Cane up on new Isis farms. ANON. *Australian Sugar J.*, 1974, **66**, 150–151.—Illustrations demonstrate the achievements of a number of farmers in the Isis region of Queensland, where young plant cane was already visible in the first week of June on land which in early March had been virgin forest land. Under the Isis Land Use Scheme, farmers are allocated level forest land for cane growing in place of eroded steep slopes on which they have previously grown cane. Priority has been given to those farmers who had at least half of their cane land with a slope greater than 8%. An irrigation channel to be built as part of the Bundaberg-Monduran Dam irrigation project will run adjacent to the new cane lands. In most cases, the early tree clearance and cane planting work was carried out on 20–30 acres before the onset of winter.

* * *

Louisiana grass infestation. L. L. LAUDEN. *Sugar Bull.*, 1974, **52**, (20), 6, 15.—The amount of grass growing in cane fields during 1974 is regarded by the author as the highest for 15 years. Opinions of a number of cane farmers indicate confidence that results would still be good despite the problems created by the grasses.

* * *

Basic sugar cane breeding, Houma, Louisiana, 1973-74 season. P. H. DUNCKELMAN and M. A. BLANCHARD. *Sugar Bull.*, 1974, **52**, (20), 8–14.—An account is given of cane breeding work carried out during 1973–74 at Houma, and plans for 1974–75 are discussed. A table shows basic cane crosses and true seed production, and illustrations are given showing the various activities.

* * *

Sugar cane breeding (in Réunion). ANON. *Rpt. Centre d'Essai de Recherche et de Formation* (Réunion), 1973, 2–37.—An account is given of breeding work at the Centre d'Essai de Recherche et de Formation (CERF) (formerly the Station d'Essai) at La Bretagne. The variety R 397 has been used as male parent in a number of combinations, chiefly with imported varieties, and a total of 179 crosses has been made. Q 72 and Q 86 are two varieties which have been used for the first time in breeding work.

Cane diseases (in Réunion). ANON. *Rpt. Centre d'Essai de Recherche et de Formation* (Réunion), 1973, 38–41.—The situation as regards gumming disease, leaf scald, smut, yellow spot, rust, pokkah boeng and pineapple disease is reported.

* * *

Weed control (in Réunion). ANON. *Rpt. Centre d'Essai de Recherche et de Formation* (Réunion), 1973, 42–43.—A list is given of herbicides tested at various sites in Réunion. Illustrations show the effect of "Glyphosate" (Mon 2139) against *Paspalidium geminatum* (whistle grass), but also indicate its phytotoxicity to young cane; brief mention is made of the fact that some herbicides having excellent weed control properties are also highly phytotoxic to young cane or to intercrops, so that caution in their use is necessary.

* * *

Varietal tests (in Réunion). ANON. *Rpt. Centre d'Essai de Recherche et de Formation* (Réunion), 1973, 45–159.—Full details are given in the form of tables showing the results obtained in cane varietal tests at different sites in Réunion.

* * *

Field preparation necessary for a successful and economical harvesting mechanization programme. R. R. DOWNS. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 179–185.—The various factors to be taken into consideration in setting up a cane mechanization programme are discussed and the economics briefly examined.

* * *

Cane varieties grown in Réunion in 1973. E. BOYER DE LA GIRODAY. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 232–238.—Details are given of the major cane varieties grown on the 44,100 hectares of cane land in Réunion, with information on their properties and susceptibilities to disease.

* * *

Role of herbicides in the maintenance of cane in Réunion. F. LÉOVILLE. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 239–243.—The use of herbicides in Réunion is discussed generally, and the economics examined. While chemicals have helped to combat some of the more important weeds on the island, it is argued that the costs of chemical control on a plantation yielding 45 metric tons of cane per ha (representing 75% of the area under cane in Réunion) are greater than on a farm yielding 75 tons per ha, and that, to derive greatest benefit from herbicide application, it is advisable to consider the problem of cane growing in its entirety (periodic replanting, correct choice of varieties, fertilization, etc.).

* * *

Correction for sulphur deficiency in sugar cane in Madagascar. P. HALAIS and A. GIRAULT. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 244–250.—Foliar diagnosis at the start of 1972 revealed a sulphur deficiency in cane growing in the north-west of the Malagasy Republic; the deficiency was ascribed to the application, since 1966, of a mineral fertilizer composed only of urea and potassium chloride. Visual signs of the deficiency became apparent later. Application of 48 kg of sulphur as ammonium sulphate per ha to ratoon cane increased yield to 77 metric tons per ha without treatment. Recoverable sugar % cane rose from 8·5 to 8·9. A mixed fertilizer containing no P (so far not required in the country) but N, S and K in varying proportions, according to whether plant or ratoon cane is treated, is expected to offer a permanent remedy.

Sugar cane fertilization—result of work by IRAT-Réunion. J. FRITZ. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 251–255.—See *I.S.J.*, 1975, **77**, 147.

* * *

Soil-water relations of cane plant. I. Measurement of soil and cane leaf water potential by thermocouple psychrometer. S. J. YANG. *Rpt. Taiwan Sugar Research Inst.*, 1973, (62), 1–12.—The total water potential of saline soil samples can be measured accurately by a thermocouple psychrometer unit, it was found in experiments, while the osmotic potential can be calculated from the difference between the capillary and total water potential. The psychrometer readings for saline soil agreed closely with values obtained with a porous plate moisture extractor. Results of tests on cane showed that leaf water potential decreased as the leaf position increased, and that the magnitude was affected by the soil moisture. The water potential of +1 leaf varied during the day, decreasing gradually after sunrise and reaching a minimum in early afternoon; after sunset, the potential increased to the same value as in the early morning.

* * *

Chemical control of pineapple disease of sugar cane. C. S. WANG and D. K. JIANG. *Rpt. Taiwan Sugar Research Inst.*, 1973, (62), 13–20.—Tests with a number of fungicides are reported, in which one-bud cuttings from eight cane varieties were dipped in solution before inoculation with a suspension of *Ceratocystis paradoxa* spores. Results, expressed as % germination 11, 17 and 29 days after planting as well as root and foliage dry weight, showed that 1 minute dipping in 0·1% "Benlate" was effective in controlling the disease as well as stimulating germination and growth, compared with untreated controls. However, soaking in 0·01% "Benlate" or 0·01–0·02% "Benlate" in calcium hydroxide for 24 hours gave much better results than did the 1-minute treatment, while "Captan" and "Folcidin" at 0·2–0·4% or a mixture of 0·1% "Captan" or "Folcidin" with 0·05% "Benlate" were as effective as 0·1% "Benlate". Hence, control measures will be largely governed by costs and availability of the chemicals.

* * *

Studies on the habits of overwintering and oviposition of *Patanga succincta* L. and chemical control. C. J. LIANG and C. H. CHANG. *Rpt. Taiwan Sugar Research Inst.*, 1973, (62), 31–40.—The overwintering and oviposition habits of the adults, migratory pattern of the nymphs and effect of insecticides were investigated in the case of this locust which annually infests upland fields in a particular region of Taiwan. While 5% "Matacil" and 2% methyl-"Parathion" at the rate of 40 kg.ha^{-1} applied in June–July killed 92% and 96% of the nymphs, respectively, 6 days after treatment, "Malathion" is still considered the most suitable chemical because of its low cost and small environmental effect.

* * *

Survey on the seasonal occurrence of sugar cane borers. VIII. Tainan District. C. J. LIANG. *Rpt. Taiwan Sugar Research Inst.*, 1973, (62), 21–30.—The seasonal occurrence of five species of borers in the Tainan region was investigated during the period from 1960/61 to 1972/73 and the degrees of damage determined. Nearly half of the dead hearts in young sugar cane was caused by the grey borer, *Eucosma schistaceana*, 30% by the shoot borer, *Chilotraea infuscatellus*, some 15% by the top borer *Scirpophaga nivella*, while only some 5% and 4% of the dead hearts was caused by the pink borer *Sesamia inferens* and the stalk borer *Proceras venosatus*, respectively. Lower borer incidence in some years was attributed to lower average temperatures than in others. Some differences were found in the times of the year when the infestation of specific borers was maximum. The grey borer also caused severe damage in maturing cane and was responsible for some 90% of borer infestation of the internodes.

* * *

Zinc adsorption by sugar cane soils of Taiwan. I. Effect of exchangeable cations and zinc concentrations on zinc adsorption and the model of the adsorption isotherm. T. C. JUANG and M. M. KAO. *Rpt. Taiwan Sugar Research Inst.*, 1973, (62), 41–51.—Primary factors governing adsorption of zinc by four clay soils, representative of those on which cane is grown in Taiwan, were studied. Adsorption at 25°C revealed two adsorption isotherm models for the clays investigated, viz. the Langmuir and the Freundlich model. Results of the investigations are tabulated.

* * *

The isolation of phenol oxidase from sugar cane and its properties. W. P. CHEN and C. S. TSOU. *Rpt. Taiwan Sugar Research Inst.*, 1973, (62), 53–62. Studies of the properties of phenol oxidase isolated from F 160 cane variety are reported and the procedure used to extract the enzyme from the cane meristem is described.

* * *

Increase of seedlings of sugar cane pricked out in five different substrates. R. CESNIK. *Brasil Açuc.*, 1974, **84**, 21–25.—The number of crosses and seedlings produced during the 1973 breeding programme at the Araras station amounted to 800,000 and the amount of earth required for individual pots or plastic bags is considerable, up to 200 tons per annum. Trials were therefore made to reduce this amount by using four other materials (tannin extract residue, dung, filter cake and coffee residues), alone and mixed with soil in various proportions, as media for growing the seedlings, and the growth measurements subjected to statistical examination. Eleven of the 22 different media were superior to soil alone and, for lowest costs, mixtures of soil with dung and with filter cake were most suitable.

* * *

Cane planting. L. L. LAUDEN. *Sugar Bull.*, 1974, **52**, (21), 5–6.—The cane varieties best suited to conditions in Louisiana are discussed. The desire has been expressed by a number of growers to plant N:Co 310, once a very popular variety in Louisiana but discarded because of its high susceptibility to mosaic. Heat treatment of the seed cane is recommended. Increased cane yields are reported by one grower as a result of using a double-drill method with a wide row. Brief mention is made of the harvesting techniques. It is suggested that a 7-ft row be used and flattened to give a height of 6 inches and thereby provide enough soil to cover the seed cane. Covering with 4 inches of soil is advocated; more than this will adversely affect the cane, particularly where a cold, sandy soil is concerned.

Sugar beet agriculture

Boron and manganese for sugar beets. B. D. KNEZEK and D. R. CHRISTENSON. *Sugar Beet J.*, 1974, **37,** (3), 12–13.—Symptoms of boron and manganese deficiencies in beet are described and recommendations given on the type and rate of application best suited to the conditions in Michigan. Application is considered necessary where the soil pH is above 6·8.

* * *

Efficiency of selection for increasing sugar beet tolerance to beet yellows. Z. PETRÁK and J. SMRŽ. *Listy Cukr.*, 1974, **90,** 123–126.—The selection efficiency for beet virus yellows tolerance at Semcice experiment station in Czechoslovakia was evaluated. Results showed that 40% of the progeny tested during two years had an average of 19·2% greater tolerance than did the parents, while the average sugar content was 13·1% greater under infected conditions than in the case of the parent beet.

* * *

Problems of the sugar industry in Iran. A. A. SADJADY. *Zeitsch. Zuckerind.*, 1974, **99,** 352–355.—The problems confronting the sugar industry of Iran which are discussed include: low beet yields and lack of monetary incentive to the farmers to increase production, the need for mechanization, heavy storage losses (to overcome which the author advocates extending the harvest period from the present 60 days by accelerating beet ripening), beet and sugar price controls and other economic problems.

* * *

Sugar beet research in France. ANON. *Publ. Inst. Tech. Franç. Betterave Industrielle*, 1973, 283 pp.—Full details are given of tests conducted during 1973 under the following headings: spring work (seedbed preparation; seed drill tests; micro-granulator trials for chemicals granulating and feeding; and mechanization); harvesting (covering both topping and harvesting trials); agronomy (varietal performances; correlation between field emergence and laboratory germination; effects of fertilization, irrigation and variety on juice purity; chemical weed control; and irrigation trials); and details of insecticide trials and experiments on *Cercospora* leaf spot control with fungicides.

* * *

Sugar beet research in Algeria. ANON. *Agron. Tropicale*, 1974, **29,** 530–532.—Results are given of beet varietal, fertilization and harvest date trials in Algeria.

* * *

Incidence and importance of beet yellowing viruses in Sweden 1946 to 1973. K. BJÖRLING and G. MÖLLERSTRÖM. *Socker Handlingar*, 1974, **26,** (1), 1–14.—The position in Sweden during 1946–73 with regard to the incidence of beet yellows virus and beet mild yellows virus is surveyed with accounts of the occurrences of vectors and sources of infection as well as control measures and various investigations and field trials. Two matters of some significance which are discussed are the change in the relative proportions of the two diseases, and the effect of both on beet yield and sugar loss and composition (particularly the increase in noxious nitrogen caused).

* * *

Possibilities of economy in the amount of seed used in sugar beet agriculture. Y. BILGIN. *Seker*, 1974, **12,** (90), 19–25.—While the quantity of beet seed planted at different sites in Turkey has been reduced to an average of 1·5 kg.ha^{-1} compared with a previous 2·5 or 3·0 kg.ha^{-1}, tests have indicated that the weight of seed planted can be reduced even further to 1 kg.ha^{-1} without appreciable fall in yield compared with the higher density planting, provided the inter-row spacing is increased to 40 cm (in some cases 45 cm) from 33 cm and provided particular attention is paid to seedbed preparation, use of precision drills and choice of seed.

* * *

The accumulation of sugar in the sugar beet. F. PAPY. *Sucr. Maghrébine*, 1974, (12), 5–10.—The processes of growth of the sugar beet and by which it accumulates sugar are explained and factors governing the sugar content are briefly discussed.

* * *

Polyploidy in plant breeding. K. YAHYAOGLU. *Seker*, 1974, **12,** (91), 25–31.—The advantages of beet polyploidy as regards increased sugar yields are discussed. It is emphasized that the benefits are not immediate but are only obtained through careful breeding work.

* * *

Soil acidity. R. VANSTALLEN. *Le Betteravier*, 1974, **8,** (79), 7, 10.—Advice is given on liming of acid soil in order to combat the problems of poor emergence and retarded growth of beet resulting from too low a pH.

* * *

Advice on harvesting. A. VIGOUREUX. *Le Betteravier*, 1974, **8,** (79), 8–9.—Guidance is given on maintenance and adjustment of equipment before the campaign, adjustment in the field during harvesting, optimum harvesting depth and beet loading.

* * *

Nitrogen fertilizer, previous cropping and soil type. A. P. DRAYCOTT and M. J. DURRANT. *British Sugar Beet Rev.*, 1974, **42,** 128–132.—Results of many hundreds of experiments have shown that, apart from nematode-infested sandy soil, all soils on which beet is grown in the UK need no more than 100 units of nitrogen per acre (1 unit = 1·12 lb) to give maximum sugar yields, and that the actual optimum dressing varied from none in 25% of the fields tested to about 85 units per acre. Hence, it is pointed out that use of more than the 100 units per acre (which already includes some "insurance") will raise costs unnecess-

arily in the form of the extra fertilizer, lower sugar contents and extra water in the roots to be transported to the factory. Factors governing the optimum N application were examined, viz. the soil N content as a result of previous cropping and the amount applied before, winter rainfall and soil texture, and from the findings of 224 experiments, recommendations have been made. (See also DRAYCOTT *et al.*: *I.S.J.*, 1974, **76**, 355–358.)

* * *

Sugar beet harvester. I. RUTHERFORD. *British Sugar Beet Rev.*, 1974, **42**, 138–144.—The performances of six different beet harvester systems, covering a total of 52 machines, were studied during the 1973/74 beet harvest under a wide variety of conditions. While the three-stage multi-row system proved the best as regards the hourly rate of harvesting, the task of managing the larger team of men and tractors plus the higher costs involved would be justifiable on only large, well-organized farms, whereas the two-stage harvester lifting beet from three rows was almost as good and combined the best features of several systems. Moreover, the three-stage system was more prone to interruptions. Over 30% of the harvesters were used for less than 100 hours, and over 56% for less than 150 hours per season. Most farmers were satisfied with the mechanical reliability of the harvesters, and only 3% of the total time was accounted for by breakdowns.

* * *

Too many beet left in our fields. G. L. MAUGHAN. *British Sugar Beet Rev.*, 1974, **42**, 158–163.—Details are given of the results of an investigation into causes of excessive losses represented by beet left in the ground[1]. The total loss was 1·26 tons per acre, or 8% of the UK beet yield. Over 25% of the losses were attributed to two causes: inadequate depth of the lifters and off-row steering (possibly a result of excessive speed). Of the one-row machines used, the self-propelled tankers generally left more beet behind than the other types; the multi-row harvesters worked more slowly than the one-row machines but recorded fewer losses. On the other hand, the numbers of both types of harvester were limited, possibly being confined to more favourable types of soil. Particular attention is drawn to the need for proper lifter setting in accordance with soil conditions and cleaning capacity of the harvester.

* * *

Delivery and care of beet—a harvesting programme. G. W. SMITH. *British Sugar Beet Rev.*, 1974, **42**, 168–171.—Recommendations are given on planned beet harvesting and delivery to the sugar factory. An efficient programme should allow the farmer to keep abreast of his delivery commitments early in the campaign, harvest his crop before the onset of bad weather, and allow for the storage and protection of that proportion of the crop remaining to be delivered. Advice is given on the most suitable conditions and best form of clamp in which some of the beet will have to be stored for several weeks.

* * *

Wind damage on sand land. G. C. PICKWELL. *British Sugar Beet Rev.*, 1974, **42**, 177–181.—Over the years, wind erosion in the UK has caused more damage than any pest or disease, and in 1973 over 11,000 acres had to be re-drilled at least once, and in some cases three or four times. Various methods of reducing wind erosion of sandy soil such as found in Lincolnshire and Nottinghamshire are discussed, including the planting of straw between the rows[1], the sowing of guard crops, application of lime sludge, spraying with a vinyl plastic emulsion and allowing self-sown cereals from the previous crop to grow. The degrees of success achieved with these methods and their costs are discussed.

* * *

Growers trials to combat soil blowing on mineral soils. R. J. HAGEN. *British Sugar Beet Rev.*, 1974, **42**, 182–185.—Of various methods tested on a farm to reduce wind erosion, the best, from the point of view of beet emergence under very dry and cold weather conditions, was direct drilling of beet into a cereal stubble, although whether beet shape and yield are satisfactory has yet to be investigated. Other techniques tried with varying degrees of success are reported in the preceding abstract.

* * *

New principle for the chemical destruction of bolting and wild beet. M. MARTENS, A. VIGOUREUX and T. VREVEN. *Publ. Trimest. Inst. Belge Amél. Betterave*, 1974, 85–90.—A simple device developed by the IBAB (Belgian Beet Institute) for chemically spraying individual bolting and wild beet plants without harm to normal beet is based on the actuation of an electric valve controlling spray jets by any beet plant which is of excessive height. The device, pushed by a tractor and straddling the row (an illustration shows six working in parallel from one tractor), comprises a horizontal cylinder with a section cut out of the bottom to allow the plant to intrude and, if tall enough, actuate the valve, whereupon it is sprayed by the side jets. Excess chemical collects in a gutter to the side of the notched section and is discharged by flexible tubes to the ground or is recovered in small tanks located below the cylinder. "Roundup" ("Glyphosate") has been found to be the most effective chemical.

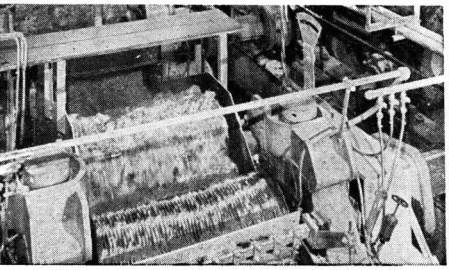
* * *

Effect of herbicides on the processing properties of sugar beet. A. S. KOROL'KOV and A. S. PUZIKOV. *Sakhar. Prom.*, 1974, (9), 65–66.—Tests with a number of herbicides are reported, in which it was found that the processing properties of the beet were better than those of the untreated control, the highest yields of sugar being obtained from beet treated with "Lenacil", "Betanal" and "Ro-Neet" (16·93%, 16·31% and 16·12%, respectively, compared with 14·27% from untreated beet), although "Betanal" did cause a slight rise in molasses sugar compared with the control.

* * *

Variation in sugar beet processing properties with sowing density and irrigation. P. E. SHCHEPETNEV, I. M. NIKUL'NIKOV and N. D. BELOVA. *Sakhar. Prom.*, 1974, (9), 66–68.—Studies showed that a sowing density of 100,000 plants per hectare gave better processing properties, including higher sugar yield, than did a density of 50,000 and 150,000 plants per hectare, although the maximum density was still better than the lowest density studied. Irrigation improved the beet properties still further in a season of low rainfall, but had a detrimental effect when rainfall was above the seasonal average.

[1] *I.S.J.*, 1975, **77**, 2.
[2] NORRIS: *ibid.*, 52.



Cane sugar manufacture

First year's operation—Cowley sugar factory. F. J. BLANCHARD. *Sugar J.*, 1974, **37**, (2), 12–16.—The performance of Cowley sugar factory in its first cane crushing season is examined and operational features of various pieces of equipment and process stations described.

* * *

Sugar manufacture in Mauritius. ANON. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1973, 49–53. Apparent discrepancies in cane fibre content reported from St. Antoine sugar factory following installation of a "Saturne" diffuser showed that calculated bagasse weight averaged 21% more than did the weight established by an "Ohmart" gamma-ray weigher, found by regular calibration to be accurate to within ± 2%. The difference between the calculated and directly determined weights was reduced to 10% when extraction was carried out with mills during a 2-week period. Comparison of primary and secondary juice analyses at St. Antoine with those at Belle-Vue factory, which operates a conventional milling tandem, showed that there was a 58·5% increase in suspended solids % Brix, a 45·4% increase in precipitated muds % Brix, a 45·4% increase in precipitated muds % Brix and a 66·6% increase in starch % Brix from primary to secondary juice at Belle-Vue, while at St. Antoine there was an average *decrease* in the corresponding parameters of 27·7%, 34·1% and 38·9%, indicating that filtration, clarification and starch elimination were particularly affected by diffusion. Tests were carried out in which sub-samples of 1st mill bagasse were subjected to cold extraction in a wet disintegrator either immediately after sampling or after 40 minutes' exposure to conditions normally occurring in a "Saturne" diffuser (with respect to pH, temperature and solid:liquid ratio). Results, expressed as average Brix, pol and reducing sugars content in the liquid extract after treatment, showed that hot maceration improves extraction to such an extent that inversion of sucrose is not likely to occur in diffusion. Inadequate purity drops in high-grade strikes at Mon Loisir factory were caused, it was concluded from investigations, by too high a feed rate of diluted runnings and/or circulation water towards the end of boiling just before tightening-up, which prevented the required drop in mother-liquor purity. Continuous crystallizer tests at two factories gave satisfactory cooling rates, but because of certain problems, conclusions could not be drawn concerning mother-liquor exhaustion. Comparative evaluation of the suitability of four methods (double polarization, the A.O.A.C. method with invertase, the Sugar Research Institute acid inversion method and the Canadian National Committee method using invertase) for sucrose determination in final molasses showed that the A.O.A.C. and Canadian National Committee methods are not appropriate for routine analysis, and that while the Sugar Research Institute method is much simpler than the double polarization method, the standard deviation is too high and recovery too low for adoption as a routine method. Brief mention is made of investigations into a number of other process and chemical control parameters.

* * *

The sugar industry in Egypt. ANON. *Sucr. Maghrébine*, 1974, (12), 11–14.—Some information is given on the Egyptian cane sugar industry with brief mention of by-products, A proposed beet sugar factory is indicated in the list of sugar factories.

* * *

Ingenio El Naranjo—a new sugar factory for Mexico. J. PRIETO. *Sugar y Azúcar*, 1974, **69**, (7), 34–35. Some information is given on the equipment installed in this new cane sugar factory which started its first trial season in May 1974. It has a crushing rate of 4000 metric tons of cane per day, with possibility of expansion to 6000 t.c.d.

* * *

Study on the microflora in the production of raw sugar. E. DUARTE, I. VALDÉS, L. PAZ and M. NEGRETE. *Sobre los derivados de la caña de azúcar*, 1973, **7**, (3), 37.—A summary is presented of work carried out on determination of microbial counts on samples from the compartments of a De Smet diffuser and also from the milling tandem, clarifier house and boiling house of a different factory. The variations in counts through the process are tabulated and discussed.

* * *

Influence of the quality of filtrate on clarifier capacity. P. M. FABRÉGAT P. *Centro Rev. Cient. Univ. Central Las Villas, Serie: Azúcar*, 1973, **1**, (1), 19–27.—A study was made of the influence of the solids content of the recirculated filtrate stream on clarifier capacity. To do this, material balances were made on the clarifier-filter station using process data, and the weight of solids returned in the filtrate were calculated for extreme and average conditions, and their influence on clarifier capacity determined. The quantity of recirculated solids when plotted against the available clarifier capacity gives a straight line graph of negative gradient and it is seen that clarifier capacity occupied by recirculated filtrate is between 5% and 20% of the total.

* * *

Evaporator entrainment separator. J. C. MARTIN. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 263.—A simple means of reducing juice droplet entrainment with 1st effect vapour passing to two 2nd effects in parallel is described. It consists of a piece of narrow tubing closed at one end by a valve and located opposite the end of the vapour feed line where this enters a transverse section of feeding to both vessels. Thus, the entrained droplets leave the end of the vapour line and cross the transverse section to the extension tube. By this means, 10 litres of juice have been recovered in a day, representing 1–1·5 kg of sugar.

Preventive maintenance and wear in the sugar industry. J. NANUEL. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 264–266.—The problem of sugar factory equipment wear and its major causes are discussed and the need for adequate preventive maintenance by use of suitable wear-resistant alloys and finishes is emphasized as a major economic factor.

* * *

Adaptation of continuous crystallization to the cane sugar factory. G. WINDAL. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 267–273.—After describing the continuous Fives-Cail Babock vacuum pan designed for beet sugar factories, the author gives some information on the 2500 tons/day continuous pan installed at Quartier-Français cane sugar factory in Réunion for *A*-massecuite boiling.

* * *

Operation of the continuous vacuum pan at Quartier-Français sugar factory. M. RIVIÈRE. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 274–279.—An outline is given of preliminary test results with the Fives-Cail Babcock continuous vacuum pan installed in 1969 and fuller details are given of its performance on *A*- and *B*-massecuite in the latter half of 1973.

* * *

Recent trends in cane preparation in South Africa. N. ALLAN. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 280–289.—A critical survey is presented of cane preparation equipment in South African sugar factories with descriptions of specific equipment at individual factories. It is concluded that an installed power rating of about 50 kW per ton of fibre.hr^{-1} is adequate to give a Preparation Index value of 85–90 at up to 270 t.c.h. throughput (at a cane fibre content of about 16%). Where there is an inclination to consider increasing the power consumption to achieve the required preparation, the author feels that it would be more advisable to examine ways of improving equipment efficiency.

* * *

Influence of preparation, temperature and pH in cane diffusion. J. HITIÉ. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 290–297.—Details are given of tests which showed that finely prepared cane is requisite for high diffusion efficiency, that the temperature should be 65–70°C (below 65°C the extraction efficiency was found to be relatively poor), while more experiments are needed before conclusions can be drawn on the effect of pH on diffusion.

* * *

New approach to the development of a continuous vacuum pan. F. LANGRENEY. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 298–301.—The author considers the possibility of developing horizontal continuous vacuum pans which would be similar in design to a floating calandria pan and fixed calandria pan with central downtake, the only difference lying in the fact that the upper section of the pan would be circular and not as with conventional pans. A third design has a longitudinal baffle inserted through the middle of the calandria and passing down the length of the pan, thus dividing the vessel into two sections and permitting forward and return flow of the massecuite along each section. For massecuite feeding, the author envisages a type of rectangular sectioned conduit having a height almost the same as the massecuite space and running along inside the pan, continuous feeding being assured by an overflow arrangement. An alternative system of double conduits would permit forward and return flow, while sloping of the conduit would allow the feed rate to be varied.

* * *

Incidents in the operation of a new steam generator. L. LINCOLN. *Rev. Agric. Sucr. Maurice*, 1973, **52**, 302–308.—Details are given of a bagasse furnace with a rated capacity of 70 tons of steam per hour installed at Bois-Rouge sugar factory, and an account is given of the problems created by malfunction of the induced draft fan and ash slurry pump. The problems have been overcome, but not before a series of shutdowns and more or less continual trouble from start-up of the furnace, and the author warns against buying such equipment from suppliers who know nothing about cane or bagasse and who fail to give sufficient information on major components, or assembly details (of great importance where, as in the case of boiler plant, there is a maximum of construction to be done on site).

* * *

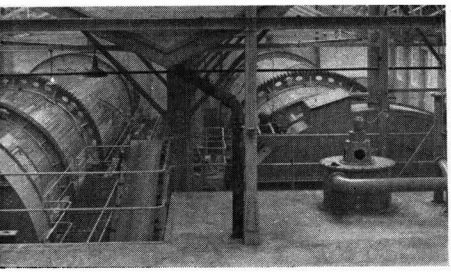
Variation of polarization of bagasse along the roller of the crusher and mills. U. DE A. LIMA, L. G. DE SOUZA, M. M. MISCHAN, J. S. GOLDONI and M. P. CEREDA. *Brasil Açuc.*, 1974, **84**, 44–55.—Experiments in Cuba showed a higher polarization in bagasse sampled at the ends of the rollers compared with samples taken from midway, and this was interpreted as indicating better imbibition in the centre of the roller length. In experiments carried out at Usina Indiana samples were taken at the extremities and three equidistant points along the rollers of the crusher and three mills, and analyses made of the bagasse pol; the pol from the extremity samples was higher than for the other three, as in Cuba, but there was considerable and unsystematic variation between the pol measurements for the three inside samples.

* * *

Improvements to a transmitting refractometer for sugar pan control. R. J. BATTERHAM, W. T. DENHOLM and C. H. WEEKS. *C.S.I.R.O. Div. Miner. Chem. Invest. Rpt.*, 1973, (545R), 19 pp; through *S.I.A.*, 1974, **36**, Abs. 74-1168.—Factory tests on a Bellingham & Stanley Model R23E refractometer, being used for monitoring mother liquor Brix during sugar boiling, showed that the instrument was subject to unpredictable calibration shifts of up to 10%. These shifts arose mainly from sensitivity to variations in applied voltage, in the temperatures of the optical housing and transmitter, and in lamp position. The transmitter was modified by arranging the photo-detector in a full-bridge, rather than a half-bridge, circuit; the optical housing was kept cool by a current of air. These modifications reduced the sensitivity to lamp position or temperature by one-half and that to mains voltage by five-sixths; the useful working range was increased from 3–4°Bx to 5–6°Bx. The calibration should be checked weekly and the instrument overhauled annually. Full technical details are given in an appendix.

* * *

Modern milling methods. T. N. MAHALINGAM. *Indian Sugar*, 1974, **24**, 19–21.—A brief survey is presented of modern equipment and practices being used in cane preparation and milling in certain countries.



Beet sugar manufacture

Sugar beet and sugar cane in competition. Problems of development of the sugar economy in Khuzestan, Iran. B. ANDREAE. *Zeitsch. Zuckerind.*, 1974, **99,** 359–368.—While the beet farmer in Khuzestan earns more per hectare than if he grew cane in the region (where both beet and cane can be grown on the same farm), cane processing costs are lower because of the longer cane season. It is suggested that combined cane and beet sugar factories should be set up in Khuzestan which could operate from end-September to end-March for cane processing and from mid-April to end-June with winter-grown beet. The only economical alternative to the combined factory would be a beet sugar factory with double the normal diffusion capacity and thick juice storage. A beet sugar factory with refinery section would be economically viable only so long as raw sugar was being imported.

* * *

Inhibitory action of various quaternary ammonium compounds on micro-organisms present in diffusion. G. VACCARI, D. MATTEUZZI and G. MANTOVANI. *Ind. Sacc. Ital.*, 1974, **67,** 55–60.—The importance of microbial infection in diffusers and its control are discussed, including the use of increased temperatures and of formalin. Use of antiseptic agents other than formalin is also discussed, with especial reference to quaternary ammonium compounds, and an account given of experimental work on testing seven such compounds against *Leuconostoc mesenteroides*, *Saccharomyces* sp. and two strains of *Bacillus subtilis*.

* * *

Oriental sugar factory. ANON. *Sucr. Maghrébine*, 1974, (11), 8–11.—Information is given on equipment and processes at the Oriental sugar factory/refinery (SUCRAFOR) which started operations in 1972 and has a daily slicing capacity of 3000 metric tons of beet during a 2½-month campaign between the end of May and the beginning of August; it also processes cane during a 2-month period from the end of March to the beginning of May at the rate of 2000 t.c.d. The factory is located midway between Berkane and Nador in Morocco.

* * *

Sugar losses in beet washing. R. DE VLETTER and W. VAN GILS. *Sucr. Franç.*, 1974, **115,** 350–358.—See *I.S.J.*, 1974, **76,** 233–237, 266–269.

* * *

Thick juice storage. J. NAGY. *Cukoripar*, 1974, **27,** 139–143.—Details are given of pilot-scale and full-scale tests on thick juice storage in a closed tank. Results indicated that after 46 days, the juice had suffered no deterioration in terms of purity, colour, invert sugar content and microbial populations. pH and Brix remained reasonably constant.

* * *

Foaming of industrial fluids. P. D. BERGER. *Sugar J.*, 1974, **37,** (2), 22-27.—The theory and practical aspects of foam formation are examined, and the two basic forms of foam (with spherical and polyhedric bubbles) described. Factors contributing to foam stabilization (high values of surface viscosity, surface charge and surface transport, the presence of condensed surface layers and a slow rate of surface absorption from bulk solutions) and techniques used for their measurement are reported, and the action of defoaming agents on beet diffusion juice explained.

* * *

The theory of sugar crystallization. V. M. KHARIN. *Izv. Vuzov, Pishch. Tekh.*, 1974, (3), 97–101.—A theory postulated by the author is based on mass transfer between mother-liquor and particles whereby the local difference in temperature between the crystal surface and the bulk of the mother-liquor is so small that it can be ignored. While preliminary studies have indicated a close correlation between the theoretical results and experimental values obtained by SILIN, the author considers it necessary to carry out further tests of a broader nature.

* * *

Causes of a sugar dust explosion and preventive measures. E. OZKAN. *Seker*, 1974, **12,** (90), 12–18. The theory of sugar dust explosions is explained and measures for their prevention discussed. Brief reference is made to well-documented cases of dust explosions which have occurred in recent years.

* * *

"Blankit" and sulphitation. P. GÜRAY. *Seker*, 1974, **12,** (90), 26–41.—The merits and demerits of the use of "Blankit" (sodium hydrosulphite) as opposed to SO_2 in thick juice sulphitation are discussed with the aid of results obtained from Turkish sugar factories.

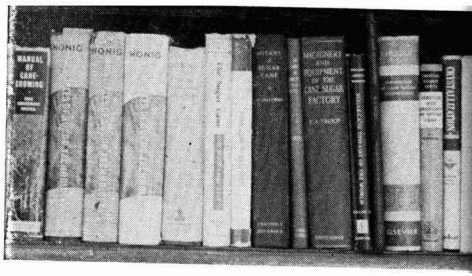
* * *

High-pressure pneumatic conveying of white sugar. T. K. VASIL'EVA. *Sakhar. Prom.*, 1974, (7), 15–21. Tests on pneumatic conveying of white sugar over a distance of 100–150 m are described, in which no difficulties were encountered at sugar moisture contents of up to 0·19%. An experimental system designed on the basis of the test results has a rated throughput of 70 tons.hr^{-1}.

* * *

Rapid method for determination of slightly and deep frozen, thawed and rotted (beet) roots. A. YA. ZAGORUL'KO, R. TS. MISHCHUK, A. K. KOSIK, S. A. BOGDANOV and N. S. KOCHUBEI. *Sakhar. Prom.*, 1974, (7), 39–44.—The frozen status of a beet is determined by measuring the temperature by means of thermometers inserted in the sample at four different points. The presence of rotted tissue is indicated by green or dark-green fluorescence in ultra-violet light, while determination of possible thawing of the beet depends on the relationship between cryoplasmolysis and resistivity of the tissue. A description is given of a device for measuring the thawed state (or otherwise) of the beet, and some experimental data are tabulated.

New books



Yearbook and directory of Indian sugar factories 1969-70 and 1970-71; Year book and directory of Indian sugar factories 1971-72. ANON. 275 pp and 226 pp; 18·5 × 23·0 cm. (Sugar Technologists' Association of India, P.O.N.S.I., Kanpur, 208017 India.) 1974. Price: Rs. 20 and Rs. 10.

These two publications provide between them detailed results achieved in Indian sugar factories during three seasons which including milling inforation, rendements, details of clarification efficiency and boiling house work. In addition, they include information on the sugar factories and distilleries operating in India for the seasons 1971–72 and 1973–74, with the addresses of head offices, factory locations, nearest railway station, telegraphic addresses, make of plant installed, crushing capacities and details of the milling plant, clarification process used, and the names of the senior executives. Even more detailed information is given on a small number of individual sugar companies. The books will be of great use to any reader seeking detailed information on the Indian industry since they contain statistics not available, so far as we know, in any other publication.

* * *

The Caribbean sugar industries: Constraints and opportunities. G. B. HAGELBERG. 173 pp; 13·7 × 21·5 cm. (Antilles Research Programme, Yale University, Box 1970, Yale Station, New Haven, Conn., 06520 USA.) 1974.

This book is the third in a series of *Occasional Papers* published by the Antilles Research Programme. It examines the situation of the sugar producing countries of the Caribbean area in terms of its past history as a colonial region, of its dependence on a largely monoculture of sugar cane and on the circumstances which affect the independent countries of the area in relation to the rest of the world. It is pointed out that sugar cane is a crop uniquely appropriate in a tropical climate subject to extremes of weather which will destroy others; it is also of immense benefit in maintaining soil fertility and protects the earth by its perennial cover.

The plantation concept, of large areas devoted to cane cultivated by slaves and dependent on an expatriate management from a colonizing power, has produced a reaction which can have economically harmful effects; land reform, with splitting of cane lands into smallholdings, prevents the application of modern farming techniques, and research has shown that sugar companies in the BWI and Cuba used their large areas efficiently so that there is no gain in breaking up the plantations. Again, sugar cane is a remarkably efficient crop and, while diversification may be desirable, in some cases it is not possible while, in others, it is cheaper to import other crops, such as corn, from areas where it is a more suitable crop while paying for it with the proceeds from sugar. Certain diversifications on a basis of cane have favourable prospects, e.g. animal feeding, bagasse board, fermentation products from molasses, etc., but obstacles to diversification into other crops are often glossed-over.

Development of the small open economies of the area cannot be independent of the rest of the world, however, because of the need for imported capital and capital equipment and, while there is a danger of violent fluctuations in earnings from sugar (as a consequence of inelasticity of demand to changes in production levels), the existence of agreements such as the CSA and US Sugar Act quota system have served and can serve as a protection against them.

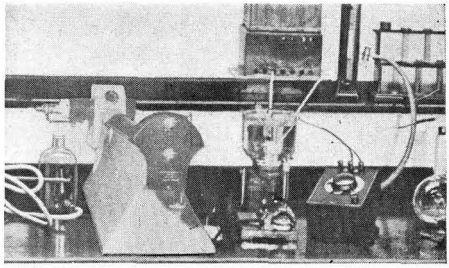
The author concludes that sugar cane has still a large role to play in providing for the welfare of the peoples of the Caribbean and that, if this is so, the policy must be to rationalize and expand production.

* * *

IAA estaçoes experimentais. Relatório anual 1973. 64 pp; 21 × 28 cm. (Instituto do Açúcar e do Alcool, Praca 15 de Novembro, 42, 2000 Rio de Janeiro, Guanabara, Brazil.) 1973

During 1973 PLANALSUCAR, the Brazilian programme for the sugar industry, extended its activities to the states of Pernambuco and Rio de Janeiro, anticipating the work of the second phase of the programme originally planned for 1974–76. The experiment stations were generally improved, two state experiment stations and five sub-stations for selection being established as well as an entomological laboratory. Seedling production reached the 2,000,000 mark, bringing the total number of new clones for selection since the start of the programme to 3,170,000.

The work carried out under PLANALSUCAR has been intensified in many sectors, and this annual report gives information on the cane breeding activities as well as plant pathology, agronomy and agroclimatology work. The book is well illustrated with colour photographs and is printed in both Portuguese and English. A map showing the sugar cane areas and the sites of the experiment, quarantine and sub-stations is of great help in understanding the enormity of the task which the organizers of PLANALSUCAR have set themselves. By this planned approach to the many problems confronting the industry and by expanding cane into new areas, as well as establishing closer liaison with the University of São Paulo, the Brazilians have ensured that they will be making a notable contribution to world sugar production and that their industry will be in the hands of highly trained personnel. For cane agriculturalists this book will be of great interest, but also for others only slightly associated with the agricultural aspects of sugar production the work will have something to offer.



Laboratory methods & Chemical reports

Neutralizing potentiometric titration of sugar factory juices, syrups and other products. M. FRIML and B. TICHÁ. *Listy Cukr.*, 1974, **90**, 150–155.—Experiments on the use of potentiometric titration to determine the pH of raw, thin and thick juices, raw sugar, syrup and molasses are reported and the value of the technique to determine microbial activity discussed. Values obtained for raw juice heated for 4 hours at 40°C with and without formaldehyde addition showed that in the presence of formaldehyde the pH approached that of the juice before heating, whereas without formaldehyde the pH was very much lower than originally.

* * *

Investigation of melanoidins and colorants in liquid beet sugar products. V. A. KOLESNIKOV and D. M. LEIBOVICH. *Sakhar. Prom.*, 1974, (7), 21–25.—Results are given of investigations aimed at establishing the nature of colouring matter formed during heat treatment of buffered invert sugar solutions (of 0·4% concentration) in the presence of the amino-group NH_2 and ammonia from amides (represented by glycine and ammonium chloride, respectively). A sharp difference in the optical density was established, whereby the value was much greater in the presence of NH_2 than in the presence of NH_3. In the latter case, a colorant fraction of considerable proportions was formed which could not be separated by treatment with anion exchange resin; this fraction had spectral properties which were similar to those of inseparable fractions of colouring matter found in all beet sugar factory juices and syrups. Elution with HCl of the colouring matter adsorbed by the resin was followed by a sharp fall in the optical density of the fraction, whereas elution with an alkali resulted in a rise in the optical density.

* * *

Formation and composition of beet molasses. XIV. Summary of previous reports and supplementary information. G. VAVRINECZ. *Zeitsch. Zuckerind.*, 1974, **99**, 417–421.—Results indicated in the previous thirteen parts of this work are summarized and values of constants *b*, *c* and *m* derived from saturation functions established by a number of authors are tabulated for both electrolytes and non-electrolytes. It is pointed out that the various factors discussed in all fourteen parts of the article are only some of the causes of molasses formation, while others, e.g. viscosity and particle movement associated with crystallization and dissolution rates, are still in need of detailed investigation, as is the behaviour of melassigenic substances in infra-red light.

* * *

Influence of amino-acids on the colorimetric determination of carbohydrates. J. KOPECKY and N. GONZÁLEZ. *Sobre los derivados de la caña de azúcar*, 1973, **7**, (3), 19–26.—The anthrone and phenol methods for measurement of dextrose are subject to interference by a number of amino-acids (tryptophane, lysine, leucine, albumin, cytochrome C and pepsin) and the extent of this interference is quantified and indicated in graph form.

* * *

A rapid method for determining the volume of filter mud on the laboratory scale. L. CARRAZANA R., M. DARIAS P., R. FAJARDO G., S. FLEITES E. and S. CEPERO G. *Centro Rev. Cient. Univ. Central Las Villas, Serie: Azúcar*, 1973, **1**, 29–38.—The settling of mud from a turbid juice sample in a calibrated cylinder can be followed by noting the position of the clear juice/mud interface (height *h*) at intervals *t*, and a method is described for determining the final volume of mud from two such measurements after 30 and 40 minutes. Plotting the values of t/h on a graph gives a straight line, the gradient of which is given by $-1/h_\infty$, where h_∞ is the mud height at zero sedimentation velocity, i.e. the final mud height. Derivation of the mathematics involved is explained.

* * *

Qualitative and quantitative determination of organic acids in final molasses by chromatographic and conductimetric methods. J. MEDRANO U. and L. BOBROVNIK. *Centro Rev. Cient. Univ. Central Las Villas, Serie: Azúcar*, 1973, **1**, (1), 39–62.—Cuban final molasses samples were treated by ion exchange to remove amino-acids and the organic acids separated and identified by paper chromatography using 7:1:2 *n*-butanol:formic acid:water as the solvent system and subsequently determining the individual acids quantitatively by conductimetric means.

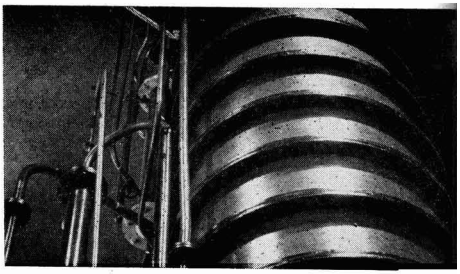
* * *

Adaptation of the molecular sieve method for the determination of colloids in cane juice. M. DARIAS P., L. CARRAZANA R., R. FAJARDO G. and S. FLEITES E. *Centro Rev. Cient. Univ. Central Las Villas, Serie: Azúcar*, 1973, **1**, (1), 63–72.—An account is given of the separation of cane juice constituents of progressively smaller particle size by screening to remove bagacillo, centrifugation to remove mucilaginous material resulting especially from borer attack, filtration through paper to remove mud solids, ultrafiltration through membranes to remove small particles, and finally gel filtration on "Sephadex G-50" to separate the colloidal material.

* * *

Partial specific and molar volumes of water and sucrose in aqueous solutions. S. E. KHARIN, G. S. SOROKINA and L. A. KOROTKOVA. *Sakhar. Prom.*, 1974, (8), 36–38.—Equations are given for calculation of partial volumes of water and sucrose in solutions based on the relationship between them and water and sucrose temperature and concentration. Tabulated results (calculated from experimental data) are given for temperatures of 0°, 20°, 40°, 50°, 70° and 90°C.

By-products



Sugar cane as the basis for beef production in the Tropics. T. R. PRESTON. *Proc. 15th Congr. ISSCT*, 1974, 1895–1917.—Experimental work on derinded cane tops, molasses and bagasse as animal fodder is reviewed with 36 references to the literature. Results of the various tests reported are given in the form of tables or graphs and are discussed.

* * *

Pulp and molasses nutrition, economical. D. C. ROCHE. *Sugar Beet J.*, 1974, **37**, (3), 13–14.—A brief mention is made of the advantages of beet pulp and molasses as animal fodder.

* * *

By-products of sugar beet in animal feeding. ANON. *Cultivo de la remolacha azucarera en Chile*, 1973, (6), 31 pp.—Characteristics of the various by-products (tops and crown, wet and dry pulp, molasses, Torula yeast and lime cake) are described and their use in the feeding of various types of cattle (calves, milch cows, etc.) discussed with a note on future investigations.

* * *

Studies on wet storage of bagasse in bulk form. I. Storing process. W. C. HSIEH, Y. T. LIU and M. S. CHEN. *Rpt. Taiwan Sugar Research Inst.*, 1973, (61), 83–90. **II. Pulping conditions.** W. C. HSIEH and M. S. CHEN. *ibid.*, 91–99.

I. Experiments on small-scale wet storage of bagasse with a biological culture showed that careful control of the pH of the biological flushing solution within the range 4·5–5·0 and maintenance of the bagasse moisture content at 75–80% permitted more than 300 days' storage. The acidic flushing solution caused a slight decrease in the bagasse pentosan and lignin contents while the cellulose content rose by 2·5–3·0%. Preliminary pulping tests indicated a higher pulp yield, lower permanganate number and better physical properties than in the case of dry-stored bagasse.

II. Further pulping studies showed that best conditions were a chemical usage of 10–11% Na_2O (on oven-dry bagasse), 15–20% sulphidity, a 40-minute cook at 160°C and a liquid ratio of 1:4.

* * *

(Effects of) Housing, density and forage feeding system on the performance and carcass characteristics of bulls fed molasses-urea diets. H. LOSADA and T. R. PRESTON. *Cuban J. Agric. Sci.*, 1974, **8**, 1–10.—Experiments in which Brahman bulls were fed on molasses-containing rations showed that toxicity increased and live weight increase was reduced with reduction in the space occupied by the animals and with greater intervals between forage feeding, while molasses consumption increased but feed conversion was poorer with low density housing. Animals in dry lot suffered a greater mortality rate and consumed more metabolizable energy than did bulls housed on a slatted concrete floor.

Effect of final or high-test molasses on molasses toxicity. H. LOSADA and T. R. PRESTON. *Cuban J. Agric. Sci.*, 1974, **8**, 11–20.—When Brahman bulls were fed on rations containing molasses but no fresh forage, they displayed classical intoxication symptoms, whereas molasses toxicity was absent when roughage was incorporated. The toxicity was attributed to changes in the rumen fermentation pattern caused by a fall in voluntary dry matter intake induced by the lack of forage.

* * *

The effect of sodium hydroxide and pressure on the dry matter digestibility of bagasse and bagasse pith. P. C. MARTÍN, T. C. CRIGEIRO, A. CABELLO and A. ELÍAS. *Cuban J. Agric. Sci.*, 1974, **8**, 21–28.—As a contribution to improvement of lignocellulose digestibility (lignin is not degraded in the rumen because the degradation is an oxidative process), studies were conducted on the effects of NaOH and $Ca(OH)_2$ on bagasse and bagasse pith. Results showed that both chemicals increased digestibility, higher levels of NaOH (6% and 14% w/w) having greater effect than higher levels of $Ca(OH)_2$ (8% and 16% w/w). Application of 4 or 6 atm pressure for specific periods during *in vitro* tests with NaOH had a positive effect on bagasse digestibility which was, nevertheless, not as great as that of 6% NaOH. Differences between bagasse and bagasse pith digestibility with the same amount of NaOH were attributed to differences in the carbohydrate composition of the two forms.

* * *

Characteristics of the digesta in the gastrointestinal tract of cattle given a forage basal diet, supplemented with molasses. I. Dry matter and structural materials. Y. REYES. *Cuban J. Agric. Sci.*, 1974, **8**, 29–38. **II. pH and volatile fatty acids.** *idem ibid.*, 39–45.

I. Dry matter, fibre, cellulose and lignin were determined in the contents of the gastrointestinal tract of bulls fed on napier grass *ad libitum* with and without molasses. In general, when only forage was consumed, the amounts of total digesta, fibre and cellulose were greater than when molasses was given, although the differences were not significant. No significant difference in lignin content was found for the two types of feed.

II. Under experimental conditions, addition of molasses to the feed appeared to have little effect on the pH and volatile fatty acids concentration (total acids and individual acids) in the various sections of the digestive tract.

* * *

Peripheral circulation of hexoses during the digestion of high-test molasses in the pig. J. LY. *Cuban J. Agric. Sci.*, 1974, **8**, 53–59.—Determination of dextrose, levulose and lactic acid in peripheral and portal blood of pigs fed on high-test molasses is described and the results discussed. From the findings it is

concluded that dextrose is the principal metabolite arising from the digestive tract, levulose having a secondary role, while lactic acid levels fluctuated considerably.

* * *

By-products research in Mauritius. ANON. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1973, 53.—Studies on increasing the digestibility of bagasse used as animal fodder by treatment with steam under pressure showed that at pressures between 14 and 18 bars the best conversion of insoluble matter into water-soluble material was obtained after treatment with saturated or wet steam for 5–10 minutes. Longer steaming periods caused a reduction in the soluble matter content. At pressures of about 10 bars, solubility increased with treatment time, although the rate of increase became negligible at 30 minutes. However, the level of solubility after 30 minutes did not reach that obtained at the higher pressures tested. With a view to using cane tops, rind and derinded cane as cattle fodder, tests were conducted at two sites to establish the effects of age and variety on yields of the various components. Results indicated that 9–10 months cane planted "under proper conditions" could be utilized as animal fodder.

* * *

Drying of (beet) pulp and possible fuel economies. A. BAUSIER. *Sucr. Belge*, 1974, **93**, 293–307.—It is pointed out that in a white sugar factory employing a 3-strike boiling scheme, drying of the beet pulp (of e.g. 22% dry solids content) may consume more energy per kg than does production of the same weight of white sugar, which sells at a much higher price, so that it is of advantage to improve the pressing so as to reduce the amount of water to be evaporated and to reduce fuel consumption in the drying process itself. The effect of pressing rate increase (from 20% to 26% dry solids) on fuel consumption, costs, losses and pulp quality is briefly discussed, and a detailed examination made of conventional drying and of drying with recycled gases, showing how it is possible to reduce fuel consumption.

* * *

Production of fodder yeast from *Candida tropicalis*. L. G. DE SOUZA and U. DE A. LIMA. *Brasil Açuc.*, 1974, **83**, 403–415.—Series of initial trials are described on the cultivation of *C. tropicalis* on media based on dextrose, molasses and vinasse, in order to determine the most suitable pH, desirable levels of supplementary nutrients, etc.

* * *

Hay or restricted grazing as roughage sources for Holstein steers fed molasses/urea. J. UGARTE and T. R. PRESTON. *Cuban J. Agric. Sci.*, 1974, **8**, 151–155. The daily live weights and carcass characteristics of 5-month-old steers did not differ significantly as a result of differences in feed, which was (1) a daily ration of 1 kg of hay and (2) grazing for 2 hours daily; molasses, urea and fish meal were given in both cases. The molasses intake was greater and conversion lower when the animals were fed on hay than those on restricted grazing.

* * *

The use of pasture for beef production. II. Effect of stocking rate and supplemental molasses/urea feeding on performance of grazing bulls during the wet season. J. L. VEITÍA, T. R. PRESTON and S. DELGADO. *Cuban J. Agric. Sci.*, 1974, **8**, 123–127.—From tests in which feeding of bulls with molasses-urea supplemental rations gave no improvement in daily weight gain compared with animals fed only on pangola grass, while stocking rate was negatively related to daily gain and dry matter availability, it is concluded that the use of molasses and urea is not an efficient method of improving growth of bulls when an appreciable amount of medium-quality pasture is available.

* * *

Rumen fermentation in bulls fed sucrose as the main carbohydrate source. R. J. MARTY, M. BENAVIDES and T. R. PRESTON. *Cuban J. Agric. Sci.*, 1974, **8**, 157–165.—Infusion of sugar solution into bulls fitted with rumen cannulae was studied. An increase in the sugar level caused a fall in rumen pH and in the molar proportions of butyric and valeric acids as well as increases in the total volatile fatty acids concentration and molar proportion of propionic acid. The various correlations established are discussed.

* * *

Post-ruminal digestion by cattle fed on a forage basal diet. Influence of molasses supplementation. Y. REYES. *Cuban J. Agric. Sci.*, 1974, **8**, 167–175.—Studies of post-ruminal digestion by cattle fed on diets with and without molasses and urea incorporation are discussed. Generally, the molasses/urea content had little effect on cellulose and fibre digestion in the rumen and caecum.

* * *

Aconitic acid and formation of scale in ethanol distillation columns. L. G. DE SOUZA, U. DE A. LIMA and O. G. BRASIL. *Brasil Açuc.*, 1974, **83**, 503–506. Examination of scale from columns of distilleries in various parts of Brazil showed only traces of aconitic acid.

* * *

Effect of molasses properties on fermentation. N. TAYGUN. *Seker*, 1974, **12**, (90), 42–50.—The effects of beet molasses sugars and non-sugar constituents, both organic and inorganic, and pH on fermentation processes (citric acid, acetone-butanol and alcohol productions) are discussed at some length.

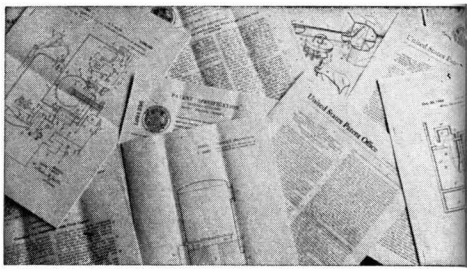
* * *

Influence of the concentration of sugars on the production of Torula yeast. R. ESTÉVEZ and O. ALMAZÁN. *Sobre los derivados de la caña de azúcar*, 1973, **7**, (3), 60–67.—Comparative experiments were made on the fermentation of *Torulopsis utilis* in media with equal N and P contents and equal oxygen supply, but using cane juice and molasses as the carbohydrate source, at low, intermediate and high sucrose contents (about 30, 60 and 100 mg.cm^{-3}). In both cases, the yield fell with higher initial sucrose content, and reasons for this are suggested. The yields with cane juice were a little higher than those using molasses.

* * *

Hydrolysis of bagasse. II. Influence of temperature and acid concentration on the velocity of hydrolysis of the hemicelluloses. R. BLANCO A. and J. LASTRA R. *Sobre los derivados de la caña de azúcar*, 1974, **8**, (1), 3–13.—A study of the kinetics of bagasse hydrolysis with dilute sulphuric acid at 110–140°C has been carried out and equations developed for two simultaneous first-order reactions from which it is possible to predict the residual readily-hydrolysable polysaccharide content as a function of time, acid concentration and temperature.

Patents



UNITED KINGDOM

Process for producing feed material and glutamic acid. C. T. Ho of Taichung and L. H. CHANG, of Taipei, Taiwan. **1,339,041.** 15th March 1971; 28th November 1973.—Carbohydrate-containing raw material (molasses, sugar, starch, etc.) is hydrolysed with acid (HCl, H_2SO_4) and brought to pH 3·2, filtered, neutralized (with ammonia) (treated with active carbon) and fermented with known micro-organisms to produce glutamic acid in the broth. This is divided into two parts and glutamic acid recovered from one part while the other is processed to produce more glutamic acid and a waste broth fraction which is de-toxified (and mixed with powdered hay) to give an animal fodder. The de-toxification includes removal of ammonia by reacting with e.g. $Ca(OH)_2$ (or a Ca salt mixed with a Na, Mg, or K salt). The ammonia liberated is recycled to the neutralization of the filtered hydrolysate or may, with CO_2 produced in fermentation, be reacted with NaCl to give $NaHCO_3$ and NH_4Cl.

* * *

Beet cleaner. DEERE & CO., of Moline, Ill., USA. **1,339,706.** 16th August 1972; 5th December 1973.

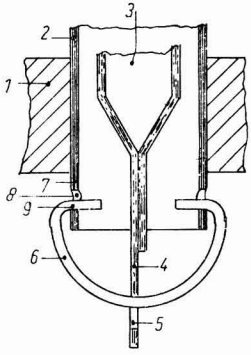
* * *

Cane harvester. J. M. MIZZI, of Ingham, Queensland, Australia. **1,339,816.** 19th November 1971; 5th December 1973.

* * *

Thin-film evaporator. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **1,341,805.** 9th June 1972; 28th December 1973.

To produce a climbing film evaporator, the tubes 2 held between tube plates are provided with extensions below the bottom plate 1 and holes 8 drilled on opposite sides of the extension 7. Within the tube 2 is located an inserted tube 3, so leaving an annular path for the liquid being evaporated; the tube 3 is sealed at is lower end and a hole 5 drilled in its extension place 4. A spring clip 6 is provided which locates the hole 5 with respect to the holes 8 and thus the bottom of tube 3 relative to tube 2.



* * *

Citric acid production by submerged fermentation. A.G. JUNGBUNZLAUER SPIRITUS- UND CHEMISCHE FABRIK, of Vienna, Austria. (A) **1,342,297.** 13th May 1971; 3rd January 1974. (B) **1,342,311.** 21st May 1971; 3rd January 1974.

(A) A nutrient medium containing e.g. sugar, purified by decationization, is fermented with *Aspergillus niger* in the presence of 0·012 cm^2 per cm^3 of nutrient solution of stainless steel which, in addition to Fe and Cu, contains Cr, Mn, Ni, Mo, Nb and/or Ti (stainless steel type DIN 4505 or 4586).

(B) The submerged fermentation with *A. niger* (at pH < 3) of a nutrient medium containing partly decationized sugar is carried out in the presence of < 500 ppm of K ferrocyanide as a cell growth inhibitor, the ferrocyanide being added in doses of 0·05–10 ppm on total solution as indicated by microsope observation of mycelial growth.

* * *

Purification of crude sugar solutions. SUGAR CHEMICAL CO. ETBT., of Vaduz, Liechtenstein. **1,343,847.** 19th April 1971; 16th January 1974.—A technical sugar solution from a sugar factory (a beet juice or molasses) is pretreated with (a) a carbonate or bicarbonate anion exchanger and (b) an ammonium or weakly acid cation exchanger in the H^+ form. At least a part of the ammonia and carbonic acid introduced into the solution are removed and the solution is then treated with a strongly acid cation exchanger in the H^+ form and recycled to the carbonate or bicarbonate exchanger to give a purified sugar solution.

* * *

Clarifier. THE MIRRLEES WATSON CO. LTD., of Bromley, Kent, England. **1,344,064.** 1st July 1970; 16th January 1974.—See BACH: US Patent 3,718,257[1].

* * *

Production of caramel syrup. GÉNÉRALE SUCRIÈRE S.A., of Paris, France. **1,344,530.** 23rd November 1971; 23rd January 1974.—A sugar syrup (containing added pectin or aqueous colouring matter) is passed along a pipe and subjected in the pipe to a heating zone where the temperature and pressure cause caramelization of the syrup, at the same time producing water vapour. Part of the latter is separated

[1] *I.S.J.*, 1974, **76**, 157.

Copies of Specifications of United Kingdom Patents can be obtained on application to The Patent Office Sale Branch block C, Station Square House, St. Mary Cray, Orpington, Kent, England (price 25p each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C., 20231 USA (price 50 cents each).

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 abstrated 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. Please ask us to quote you the cost of your requirements, indicating whether surface or air mail delivery is to be provided.

photocopy service

Please submit your pro-forma invoice for the supply of 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 £3.00 or U.S. $10.00 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 £3.00/$10.00.

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.

(in accordance with the syrup feed) and the caramelized syrup cooled to a temperature below its boiling point under the pressure prevailing at the outlet of the pipe. The vapour removed is condensed and subsequent vapour separation adjusted in accordance with the volume of condensate.

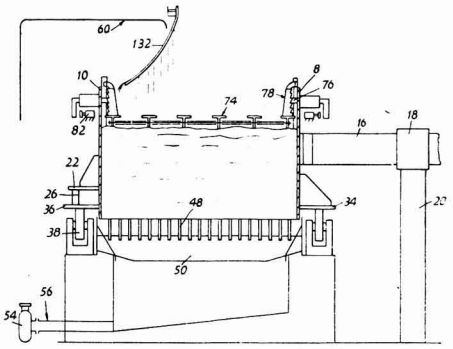
* * *

Drying crystallized sugar. RAFFINERIE TIRLEMONTOISE, of Brussels, Belgium. **1,345,601.** 26th May 1971; 30th January 1974.—Crystallized sugar containing some water is brought within a heated environment at a drying temperature of 75–85°C and a relative humidity between 85 and 100%. The sugar is then moulded and compressed into tablets and left in the environment to dry.

* * *

Cane diffuser. FIVES LILLE-CAIL, of Paris, France. **1,345,793.** 19th April 1971; 6th February 1974.

The ring-type diffuser employs a number of bottomless cells formed within an inner annular wall 8 and outer wall 10 which are linked by fixed radial partitions and, held by arms 16, rotate about the vertical axis of shaft 20 either under the action of a driven peripheral gear or by the action of jacks upon the pins 26 located between rings 22 and 36 on the outside of wall 10. The ring 36 and inner ring 34 are supported on rollers 38 which are held by the stationary part of the diffuser.



Beneath the cells is a stationary grid 48 which covers the entire annular surface of the diffuser except for the section through which exhausted material is discharged, while below the grid are troughs 50 from which juice is collected through pipe 56 and delivered by pump 54 to a pipe 60 and so through screen 132 to the top of the next cell nearer the head of the diffuser. Fine particles separated from the juice are delivered by screen 132 to the outer edge of the cell. A cover 74 is provided for each cell which comprises a series of T-shaped bars linked by transverse rods. The tops of the bars correspond to a magnetic plate on a vertical jack over the section of the diffuser where the fresh cane is added. The outer bars are connected to anchoring devices 78 which have racks and are locked by fingers 76. Cane is fed into the empty cell and is then compressed by the cover 74 under the action of the jack. Compression is maintained by locking the cover in place by fingers 76 while the cell passes round the diffuser. After discharge of the exhausted cane the jacks 82 are operated to unlock the cover which is then raised by the magnetic plate on the vertical jack, when fresh cane can be admitted to the cell.

Refining of sugar. W. R. GRACE & CO., of New York, N.Y., USA. **1,346,614.** 20th April 1971; 13th February 1974.—Affination syrup and/or last strike syrup from granulated sugar boilings is decolorized and air-dried in a spray dryer and crystallized upon previously spray-dried crystallized material, to give a particulate, substantially dry, free-flowing, sucrose-containing product. The affination syrup may be dried without decolorization to give a brown product, and the last strike syrup decolorized to give a white product.

* * *

Production of citric acid by submerged fermentation. A.G. JUNGBUNZLAUER SPIRITUS- UND CHEMISCHE FABRIK, of Vienna, Austria. **1,348,798.** 26th July 1971; 20th March 1974.—Citric acid is produced by submerged fermentation of a carbohydrate solution, e.g. decationized sugar solution, with *Aspergillus niger* in a nutrient medium containing K^+ and PO_4^{---} ions where the alkali metal ion:phosphate ion weight ratio is adjusted to between 1·01 and 3·42 to 1 by addition of NaCl in such an amount that the Na^+:K^+ weight ratio is between 1·46 and 7·30:1. The fermentation is effected in the presence of stainless steel DIN 4586 or DIN 4505. As a mycelial growth inhibitor, 0·05–10 ppm of $K_4Fe(CN)_6.3H_2O$ is added. N-containing compounds may be added 24–36 (30) hours after inoculation and the pH is adjusted to 2·9. NaOH may be added to the medium, the first amount 24–36 (30) hours after inoculation.

* * *

Beet and cane diffuser. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **1,349,422.** 21st January 1972; 3rd April 1974.—A trough-type diffuser, of the type used for cane, may be used for diffusion of juice from beet by provision of a fabric layer supported by the conveyor chains and permeable to juice while separating the beet cossettes from the perforated screen bottom of the diffuser where they would be rapidly disintegrated to pulp. Suitable scrapers are also carried by the chains so as to wipe the surface of the screen and thus prevent any blockage or contamination.

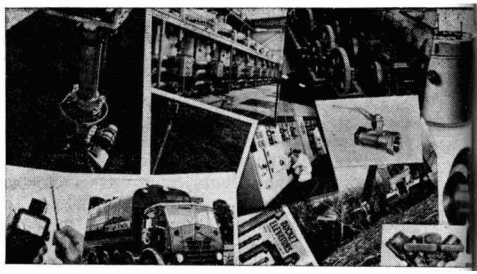
* * *

Sugar manufacture. HITACHI SHIPBUILDING & ENGINEERING CO. LTD., of Osaka, Japan. **1,350,261.** 19th April 1971; 18th April 1974.—Raw cane juice is subjected to continuous carbonatation, (filtered) and decolorized with granular active carbon. Further impurities and colour are removed by ion exchange treatment and ion exchange membrane dialysis, the last step in combination with juice concentration by multiple-effect evaporation to give a syrup which is concentrated to a plantation refined sugar.

* * *

Bagasse fibre product and process. PLASTI-FIBER FORMULATIONS INC., of Mercedita, Puerto Rico. **1,347,462.** 14th April 1972; 19th June 1974.—Bagasse is treated with an aqueous alum solution for sufficient time to leach out the residual sugar, with agitation to provide mechanical attrition. The fibre is separated from the liquor, dried, classified and the ¼–4-inches fraction recovered. The fraction of fibre smaller than ¼ inch is recovered and converted to a flour. The fraction of fibre larger than 4 inches is cut and reclassified. The fibre fraction, containing 0·1–0·4% alum by weight, is used to reinforce synthetic resin bodies while the bagasse flour may be used as a filler.

Trade notices



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

PUBLICATIONS RECEIVED

STAINLESS STEEL FABRICATORS' ASSOCIATION OF GREAT BRITAIN. LIST OF MEMBERS AND CLASSIFIED LIST OF PRODUCTS. Stainless Steel Fabricators' Association of Great Britain, Chamber of Commerce House, 75 Harborne Rd., Birmingham, B15 3DH England.

Any UK firm which fabricates stainless steel in any form is eligible for membership of this Association which was formed in 1946. The List of Members is followed by a Classified List of Products and a Technical Data Section which includes British Standard Specifications relating to stainless steel materials and components as well as certain other tables of weights and gauges.

* * *

KINA PRODUCTS. Kina Engineering Ltd., Industrial Estate, Hadleigh, Suffolk, England.

The latest Kina brochures give information on ultra-high pressure washers and water jet blasters for use in many applications, including rust and scale removal.

* * *

WATER TREATMENT. Metraco S.A., rue du Beau-Site 13, B-1050 Bruxelles, Belgium.

A recent brochure gives details of Metraco units for preparing and metering chemicals for use in water treatment. The units are completely automatic, need practically no supervision, and are particularly designed with the problems of polyelectrolyte dispersion and solubilization in mind. High metering accuracy and perfect dilution of the flocculant are provided at viscosities as high as 6000 cP.

* * *

GRINDING AND PULVERIZING MILLS. Babcock & Wilcox (Operations) Ltd., 165 Great Dover St., London, SE1 4YB England.

Information and diagrams are given describing the Babcock E mill, in which the grinding elements are large hollow hardened-steel balls spiralling between horizontal rings; the upper ring is fixed and uses hydro-pneumatic loading cylinders to maintain constant pressure on the balls, while the lower ring rotates and grinds the material between it and the balls. Originally designed for coal pulverization, the E mill is now applicable to treatment of a number of materials, including limestone, for which it has certain advantages.

* * *

SCALE PREVENTION WITH I-12S. Fabcon International Inc., 1275 Columbus Ave., San Francisco, Calif., 94133 USA.

A 4-page brochure gives information on the I-12S scale prevention chemical for use in evaporators and gives advice on daily calcium hardness determination for calculating the amount of I-12S to add whereby the Critical Scaling Index is maintained at as low a value as possible and evaporator operating time increased.

* * *

INTRODUCTION TO ACTIVE CAREON. Norit N.V., Postbus 1720, Gebouw Metropool, Weesperstraat 93, Amsterdam-C, Holland; Norit-Clydesdale Co. Ltd., 105/147 Millerston St., Glasgow, G31 ITG Scotland.

A 16-page brochure from Norit and its wholly-owned subsidiary Norit-Clydesdale, manufacturers of "Norit" and "Actibon" active carbon, discusses active carbon in general terms, covering types of carbon, active carbon production, the chemical composition of "Norit" active carbon, selection and laboratory evaluation. A shorter section deals separately with granular carbons, selection of which involves evaluation of additional factors compared with powdered carbon.

* * *

SUGAR DECOLORIZED WITH ACTIVATED CARBONS. Norit N.V., Postbus 1720, Gebouw Metropool, Weesperstraat 93, Amsterdam-C, Holland.

Application of "Norit" carbons to beet and cane sugar refining is discussed with the aid of graphs, diagrams and tabulated data. "Norit" carbons have been used in the sugar industry for over 50 years, and the manufacturers offer their advice in selecting the most suitable type for a given task.

* * *

ELECTRONIC PRESSURE TRANSMITTERS AND CONTENTS GAUGES. KDG Instruments Ltd., Crawley, Sussex, England.

Series 4000 electronic pressure and differential pressure transmitters manufactured by KDG Instruments are designed for flow, pressure and liquid level measurement. All models in the series will withstand a pressure overload of the maximum pressure rating without permanent damage or change of calibration greater than 0·1% of nominal input range, while long-term stability is typically better than 0·1% of nominal input range *per annum*. Repeatability is better than $\pm$ 0·02% of nominal input range, while built-in temperature compensation is provided for temperatures in the range —25°C to +70°C.

The electronic contents gauges are mains- or battery-powered, permitting remote reading at up to 1500 m from the transmitter. The "Tees-Tronic" series is designed for use with corrosive and viscous liquids and is available with on-off control and alarm facilities, while the "Thames-Tronic" incorporates a submersible transmitter for accurate level indication in open top tanks, reservoirs, etc. The "Thames-Trol" electronic indicating alarm and on-off control systems are available in various forms according to application. Hydrostatic tank contents gauges are also available from KDG.

* * *

CANE SLINGS. McKinnon Chain (South Africa) (Pty.) Ltd., Burlington House, 22 Rissik St., P.O. Box 7770, Johannesburg, 2000 South Africa.

A leaflet in English, French, Portuguese and Spanish gives information on McKinnon cane slings which are standardized on two chain sizes and grades for loads up to 10 tons.

* * *

STAINLESS STEEL APPLICATIONS IN THE SUGAR INDUSTRY. Jacksons, P.O. Box 3803, Durban, South Africa.

Applications of stainless steel tubes and plate in the sugar industry are examined and technical specifications given for the various types and grades available from Jacksons.

* * *

SUGAR CANE PELLETIZING. Bishop Process Equipment Inc., P.O. Box 1403, Tampa, Fla., 33601 U.S.A.

Cane dehydrating and pelletizing for use as animal fodder, either on its own or with additives, and the plant manufactured by Bishop Process Equipment Inc. for the processing are described in literature available from the above address.

* * *

HIGH-CLEARANCE TRACTORS. Hi-Wide Swaziland (Pty.) Ltd., 108 Ordnance Rd., Durban, South Africa.

A simple leaflet describes the various applications of "Hi-Clear" tractors for use in crop cultivation, spraying and fertilizing; the tractors have clearance of up to 1420 mm.

Mauritius sugar exports[1]

	1974	1973
	(*long tons, raw value*)	
Burundi	30	0
Canada	163,585	189,669
Indonesia	5,167	12,402
Iran	25,667	12,364
Iraq	22,304	11,368
Malaysia	0	12,600
Seychelles	585	20
Somalia	4,921	0
Sudan	12,000	0
UK	400,850	380,000
USA	39,420	38,600
USSR	0	12,200
Vietnam, South	0	12,599
Yemen	0	4,781
	674,529	686,603

New sugar factory for Angola[2].—The Sociedad de Promoção de Empreendimentos de Angola has announced plans to invest money in establishing a sugar cane plantation and factory in the Malange area. Sugar production of 40,000 tons a year in the first stage will later be expanded to 400,000 tons a year.

* * *

Laser beams and beet sugar content.—It is reported[3] that tests are being conducted in the USSR on increasing beet sugar content by means of laser beams. The experiments have already proved successful with two varieties which have yielded more sugar under identical growing conditions than have untreated beet.

* * *

Jamaica sugar exports tax[4].—The Jamaican Government has announced that an export tax on sugar is to be imposed in 1975 although the size of the tax has not been revealed. The levy is to be credited to the sugar price stabilization fund and earmarked for industry rehabilitation and development between 1975 and 1980.

* * *

Nepal sugar factories[5].—It has been officially announced that two new cane sugar factories are to be built in the vicinity of Kapilvastu and Sunsari.

* * *

Fiji sugar.—Under a new contract, New Zealand will more than double her current imports of 40,000 tons of sugar per annum from Fiji. It is reported[6] that New Zealand will pay NZ$300 per ton f.o.b. in 1975 and 1976 compared with the previous price of NZ$140.

* * *

Iran sugar project[7].—Karun Cane Sugar Agro Industry Co. is to construct a sugar complex in Khuzestan, which will include a cane plantation of 32,000 hectares and a factory to produce 240,000 tons of sugar per annum. Another factory, at Susa (also in Khuzestan), is at present under construction; the cane is to be supplied from 17,000 hectares, all under irrigation.

* * *

Denmark beet sugar campaign, 1974/75[8].—The six Danish sugar factories worked an average of 89·3 days in the recent campaign and, from a total of 2,811,300 metric tons of beet, produced 381,000 tons of white sugar, 1200 tons of raw sugar and 131,200 tons of molasses.

* * *

Ivory Coast sugar production target[9].—The Minister of Agriculture of the Ivory Coast has said that his country should aim at producing 600,000 metric tons of sugar per year, of which 500,000 tons would be for export after serving domestic needs of 100,000 tons. Several new sugar factories are to be built to attain this. The Ivory Coast currently imports 60,000 tons of sugar a year.

* * *

Finland campaign results 1974/75[10].—The four Finnish sugar factories sliced a total of 629,499 metric tons of beet in 1974/75 as against 611,807 tons in the previous campaign. Output included 64,115 tons of white sugar (61,977 tons in 1973/74), 12,489 tons of raw sugar (13,388 tons) and 26,218 tons of molasses (30,254 tons).

* * *

Hawaii sugar production, 1974[11].—Sugar production in Hawaii in 1974 was 1,040,742 short tons, raw value, as against 1,128,529 tons in 1973.

Brevities

Sweden beet sugar production[12].—The seven Swedish sugar factories sliced a total of 2,105,751 metric tons of beet in the past campaign, to produce 223,155 tons of white sugar, 54,299 tons of raw sugar and 86,065 tons of molasses.

* * *

Venezuela bagasse paper factory[13].—The Río Guanare sugar undertaking is to invest 200 million bolivares ($48,000,000) in installing a factory to process bagasse to produce 35,000 tons of paper a year.

* * *

Switzerland beet sugar production[14].—The two Swiss sugar factories sliced a total of 518,443 tons of beets in the 1974/75 campaign as against 539,619 tons in the previous. White sugar outturn was 66,486 tons as against 71,578 tons in 1973/74.

* * *

Cane smut in Guyana[15].—Smut disease of sugar cane, previously unknown in the Commonwealth Caribbean, has been reported in Guyana, according to the Agricultural Department of Bookers Sugar Estates Ltd. The outbreak was discovered on estates on the coast near the Corentyne River border with Surinam.

* * *

Taiwan sugar production 1974[16].—Taiwan's sugar output in 1974 rose to 890,000 metric tons from 850,000 tons in 1973, according to the Central News Agency.

* * *

Yugoslavia sugar beet crop, 1974[17].—Reports from Yugoslavia indicate that sugar beet production reached a record level of 4·2 million tons in 1974 as against a total of 3·27 million tons processed in 1973.

* * *

Molasses lysine production[18].—A 90 million-peso mixed company, Fermex, is to be formed by a Mexican company, Albamez (60%), and two Japanese companies, Sumitomo Shoji Kaisha (10%) and Kyowa Hakko Kogyo Co. Ltd. (30%), for the production of the amino acid L-lysine from cane molasses, for use as a food additive.

* * *

French beet harvesters for Poland[19].—The French company Matrot is to supply 1200 sugar beet harvesters to Agromet of Poland during the next two years. Subsequently additional machines are to be constructed jointly by Matrot and Agromet.

* * *

East Germany sugar factory plans[20].—Sugar production in East Germany during the 1974/75 campaign was insufficient to cover the country's requirements and plans are being made for building a new sugar factory in Gröningen with a capacity of 4000–6000 tons of beet per day. The old factory at Gröningen near Halberstadt was dismantled after the 1939–45 war.

---

[1] *Mauritius Sugar News Bull.*, 1974, (12).
[2] *Bank of London & South America Review*, 1975, **9**, 237.
[3] *Die Lebensmittelind.*, 1975, **22**, 135.
[4] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (9), 10.
[5] *Amerop Noticias*, 1975, (17), 11.
[6] *Public Ledger*, 26th April 1975.
[7] *Amerop Noticias*, 1975, (17), 11.
[8] *Zeitsch. Zuckerind.*, 1975, **100**, 106.
[9] *Public Ledger*, 15th February 1975.
[10] *Zeitsch. Zuckerind.*, 1975, **100**, 106.
[11] *Lamborn*, 1975, **53**, 19.
[12] *Zeitsch. Zuckerind.*, 1975, **100**, 107.
[13] *Bank of London & S. America Review*, 1975, **9**, 114.
[14] *Zeitsch. Zuckerind.*, 1975, **100**, 107.
[15] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (1), 9.
[16] *Public Ledger*, 4th January 1975.
[17] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (1), 6.
[18] *Amerop Noticias*, 1975, (15), 9.
[19] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (1), 7.
[20] *Zeitsch. Zuckerind.*, 1975, **100**, 51.

Brevities

Guyana sugar production, 1974[1].—The Guyana sugar industry produced a total of 340,806 long tons, tel quel, of sugar for the year, as against 265,704 tons in 1973 and 314,600 tons in 1972. The crop yielded just over $G 90,000,000 to the public exchequer through the special sugar levy which automatically takes off "super profits" when prices are high. The industry is setting itself a target of at least 360,000 tons for 1975.

* * *

Record Australian sugar production in 1974/75[2].—Preliminary estimates show Australian raw sugar production to have reached a record 2,850,000 metric tons 94 n.t. in the season just ended, according to the Assistant Secretary of the Australian Sugar Producers' Association. This output compares with a final 2,526,950 tons made in the 1973 season and the previous record of 2,817,046 tons made in 1972. The cane crushed for the 1974/75 crop totalled a record 20·1 million tons, as against the previous 18·3 million tons.

* * *

Belgian sugar beet area expansion[3].—The area under sugar beet in Belgium in 1975 is expected to rise to 115,000 hectares, an increase of 11·65% over the 103,000 ha sown to beet in 1974.

* * *

German sugar technological aid for the Central African Republic[4].—The Agricultural Ministers of West Germany and the Central African Republic have agreed on cooperation between the two countries in the development of cane growing in the African state. A sugar cane research institute is to be set up and, during a visit to the Institut für Zuckerindustrie in Berlin, the African Minister examined the possibility of training African sugar technologists and the creation of a sugar industry in his country.

* * *

US sugar consumption[5].—Sugar consumption in the United States in 1974 reached 11,203,000 short tons, raw value, as against 11,482,000 tons in 1973 and 11,415,000 tons in 1972. A further noticeable drop is expected for 1975 and although it has been suggested that consumption might fall by a million tons, this seems to be unduly pessimistic in view of the relatively low price–consumption elasticity in industrialized countries.

* * *

US sugar production, 1974[6].—Sugar production in the USA dipped 3% to 5,549,000 short tons, from 5,749,000 tons in 1973, according to estimates by the US Department of Agriculture. Based on its final estimates of sugar from beet and cane in the producing states, the Department said that the US mainland cane sugar crop was 1,459,000 tons, raw value, compared with 1,420,000 tons in 1973, while sugar output in Hawaii amounted to 1,040,000 tons in 1974 as against 1,129,000 tons previously. The US sugar beet crop was expected to yield 3,050,000 tons, 5% less than the 3,200,000 tons produced in 1973. The smaller beet sugar crop was due primarily due to a lower average yield (18·3 tons of beet per acre compared with 20·1 tons in 1973) giving the smallest beet crop since 1967. In 1975, however, according to the Crop Reporting Board, beet growers in 14 states intend to plant 1,438,000 acres, 22% more than in 1974. The 14 states accounted for over 94% of the 1,216,500 acres planted last year.

* * *

Venezuela sugar expansion plans[7].—Farmers and sugar producers have agreed on a six-year plan for the sugar industry in 1975–1980, during which cane and sugar production are to be increased by not less than 50%. The area under cane is to be enlarged from 87,400 hectares in 1975 to 181,000 ha in 1980 and sugar production in the same period from around 600,000 tons to 1,275,000 tons. This steep increase in production is to be achieved by the modernization of several existing factories and the erection of three new ones.

* * *

Bulk sugar terminals in Brazil[8].—A terminal for bulk handling of sugar is to be built at Santos and another at San Sebastián, north of Santos, to improve exports from the south of Brazil. The Recife terminal, in operation since 1972, has a storage capacity of 200,000 tons.

South Africa sugar exports[9]

	1974	1973	1972
	(metric tons, raw value)		
Canada	167,552	281,461	272,384
Finland	13,278	36,412	73,198
Hong Kong	0	1,848	6,033
Israel	14,964	35,871	55,435
Japan	528,278	467,272	568,625
Jordan	2,174	0	0
Portugal	28,067	0	0
Seychelles	976	2,012	2,210
Sri Lanka	0	0	13,077
UK	24,799	0	19,363
USA	42,368	89,550	28,576
Other countries	4,526	282	7,040
	826,982	914,708	1,045,941

New Philippines sugar factory[10].—A new sugar factory is to be established by Masagana Sugar Mills Inc. at Anupul, Bamban, Tarlac. The factory will operate a cane diffuser, will be built by Marubeni Corporation of Japan and will process 4000 tons of cane per day. Farmers have assigned about 16,000 hectares for cane to be supplied to the factory from a total of about 29,000 hectares suitable for cane.

* * *

Bolivia by-products utilization plans[11].—The Corporación Boliviana de Fomento is studying several investment projects including two pulp and paper factories using bagasse, of which one at Guabira would cost the equivalent of US $20,000,000 and the other at Bermejo $30,000,000, as well as two furfural plants at Guabira and Bermejo costing a total equivalent to $16,600,000.

* * *

Panama sugar factory[12].—Kawasaki Heavy Industries Ltd. of Japan has announced that it has signed a $40,000,000 contract to export a factory capable of processing 6000 tons of cane per day. The plant will be built at Pacola at the beginning of 1977.

* * *

New Brazilian sugar factory[13].—AGASA (Açúcar Gaúcho S.A.) is to invest 180 million cruzeiros in the erection of a sugar factory and attached distillery. The company also intends to double production of its factory near Santo Antonio to 24,000 tons per year.

* * *

Philippines sugar expansion plans[14].—The Philippines aims to increase its annual sugar output to four million short tons by 1980-81 compared with 2·69 million tons in 1973/74 and an estimated 2·4 million tons after typhoon damage in 1974/75. The expansion is based on a larger planted area for the 38 existing mills, the establishment of five new mills and an expected increase in yield stemming from technical improvement. The sugar industry is running an intensive campaign to improve productivity, which is affected at the moment by the number of small, comparatively inefficient farms. The projected four million short tons will include 1,150,000 tons for the world market, after subtracting 1,340,000 tons for home consumption and 1,500,000 tons for the Philippines' standing quota for the US, which should be retained. Even by 1975/76, 75,000 tons should be available for the world market (projected output 3,250,000 tons, domestic use 1,000,000 tons, US 1,500,000 tons). The Philippines is aiming to find new markets with non-traditional importers, particularly Asian countries willing to enter into a long-term agreement.

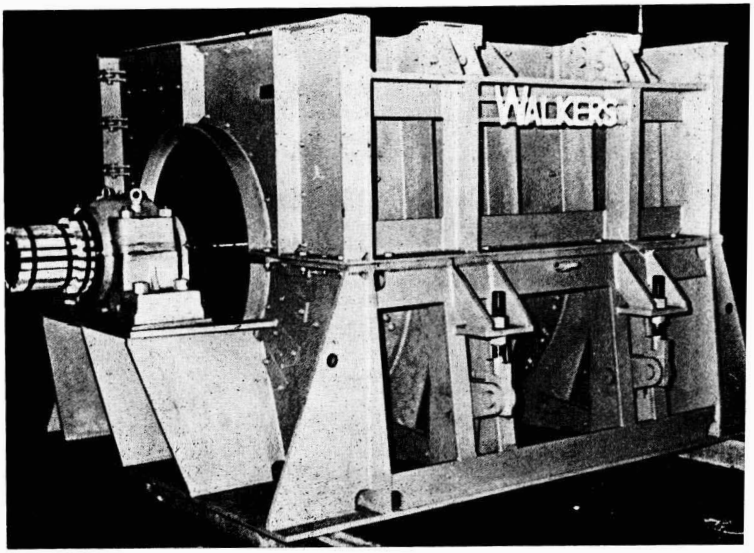
---

[1] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (1), 10.
[2] *Public Ledger*, 18th January 1975.
[3] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (2), 9.
[4] *Zeitsch. Zuckerind.*, 1975, **100**, 49.
[5] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (2), 10.
[6] *Public Ledger*, 25th January 1974.
[7] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (3), 11.
[8] *Amerop Noticias*, 1975, (16), 16.
[9] *I.S.O. Stat. Bull.*, 1975, **34**, (2), 94.
[10] *Sugar News* (Philippines), 1974, **50**, 368.
[11] *Bank of London & S. America Review*, 1975, **9**, 145.
[12] *Amerop Noticias*, 1975, (16), 17.
[13] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (8), 14.
[14] *Standard & Chartered Review*, March 1975, 31.

THE DAY IT RAINED SHREDDERS

THIS IS HOW YOUR SHREDDED CANE SHOULD LOOK

WE HOPE YOU CAUGHT ONE. IF NOT, WRITE TO US.



HEAVY DUTY CANE SHREDDER
60 in. DIAMETER OVER HAMMER TIPS

HAMMERS COVER AXIAL LENGTH OF 84 in.

CELL BREAKAGE UP TO 90%.

ADJUSTABLE BREAKER SECTOR.

WALKERS LIMITED

CONSULTANTS
DESIGNERS
ENGINEERS

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

Telex: 71578

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.