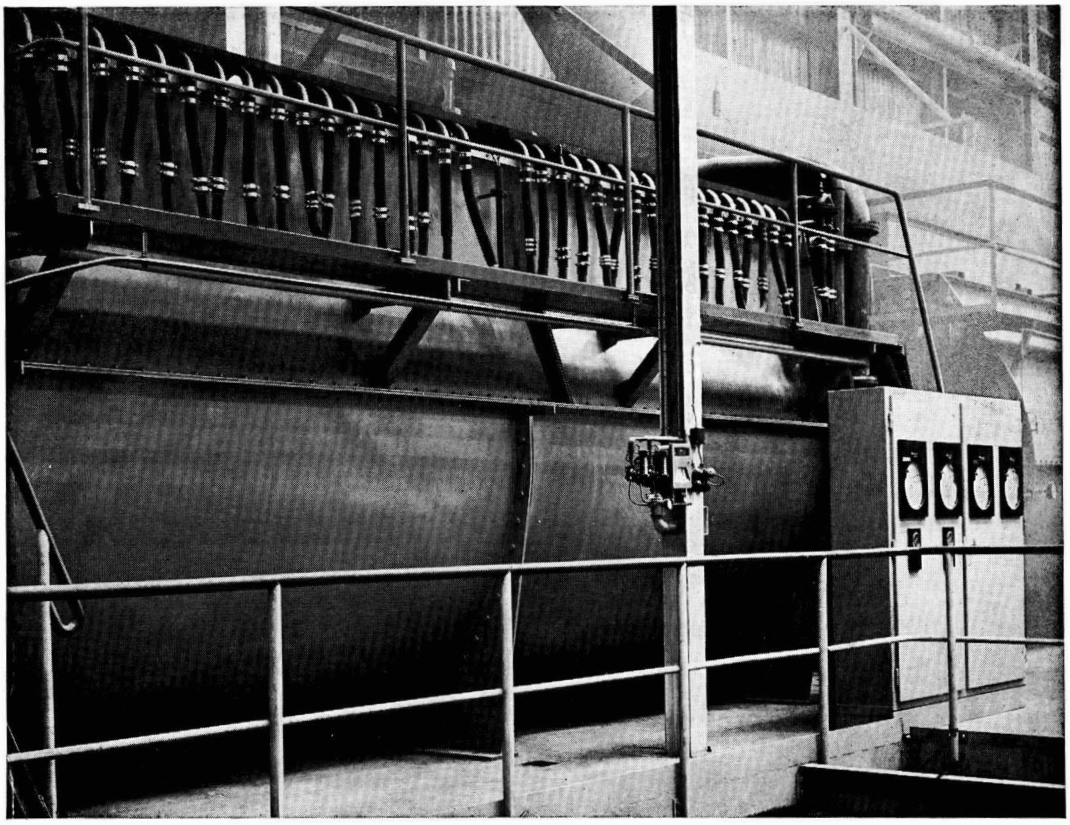
THE International Sugar Journal

JUNE 1974



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!

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

Member of VMF/Stork-Werkspoor
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Sugar cane weeds defeated!

The safe and effective control programme of weeds in sugar cane is of first importance in growing profitable crops and May & Baker have developed two products specifically for this purpose.

Asulox 40

for the control of "difficult" grass weeds – even Johnsongrass *(Sorghum halepense)!*

Actril DS

for the control of the toughest broad-leaved weeds.

'Asulox' 40 and 'Actril' DS are fully compatible and together give a complete weed control programme.

M&B May & Baker

A member of the Rhône-Poulenc Group of Companies

HA5049

To:
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Dagenham Essex RM10 7XS England

Please send me your latest publications on 'Asulox' 40 and 'Actril' DS.

Name_____

Address_____

'Asulox' and 'Actril' are trade marks of May & Baker Ltd.

This system doesn't play games with sand.

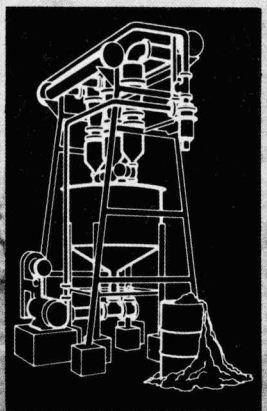
It's no child's play to get the sand out of raw juice, before it can get further into the system to cause erosion and clogging. Dorr-Oliver has a full-grown solution.

The DorrClone® Desanding System.

The DorrClone System, with its unified package design and its simplicity of operation, is one of the most efficient methods of desanding ever available to the sugar industry.

It achieves maximum sand removal with minimum sugar loss.

DorrClone is an old hand at the sand game. It offers you these proven advantages: • Reduces erosion in piping, pumps, valves and vessels. • Reduces sand loadings in filters, clarifiers and heater passes. • Minimizes sugar loss. • Low initial cost—can utilize existing raw juice pump and other equipment. • Low maintenance and operating costs due to few moving parts. • Removal of fine as well as coarse material—designed for separating most sand over 325 mesh.



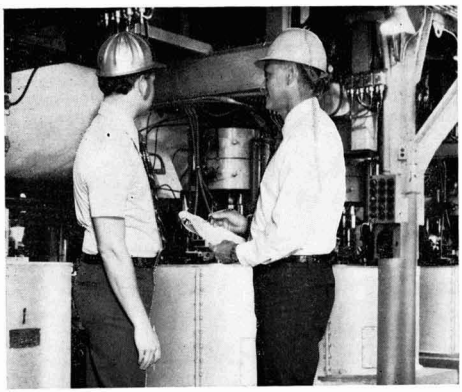
Sand and sugar are a costly combination. The name of the game is profit. Call or write Dorr-Oliver, 77 Havemeyer Lane, Stamford, Conn. 06904.

We'd like to help you be a big winner.

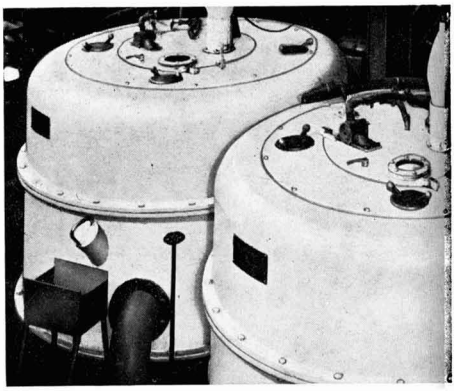
DORR OLIVER

think R.O.I.

(return on investment)

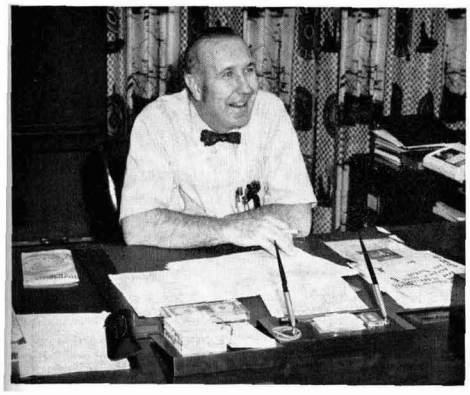


George Conrad, Western States Sugar Technologist, says, "Maximum productivity results when you operate your centrifugal at top efficiency." George regularly visits Western States installations world-wide to develop centrifugal operating know-how and to communicate this to our customers.



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

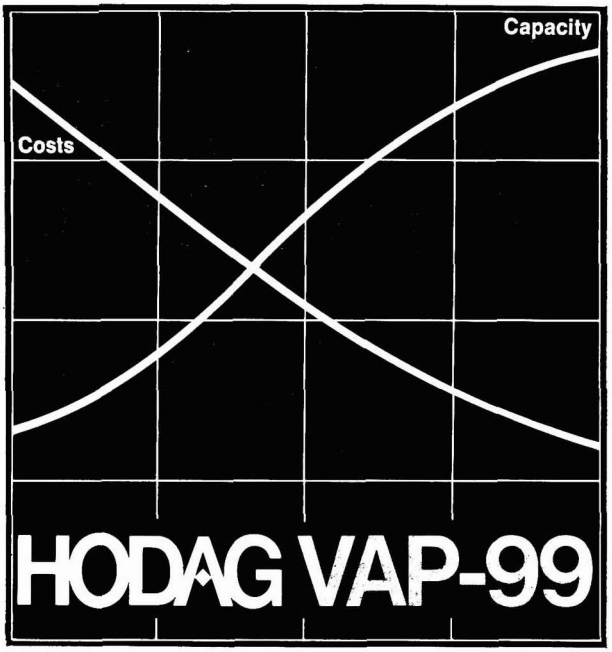
think Western States



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

Super-rugged components ...durability...long life... minimum downtime...high productivity...competent manpower...prompt service ...all are Western States benefits contributing to R.O.I....your return will be high for many years to come. Think about the sugar processors that have used the same battery of Western States centrifugals for 20 or 30 years...their capital investment cost per year is low and their R.O.I. gets higher year after year. Want to talk to some of them? Contact Mr. James Coleman, General Sales Manager.

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



Hodag VAP-99 Increases Evaporator Efficiency

Hodag VAP-99 is a chemical additive that acts in many ways at once to improve the operating efficiency of multiple effect evaporators.

Scale formation is reduced. VAP-99 inhibits the deposit of scale on evaporator tubes and end plates. This aids heat transfer—increases evaporator efficiency.

Maximum throughput of clarified juice is maintained. Circulation of juice is improved and heat transfer efficiency rises. Greater daily tonnage from existing mill tandems or diffusers can be realized.

Evaporator capacity goes up. With Hodag VAP-99, time between cleanings is lengthened . . . evaporators work harder, longer. Because heat transfer characteristics are improved, more water can be evaporated from the juice per pound of steam.

Cleaning costs go down. Fewer boilouts are needed in a season. The cost of chemicals and labor for cleaning is reduced.

For most conditions, the cost of inhibiting scale and increasing evaporator efficiency is less than 1 cent per ton of cane. Processing conditions, type of scale, and condition of evaporator bodies determine the concentration of Hodag VAP-99 needed to show benefits in your operation.

Get the benefits of regular use of VAP-99. Let your Hodag representative show you how. Fill out and return the inquiry coupon today.

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

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

☐ Please send complete information on products indicated.

☐ Please have Hodag representative contact me.

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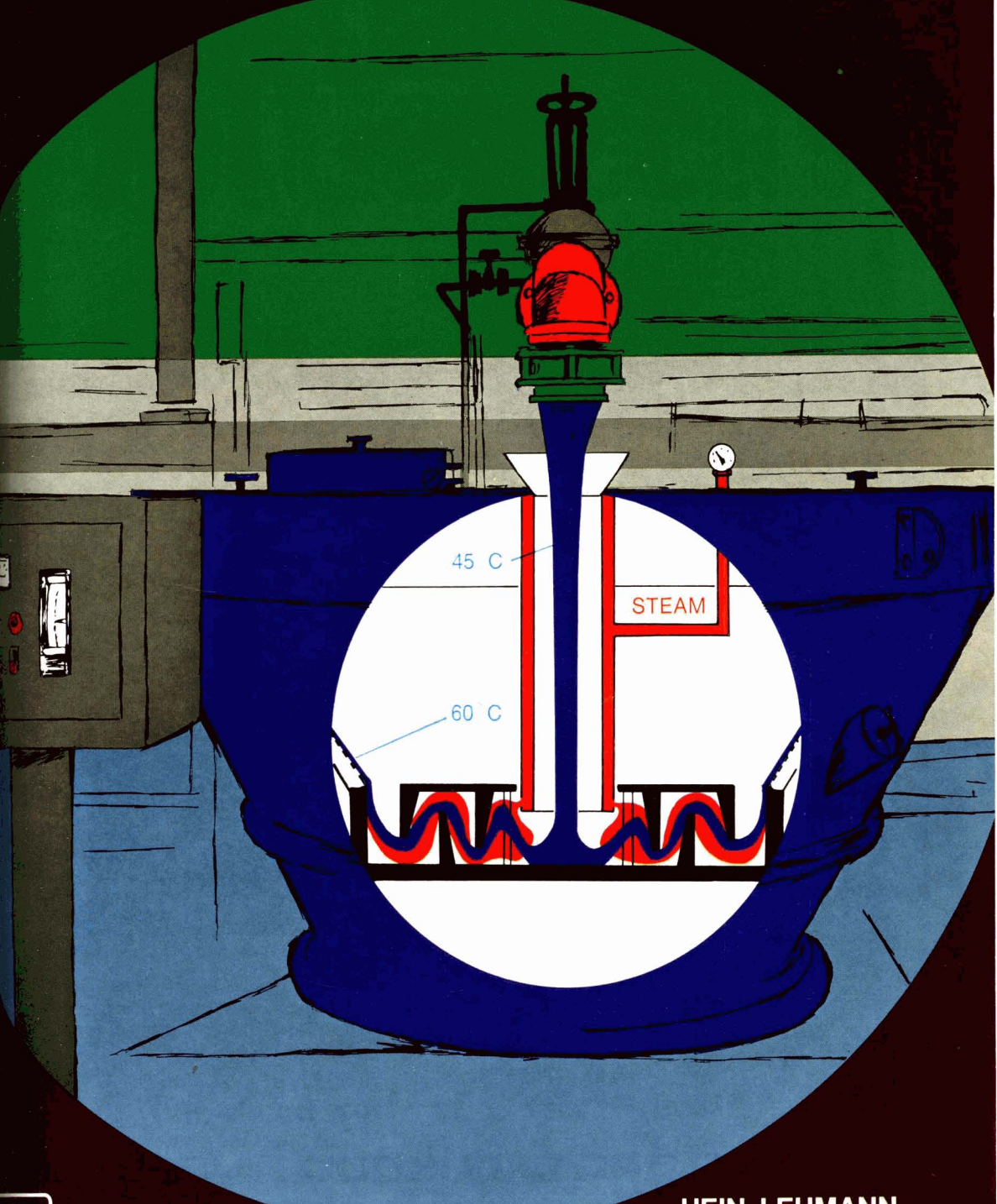
in, Lehmann Centrifugal

New with inner heating system

Much more capacity
Better sugar quality
Lowest molasses purity



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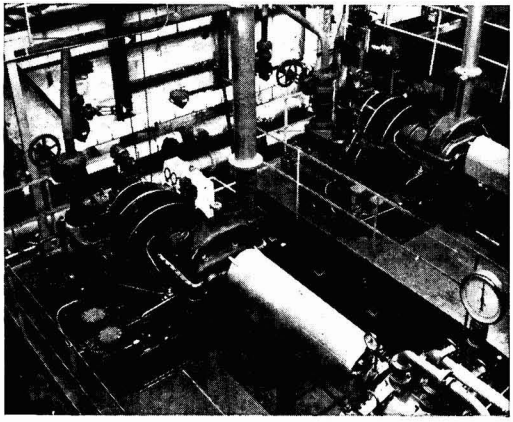
Sweet success for Brotherhood steam turbines

When the big names in sugar mill plant specify Brotherhood turbines, we count it as success. Not that it is unfamiliar, because we have been making turbines for over 60 years, but success is no less sweet.

Throughout the sugar producing world Brotherhood turbines are at work. The illustration shows part of a recent contract for horizontal, multi-stage steam turbines developing 2,500 kW on test prior to despatch to the Caribbean.

Brotherhood build single-stage and multi-stage turbines for mill, cane knife and generator drives, with controlled or uncontrolled pass out to process.

Detailed brochure SMT66 tells you all about Brotherhood turbines. Send for your copy today.



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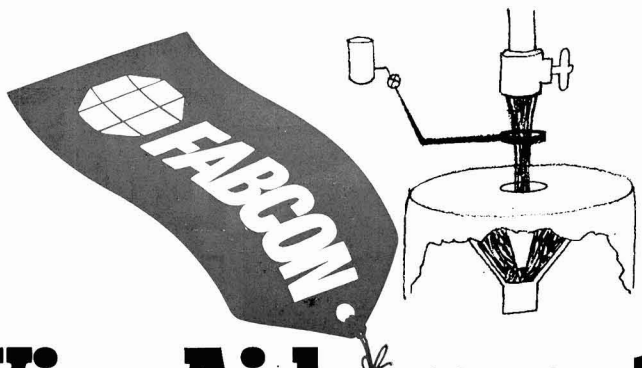
PT580

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

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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.

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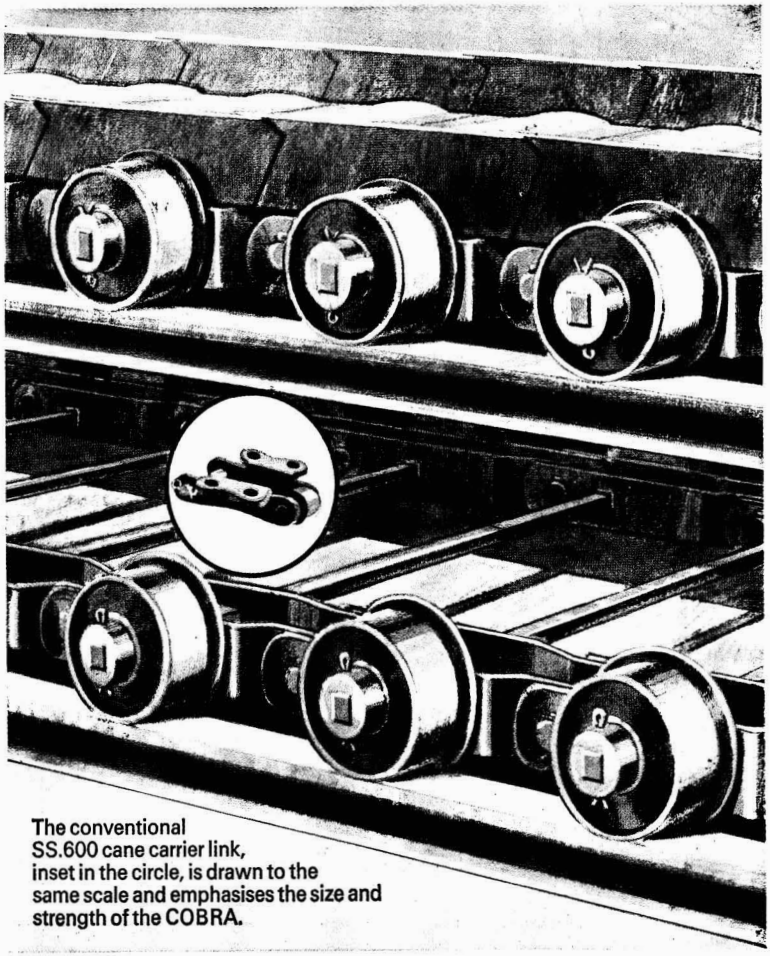
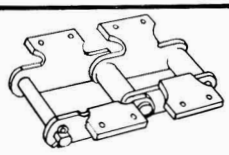
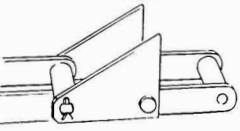


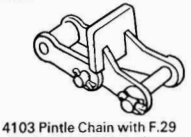
The conventional SS.600 cane carrier link, inset in the circle, is drawn to the same scale and emphasises the size and strength of the COBRA.



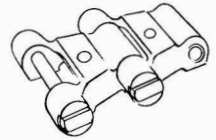
S & M Combination Chain



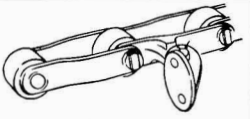
S & M Combination Chain with spur attachment – malleable inner links, with high carbon steel outer sidebars.



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

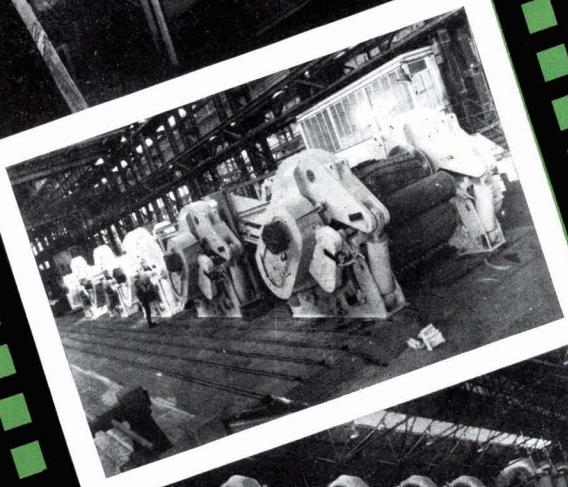


B.907 – E.51 Intermediate Carrier Chain – malleable or stainless steel.



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

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

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Why over half of the world

Red is the colour of the biggest range of tractors, combines and farm machinery in the world: the Massey-Ferguson range.

And red was the colour of over half of the world's self-propelled chopper harvesters at the latest count, in February 1973.

The reasons for this world-market lead are not hard to find. They have

1. 'Big Red'. The mighty MF 201 Cane Commander. Handles up to 100 tons an acre in all conditions.

The MF 201 is, in fact, the only machine which has shown itself capable of 3-shift round-the-clock harvesting in the competitive Australian market.

2. 'Big Little Red'. The MF 102, built to handle over 15,000 tons of cane in a season. Picture shows the MF 102 cutting green cane for seed at Cambalache, Puerto Rico, 1973. On this occasion it is accompanied by the 4 wd MF 1200 tractor pulling a 3-ton chopped cane planter.

hopper harvesters are red

their origin in the simple fact that mechanical chopper harvesting as we know it today was first developed commercially by Massey-Ferguson.

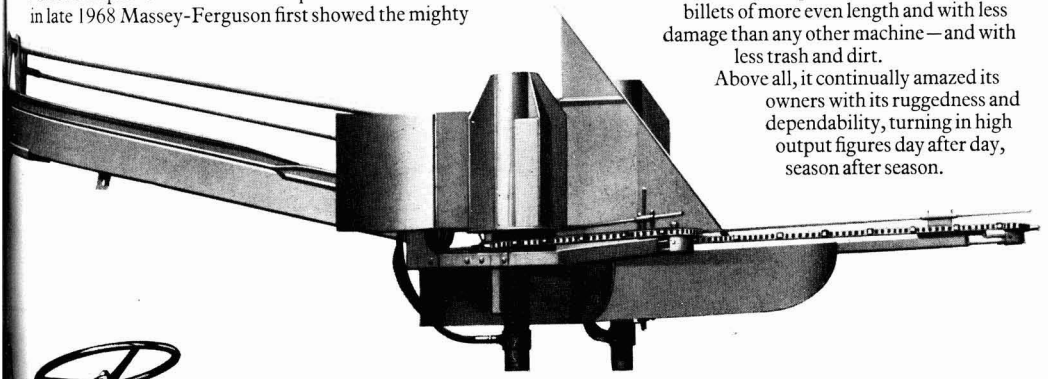
In 1959 Massey-Ferguson pioneered the system of cutting, chopping, cleaning and loading cane in one continuous operation and using only one machine.

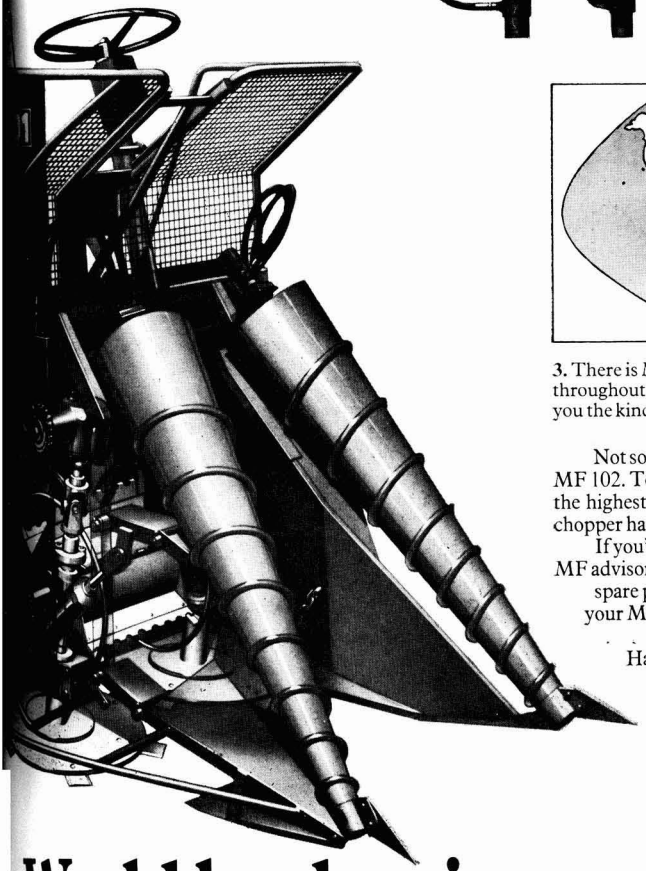
Various improvements and developments followed and in late 1968 Massey-Ferguson first showed the mighty MF 201 Cane Commander to the public.

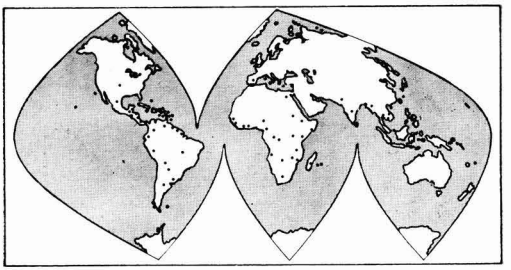
This machine quickly established new, high standards in cane harvesting. It demonstrated, firstly, an astonishing ability to handling crops of all kinds and in all conditions up to 100 tons an acre.

It also showed how it could leave the ground cleaner and at the same time produce a cane sample with billets of more even length and with less damage than any other machine—and with less trash and dirt.

Above all, it continually amazed its owners with its ruggedness and dependability, turning in high output figures day after day, season after season.







3. There is MF coverage in the cane countries throughout the world. Wherever you are, MF will give you the kind of service you want.

Not so long ago the MF 201 was joined by the 'big little' MF 102. Together, these two machines, manufactured to the highest production line standards in the world's biggest chopper harvester factory, have led the world markets.

If you'd like to know more about these products and the MF advisory services and the world-wide distribution and spare parts services that back them up, please contact your MF distributor, or write to Special Crop Systems Massey-Ferguson AG, Haldenstrasse 11, 6006, Lucerne, Switzerland.

MF
Massey Ferguson

World leaders in cane harvesting.


Half the sugar cane grinding mills in Florida were made by Farrel
...and the other half nearly all use Farrel drives.
Of the 54 mills grinding sugar cane in Florida, 27 are of Farrel manufacture. And 46 are powered by Farrel drives. Some Farrel machinery is used in each and every Florida sugar factory.
Farrel is a major participant in the expansion of the Florida sugar industry, which has seen production skyrocket from just over 200,000 short tons of sugar in 1961 to almost one million short tons annually.
If you are in the market for sugar mills, talk to the best in cane grinding machinery, Farrel. Send for a copy of Bulletin 312B. It details the many outstanding features of Farrel equipment. Write to Farrel Company Division, USM Corporation, Ansonia, Connecticut, U.S.A. 06401.
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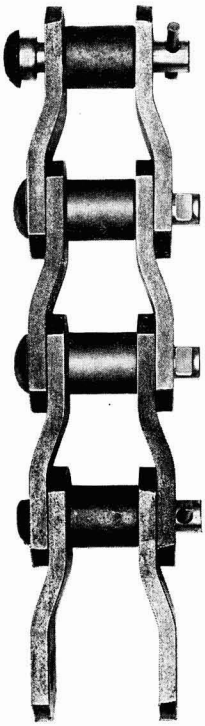
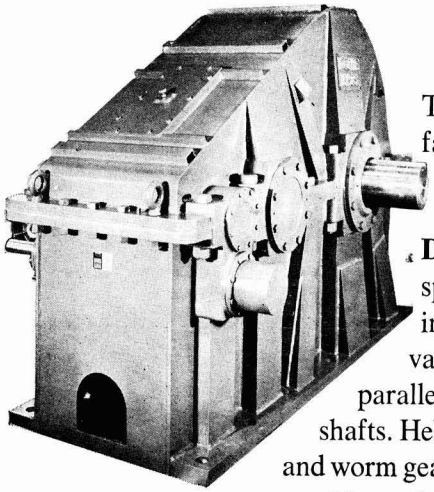
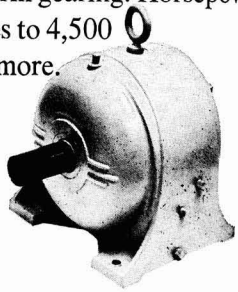


Jeffrey now serves the international sugar industry with over 32,000 power transmission products.

The standard and special engineered class chains of **Jeffrey Chain Division** drive, convey, and elevate the industry's materials and machinery.

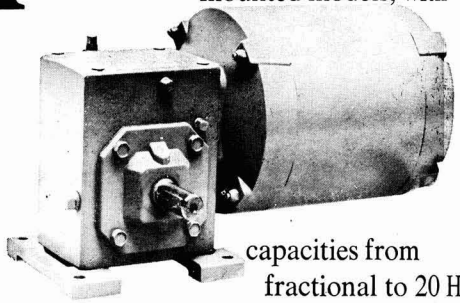


The manufacturing facilities of our **Electra Motors** and **Foote-Jones Divisions** produce speed reducers in problem-solving variety. Concentric, parallel, and right angle shafts. Helical, spiral bevel, and worm gearing. Horsepower capacities to 4,500 and more.



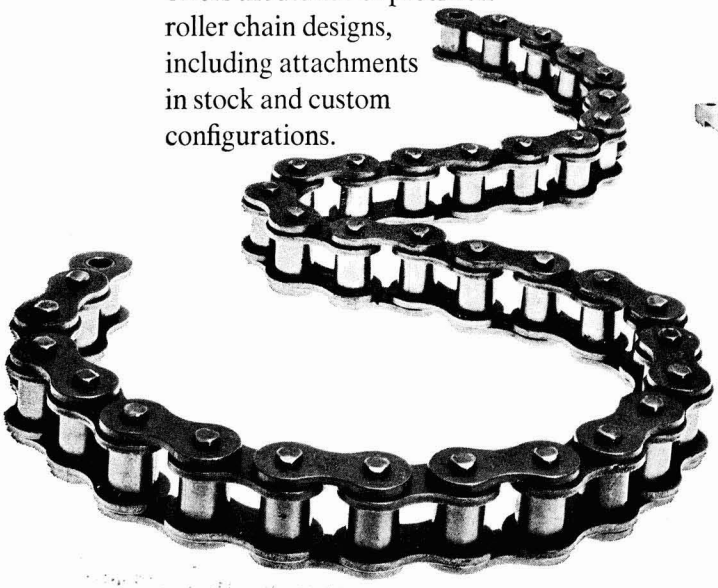
Jeffrey & Sugar

Electra and **Foote-Jones** worm gearmotors are available in adaptable, fixed base, and shaft-mounted models, with



capacities from fractional to 20 HP. Helical gearmotors come in more than 3,000 catalogued combinations, with capacities from fractional to 200 HP.

Whitney Chain Division offers thousands of precision roller chain designs, including attachments in stock and custom configurations.



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International Sugar Journal

June, 1974

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Densité et indice de réfraction de solutions de saccharose et de glycine. C. A. ACCORSI, G. MANTOVANI et G. VACCARI. *p.* 163–166

Des études, basées sur des données obtenues pour le système saccharose-sels inorganiques-eau, ont été faites pour les systèmes eau-glycine-saccharose, *eau-saccharose et eau-glycine. On donne* les détails des procédés utilisés, comprenant des mesures de densité et d'indice de réfraction. On émet des suggestions quant aux variations des valeurs obtenues pour le volume molaire partiel et la réfraction spécifique du saccharose.

* * *

Les efforts de la Chine pour couvrir ses besoins en sucre. J. F. WILLIAMS. *p.* 166–169

Se basant sur des informations de données de production, l'auteur expose la situation générale en Chine en ce qui concerne la production de sucre de betterave et de canne et il indique l'évolution future possible des besoins en sucre de la Chine et sa position dans le commerce mondial du sucre.

* * *

Viscosité et sursaturation de solutions sucrées. Propriétés rhéologiques au cours d'un cycle de cuisson. 2ème partie. H. THIELE et A. LANGEN. *p.* 169–173

La conduite de la cuisson à l'aide du système rhéométrique, décrit dans la première partie, est illustrée à l'aide d'un diagramme décrivant l'allure d'un cycle de cuisson en sucre blanc de 1er jet, sur lequel la valeur rhéométrique est indiquée en 9 points correspondants à des stades décrits. Ensuite sont reproduits des diagrammes qui illustrent les variations de viscosité et de sursaturation au cours d'une cuisson de sucre raffiné. Le diagramme de viscosité peut être utilisé pour fixer et ajuster les conditions de cristallisation dans chaque jet.

Dichte und Brechungsindex von Saccharose- und Glykokoll-Lösungen. C. A. ACCORSI, G. MANTOVANI und G. VACCARI. *S.* 163–166

Auf Grund von Daten, die für das System Saccharose-anorganische Salze-Wasser erhalten wurde, wurden Untersuchungen an den Systemen Wasser-Glykokoll-Saccharose, Wasser-Saccharose und Wasser-Glykokoll durchgeführt. Ueber die angewendeten Methoden einschliesslich der Messung der Dichte und des Brechungsindex wird im einzelnen berichtet. Schliesslich werden Vorschläge gemacht, die sich auf die beobachtete Aenderung der Werte für das partielle Molvolumen und die spezifische Brechung der Saccharose beziehen.

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China auf dem Wege zur Selbstversorgung mit Zucker. J. F. WILLIAMS. *S.* 166–169

An Hand von Produktionsdaten aus verschiedenen Quellen schildert der Verfasser die allgemeine Situation in China hinsichtlich der Erzeugung von Zucker aus Rübe und Rohr und zeigt die Entwicklung auf, die für die Zukunft in bezug auf Chinas heimischen Zuckerbedarf und seine Stellung im Weltzuckerhandel möglich ist.

* * *

Viskosität und Uebersättigung von Zuckerlösungen. Rheologische Eigenschaften im Verlauf eines Sudes. Teil II. H. THIELE und A. LANGEN. *S.* 169–173

Die Kochkontrolle mittels des in Teil I beschriebenen Rheometersystems wird an Hand eines Schreibstreifens demonstriert, der den Verlauf eines Weisszucker-1-Sudes zeigt, bei dem der Rheometerwert an neun, den beschriebenen Stadien entsprechenden Stellen angegeben ist. Weiter sind Diagramme wiedergegeben, aus denen die Aenderung der Viskosität und der Uebersättigung während eines Raffinadesudes ersichtlich ist. Das Viskositätsdiagramm kann zur Bestimmung und Einstellung der Kristallisationsbedingungen für jeden Sud benutzt werden.

Densidad y indice de refracción de soluciones de sacarosa y de glicina. C. A. ACCORSI, G. MANTOVANI y G. VACCARI. *Pág.* 163–166

Basado en dados obtenido para sacarosa-sales inorgánicos-agua, se han estudiado las sistemas agua-glicina-sacarosa, agua-sacarosa y agua-glicina. Se presentan detalles de los precedimientos que se han empleado, usando medición de densidad y indice de refracción. Se proponen sugerencias para variaciones en los valores obtenido del volumen parcial molal y refracción especifica de sacarosa.

* * *

La busca de China para auto-suficiencia en azúcar. J. F. WILLIAMS. *Pág.* 166–169

Con referencia a información sobre dados de producción, obtenido de varias fuentes, el autor expone la situación general en China son respecto a la producción de azúcar de remolacha y de caña, y indica desarrollos posibles del futuro en las necesidades domésticos de azúcar en este país, y su posición en el comercio mundial azucarero.

* * *

Viscosidad y sobresaturación de soluciones de azúcar. Propriedades reológicas durante una templa. Parte II. H. THIELE y A. LANGEN. *Pág.* 169–173

Control de cocción por medio de la sistema reométrica, describido en Parte I, se demuestra por una carta en que se traza el progreso de una templa virgen de azúcar blanca. El valor reométrico se indica en 9 puntos que se corresponden a etapas de la templa que se describen. Se reproducen diagramas que ilustran los cambios de viscosidad y sobresaturación que ocurren durante una templa de azúcar refinado. La diagrama de viscosidad puede usarse para determinar y ajustar las condiciones de cristalización en cada templa.

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Notes & Comments

Commonwealth Sugar Agreement

The UK Minister of Agriculture, Fisheries and Food made a statement in Parliament that, having regard to the substantial increases in costs of sugar production since 1971 and to the effect this has had on the economies of the developing Commonwealth sugar exporting countries, it had been agreed to pay an adjustment of £11 per ton to Australia and £22 per ton to the other CSA suppliers on the price paid for "negotiated price" sugar supplied in 1972; this payment in respect of certain countries has already been reported[1]. The cost to the UK Exchequer has been estimated at £35 million but no effect will be made on the current domestic price of sugar. The exporting parties to the Agreement are reported to have undertaken to use their best endeavours to fulfil their commitments to supply sugar to the UK market in 1974, but the Barbados Government has instructed sugar producers to export 32,000 tons of sugar to the UK this year, 54,000 tons less than in 1973[2].

* * *

EEC sugar arrangements for 1974/75

In a statement in the UK Parliament, the Minister of Agriculture, Fisheries and Food announced that the Community's intervention price for sugar is to be increased by 7%; the intervention price in the UK will not be increased until July, however, and will remain below the price now effectively being paid for sugar from Commonwealth suppliers. "Moreover, the arrangements for the refining margin for the sugar refiners have been substantially improved. From July, the new arrangements will enable them to secure an adequate refining margin without recourse to the present Exchequer subsidy and without increasing their selling prices in relation to the United Kingdom intervention price."

The main points of the arrangements have been published by C. Czarnikow Ltd.[3]:

The target and intervention prices for white sugar have both been increased for the EEC except for Italy and United Kingdom to 265·50 accounting units and 252·20 a.u. per metric ton respectively. The intervention price for Italy has been set at the higher level of 274·30 a.u. per ton, while the UK intervention level for white sugar stands at 218·50 a.u. per ton, an increase of 10·41%.

The minimum guaranteed levels for beet roots produced within quota have also been raised and for the main part of the EEC the increase is 5·5% to 18·85 a.u. per ton for Quota "A" and 11·08 a.u. per ton for Quota "B". Minimum prices for sugar beet in the UK have been raised by 9·13% for Quota "A" bringing the level to 16·30 a.u. per ton while for the first time a minimum price has been established for Quota "B". This will be set at 11·08 a.u. per ton, the same level as in the main EEC area.

This minimum beet price for Quota "B" in the United Kingdom follows the establishment of a separate Quota "B" amounting to 10 per cent of Quota "A" and resulting in a total production quota of 990,000 metric tons, white value. There has also been an adjustment to the quota structure in the rest of the Community. The former Quota "B" proportion of 35% has been raised to 45% of Quota "A". This, of course, will not apply to those countries which have opted for a mixed price system and in their case the special maximum quota level for the period July 1973/June 1975 has been increased from 230% to 235%.

If world market prices remain high it is likely that the payment for beet roots produced within Quota "B" will be above the minimum. Indeed, if no charges are incurred in exporting quota sugar to third countries, receipts under Quota "B" will be the same as for Quota "A".

The entry price for sugar produced under the Commonwealth Sugar Agreement for the period from July 1974 to the end of February 1975 has been fixed at 163·90 a.u. per metric ton for raw sugar which results in a theoretical refining margin of 40·30 a.u. per ton. The present supplement being paid to British refiners by the UK Government will cease on 30th June.

[1] *I.S.J.*, 1974, **76** 97.
[2] *Public Ledger*, 23rd March 1974.
[3] *Sugar Review*, 1974, (1172), 55.

World raw sugar price

During April the London Daily Price varied from a low of £200 to as high as £240 but the changes have been mostly based on sentiment since there was little sugar on offer and little concrete to affect the current tight stock position. Requirements have been met but with little competition so that prices have remained high. A feature in the past few weeks has been spurious offers of sugar which did not exist and this has sometimes caused refusal of sugar which was genuinely available but had been offered at a higher price.

* * *

European sugar beet area, 1974

A first estimate of the area to be sown to beet in European countries for the 1974 crop has been published by F. O. Licht[1] and is reproduced below:

	1974 Estimate	1973
	hectares	
Western Europe		
Belgium	106,000	105,000
Denmark	69,000	64,000
France	502,000	478,000
Germany, West	370,000	356,467
Holland	117,000	117,308
Ireland	30,000	30,150
Italy	200,000	226,000
UK	197,000	188,698
Total EEC	1,591,000	1,565,623
Austria	53,700	51,300
Finland	23,500	21,306
Greece	28,700	25,000
Spain	180,000	170,000
Sweden	46,000	42,500
Switzerland	10,400	9,919
Turkey	182,000	153,204
Yugoslavia	97,000	80,000
Total Western Europe	2,212,300	2,118,852
Eastern Europe		
Albania	6,000	6,000
Bulgaria	58,000	50,000
Czechoslovakia	189,000	180,000
Germany, East	230,000	230,000
Hungary	103,000	92,762
Poland	445,000	445,000
Rumania	250,000	235,000
USSR	3,650,000	3,570,000
Total Eastern Europe	4,931,000	4,808,762
TOTAL EUROPE	7,143,300	6,927,614

The total is 216,000 hectares or 3·11% greater than the area sown to beet in 1973. In the EEC as a whole the increase is only 25,400 ha or 1·62% although this figure is greatly affected by the fall in the Italian beet area of 26,000 ha; the overall increase for the rest of the Community is about the same as the overall European rate of expansion. The rise in Western Europe outside the EEC is more marked, averaging 12·3%, the most important increases being set for Turkey and Yugoslavia, where considerable quantities of sugar had to be imported last year.

In Eastern Europe the major increase in area is in the USSR, as befits the largest beet sugar producer yet the 80,000 ha rise represents only a 2·2% increase. Smaller increases, although greater in proportion, are expected in Rumania (15,000 ha), Hungary (10,000 ha), Czechoslovakia (9000 ha) and Bulgaria (8000 ha). The 3·11% area increase is not striking and cannot be expected to contribute greatly to an easing of the tight statistical picture for sugar in 1975 unless sugar yields are very high. It should be remembered, in this connexion, that the sugar outturn in the area represents about one-third of world sugar production.

* * *

US sugar arrangements

After three weeks of hearings by the House Agriculture Committee in Washington, a special sub-committee was set up to formulate a Sugar Bill for consideration by the full committee and possible forwarding to Congress. The sub-committee heard representations by spokesmen of the domestic sugar industry and other interested parties and is reported[2] to have tentatively decided on a five-year extension of the current US Sugar Act, providing for total annual foreign and domestic quotas of 12,000,000 tons, of which 5,465,000 tons would be imported. Allocations within the 6,535,000-ton domestic quota would be 3,500,000 tons for the beet sugar industry, 1,600,000 tons for Louisiana and Florida cane sugar (divided 42·5% and 57·5%), 125,000 tons for Texas cane sugar, 1,110,000 tons for Hawaii and 200,000 tons for Puerto Rico.

* * *

Tate & Lyle Ltd. 1973 report

Sugar refining in Great Britain, the traditional activity of Tate & Lyle, contributed only 16% to Group profits in 1973, although refining activities of subsidiaries in Canada and Africa added another 18%. The largest contributor was the Group's shipping interest (32%) while a further 18% arose from molasses, sugar and other commodity trading, storage and distribution. Pre-tax profits rose by £1·66 million to £17·89 million of which £7·75 million is paid in tax.

In 1973 Jamaica experienced its worst drought for fifty years, giving a poor cane crop and resulting in a loss. Rains came in late 1973, improving prospects for 1974. Record cane crops were obtained in Belize and at Illovo Sugar Estates in South Africa, while the planned expansion of production in Zambia was achieved.

UK trade sales tonnage was maintained in 1973 despite a number of problems associated with EEC entry, although profitability declined owing to a combination of cost inflation in the UK and Government price policy on the company's margin to cover cost and profit.

The consulting services of Tate & Lyle Enterprises have continued to enjoy international demand, particularly in Brazil. Substantial engineering contracts have been gained in Tanzania, Venezuela and Mozambique by Smith-Mirrlees, the benefit of which will be felt in 1974/75.

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[1] *International Sugar Rpt.*, 1974, **106**, (9), 1–4.
[2] *Public Ledger*, 23rd March 1974.

Density and refractive index of solutions of sucrose and glycine

By C. A ACCORSI, G. MANTOVANI and G. VACCARI
("Serafino Cevasco" Sugar School, University of Ferrara, Italy)

THE study of the structure of sucrose solutions through density measurements, in the absence and in the presence of impurities, has given some interesting results[1,2,3]. On the basis of the data obtained on sucrose-inorganic salts-water solutions[1], and in accordance with the Recommendation 2 on Subject 13 of the 15th Session of ICUMSA[4], we have studied, by density and refractive index measurements, the ternary systems water-glycine-sucrose and the binary systems water-sucrose and water-glycine.

Experimental

Sucrose (BDH "Analar"-grade) and glycine (C. ERBA R.S.), dried during 24 hours under vacuum and stored over silica-gel, were used. The solutions were made by weighing appropriate amounts, corrected to vacuum, and dissolving in deionized water distilled over potassium permanganate and having a specific conductivity at 20°C less than 1×10^{-6} mho. Densities of 1·601 and 1·588 were assumed for glycine and sucrose, respectively. For the calculation of the molalities, molecular weights of 75·07, 342·3 and 18·016 were assumed for glycine, sucrose and water, respectively. With equal molalities of glycine, the presence of sucrose causes only a small decrease in pH which, for the whole range of concentrations studied, varies from 6·2 to 5·8. Within this range, about 99·95% of glycine is present in zwitterion form[5].

Densities were measured, as previously[1], using a modified Sprengel pycnometer[6], which was calibrated in a thermostatic bath at 20·00 ± 0·01°C. The density of water at this temperature was assumed to be 0·99823[7]. Taking into account the precision obtained in the pycnometer calibration and the error made in weighing the solutions, the relative error in density measurements was of the order of 7×10^{-6}. The reproducibility of repeated density measurements was of the order of $\pm 1 \times 10^{-5}$.

For the refractive index measurements a Pulfrich refractometer, modified for liquids and with thermostatic control of the solutions, was used. The temperature was maintained at 20·0 ± 0·1°C, which was sufficiently constant, having in mind that, according to SCHÖNROCK[8], a variation of ± 0·05°C causes a refractive index variation for sucrose solutions of $\pm 1 \times 10^{-5}$. Moreover, the measurement reproducibility of Pulfrich refractometers of 5 seconds involves a variation of $\pm 2 \times 10^{-5}$. A sodium D-line was used as light source. The characteristics of the prism were periodically checked through water refractive index measurements. At 20·0 ± 0·1°C, a value of 1·33298 was obtained which was in good agreement with the datum of TILTON and TAYLOR[9].

Experimental values of densities of the solutions examined, having a fixed molality of one solute and variable molality of the other solute, were correlated to the molalities of this latter. This correlation was carried out through the calculation programme E 202 "Least square fit of polynomial with statistical analysis" of the CERN 7090 Programme Library. The use of this programme allows choice, on the basis of the sum of the residual deviations, of the best polynomial in agreement with the experimental data.

These equations have the general form:

$$d = A + B\,m + C\,m^2 + D\,m^3 \quad \ldots\ldots\ldots\ldots (1)$$

where m is the molality of the component studied and A, B, C, D are the calculated parameters.

The partial molal volumes, in ml/mole of the solutes and the solvent, were calculated by means of the values which can be obtained by this expression and by the equation[10]:

$$V_i = \left[\frac{1}{d^2}\left\{M_i d - 1000\left(1 + \sum_{J=1}^{q}\frac{m_J M_J}{1000}\right)\left(\frac{\delta d}{\delta m_i}\right)\right\}\right]_{m_K \neq i} \quad \ldots\ldots (2)$$

where M_i is the molecular weight of the solute, q is the number of solutes and the summation $\sum_{J=1}^{q}$ is that of molecular weights multiplied by molalities extended to all the solutes, and by the equation:

$$V_o = M_o\left[\frac{1000 - c_1V_1 - c_2V_2}{1000\,d - c_1M_1 - c_2M_2}\right] \quad \ldots\ldots\ldots\ldots (3)$$

where c_1 and c_2 are the concentrations in moles/litre of the solutes (glycine and sucrose, respectively).

Refractive indices and density values of the solutions examined were used for the calculation of the specific refractions by the LORENTZ-LORENZ formula:

$$r_D^{20^\circ} = \frac{n^2 - 1}{n^2 + 2} \cdot \frac{1}{d} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Assuming that the solvent specific refraction is constant[11,12], the apparent specific and molar refractions of the solutes were calculated from the equation:

$$r_1 = \frac{r - r_o(1 - x)}{x} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

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[1] MANTOVANI and INDELLI: *I.S.J.*, 1966, **68**, 104–108.
[2] SCHNEIDER *et al.*: *Zucker-Beihefte*, 1963, **16**, 1–19.
[3] SCHNEIDER: *Ind. Sacc. Ital.*, 1964, **57**, 225–237.
[4] MANTOVANI: *Proc. 15th Session ICUMSA*, 1970, 114–128.
[5] WOOLF *et al.*: *J. Amer. Chem. Soc.*, 1962, **84**, 317.
[6] INDELLI: *Annali di Chimica* (Rome), 1963, **53**, 605.
[7] LANDOLT-BORNSTEIN: "Physik.-chem. Tabellen", 5th Edn., 1923.
[8] *Z. Ver. Deut. Zuckerind.*, 1911, **61**, 421.
[9] *J. Research* (Nat. Bur. Standards), 1938, **20**, 420.
[10] DUNLOP and GOSTING: *J. Phys. Chem.*, 1959, **63**, 86.
[11] POINDEXTER and ROSEN: *Phys. Rev.*, 1934, **45**, 760.
[12] KRUIS: *Z. Phys. Chem.*, 1936, B **34**, 93.

where r is the specific refraction of the solution, r_o is the specific refraction of the solvent and x is the number of grams of solute per gram of solution.

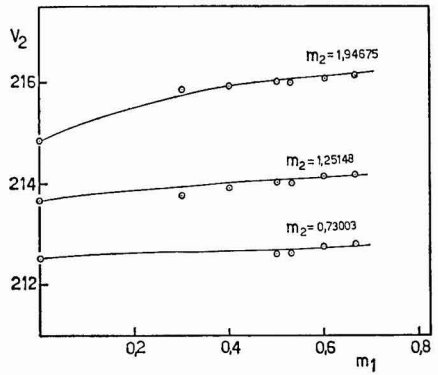

Fig. 1. Partial molal volumes of sucrose as a function of glycine molality. $T = 20{\cdot}00 \pm 0{\cdot}01°C$

In Fig. 1, the partial molal volumes of sucrose are plotted as a function of the molality of glycine and at fixed molalities of sucrose. The values for $m_1 > 0$ were calculated from equation (2) and by the equations $d = f(m_2)$ calculated for sucrose at fixed molality of glycine. The experimental data deviate from the values calculated using these equations by amounts higher than those due to experimental error (from 5 to 16 $\times$ 10^{-5}). This fact can be ascribed either to the limited number of sucrose concentrations studied or because the degree of the polynomial was limited to 3.

The values corresponding to $m_1 = 0$ were calculated from the values (with $m_1 = 0$) of the equations $d = f(m_1)$ previously calculating the apparent molal volumes by the equation:

$$\varphi_2 = \frac{1000}{m_2}\left(\frac{1}{d} - \frac{1}{d_o}\right) + \frac{M_2}{d} \qquad (6)$$

where d_o is the density of water and d is the density of the solution, when $m_1 = 0$.

Thereafter the values of φ_2 were fitted in molality m_2 and from the values obtained by interpolation, densities were calculated using the equation (6) knowing φ_2. The densities were fitted in molalities so allowing the calculation of V_2 by the equation (2).

The values of the partial molal volumes so obtained are slightly higher than those calculated through the densities of the water-sucrose binary solutions, by using the same procedure of calculation through the equations (6) and (2), after having calculated, from the experimental data, the equation:

$$\varphi_2 = 210{\cdot}76 + 1{\cdot}2816\, m - 0{\cdot}08179\, m^2 \qquad (7)$$

At infinite dilution the value of 210·76 is obtained, which is in good agreement with the value of 210·83 calculated by the equation which correlates the volume at infinite dilution with the temperature[13].

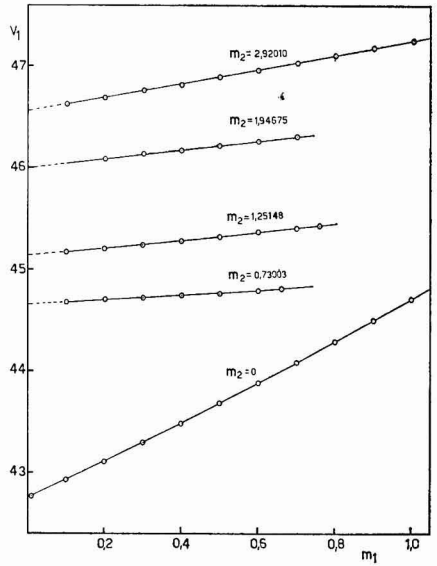

Fig. 2. Partial molal volumes of glycine as a function of glycine molality and at fixed molalities of sucrose. $T = 20{\cdot}00 \pm 0{\cdot}01°C$

In Fig. 2 are shown the partial molal volumes of glycine as a function of glycine molality and at fixed molality of sucrose. In this case, the equations $d = f(m_1)$ were quadratic for all values of sucrose molalities. The deviations between calculated and experimental densities were of the order of experimental errors, that is a maximum of $1{\cdot}5 \times 10^{-5}$.

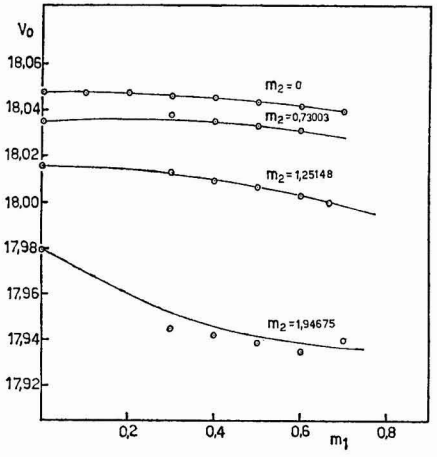

Fig. 3. Partial molal volumes of water for glycine-sucrose-water system. $T = 20{\cdot}00 \pm 0{\cdot}01°C$

In Fig. 3 are shown the values of partial molal volumes of the solvent as a function of m_1 for different values of m_2.

[13] GARROD and HERRINGTON: *J. Phys. Chem.*, 1970, **74**, 363.

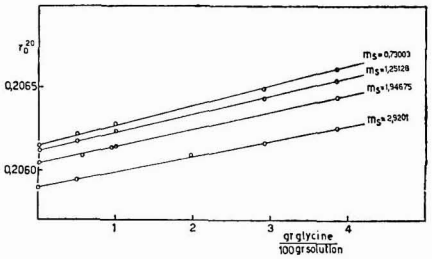

Fig. 4. Specific refractions of sucrose-glycine-water solutions as a function of weight percentage of glycine

The results of the refractometric measurements are shown in Figs. 4, 5 and 6. In Fig. 4, the specific refractions of solutions with fixed molalities of sucrose are plotted as a function of the weight percentage of glycine in the solution.

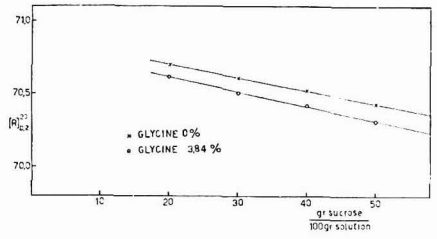

Fig. 5. Apparent molar refractions of sucrose in the presence of glycine 0% and 3·84%, as a function of weight percentage of sucrose

In Fig. 5 are plotted the apparent molar refractions of sucrose, calculated from equation (5) using the values shown in Fig. 4. In the upper curve, r_o is the refraction of water; in the lower curve r_o is the refraction of the aqueous solutions containing 3·84% glycine, assuming for the specific refraction of glycine the value 0·21926 which we have obtained for the water-glycine solutions.

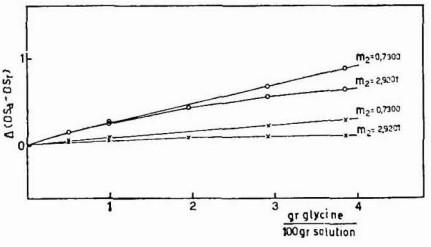

Fig. 6. Δ (DS_{app} - DS_{real}), calculated from refractive index values o and density values x, as a function of weight percentage of glycine, relative to two sucrose molalities (m_2 = 0·7300 or 2·9201)

In Fig. 6, differences between apparent dry substance and real dry substance of sucrose-water-glycine solutions, as a function of the weight percentage of glycine and at two fixed molalities of sucrose, are shown. The values of apparent dry substance were obtained from experimental values of refractive index and density, compared with values in the literature concerning pure sucrose solutions[14].

Discussion

A number of authors agree, in general, on the existence of interactions between water and sucrose molecules in aqueous sucrose solutions. On the basis of thermodynamic and volumetric data concerning sucrose and glucose solutions, TAYLOR and ROWLINSON[15] assume the existence of strong hydrogen bonds between sucrose and water molecules. These bonds are discussed from the quantitative point of view by STIGTER[16], taking into account the fact that, when a hydrogen bond is formed between sucrose and water, one should also account for the cleavage of a hydrogen bond between two water molecules. SCHNEIDER and co-workers[2,3] proposed a model of these solutions: the sucrose molecule in aqueous solution is hydrated, the extent of hydration decreasing with increase in the sucrose concentration. When the latter becomes critical, the interactions between the solute molecules begin to become so considerable as to cause their association by means of water molecules which act as bridges and originate the so-called clusters.

Our values of partial molal volumes of sucrose in aqueous solution may be interpreted on this basis. The variation of the partial molal volume of sucrose on increasing its concentration can be attributed either to a lower degree of solvation or to a tendency to association among the sucrose molecules. The corresponding values of partial molal volume of the solvent decrease either as a consequence of the solvation effect or according to the different structure of the solvent itself. This last condition favours the presence of free water molecules in comparison with clusters of hydrogen-bonded water molecules, according to the model of water structure proposed by FRANK and WEN[17] and developed by NEMETHY and SCHERAGA[18].

The presence in the solution of a second solute, i.e. glycine, favours these effects. In fact, either the values of V_2, when $m_1 = 0$, higher than the ones observed in the system sucrose-water, or their increasing trend on increase of both m_1 and m_2, as shown in Fig. 1, can be connected to a lower solvation and to an increasing tendency to association.

Correspondingly, the volume of the solvent decreases more and more and, though taking into account that the errors of V_2 influence the values of V_o, the contraction becomes obvious.

The behaviour both of the solutes and of the solvent are quite similar to that previously observed at 25°C for the water-sucrose-inorganic salts systems[1].

[14] BROWNE and ZERBAN: "Physical and Chemical Methods of Sugar Analysis" (Wiley, New York), 1941.
[15] *Trans. Faraday Soc.*, 1955, **51**, 1183.
[16] *J. Phys. Chem.*, 1960, **64**, 118.
[17] *Disc. Faraday Soc.*, 1957, **24**, 133.
[18] *J. Chem. Phys.*, 1962, **36**, 3382.

The variations in specific refraction of an ionic solute with its concentration were ascribed by FAJANS and co-workers[19] to variations in interactions among the ions and between ions and water depending on concentration change. In particular, it was observed that the ionic interactions increase on increasing the concentration, while water-ions interactions show a tendency to decrease.

For non-ionic solutes, solute-solute and solute-water interactions can be likewise considered together with the hypothesis that the tendency of these two effects in relation to the concentration can be similar to that suggested for ionic solutes.

From the upper curve in Fig. 5, it appears that for pure sucrose solutions, in the concentration range examined, an increasing interaction among sucrose molecules causes a decrease in its molar refractions. The presence of glycine (lower curve), at equal sucrose concentrations, causes lower values of sucrose molar refraction than those of pure sucrose solutions and therefore seems to favour greater interaction between sucrose molecules.

These measurements have a direct bearing on the evaluation of the reliability of the densimetric and refractometric determinations of dry substance. As is shown in Fig. 6, the values of apparent dry substance of sucrose solutions in the presence of glycine are always higher than those of real dry substance. Moreover, the relative differences are greater with increase in glycine concentration. In particular, it can be pointed out that the differences related to refraction index data are higher than the ones connected with density data.

The calculations were carried out in the CINECA Calculation Centre of the University of Ferrara.

[19] *Z. Physikal. Ch. (Series B)*, 1933, **23**, 428.

China's quest for self-sufficiency in sugar

By JACK F. WILLIAMS

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A BASIC guideline of China's development strategy since 1949 has been a stress on self-sufficiency. This policy has been energetically pursued in the development of the sugar industry, by pushing domestic production on all four fronts—cane and beet, centrifugal and non-centrifugal—and by holding down imports as much as possible. In spite of impressive gains, however, total success has so far eluded the Chinese. This paper presents some preliminary findings on China's sugar industry and the efforts to achieve self-sufficiency in sugar supply.

Total sugar production

There is considerable disagreement between the various data on sugar production in China. Some of these discrepancies arise from the fact that the total supply consists of both cane and beet sugar, a sizeable amount of which is non-centrifugal sugar produced in extremely small, rather primitive mills on communes, whose production figures are probably not even clearly known by the Chinese government itself. Another contributing factor has been the failure of the Chinese to report actual production figures since about 1960, so that estimates for production since then must be based on percentage production increases that have been reported, export-import figures, estimated yields and factory milling capacities, and much speculation.

There is general agreement that China's peak pre-war sugar production was around 500,000 metric tons in the late 1930's, and that that fell to under 200,000 tons by 1949. All but a tiny fraction of this sugar was from cane. The sugar industry was revived along with the rest of the economy during the period of recovery, 1949/52, so that production had reached pre-war levels by the 1952/53 crop year[1].

Expansion of sugar production was steady and fairly rapid up to 1957/58. Production in 1958/59 reached 960,000 tons of centrifugal sugar, 59% higher than pre-war levels, and 431,000 tons of non-centrifugal sugar. These were figures released by the Chinese and are believed to be correct[2]. It is with the collapse of the economy following the "Great Leap Forward" that the discrepancies in data began. The major sources of data for sugar production in China today are the I.S.O.[3], the U.S.D.A.[4], and the F.A.O.[5] For 1970, the figures are: 2·9 million metric tons, 3·0 million tons, and 3·7 million tons, respectively. All three estimates include cane and beet, centrifugal and non-centrifugal sugar. There is no way to account for the much higher figure reported by the F.A.O.,

[1] "The World Sugar Economy, Structure and Policies. Vol. 1: National Sugar Economies and Policies" (International Sugar Council, London), 1963, pp. 208–210.
[2] "Ten Great Years" (State Statistical Bureau, Peking), 1960.
[3] "Sugar Year Book 1970" (International Sugar Organization, London).
[4] *Foreign Agriculture Circular on Sugar* (U.S. Dept. of Agriculture), July 1973, (FS-1-73).
[5] "FAO Production Yearbook 1970" (Food and Agriculture Organization, Rome).

which shows a nearly 300% increase since 1959. Neither is there any reason to believe that the estimation techniques of the F.A.O. are superior to those of the I.S.O. or U.S.D.A. For the most recent crop year estimate, 1972/73, the U.S.D.A. put sugar production at 3,214,000 tons. A reasonable assumption is that China's total sugar supply is now at least 3·2 million tons, and perhaps as high as 3·5 million tons or more. Regardless of which figure one accepts, China is clearly one of the world's major sugar producers, and in Asia second only to India.

An important aspect of China's increased production of sugar has been the rising importance of beet and non-centrifugal sugar. In pre-modern China, non-centrifugal cane sugar was the only kind produced. Then in the 20th century modern milling techniques were introduced and centrifugal sugar became available, although most Chinese continued to consume non-centrifugal sugar[6]. Beet sugar was produced in very small amounts in the Northeast in pre-war days, but major expansion of the beet sugar industry since the 1950's has greatly increased the supply, so that about 40% of China's sugar supply is now from beets. Likewise, although centrifugal sugar has taken over the lead and now accounts for about 70% of total domestic supply, non-centrifugal sugar production has increased three-fold since the early 1950's, making China the second largest producer of non-centrifugal sugar in the world, after India.

Regional expansion of cane and beet cultivation

A major problem facing the Chinese in their efforts to increase sugar production has been a shortage of land on which to grow cane or beets. Pre-war cane production was confined largely to the provinces of Kwangtung and Szechuan. There was also a minute area sown to beets in Heilungkiang in the Northeast. Because of China's rapid population growth, after 1949 production of essential food crops had priority in allocation of land resources. Significant production increases in cane could not be achieved solely in the historic areas of cane growing. Thus, a basic policy, especially since 1958, has been to expand production of cane in other provinces, particularly by utilizing reclaimed marginal lands. Although Kwangtung still produces over half of China's cane sugar, and around one-third of the total sugar supply, at least seven other provinces now grow cane: Fukien, Yunnan, Kwangsi, Szechuan, Kiangsi, Chekiang, and Hupei (in decreasing order of importance)[7]. (See Fig. 1.) Total area planted to cane grew from an average of 161,000 hectares in the 1948/49–1952/53 period, to around 460,000 ha by 1969/70, nearly a three-fold increase[5].

Expansion of beet cultivation has been even more dramatic. Heilungkiang multiplied its beet planted area several times over, to 93,000 ha by 1970[8]. Beet cultivation also expanded on a major scale to at least eight other provinces—Inner Mongolia, Kirin, Sinkiang, Chinghai, Liaoning, Kansu, Shansi and Kiangsu. Of these, the first three are the most important by far. The remarkable growth of beet production was the result of a policy shift in 1959, when there was a call for "Cane South, Beet North", meaning the balanced development of both cane and beets. The overall goal was to make each province, if possible, produce at least some of its sugar requirements[7]. Expansion of beets was relatively easier than for cane, because beets could be grown fairly well in marginal lands that few other crops could tolerate. Hence, beet planted area for the country as a whole increased from only about 30,000 ha in the early 1950's to 228,000 ha by 1969/70[5].

Besides expanding the cane and beet planted area, production increases were also achieved by improved unit area yields. The average annual cane yield in the early 1950's was only 35 tons/ha, and for beets about 12 tons/ha. By 1969/70 the corresponding figures were estimated[5] at 64 and 22 tons/ha. The cane yield was only slightly below the 70 tons/ha recorded in Taiwan in the same year, which gives some indication of how far China had come in just 20 years. These yield improvements were the result of effective measures for more scientific cultivation and harvesting of cane and beets. The First Five-Year-Plan gave high priority to sugar research. A cane research institute was established at Canton in 1956, and one for beets at Harbin[7]. Among the significant achievements of these research centres were: the development of many new high-yielding cane varieties adapted to local conditions and supplanting the old Taiwan varieties that had been in use since pre-war days[9]; the setting up of numerous field stations and experimental farms for testing of new varieties and for disseminating advanced cultivation techniques to the communes[10]; and the use of natural enemies, such as red ants, to control cane pests, which has resulted in savings on chemical control and proved highly effective[11].

Expanded sugar production capacity

Another important aspect of the 1959 policy shift dealt with sugar manufacture. In 1949 there were only four modern cane sugar mills in China, but by 1959 there were over 100. There were still only about 8 modern beet sugar factories by 1959[1]. Up to that time, however, priority had been given to the construction of relatively large, mechanized mills located predominantly in the traditional cane producing areas. Because of shortage of land, milling capacity grew faster than cane supply, so that by 1958 it has been estimated[7] that only about 60% of the country's milling capacity was being used. To rectify this situation, the trend after 1959 was toward smaller "half-native, half-modern" mills located on the communes as near as possible to newly-created, as well as existing, cane and beet producing areas.

[6] CHEN: *Geographical J.*, 1971, **137**, (March), 29–40.
[7] LIU: "The Sugar Industry in Communist China" (Unpublished report, Taiwan Sugar Corporation), 1968?
[8] *SCMP (Survey of China Mainland Press)*, 19th December 1970, p. 43.
[9] *ibid.*, 10th September 1965, p. 16.
[10] *ibid.*, 7th October 1965, p. 15.
[11] *ibid.*, 30th July 1965, p. 13.

These were mills that could be built with a small capital investment and be operated by commune personnel with only minimal training, and supplying commune and local regional sugar needs. Sugar produced from the larger and more modern state-run sugar factories was then used primarily to support larger urban markets. This policy also reduced the demands of the sugar industry on the country's inadequate transportation system[6]. Fig. 1 shows the distribution of sugar manufacturing capacity in China as far as is known at the present time. Although many provinces are now producers and refiners of sugar, the continued dominance of Kwangtung for cane production and Heilungkiang for beet production is very clear.

low *per caput* needs of the 1950's, and because of the policy (referred to above) of reliance on the old sugar producing areas. The collapse of the economy in 1959 led to an even sharper increase in imports, to over 464,000 tons in 1960, and a record 1·5 million tons in 1961. China concluded trade agreements with Cuba in 1959 and 1960, which made Cuba the major supplier of China's sugar imports for the decade of the 1960's[1].

Imports of sugar decreased substantially after 1961, as China's economy recovered and the expansion of the sugar industry continued. Nevertheless, imports never fell below 400,000 tons a year from then on[8]. The import figures for 1972 show that not only

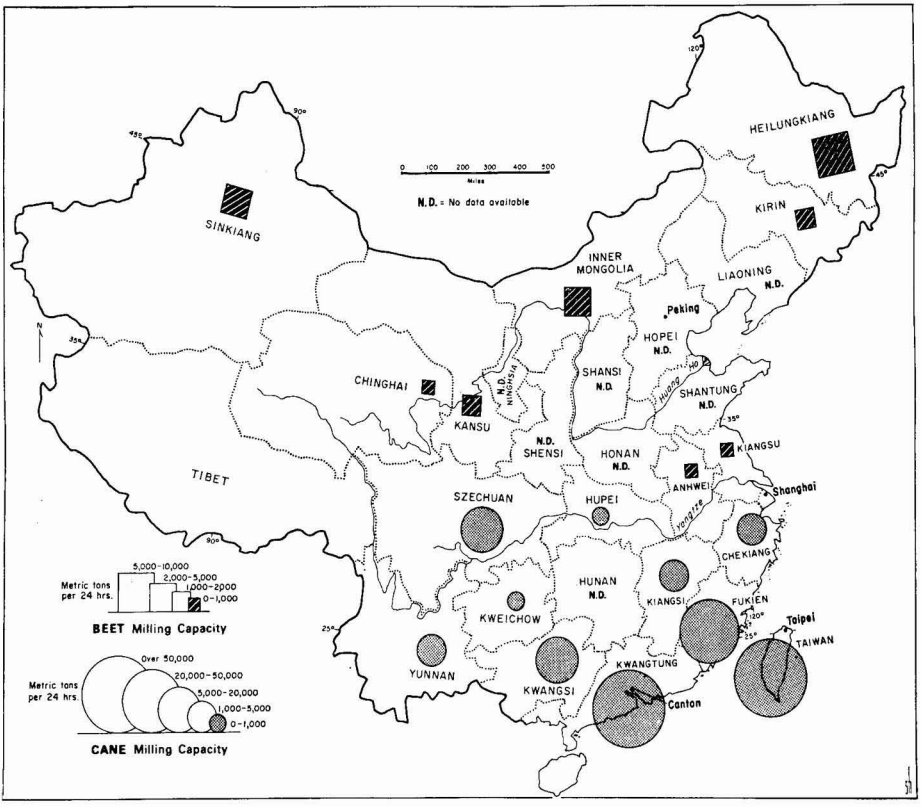

Fig. 1

Rôle in world sugar trade

China had been more or less self-sufficient in sugar up to 1895. When Taiwan was then taken over by the Japanese, imports reached a pre-war peak of over 870,000 tons. After 1930, imports averaged 500,000–600,000 tons a year, much of it cane sugar smuggled in from Taiwan by the Japanese[6].

After 1949 imports rose steadily again because domestic production could not meet even the relatively

is China still not self-sufficient, but that it is also becoming more active in world trade. Whereas Cuba supplied practically all China's sugar imports up to 1971, a poor crop in Cuba in 1971–72 forced China to shop elsewhere as well. Brazil supplied 400,000 of China's 700,000 tons of sugar imports in 1972[12]. In 1972 China also made its first purchase of Australian sugar, a modest 12,500 tons, leading observers to

[12] *Foreign Agriculture*, 16th July 1973, p. 10.

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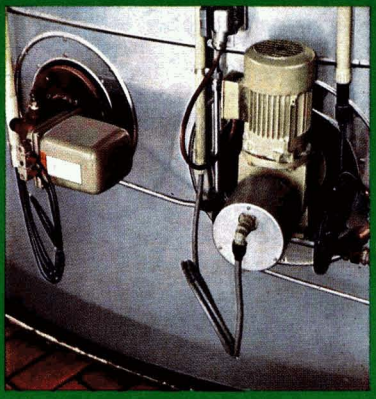

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speculate on the potential of China as a major world buyer of sugar[13].

A curious aspect of China's sugar trade has been the export of raw and refined sugar. There appears to be a strong correlation between world sugar prices and China's exports. When world prices reached their record high levels of 1964, China actually exported more sugar than it imported, 527,000 metric tons as opposed to 408,000 tons, respectively. As world prices reached rock-bottom levels in the last half of the 1960's, China's exports dwindled steadily, reaching a mere 79,000 tons in 1970. In view of current high world sugar prices, it would not be surprising if China were once again to export larger amounts of sugar.

It appears likely that China will continue to play at least a modest rôle in trade on the "free" sugar market, outside of the major quota systems, because sugar remains an important, albeit small, means of acquiring foreign exchange. There is also speculation that China might try to win new markets in South East Asia and the Middle East. China's principal export markets at present are Hong Kong, Malaysia, and Singapore[3]. A speculative, but very important, question concerns what changes might occur were the mainland to recover Taiwan in the near future or at least reopen commercial relations with the island. Taiwan's annual production of more than 800,000 tons of sugar could be a major asset to China's domestic needs and provide much greater amounts of sugar for export than China presently can squeeze out of its tight supply-demand situation.

Domestic sugar consumption

The chief restraint on China's playing an even larger rôle in exports of sugar is of course the pressure of domestic demand for sugar. Although China probably can control the domestic demand better than most other countries, and although sugar plays a relatively minor rôle in the Chinese diet, the rising demand from population growth alone cannot be ignored, nor can the needs of the growing food processing industry. Thus there are definite restraints on how much sugar China can use in foreign trade.

Assuming for the moment that the U.S.D.A. figures are reasonably correct, it is possible to estimate *per caput* consumption of sugar. In 1970/71, the most recent year for which data are complete, China's estimated total sugar supply was as follows[14,15]:

Centrifugal sugar	2,267,000	metric tons
+ Imports	464,000	„ „
	2,731,000	„ „
— Exports	103,000	„ „
Balance	2,628,000	„ „
+ Non-centrifugal sugar	730,000	„ „
Total supply	3,358,000	„ „

Assuming China's population to be approximately 800 million in 1970, *per caput* consumption of sugar would have been 4·19 kg. This was a marked improvement over the 1 kg *per caput* consumption recorded in 1951[1], but still left China one of the smallest *per caput* consumers of sugar in the world, and far below even Taiwan's relatively low consumption of 15 kg in 1970.

The obvious obstacles to substantially raising the *per caput* consumption are the rapid increase in the population each year, plus other demands on China's limited and already intensively utilized agricultural land. If the government's goal is to maintain *per caput* consumption near its present very low level, then China could be said to have achieved near self-sufficiency in sugar. But if the government wants to allow for more rapid increases in *per caput* consumption, the chances are marginal at best that consumption will get even remotely close to the figure for Taiwan, let alone the rate for Japan and other developed nations, in this century at least. Hence, China's quest for self-sufficiency in sugar is far from over.

[13] *Far Eastern Economic Review*, 17th June 1972, p. 32.
[14] *ibid.*, 10th June 1972, p. 42.
[15] *Foreign Agriculture Circular on Sugar* (U.S. Dept. of Agriculture), September 1972, (FS-2-72).

Viscosity and supersaturation of sugar solutions

Rheological properties during the course of a strike

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PART II

When comparing the two graphs in Figs. 2 and 4 with the lines of equal saturation or equal viscosity, the similarity of the curves of the different parameters becomes obvious and it is thus easy to recognise that when viscosity is influenced, the supersaturation of the solution is simultaneously influenced. This again means that one can measure and control the viscosity to attain optimum conditions, as carried out with the rheometer automatic boiling control system*. Precise control of the viscosity is absolutely necessary, since a very wide range must be covered, as clearly shown

* The rheometer automatic boiling control system is manufactured by Fischer & Porter, Mess- und Regelungstechnik.

Course of various parameters during 1st white sugar strike

	Massecuite				Mother liquor	
Point No.	*Time (min after start of strike)*	*Rheometer value(%)*	*Level (%)*	*Temperature (°C)*	*Concentration (°Bx)*	*Viscosity (cp)*	*Super-saturation*
1	—	3	24	71·0	72·0	34	0·78
2	19	19	24	70·0	83·6	675	1·57
3	20	21	24	70·0	84·2	850	1·64
4	23	15	26	77·5	83·4	380	1·40
5	52	13	36	84·0	82·6	195	1·22
6	92	14	52	78·5	81·2	180	1·19
7	143	37	74	75·5	80·2	160	1·16
8	178	58	97	69·5	78·4	141	1·12
9	186	93	95	68·0	77·8	131	1·10

by the following examples of a rheometer-controlled 1st white sugar strike.

Fig. 5 shows the course of a 1st white sugar strike with the corresponding times of sampling and the various measured and calculated parameters. The time is marked on the abscissa, and as ordinates are recorded the rheometer value, level, temperature and concentration, viscosity and supersaturation of the syrup or mother liquor. Of these 6 parameters, the rheometer value, level and temperature were measured inside the vacuum pan during boiling, while concentration (°Bx), viscosity and supersaturation were determined in the laboratory from samples taken from the vacuum pan.

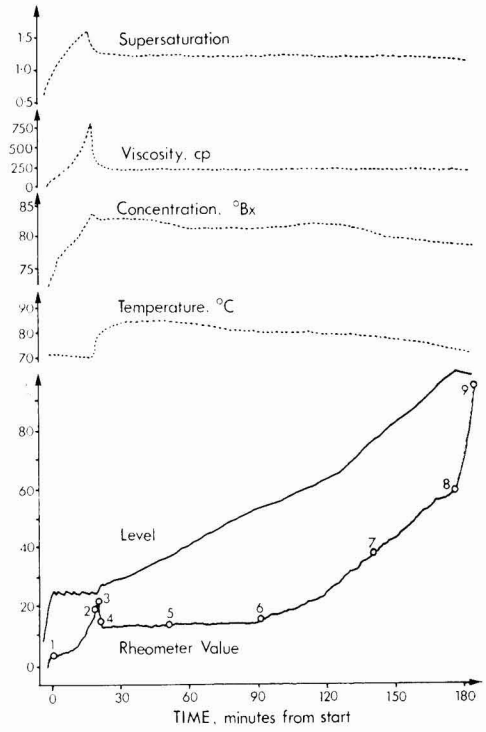

Fig. 5. Variation of different factors during refined sugar strike

In this strike crystals, of which 60% were larger than 1mm, were boiled from a clear liquor with a dry substance content of 68% and a purity of 99·9 without any addition of water. The strike was controlled with the rheometer automatic boiling control system. The steam pressure to the calandria fluctuated during the boiling period between 0·3 and 0·6 bar and the boiling temperature of the strike lay between 67·5° and 84°C. The only control factor during the strike was the rheometer value, by means of which the viscosity of the mother liquor and the rheological influence of the crystals were determined additively. During the period of the strike, 22 samples were taken from the pan, the temperature of the syrup or massecuite at the time of sampling being measured with the aid of a glass thermometer. The mother liquor was separated from each sample by spinning in a laboratory centrifuge lined with synthetic felt which retained all crystals over 10 microns. The respective mother liquors were fed into bottles with tight caps; from each of these a 1:1 dilution was made, held at a constant temperature of 20°C and its dry substance content determined with a refractometer. The course of the concentration and temperature values during the whole boiling process is shown in Fig. 5.

The rheometer value is marked at 9 significant points corresponding to the samples taken at these points, which are:

(1) Calandria covered with syrup and evaporation begins (t = 71·0°C, concentration = 72·0% dry substance).

(2) Seeding point (t = 70·0°C, concentration = 83·6% dry substance).

(3) End of phase of seed crystal formation immediately before the first syrup addition (t = 70·0°C, concentration = 84·2% dry substance).

(4) Beginning of controlled crystallization at constant set point (t = 77·5°C, concentration = 83·4% dry substance).

(5) Middle of first crystallization stage (t = 84·0°C, concentration = 82·6% dry substance).

(6) End of first crystallization stage at constant set point and beginning of second crystallization stage with rising set point (t = 78·5°C, concentration = 81·2% dry substance).

(7) Middle of second crystallization stage with rising set point (t = 75·5°C, concentration = 80·2% dry substance).

(8) End of controlled crystallization, i.e. end of second crystallization stage with rising set point (t = 69·5°C, concentration = 78·4% dry substance).

(9) End of strike (t = 68·0°C, concentration = 77·8% dry substance).

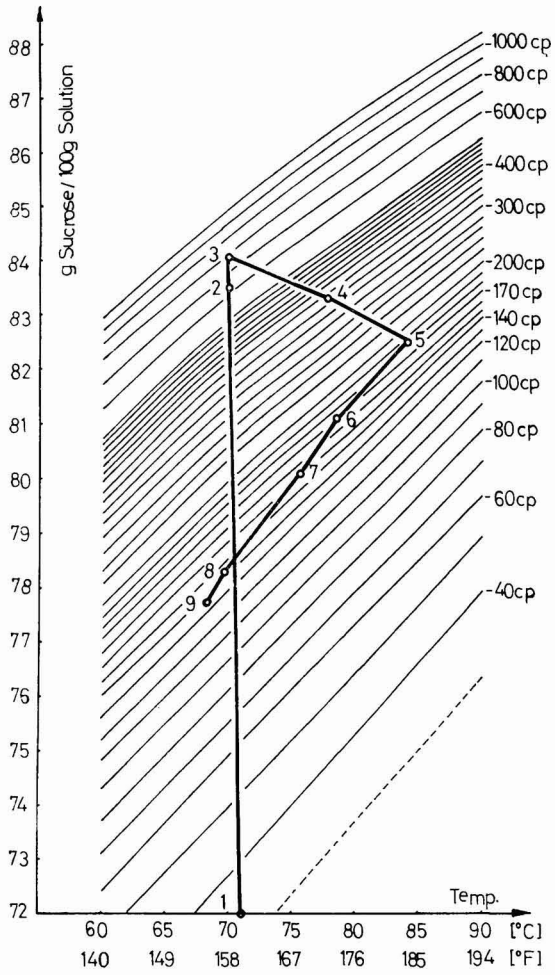

Fig. 6. Viscosity changes during refined sugar strike

If these points are located on Fig. 4 by their temperature-concentration coordinates, the progress of the strike is recorded, as shown in Fig. 6.

In the syrup concentration stage, the viscosity naturally rises sharply as a result of the evaporation of water, in the present case from Point 1 to Point 2, i.e. from 34 to 675 cp. After the seeding process at Point 2 there is a further rise in the dry substance content of the syrup up to 84·2% dry substance during the formation of seed crystals (Point 2 to Point 3). At Point 3 the viscosity has reached its highest value and stands at 850 cp. This value appears to be exceptionally high, but calculation shows the corresponding supersaturation to be 1·62. If this supersaturation is compared with the data published by KUKHARENKO in an analysis of refined sugar strikes[30], it is seen that his values for the seeding process and for the condition immediately before the beginning of the first syrup addition (reduction of syrup viscosity) are comparable. In this stage of crystal development the sucrose-water system must be brought to a higher energy level so as to bring about the reaction, which in this case represents a change of phase. The initial and final conditions are separated by the point of maximum activation energy. For this reason, the energy level of the system must first be raised before the process, which involves the release of energy and leads to the final condition, can start[31].

After the "reduction of syrup viscosity" stage, which represents the first syrup addition, the controlled crystallization begins at Point 4, corresponding to a mother liquor viscosity of 380 cp.

In the middle of the controlled crystallization stage at constant set point, viscosity has fallen to 195 cp and at the end of this first crystallization stage at Point 6 has reached 180 cp. In the second crystallization stage, in which the set point rises in accordance with the rheometer graph, the viscosity of the mother liquor drops slightly, so that in the middle of this second crystallization stage, at Point 7, 160 cp is achieved. At the end of this second crystallization stage, at Point 8, a further drop to 141 cp has occurred. In the last stage of the crystallization process, viscosity drops finally between Points 8 and 9 to a value of 131 cp.

The table below shows the various parameters of the strike discussed.

During the last campaign many strikes were examined by this means, and it was found that all 1st white sugar strikes behaved similarly to that indicated in Fig. 6. In the case of slight changes in temperature during crystallization, the loop above Points 3-5-9 was less well defined, but the patterns were similar.

Each of the points in this graph of equal viscosities can be obtained by a number of possible combinations. To demonstrate this, let us take Point 7 in the graph. The viscosity of the mother liquor at this point is 160 cp, which resulted more or less incidentally from the combination of the pair of values 75·5°C/80·2% dry substance as a consequence of the boiling conditions. If the temperature were lower, e.g. 60°C, then the dry substance content could adjust itself to 76·8%, i.e. for each point on the line of equal viscosity of 160 cp there is a different pair of values. If the temperature were to be higher, then the same applies, i.e. up to a temperature of 90°C, for instance, the pairs of values run smoothly on the 160 cp line up to a dry substance content of 83·2%.

The graph is applicable for 1st white sugar strikes boiled from clear liquor of high purity. The viscosity changes in the diagram can naturally deviate markedly from the form of the present example. If, for example, as an extreme case, the temperature is held constant during crystallization, then the corresponding values of constant viscosity adjust themselves respectively to a vertical line parallel to the ordinate.

[30] "Ratgeber des Zuckerkochers", 5th Edn. (Gustav Fock, Leipzig.) 1930, p. 120.

[31] THIELE and LANGEN: *Zucker*, 1973, **26**, 315–317.

The shape of the viscosity change diagram is mainly influenced by the fact that the temperature is increased considerably after the formation of seed crystals. This increase in temperature is programmed in the rheometer automatic boiling control system, whereby the necessary reduction in supersaturation and viscosity is effected without addition of water. By this means, coarse refined sugar could be boiled at Wevelinghoven throughout the whole of the 1972/73 campaign from a relatively concentrated clear liquor of 68% dry substance. The temperature pattern during the boiling process is shown in Fig. 5.

If the nine pairs of temperature-concentration values for the white sugar strike are superimposed on a supersaturation graph such as Fig. 2, a diagram is produced (Fig. 7) which is identical with that in Fig. 6. The shape of the diagram in Fig. 7 is, in its initial stages, similar to the supersaturation curves which were found by COSSAIRT[23] in the MIERS diagram and by WEBRE[32]. In the second crystallization stage and in the final boiling stage the course of supersaturation of the strike discussed differs from the diagrams according to COSSAIRT and WEBRE inasmuch as the supersaturation in those stages does not increase but

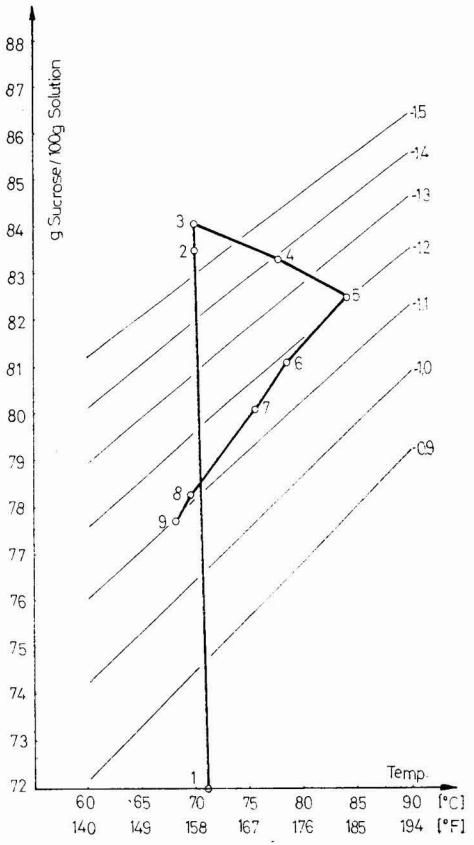

Fig. 7. Supersaturation during a refined sugar strike

decreases. The decrease in supersaturation after the formation of micro-crystals during the strike has been described by POWERS[33] and found by KUKHARENKO[36] as early as 1926 by detailed measurements of refined sugar strikes.

In the case of low-purity strikes, such as 1st and 2nd raw sugar and low-grade strikes, the diagram with lines of equal viscosity can generally be used also for checking purposes. It must, however, be observed that the viscosity becomes lower with decreasing purity, which means that the lines of equal viscosity also shift. So, for example, the dry substance content of a mother liquor at 70°C and 500 cp increases by 0·5% dry substance when the purity decreases from 90 to 60. During the crystallization process the viscosities of raw sugar strikes are generally higher than for 1st white sugar strikes, as can be ascertained from the literature of BENNETT and NEES[34] and THIEME[35]. Also, in the case of raw sugar strikes, the variation in viscosity follows the same pattern as that of a white sugar strike, although with considerably higher values, except for the last stage, that of final boiling, where, according to our tests, a marked rise is noticed in the case of all low-purity products. In some cases, in the final boiling stage, the viscosity can even exceed the high levels observed during the micro-crystal formation stage. The reason may be found in the fact that the crystallization is slower with decreasing purity, so that, for further agglomeration of sucrose molecules on the crystals, the concentration gradient must be increased. In order to maintain the concentration gradient, the concentration must rise with decreasing purity and, as can be seen in Figs. 2 and 4, the viscosity and the supersaturation also increase with rising concentration.

In conclusion it can be established that the viscosity of the mother liquor runs almost parallel with its saturation during the boiling process. This is due to the fact that both parameters reflect the energy level between the molecules, first in the sucrose solution and then in the sucrose solution-solids system. If the viscosity is precisely controlled during boiling, the supersaturation will also be automatically controlled.

Precise control by means of the viscosity has the advantage that temperature measurement and complicated arrangements for supersaturation calculation become unnecessary in contrast to control based on supersaturation. From observations of the energy levels during the boiling process made by THIELE and LANGEN[31], the rheometer value reflects the intermolecular energy levels. The connexion between the rheometer value and the intermolecular energy levels can be seen in the fact that the value transmitted by the measuring probe of the rheometer automatic

(*Continued on page* 173)

[32] "Principles of sugar technology", Vol. II, Ed. P. HONIG (Elsevier, Amsterdam.) 1959, Chapter 11.
[33] *Zeitsch. Zuckerind.*, 1971, **96**, 272–277.
[34] *Ind. Eng. Chem.*, 1930, **22**, 91.
[35] *Arch. Java Suikerind.* I., 1927, 386.

Sugar cane agriculture

The effect of smut infection on sugar yield. G. L. JAMES. *Sugarcane Pathologists' Newsletter*, 1973, (10), 32–33. Investigations showed that smut caused reductions in cane yield (mainly because of a decrease in stalk diameter) and sugar content and an increase in fibre content. The disease stimulated extension growth, especially in the terminal internodes. It was found best to top infected cane at about the 17th node, compared with the 9th node in the case of healthy cane, since there is no appreciable increase in the total sugar content when the amount contained in the more distal internodes is included.

* * *

Insects as non-vectors of sugar cane mosaic virus in Louisiana. L. J. CHARPENTIER. *Sugarcane Pathologists' Newsletter*, 1973, (10), 34–36.—While 7 species of aphids have been established as cane mosaic vectors under Louisiana conditions, 14 other species of insects have shown no evidence of transmitting the disease from cane to cane, while another two (*Sipha flava* and *Draeculacephala portola*) have transmitted the virus too erratically for them to be established as vectors. The 16 "non-vectors" are listed together with the number of cane plants exposed to them under controlled experimental conditions. Three of the 6 aphids reported to be non-vectors have been reported as mosaic vectors in India: they are *Myzus persicae*, *Aphis gossypii* and *Hyadaphis erysimi*.

* * *

Climatic conditions and mechanical transmission of sugar cane mosaic virus. N. RISHI. *Sugarcane Pathologists' Newsletter*, 1973, (10), 37.—Investigations involving strains A and F of cane mosaic virus showed that maximum infection occurred when both air temperature and humidity were high, but that incidence fell if one factor was high and the other low.

* * *

Source of resistance to red rot in hybrid sugar cane varieties and some clones of *Saccharum spontaneum*. S. SINGH. *Sugarcane Pathologists' Newsletter*, 1973, (10), 38–39.—Results of red rot resistance tests involving 79 cane varieties and 7 clones of *Saccharum spontaneum* are reported. The majority were found to be susceptible or moderately so, while only 4 proved to be completely resistant, viz. CL 41-142, CP 51-21, CP 52-68 and F 46-240.

* * *

Prevalence of vectors of sugar cane mosaic. S. M. A. RIZVI and K. S. BHARGAVA. *Sugarcane Pathologists' Newsletter*, 1973, (10), 40–41.—Of 6 aphids found to be vectors of cane mosaic in Uttar Pradesh, viz. *Aphis gossypii*, *Liaphis pseudobrassicae*, *Melanaphis sacchari*, *Myzus persicae*, *Rhopalosiphum maidis* and *R. rufiabdominalis*, only two (*M. sacchari* and *R. maidis*) are thought to play a major rôle in spreading the disease and occur on graminaceous hosts during the monsoon period. The other 4 possibly cause only chance spread because of limitations as regards host plants and period of occurrence. Both of these factors are examined for each of the 6 aphids.

* * *

Brown blotch—a new disease of sugar cane. P. APPALANARASIAH and Y. SATYANARAYANA. *Sugarcane Pathologists' Newsletter*, 1973, (10), 42.—Cane of Co 997 variety growing near the Sugar Cane Research Station at Anakapalle, India, exhibited symptoms of what is believed to be a new disease. All leaves,

(*Continued from page* 172)

boiling control system directly represents the mechanically determined energy in [kp.m]. Since viscosity can now be determined simply with the aid of the diagram of lines of equal viscosities, it is an ideal value with which the optimum course of the boiling process, in all its stages, may be easily set.

Summary

The rheological properties are an important and defined factor in the course of the boiling process. Viscosities are defined by temperature and dry substance content and can be precisely measured and programmed with the "Rheometer" automatic boiling control system developed by Pfeifer & Langen, Cologne. In order to recognise the connexion between viscosity and the condition of saturation of sucrose solutions, well-known tables in respect of concentration, temperature, viscosity and supersaturation have been taken from the literature and, on a basis of these, diagrams with lines of equal saturation and equal viscosity have been drawn. The course of a 1st white sugar strike is discussed with consideration of the two variables, both of which run approximately parallel. With the aid of the diagram showing lines of equal viscosity, the state of crystallization of each strike can be easily determined and adjusted.

Since the temperature does not have to be held constant for control of the boiling process based on the rheometer value, this parameter is highly suitable for optimum carrying-out of the boiling process in all its stages.

from top to bottom of cane of different ages, except spindle leaves, had reddish brown spots scattered over the surface which later formed blotches of varying sizes and shapes. Even sheaths and tender top portions of the rind were affected in a severe case. Affected cane clumps exhibited retarded growth when infection took place in the early growth stages and sometimes premature drying of leaves and death of some clumps was observed where there was a large number of blotches. Preliminary studies showed that spread is possible through planting of setts from infected cane but that the soil and debris from infected cane do not play any part in transmission.

* * *

The influence of D-D soil fumigation on sugar cane. H. HANDOJO. *Sugarcane Pathologists' Newsletter*, 1973, (10), 43.—Soil fumigation with D-D reduced nematode population, weed growth and the number of *Stibaropus molginus* grubs (possibly harmful to cane) in trials at two Indonesian sugar factory areas. However, on heavy soil the treatment did not affect cane and sugar yield, whereas on light and sandy soil application of 180 litres/ha and 280 litres/ha increased cane and sugar yields by the order of 25%, and in one trial by as much as 30% (cane) and 41% (sugar) with the larger dose.

* * *

Approved plant sources scheme for Bundaberg, Queensland. B. T. EGAN. *Sugarcane Pathologists' Newsletter*, 1973, (10), 44.—The scheme for producing seed cane which is free from Fiji disease in the Bundaberg area of Queensland, where serious outbreaks of the diseases have occurred, is briefly reported.

* * *

The seed cane approval scheme in South Africa. G. M. THOMSON. *Sugarcane Pathologists' Newsletter*, 1973, (10), 45.—A table is presented showing the number of seedbeds, total area planted and number of certificates awarded under the scheme. N:Co 376 is the major variety planted in the seedbeds.

* * *

Sugar cane varieties in Cuba. M. ANDÉREZ. *ATAC*, 1973, **32**, (2), 29–35.—Up to 1971 four varieties (B 4362, POJ 2878, B 42231 and PR 980) accounted for 85% of the cane grown in Cuba. Since 1964, however, there have been many trials with other varieties in the different provinces to determine which are suited to the rainfall and harvesting periods, and the results are indicated. Characteristics of the important varieties are discussed and tabulated.

* * *

Fertilization of the cane area of the Bay of Nipe. J. ALOMÁ. *ATAC*, 1973, **32**, (2), 36–43.—Fertilizer and soil studies in this area of north-eastern Oriente over 16 years are reported and conclusions and recommendations summarized.

* * *

Chemical weed control in sugar cane: a preliminary report. B. V. NIMBKAR, A. R. A. SHEIKH and A. D. KARVE. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 1–2.—In trials, "Alachlor 50 EC" [2-chloro-2′,6′-diethyl-N (methoxymethyl) acetanilide] proved more effective in reducing weed density than "Atrazine 50 WP", although the latter was more effective against dicotyledonous weeds while the former was particularly active against small seeded weeds. Best results were given at a dosage rate of 10 litres/ha, although 7·5 litres/ha gave almost as good results and was more economical. "Alachlor" in the form of granules was unsuccessful since the granules rolled down the ridges and accumulated at the bottom of the furrows.

* * *

Studies on chemical weed control in sugar cane. N. K. BEHL and M. K. MOOLANI. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 3–18.—Work conducted in India and other countries from 1960 is discussed in the form of a review of the literature covering a number of aspects of weed control, including the competition from associated weeds, effects of various herbicides on weeds and cane, their compatability with fertilizers and insecticides and lines which future work could follow.

* * *

Effect of "Asulox" and "Asulox" + "Actril D" on the yield and quality of two sugar cane varieties. L. C. GOBERDHAN. *Trop. Agric.* (Trinidad), 1973, **50**, 249–252.—Post-emergence application of "Asulox 60" + "Actril D" to 2–4 month cane at rates of 5·6 + 2·8 and 8·4 + 4·2 litres/ha gave excellent weed control without noticeably affecting cane yield or quality, while "Asulox 60" on its own did not check certain broadleaves and sedges. "Paraquat" at 2·8 litres/ha gave equally good results but only after three applications. The higher doses of "Asulox 60" and "Actril D" had little greater effect than did the smaller doses.

* * *

Pests of sugar cane in Mexico. S. FLORES. *Bol. Azuc. Mex.*, 1973, (270), 10–15.—The various pests reported in the literature are summarized with 49 references.

* * *

Sucrose enhancement with "Glyphosine" in Louisiana sugar cane. K. R. FROST and G. W. SELLECK. *Paper presented at Ann. Meeting Amer. Soc. Sugar Cane Tech.*, 1973, 10 pp.—Trials are reported in which "Polaris", a cane ripener in which N,N-*bis* (phosphonomethyl) glycine ("Glyphosine") is the active ingredient, was applied aerially at 3 lb/acre a.i. in 5–7 gal/acre of water to cane of six varieties growing in fields ranging from 2 to 5 acres at 14 locations in Louisiana. The sugar yield per acre in early and mid-season varieties increased by an average of 10·2% as a result of an increase in cane sugar content and juice purity. Cane yield per acre also rose. Brix readings indicated an optimum harvest time 5–8 weeks after treatment, the increase in Brix being most marked in the upper part of the cane, so that low topping could reduce the advantage of treatment. Indications were that cane ripening could be accelerated by 2–3 weeks, although no response in sugar content and purity was found in cane harvested at end-November

or later. Leaf desiccation occurred in all varieties, while side-shooting of the eyes, which took place within 3 weeks of spraying, was evident in all but three varieties. Treatment reduced the tendency to lodge, and had no visible adverse effects on ratoon growth in spring following application in autumn. Differences were found between increases determined from (i) wagon weights, trash + sugar content and purity, and (ii) stalk count × stalk weight + sugar content and purity; (ii) provided more conservative and less variable results, and was used for analysis of results.

* * *

The lowly weed. P. ESLEYER. *Sugarland* (Philippines), 1973, **10,** (3), 6–11.—Weed control, particularly with herbicides, is briefly discussed and details tabulated of herbicides available in the Philippines, including form in which available, weeds controlled, dosage, active ingredient and local costs.

* * *

Weeding and cultivation. PHILIPPINE SUGAR INSTITUTE. *Sugarland* (Philippines), 1973, **10,** (3), 12–14.—A brief description is given of the cultivation system used in the Philippines in which the soil is moved in stages from the base of the cane plants to the inter-row and back to suppress weeds and break surface soil crust. A typical procedure involves: (i) off-barring 4–5 weeks after ratooning, followed immediately by (ii) hand weeding at the base of the plants, (iii) middle breaking or ridge busting 4 weeks later, (iv) hilling-up 1–2 months after (iii), and (v) closing (about 4–5 months after planting). Chemical weed control is discussed, with information on types of herbicides and their effects as well as recommendations on application.

* * *

Romeo Ledesma—exemplary planter in the Silay area. A. BALCELLS. *Sugarland* (Philippines), 1973, **10,** (3), 20–22.—The techniques applied by this Negros farmer in growing cane on his 160-ha farm whereby in 1972–73 he obtained a yield of 182 piculs/ha (about 12·7 short tons/ha) are described.

* * *

Healthy plant cane is key to Fiji disease problem. O. W. STURGESS. *Producers' Rev.*, 1973, **63,** (5), 19–21. The author, Director of the Bureau of Sugar Experiment Stations, reports on the serious outbreak of Fiji disease in cane, particularly N:Co 310, in the Bundaberg area of Queensland. The disease is primarily spread by leafhoppers, although diseased planting material has also been responsible. In an effort to control the spread, the Bureau has established isolation plots for the supply of disease-free cane.

* * *

The influence of nitrogen on sugar cane. ANON. *Producers' Rev.*, 1973, (5), 25.—Recommendations on N fertilization include application of top dressing in spring or early summer, but split applications have no advantage; for ratoon crops, all of the N may be applied at ratooning, or some then and the rest shortly afterwards as a normal N fertilizer, e.g. urea, "aqua ammonia". A pre-planting dressing of "aqua ammonia" is not generally advocated for plant cane where plantings are made in the autumn or winter, since the possibility of leaching by rain falling before the rapid growth phase outweighs any advantage. The possible long-term effects of over-application of N, i.e. pollution of streams and underground water, is briefly examined. A warning is also given on the risks involved in chopper-harvesting cane for planting where there is ratoon stunting disease; use of the method for planting in leaf scald-infected areas is recommended only when cane resistant to the disease is being planted.

* * *

Tool for inserting outlets in irrigation fluming. ANON. *Australian Sugar J.*, 1973, **65,** 37–38.—Illustrations are presented showing how Mr. H. REICHARDT, a cane farmer, has devised a simple tool for cutting a hole and inserting a plastic outlet in irrigation piping and thus allowing water to flow into the cane row as required.

* * *

More on the loader. L. L. LAUDEN. *Sugar Bull.*, 1973, **51,** (16), 4.—It has been pointed out, by a representative of Cane Machinery & Engineering Co. Inc., that since 1965 that company has been producing a piler having long prongs for lifting cane off the ground to avoid excessive dirt accompanying the cane, but that it was designed for use outside the USA since no interest had been shown by US cane farmers. However, it is felt by the author that the mud problem in Louisiana mentioned earlier[1] may prompt a re-appraisal of the machine.

* * *

New variety—L 76. J. WILSON. *S. African Sugar J.*, 1973, **57,** 279.—A progress report from the director of the Experiment Station at Mount Edgecombe includes mention of the use of cobalt irradiation to induce desirable mutations in acceptable commercial cane varieties; about 160 stools have been selected from treated material, mainly on the basis of complete flowering suppression, and are being tested for general vigour and other characteristics. Briefer mention is made of trials on new varieties N 7 and N 8, while L 76 (an unreleased Queensland-bred seedling which has shown promise under Natal conditions) was to be pre-released. "Temik" at 30 kg/ha is considered, from satisfactory results, a good economical means of controlling nematodes on poor coastal sandy soil, but poorer and less consistent responses were obtained from applications made to soils of higher clay content. A number of new nematicides, one of which is applicable as a foliar spray, have also given very good growth responses in screening trials. Among a number of satisfactory substitutes for "Aretan", a mercurial fungicide withdrawn from the market, in the control of pineapple disease is "Benlate".

* * *

Need to cut down on delivery delays. M. MATIC. *S. African Sugar J.*, 1973, **57,** 299.—Investigations have shown that in South Africa the average delay between

[1] *I.S.J.*, 1974, **76,** 142.

cane harvesting and crushing is 3 days, compared with a maximum of 18 hr allowed in Australia. Losses generally average 2–3% per day during the week following harvest, except in winter.

* * *

Deterioration losses: burnt cut *vs.* burnt standing cane. R. A. WOOD. *S. African Sugar J.*, 1973, **57**, 301–305. In trials to determine relative changes in weight, juice quality and recoverable sugar in whole stalk cane burnt and cut immediately afterwards or burnt and left standing for a number of days before harvesting, it was found that the decline in recoverable sugar was more rapid in the cane left standing. However, the additional loss could not be ascribed only to the weight increase following burning as a result of water uptake from the soil via the undamaged roots. The greater deterioration was apparent even if the cane was allowed to stand for just one day. Hence, it is recommended to burn only enough cane for one day's cutting requirements.

* * *

Effect of climate on cane growth in 1971. W. H. TUNG. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (58), 1–15.—A survey of the major climatic factors affecting cane growth in Taiwan in 1971 is given, indicating a period of serious drought during the main growing months followed by four typhoons in July and September and subsequent reduced temperatures.

* * *

Studies on the effect of yield performance of consecutive ratooning on spring cane. T. P. PAO. *Rpt. Tawian Sugar Expt. Sta.*, 1972, (58), 35–47.—Trials during 1967–71 showed that the germination rate and percentage was largely governed by the soil temperature at ratooning which was unaffected by mulching with trash since the air temperature in March (when germination was quicker than in January/February) may reach 22°C in the Tainan area of Taiwan where the tests were made; in fact, non-mulched plots showed 3% more germination and higher cane yields than did mulched plots, probably as a result of shading of the old stools by the trash. Irrigation was the most important factor for cane yield, followed by fertilization; irrigation and a moderate fertilizer application (225:112:112 kg/ha of $N:P_2O_5:K_2O$) increased the yields considerably compared with un-irrigated heavy and conventional fertilizer application rates. This moderate rate is recommended for clayey soil. Climatic conditions affected yields more than did the number of the ratoon crop.

* * *

The asphalt barrier effect in sandy soil and its economic evaluation for sugar cane growth. C. C. WANG and F. W. HO. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (58), 57–83.—In trials to determine the effects of an underground asphalt barrier in sandy soil on water utilization and cane yield, a barrier at a depth of 75 cm increased the yield by 51·6% compared with the control and gave the best results. The effectiveness of the barrier varied with amount of irrigation water and rainfall: if the rainfall was low during the crop year and adequate irrigation applied, the barrier caused an increase in yield compared with the control. The barrier could result in a saving of 24% in irrigation water compared with the control and greatly increased the water holding capacity of the deep sandy soil. Because of the lower rate of percolation through the soil when asphalt barriers were used, one irrigation could maintain normal cane growth for up to 63 days (with the 100-cm barrier) in a dry winter. As regards the soil-air-water relationship, a barrier depth of 75 cm was optimum. After three crops, the number of cane roots penetrating the 6-mm thick barrier was only 10 per 1000 cm^2. A life of 10 years is considered possible for a barrier provided it does not form a mixed layer of sand and asphalt. However, the barriers are of advantage only where the water-table is low, since they would cut off any underground water supply to the cane. The economics are briefly discussed.

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Spatial distribution patterns of *Scirpophaga nivella* eggs and dead hearts caused by the larvae. J. LIN, C. J. LIANG and T. L. LIN. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (58), 85–102.—Probability equations are derived from statistical analysis for predicting, with good accuracy, the egg distribution pattern and number of dead-hearts caused by hatched larvae penetrating into the stalk of a young cane.

* * *

Survey on the seasonal occurrence of sugar cane borers. VII. Tatushan sugar cane district of Taichung. C. J. LIANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (58), 103–111.—Major damage to young cane was caused by the grey borer, *Eucosma schistaceana*, responsible for 37·2% of the total number of dead-hearts. Next in importance was the stalk borer, *Proceras venosatus*, followed by the shoot borer, *Chilotraea infuscatella*, and finally the pink borer, *Sesamia inferens*, which caused only 8·4% of the total number of dead-hearts. *E. schistaceana* caused 84·5% dead-hearts in mature cane and *P. venosatus* 14·8%. The other borers mentioned above caused only slight damage. The times of activity are discussed in the case of young cane, whereas for mature cane there were no seasonal trends.

* * *

Studies on the ecology of *Trichogramma australicum*. T. H. SU. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (58), 113–120.—The growth stages, temperature effect on life expectation, life cycle and effect of this borer parasite on the host eggs are reported.

* * *

Weed survey for sugar cane fields of Machia district. C. S. WANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (58), 121–129.—A list of 125 weeds found in the district in 1970–72 is given, while tables give details of the fresh weight and frequency of occurrence of the major individual weeds.

* * *

Cane trials in Ivory Coast. ANON. *Agron. Trop.*, 1973, **28**, 468–470.—Cane trials conducted in 1968–71 at Koudougou with three varieties are briefly reported. The region suffers from irregular rainfall and yet a short dry season, so that cane had to be harvested between 15th November and 1st March. Soil drainage

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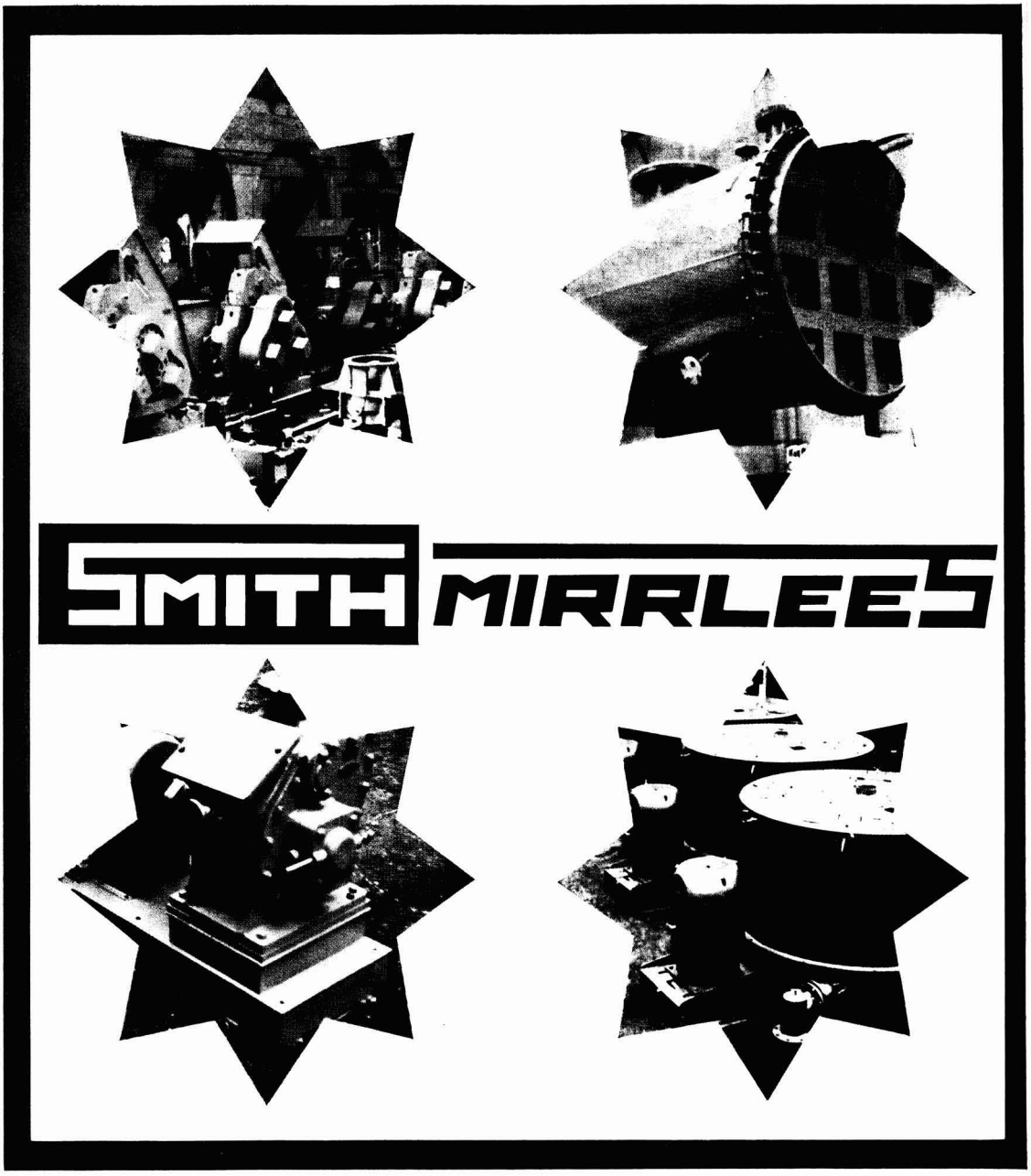

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was poor. Principal pests were stalk borers but no serious diseases occurred. No P or K deficiency was found, but recommended N-P-K levels for plant and ratoon cane are given. At Ferkessédougou[1] trials were conducted under dry conditions and with irrigation. Early, mid- and late-season canes tested are listed. On a commercial scale yield averaged 58·1 metric tons/ha, sugar content averaged 12·9% and refined sugar yield 5·8 metric tons/ha. The cycle involved one plant and three ratoon harvests. Growth period is about 12 months, the best planting time being September–October at the end of the rainy season. Deep planting is recommended to avoid lodging and improve yields. A rainy season between tillage and planting is also advocated. Where irrigation is used (about 660 mm is needed), planting is possible from October to May except between 15th November and 15th February when low temperatures and the harmattan (dry land wind) hinder growth. Recommendations on variety and fertilization are given.

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Cane trials in Niger. ANON. *Agron. Trop.*, 1973, **28,** 470.—Cane varietal, fertilization and planting date tests at Tillakeina are briefly reported. Results of surface and overhead irrigation trials are not yet available. B 52298 and PR 1013 are two early varieties which have proved superior to N:Co 310 (which nevertheless as plant cane yielded 140 metric tons/ha with 10·7% sugar content and 131 tons/ha with 12·0% sugar content at 1st ratoon), while Co 331 was better than Co 740 as mid- and late-season variety (the latter yielded 135 metric tons/ha with 10·8% sugar content as plant cane and 122 metric tons/ha with 11·8% sugar as 1st ratoon).

* * *

Cane trials in Senegal. ANON. *Agron. Trop.*, 1973, **28,** 471.—At Richard-Toll CP 44-101 proved the best early variety as regards sugar content, while a number of mid- and late-season varieties gave results differing little from one another. The optimum N application was high at 300 kg/ha, while 70 kg/ha of P_2O_5 proved best. Sulphur and potassium had no effect on cane growth. Since heat treatment of setts increased plant cane and 1st ratoon yields, it is thought probable that ratoon stunting disease exists at Richard-Toll. B 41227 variety yielded 127 metric tons/ha even as 7th ratoon. Although "Lasso" ("Alachlor") proved the most suitable herbicide, 2–3 applications were necessary because of its short residual effect. Frequent irrigation with small amounts of water was found preferable to larger quantities up to cane maturation and then complete stoppage.

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Cane trials in Malagasy Republic. ANON. *Agron. Trop.*, 1973, **28,** 471–472.—Varietal trials on the East Coast have confirmed that B 49119 is highly suitable as a late-season cane and should replace Pindar grown in the Brickaville factory area. The collection at Lac Alaotra comprises 215 varieties; 11 new ones have been received from a number of countries and there were 25 varieties still in quarantine. Fertilization tests showed that S 17 and B 49119 responded significantly to increasing N doses up to 375 kg/ha without affecting the sugar content in the first two crops, but S 17 as 2nd ratoon suffered a drop in sugar content. Tests on the nature of the N fertilizer applied showed that either urea or sulphate of ammonia could be used, in varying proportions, without affecting S 17 first crop yields. Replacement of N with green manure (*Vigna*) gave lower yields than 100 kg of mineral N/ha. Leaf scald-resistant varieties are listed. Treatment of setts with hot water for 2 hr at 50°C has proved effective against ratoon stunting disease for plant and 1st ratoon cane, but was ineffective in the case of S 17 for 2nd ratoon cane and in all cases for 3rd ratoon cane. Shortened treatment (52°C for 20 min) was beneficial to plant and 1st ratoon cane only. This treatment was better in controlling chlorotic streak than was 30 min at 52°C and was effective up to 2nd ratoons, but setts from 1–2 year cane which had been treated were unaffected by the treatment. Best control of *Yanga guttulata*, a major soil-inhabiting pest in the country, was achieved by turning the soil periodically and exposing the larvae to the sun. Control of *Chilo sacchariphagus* by *Apanteles flavipes* has proved successful and *Pediobus furvus* has been disseminated in four areas to combat *Sesamia calamistis*. Tests have been launched to find if there is any connexion between infestation by certain pests, including the two mentioned above, and outbreaks of leaf scald, smut and pokkah boeng. In herbicide trials, "Hyvar" ("Bromacil"), "Sinbar" ("Terbacil") and CRD 68-3317 ("Benzuride" or "Metachlor") were effective as pre- or post-emergence applications, but *Asytasia coromandeliana* and *Mimosa pudica* were resistant to all.

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Cane trials in Réunion. ANON. *Agron. Trop.*, 1973, **28,** 472–473.—See *I.S.J.*, 1973, **75,** 317, 318.

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Experience in the Dominican Republic. A. T. CARMO. *Brasil Açuc.*, 1973, **81,** 348–350.—Reference is made to the hiring of three Australian professional cane cutters by the Consejo Estatal del Azúcar in the Dominican Republic to demonstrate and teach local cane cutters their method of working which, during a typical day quoted, enabled two of them to cut 14·3 and 14·4 tons as against 8·3–12·15 tons cut by local men.

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Liming. F. BRIEGER. *Brasil Açuc.*, 1973, **81,** 375–378. Aspects of liming of soil to correct acidity are discussed, including the effectiveness of different forms of lime, the quantity to be applied to soils of different pH, time of application, etc.

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Clonal experimentation in sugar cane. *Mem. Chacra Experimental Agrícola de Sta. Rosa* (Argentina), 1973, 27 pp.—In Argentina sugar production has been increased both by improvement of cane cultivation and by increased recovery in the sugar factories. Experiments have been set under way in the development of early-maturing varieties which will permit the harvest in the north of the country to commence

[1] *I.S.J.*, 1973, **75,** 128.

in the first two weeks in May, 30–40 days earlier than usual, and also varieties which maintain their quality at the end of the season, cane developing quickly in the spring, and varieties resistant to frosts which affect the crop in various regions. This report indicates the behaviour of clones developed and tested in this programme and also provides a list of 1963 NA selections which have been tested with more generalized descriptions.

* * *

Juice quality and fibre in certain clones of *Saccharum* species and hybrid canes. K. C. RAO, E. LALITHA and B. V. NATARAJAN. *Indian Sugar*, 1973, **22,** 925–931. Values of juice pol content and cane fibre are given for 14 Co varieties and 89 species of *S. officinarum*, *S. spontaneum*, *S. barberi* and *S. robustum*. The tabulated data indicate the superiority of the commercial canes over the species in both factors.

* * *

Performance of some new organic insecticides in the control of sugar cane shoot borer, *Chilo infuscatellus* Snell. S. SITHANANTHAM. *Indian Sugar*, 1973, **22,** 933–938.—Tests on borer control with a number of pesticides applied in 0·1% concentration 35, 56 and 77 days after planting showed that, apart from "Endrin" and "Endosulfan" ("Thiodan"), widely used at present in India, the most effective were "Dursban" (a pyridyl phosphorothioate) and "Azodrin" ("Monocrotophos") which reduced infestation to 41% and 45%, respectively, compared with 64% infestation of the untreated control.

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Utility of soil survey and soil testing in increasing crop production in Kashipur Zone District, Nainital, Uttar Pradesh. S. SINGH, A. C. SHUKLA and R. N. RAM. *Sugar News* (India), 1973, **4,** (12), 9–15.—Results of a 3-year soil survey and of subsequent fertilizer and fertilizer × varietal tests are discussed.

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Recent research progress in sugar cane disease and insect control. ANON. *Taiwan Sugar*, 1973, **20,** 96. Results achieved in research on cane disease and insect pests control in Taiwan in 1972/73 are summarized.

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Crop tolerance to herbicide in sugar cane propagated with rayungans and ratoons. S. Y. PENG, W. B. SZE and H. J. YEH. *Taiwan Sugar*, 1973, **20,** 97–104. Ratoons showed greatest resistance to pre-emergence applications of "Diuron" and "Dalapon" in experiments, while cane from newly planted setts showed moderate tolerance; cane from transplanted setts was highly susceptible to the herbicides. The differences between the three crops are attributed to the differences in root growth relative to the herbicide in the soil. No differences were found between plant and ratoon cane in response to foliage-absorbed "Dalapon".

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Evaluation of new chemicals for control of sugar cane nematodes. C. H. HU and T. K. TSAI. *Taiwan Sugar*, 1973, **20,** 105–109.—Laboratory and field tests over 3 seasons on 11 nematicides are reported. Results indicated that "Nemafos" at 20 litres/ha killed all root-knot nematodes and 97·4% of other parasitic nematodes, while excellent results were also achieved with "Terracur P" at 100 kg/ha and "Fumazone 70 E" at 15 litres/ha, which was much more effective than the next best chemical. "Thimet" at 30 kg/ha was sixth in effectiveness, killing about 60% of both classes of nematode, but this and "Terracur P" also had some control over borers and woolly aphids. The effects of the above nematicides (excluding "Nemafos") on autumn- and spring-planted cane are tabulated and compared with the untreated controls, while the yields per ha of spring-planted cane are also given for all 11 chemicals, indicating the advantages of "Thimet", also economically the best.

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Control of sugar cane field rats with zinc phosphide. P. Y. WANG. *Taiwan Sugar*, 1973, **20,** 110–113. Tests showed that of the different concentrations of zinc phosphide tested (0·3%, 0·5%, 1·0%, 2·0% and 3·0%) for effectiveness against three species of rats found in cane fields (*Bandicota nemorivaga*, *Rattus losea* and *R. norvegicus*), the 1·0% concentration was optimum as regards amount of bait consumed and mortality rate (up to 96%). However, prolonged use of zinc phosphide may cause bait rejection once rats realize its toxicity, so that use of a moderate rodenticide such as "Warfarin" following zinc phosphide application is suggested as a means of controlling survivors and preventing invasion by rats from adjacent cane fields.

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Physiological studies on *Stagonospora sacchari* Lo & Ling, causing leaf scorch of sugar cane. T. T. LO. *Taiwan Sugar*, 1973, **20,** 114–128.—Studies of the fungus indicated that both nitrogen and carbon were required for growth, which was little affected by vitamins. Most pycnidiospores germinated from the apical cell. Cane leaf penetration by the fungus was mostly through the stomatal opening; oxygen released from the stoma enhanced penetration, while CO_2 had the reverse effect. Dissolved in the film of water on the leaf surface, CO_2 formed a weak acid which could reduce pycnidiospore germination.

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A quantitative inoculation technique for screening sugar cane varieties for resistance to leaf scald. D. NORSE. *Plant Disease Reporter*, 1973, **57,** 582–583. Details are given of a quantitative procedure for inoculating cane shoots with *Xanthomonas albilineans*, the causal agent of leaf scald. The method is described as an effective and rapid means of providing a more uniform basis for determining resistance to the disease than hitherto available.

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Eye spot from the field aspect. F. O. BRIEGER. *Brasil Açuc.*, 1973, **81,** 515–517.—The history, description of symptoms, varietal susceptibilities of some Brazilian canes, economic importance and transmission of this disease, caused by the fungus *Helminthosporium sacchari*, are described, and it is indicated that control is best achieved by planting of resistant varieties and elimination of susceptible canes.

Sugar beet agriculture

Soil water use by transplanted and field-sown sugar beets. J. T. MORAGHAN and R. TORKELSON. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 15–21.—Trials in which transplanted and field-sown beet were grown under conditions of very low rainfall showed that both types utilized soil moisture to a depth of 6 ft but that the transplanted beet utilized approximately 1 inch more of the moisture during the early part of the season. Hence, as transplantation could cause the surface soil to dry out earlier than with field-sown beet under prolonged drought conditions and since root growth could be slowed and subsoil moisture utilization adversely affected by nutrient deficiency such as phosphorus in the test area[1], the use of transplantation to overcome the problem of late emergence at low soil temperatures[2] would be of limited advantage.

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Progress report on sugar beet emergence studies. D. M. VAN DOREN and J. E. HENRY. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 30–41.—Trials aimed at stimulating emergence showed that maximum results as regards % emergence and shortness of time to emerge were achieved when empty seed was removed before planting, the remaining seed soaked in dilute salt solution, the seed encapsulated in vermiculite wafers and the rows sprayed with asphalt and vermiculite to reduce water loss through evaporation. The effects of temperature and of physical pressure were also studied in both laboratory and field tests. However, the validity of the results is limited to conditions where adequate water is available and would not apply to dry or relatively dry conditions. Despite the soil amendment treatments, no high stand of beets was sufficiently consistent to warrant recommendation of any one treatment for planting to final stand.

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Uptake patterns of ^{15}N-tagged nitrate by sugar beets as related to soil nitrate level and time. F. N. ANDERSON, G. A. PETERSON and R. A. OLSON. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 42–48.—It was found in tests that beet can affectively extract NO_3-N from depths greater than 135 cm and that a soil profile of at least 150 cm should be sampled for residual NO_3-N, which in the lower portion of a soil profile will be absorbed by the beet roots late in the season, such late absorption influencing the beet sugar content at harvest. The NO_3-N extraction patterns over the season were established by sampling the beet leaf petioles in which the % excess ^{15}N was used as an index of N uptake from the various profile depths.

Additional criterion for evaluating insecticide. Treatments for control of sugar beet root maggot larvae. Y. M. YUN. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 49–52.—In addition to stand losses, larval counts and yield data, which the author has found frequently provide insufficient information on the relative effectiveness of insecticide treatments, a root damage rating scale is suggested which has a number scale from 1 to 5 and a corresponding range for beet condition from healthy roots with no feeding scars to severely damaged roots, where the beets are dead or nearly so and more than one-third of the root tip is cut off. The system is claimed to be easy, accurate and consistent.

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Response of weeds and sugar beets to EP-475, a "Phenmedipham" analogue. H. LAUFERSWEILER and C. M. GATES. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 53–57.—While not as effective as "Phenmedipham" (methyl *m*-hydroxycarbanilate *m*-methylcarbanilate) against a number of specific weeds, ethyl *m*-hydroxycarbanilate carbanilate (EP-475), an analogue of "Phenmedipham", was effective against redroot pigweed (*Amaranthus retroflexus*) which "Phenmedipham" cannot control after the 2-leaf stage. A 1:1 mixture of EP-475 with "Phenmedipham" (SN 503) was not as effective as EP-475 against redroot pigweed but was still better than "Phenmedipham" and came between EP-475 and "Phenmedipham" in its effect on the other weeds specified.

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Economic comparison of herbicides for weed control in sugar beets. G. A. LEE and H. P. ALLEY. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 58–66.—The economics, under US conditions, of chemical weed control *vs.* manual control favour the former, both as regards labour costs and gross returns from the beet fields. The costs of treatment with various herbicides are also compared.

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Comparison of different spacing methods in sugar beet cultivation. H. SCHAFMAYER and C. WINNER. *Zucker*, 1973, **26**, 367–372.—Field trials at a number of locations showed that with drilling to stand, yield was much more dependent on field emergence than with manual thinning, where low emergence gave stands which in yield and quality were hardly inferior to the results of a medium emergence. Mechanical

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[1] VIETS: *Advances Agron.*, 1962, **14**, 223–264.
[2] *I.S.J.*, 1970, **72**, 242.

thinning, with automatically steered machines, still produced a high yield even where field emergence was poor, but this was obviously governed by weather conditions and weed situation which, at worst, could prevent use of the thinners. The economics of mechanical thinning must also be considered. The advantages and disadvantages of all three procedures are discussed.

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Trials of commercial varieties of sugar beet. L. A. WILLEY. *British Sugar Beet Rev.*, 1973, **41**, 63–68. Results of beet varietal trials in the UK in the 3-year period 1970–72 are tabulated and discussed. Both commercial variety trials (with more extensive growing) and low seed rate trials are covered, and data include number of roots and calculated sugar yield as a percentage of the mean of varieties recommended by the National Institute of Agricultural Botany, average juice purity, root sugar content and percentage of bolters. The data, covering 8 varieties, show that monogerm varieties continued to perform well and better than multi-germ varieties.

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Self-steering devices and trailed harvester efficiency. J. D. BAKEWELL. *British Sugar Beet Rev.*, 1973, **41**, 69–71.—Automatic self-steering devices for regulating harvester alignment to the tractor pulling it, as shown at the national sugar beet autumn demonstration in the UK in 1972, are briefly described with the aid of illustrations.

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Sugar beet growing as shown by the figures. D. BRISBOURNE. *British Sugar Beet Rev.*, 1973, **41**, 75–78, 81.—The crop reporting system adopted by the British Sugar Corporation with occasional modifications is a means of recording the methods used by UK beet farmers. The data submitted for the period 1968/9–1972/3 have been used to produce a general picture of trends, and these are discussed, covering herbicide and fertilizer usage, drilling date and plant population in relation to beet and sugar yields, as well as spacing trends and type of seed (pelleted, monogerm or polyploid) planted.

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Ingenuity on the farm. B. B. JAMES. *British Sugar Beet Rev.*, 1973, **41**, 82–84.—A front-mounted detachable beet seed drill which is interchangeable with a hoe frame unit bolted to the main frame of a specially-designed power unit, and a trash remover mounted on the top elevator of a harvester are described. Both are the work of Mr. C. BAGGALEY, manager of a farm of which one-tenth is devoted to beet.

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Seminar on sugar beet cultivation, April 1973. ANON. *Sucr. Maghrebine*, 1973, (6), 13–15.—The principal recommendations of a seminar organized by the Association Professionnelle Sucrière in Morocco in conjunction with two Government ministries are listed, covering soil preparation, fertilization, sowing, cultivation, irrigation, harvesting, crop rotation and pest and disease control.

Test on development of beet processing quality in the vicinity of Mechrass-bel-Ksiri for the 1973 campaign. M. DEBBARH. *Sucr. Maghrebine*, 1973, (6), 19–21. Comparison between the processing qualities of beet lifted on 17–18th April and on 2–3rd May showed that the beet lifted in May was much better as regards sugar rendement and molasses yield and purity.

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Organization of the Agronomic Service. Participation in seed and beet harvesting work. A. BEGASSE DE DHAEM. *Sucr. Belge*, 1973, **92**, 263–272.—The activities and aims of the Agronomic Service of Notre-Dame refinery at Oreye in Belgium are described. The Service promotes beet agriculture, buys and receives the seed and organizes supplies to the sugar factory. It participates actively in precision drilling and harvesting; for the former, the sugar factory owns the equipment and employs contractors to do the work, while for harvesting, the sugar factory and farmers have set up a cooperative for use of agricultural machinery. Advantages and disadvantages of these two types of participation are discussed and the costs per ha calculated.

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Precision drilling. M. AUBINEAU. *Hautes Etudes Betterav. Agric.*, 1973, **5**, (20), 23–28.—Requirements of a precision drill are discussed under seedbed preparation, deep placement of seed, population and type of seed, and rate of work. Descriptions are given of distributors of both mechanical and pneumatically-operated drills.

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Sugar beet research in France. ANON. *Publ. Inst. Tech. Franç. Betterave Industrielle*, 1972, 303 pp.—Full details are given of tests carried out during 1972, covering a wide range of subjects grouped under the four main headings of spring work, harvesting, agronomy (including weed control, irrigation, soil conditioning and varietal trials) and pest and disease control.

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Distinction between *Aphanomyces laevis* and *Aphanomyces cochlioides*. II. Comparative studies of the lipids in the fungal mycelium. U. BEISS and W. R. SCHÄUFELE. *Zucker*, 1973, **26**, 417–420.—From paper chromatographic studies of the lipids from isolates of *A. laevis* and *A. cochlioides* it is concluded that the species which occurs as a beet root parasite in Europe is *A. cochlioides* and not *A. laevis*[1].

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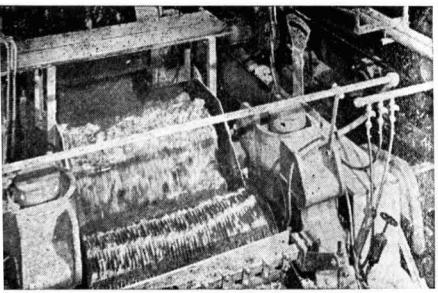
Research on the economic use of phosphorus fertilizer in sugar beet growing in Turkey. S. KAYIMOGLU. *Seker*, 1973, **23**, (87), 62–70.—Two methods were used to calculate beet phosphorus requirements according to soil P levels and required yields. Recommended quantities are subject to local adjustment and should only be regarded as guidelines.

[1] *I.S.J.*, 1974, **76**, 113.



Cane sugar manufacture

The disposal of sugar mill effluents. D. BEVAN. *Sugar y Azúcar*, 1973, **68**, (6), 38–42.—See *I.S.J.*, 1974, **76**, 23.

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Mills and milling. IV. C. BAYMA. *Brasil Açuc.*, 1973, **81**, 351–357.—Aspects briefly discussed include roller speed, turnplates, juice trays, steam engines and gearing.

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Studies on the behaviour of phosphorus in the clarification of sugar cane juice. I. Behaviour of juice from three sugar cane varieties in clarification as a function of phosphorus content. A. A. DELGADO, L. J. FERREIRA and D. BARBIN. *Brasil Açuc.*, 1973, **81**, 495–514. Juice from three varieties of cane from Usina Monte Alegre and from the José Vizioli Experiment Station was clarified by simple defecation at regular intervals of 15 days. The results, which are tabulated, show that clarification was better with variety CB 41–76 although its phosphate content did not reach 300 mg P_2O_5 per litre and was, in fact, lower than one of the other varieties.

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Some observations on recent milling statistics. E. J. BUCHANAN. *Proc. 47th Congr. S. African Sugar Tech. Assoc.*, 1973, 24–31.—Detailed statistical analyses were made of weekly data for each South African sugar factory during the 1972–73 season from which conclusions were drawn on the effects of certain variables on milling extraction, as expressed by bagasse pol % cane. Good correlation was found between this factor and both pol % cane and fibre % cane; that statistically significant relationships were established at a greater number of factories than hitherto is attributed to improved laboratory techniques.

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Temperature distribution in a stirrer-equipped vacuum pan boiling *C*-massecuite. G. N. ALLAN and J. P. M. DE ROBILLARD. *Proc. 47th Congr. S. African Sugar Tech. Assoc.*, 1973, 32–38.—Tests at Darnall and Umzimkulu on *C*-massecuite boiling in a pan fitted with an agitator, the vertical shaft of which rotated at a maximum speed of 13·5 rpm, are reported, the tests at Darnall being of a preliminary nature and only briefly mentioned. Maximum massecuite temperature deviation was ± 5°C and overall boiling time was cut by about 1 hr to approx. 10½ hr. Local high temperature spots occurred towards the end of boiling at both factories. No perceptible false grain or grain damage occurred.

A preliminary report on a new sieve plate scrubber for bagasse-fired boilers. A. B. RAVNÖ and M. R. JUDD. *Proc. 47th Congr. S. African Sugar Tech. Assoc.*, 1973, 49–50.—Pilot-plant tests, in which flue gas from the No. 1 boiler at Darnall was passed through a vessel having a single wetted sieve plate of 5000 $Nm^3.hr^{-1}$ throughput, showed that more than 97% of the incoming fly ash was removed at inlet dust loads of up to 7 g per Nm^3. Because of the simplicity of the scrubber, of which the only design parameters are hole size, free area and water flow rate, it is possible to use the results of the experiments to work out a design which will give a required efficiency at minimum pressure drop.

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Some economic approaches to turbo-generated power in sugar factories. T. H. UMLAUFT. *Proc. 47th Congr. S. African Sugar Tech. Assoc.*, 1973, 51–60.—The operational parameters and economics of turboset operation for power generation in a sugar factory are examined by the author, representing Siemens (Pty.) Ltd., using the so-called DCF procedure of cost analysis. The greater use of electricity for increased irrigation and use of bagasse for purposes other than as fuel are assumed in the investigation.

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Use of computer simulation in predicting the effect of mill stoppages on cane transport fleet utilization for a cane-handling installation using a spiller. R. G. HOEKSTRA. *Proc. 47th Congr. S. African Sugar Tech. Assoc.*, 1973, 61–69.—The Monte Carlo method of simulation (used where the more important variables are random variables) is explained and its use to analyse the problem of cane unloading by means of a spiller described where, in the event of a mill stoppage, there could be (it was thought) serious effects on a fleet of trucks carrying loose cane as required for such an installation. Details are given of the results, indicating that the problem would be less serious than envisaged and pointing to the advantages of a spiller in comparison with an extra gantry crane at Darnall where transport congestion has been a problem for some years.

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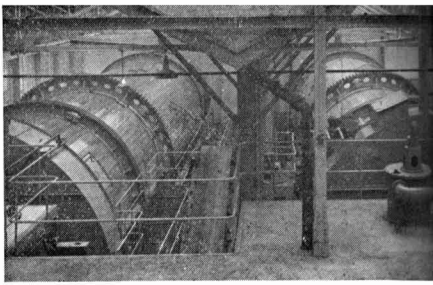
Recovery improvement. J. H. PAYNE. *Rpts.* 1972 *Meeting Hawaiian Sugar Tech.*, 100–108.—Processes which can be made more efficient as a contribution to increased cane sugar recovery are examined, including cane cleaning, milling, diffusion and boiling house processes. The factors requiring attention in each process are discussed, and the setting of targets for filter cake, final molasses and undetermined losses advocated.

Beet sugar manufacture



Comparison of juice deliming methods. H. ZAORSKA. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Comparison of ancillary methods of carbonatation juice deliming where poor quality beet are processed, viz. treatment with sodium carbonate, with cation exchange resin on Na^+ cycle, and with ammonia and sodium carbonate, with or without juice decolorization with granular active carbon, showed that best results were given by the ammonia with a small amount of sodium carbonate, subsequent carbon treatment reducing molasses sugar. The methods were evaluated in terms of juice lime salts, alkalinity, invert content and colour as well as molasses purity, yield and sugar loss, chemicals usage, waste water yield and degree of juice dilution. Neither the ammonia-sodium carbonate method nor the carbon treatment gives waste water.

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Application of ion exclusion in the sugar industry. K. Čížek. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—See Čížek *et al.*: *I.S.J.*, 1971, **73,** 154; 1973, **75,** 121, 395.

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Corrosion of evaporator tubes: detection—remedies—prevention. P. DEVILLERS. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Corrosion in evaporators can be detected by determining the juice iron content before and after evaporation, appropriate treatment then being carried out whereby no further corrosion occurs before the end of the campaign. Similar steps can be taken at the start of a campaign to prevent corrosion, especially in new tubes.

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Methods for comparative evaluation of technological results from processing sugar beet of varying quality. K. VUKOV. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Because of variation in the chemical composition of raw juice caused by differences in beet quality, comparison of the filtration and settling coefficients as well as certain chemical and physical properties of thin and thick juices can be open to error. However, this error can be reduced to a relatively small value by establishing indices based on raw juice ash, amino-N, invert sugar and non-sugar contents. Comparison of the white sugar yield and molasses sugar content is possible with indices based on the chemical composition of beet, raw and thick juice. The indices are of value in predicting the effects of diffusion, carbonatation and sugar house work on molasses sugar content.

Development of technology and apparatus for continuous massecuite production. I. S. GULYI, V. D. POPOV, I. G. BAZHAL and S. I. SIRENKO. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—See *I.S.J.*, 1969, **71,** 379; 1970, **72,** 373; 1973, **75,** 391.

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Hydrodynamics and heat exchange in sugar industry vacuum pans. V. T. GARYAZHA, YU. G. ARTYUKHOV, V. I. PAVELKO and V. R. KULINICHENKO. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973. See *I.S.J.*, 1972, **74,** 217; 1973, **75,** 391.

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Use of the "Saturoskop" for low-grade massecuite crystallization. P. KADLEC. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—See *I.S.J.*, 1974, **76,** 55.

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Problems and results of water economy in the Hungarian sugar industry. A. VIGH. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—The problems of fresh water supply and waste water treatment in Hungary are discussed. (See also *I.S.J.*, 1971, **73,** 213.)

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Results of sugar research in Czechoslovakia and its main trends. A. KOVAŘÍK. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—The organization of sugar research in Czechoslovakia and recent results obtained are discussed, and the principal trends indicated.

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Approach to organization of a waste water economy at Polish sugar factories. K. SKALSKI. *Gaz. Cukr.*, 1973, **81,** 119–121.—The subject is discussed generally and a number of schemes suggested for Polish sugar factories. It is pointed out that under the climatic conditions of that country it is easier to treat effluent to a required extent in storage ponds than use a system based on fresh water which is more economical.

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Inter-campaign maintenance of medium-pressure boilers at Dobrzelin sugar factory (Poland). W. KACPRZAK. *Gaz. Cukr.*, 1973, **81,** 122–126.—Because it is not possible to dry out the inside of steel tubes when the campaign closes, there is danger of corrosion during the inter-campaign period while the boilers are inactive. At Dobrzelin the problem has been overcome by filling the tubes with an aqueous solution of hydrazine (2000 $g.m^{-3}$ water) at pH 10.

Losses in raw material during harvesting and transfer of beet. II. E. BAKOWSKA. *Gaz. Cukr.*, 1973, **81**, 127–133.—Factors affecting losses in beet are considered: length of storage period; ripeness of the beet; beet size and harvesting technique; beet dirt content; size of storage piles; means used to maintain beet quality during storage; health of the beet; and atmospheric conditions during storage. Of these, the last, particularly temperature and its fluctuations, had greatest effect, according to investigation, which also covered the influence of fall in quality during storage on processing.

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Spreckels-Amstar factory installs largest Steffen plant. L. H. LOFTON and E. M. HARTMANN. *Sugar J.*, 1973, **36**, (1), 26–28.—Details are given of the open-air Steffen plant, which has a daily capacity of 400 tons of molasses, at the company's factory at Spreckels, California. One operator can control operation of both the Steffen plant and the juice carbonatation station (where the central console is located) except for lime pulverization and filtration. A simplified block flow diagram and a number of illustrations are presented.

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The Japanese sugar industry. I. Generalities. Beet transplanting and some aspects of beet cultivation in Japan. C. BOINET. *Sucr. Franç.*, 1973, **114**, 328–331. **II. Technical aspects of the sugar industry and refining in Japan.** –. FRANQUET and –. LUTTON. *ibid.*, 331–341, 375–378. **III. Commercial and financial aspects of the sugar industry in Japan.** J. LESAFFRE and H. J. PETIT. *ibid.*, 379–382. **IV. Human aspects of Japanese business.** J. RENARD. *ibid.*, 382–386.—Information is given on the Japanese beet sugar and refining industry as seen by a group of French sugar manufacturers who visited four sugar factories and two refineries during the past two years. Apart from details of the sugar manufacturing equipment and processes used, information is given on beet agriculture, particularly the techniques used in beet transplanting which is made necessary by the rigorous climate on the island of Hokkaido where all the beet is grown. For transplanting (which applies to about 80% of the beet), a patented process is used which involves the use of a paper "pot"; this consists of a type of paper "accordion" which, when opened-up, forms a set of about 1400 paper cylinders with a plan view resembling a honeycomb. This is placed on an iron frame, the cylinders (13 cm deep) are filled with soil and the seeds planted by hand, perhaps with the aid of a plastic plate device with holes in it corresponding to a row of the cylinders. Transplanting takes place after about 3–40 days when the seedlings bear 4 leaves. Mention is also made of the Japanese sugar economy and financing arrangements, and of the position with regard to employees and labour relations generally.

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Some experiences in measurement of raw juice flow. J. ŘÁDEK and V. VALTER. *Listy Cukr.*, 1973, **89**, 136–140.—Laboratory and factory tests have shown that foam causes marked error in measurement of flow using rotary and induction type meters. It is therefore recommended to install a tank for foam reduction between the diffuser and the flowmeter; this would also help to regularize juice withdrawal from the diffuser.

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Measurement of supersaturation and crystal content in technical boiling. D. SCHLIEPHAKE, F. SCHNEIDER and J. SCHWERTFEGER. *Zucker*, 1973, **26**, 407–411. A method for direct continuous determination of supersaturation and massecuite crystal content is described in which the syrup refractive index was measured by a modified continuous flow refractometer based on the total reflection principle and the temperature measured by means of a platinum resistance thermometer; from these two values syrup concentration, saturation concentration and supersaturation can be calculated, as can syrup Brix and hence crystal content. However, massecuite average Brix was measured by a caesium-137 radiation counter in a 100-mm tube. The measured values for a number of white sugar strikes were processed by analogue computer to yield supersaturation and crystal content values which were found to be in close agreement with laboratory-determined values.

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Decomposition of invert sugar during carbonatation in the presence of atmospheric oxygen. H. SCHIWECK. *Zucker*, 1973, **26**, 412–416.—See *I.S.J.*, 1974, **76**, 151.

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Experimental industrial model of KDA 25/30-66 diffuser. A. P. PARKHOD'KO. *Sakhar. Prom.*, 1973, (7), 13–17.—The performance of a full-scale model of the Soviet KDA 25/30–66 tower diffuser during 1972/73 is discussed. Achievement of the maximum rated throughput of 3000 tons/day was not possible because of limitations imposed by the factory in which it was installed, but at a maximum throughput of 2443 tons/day and a draft of 118·8% losses were 0·47%.

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Improvement in the juice purification scheme at Lebedyansk sugar factory. A. S. TURKINA. *Sakhar. Prom.*, 1973, (7), 18–19.—The modified scheme described includes a specially-made horizontal preliming tank designed for 25 minutes juice retention time at 60°C and a direct flow carbonatation vessel. Results indicate that juice, syrup and white sugar colours have been reduced compared with the previous system.

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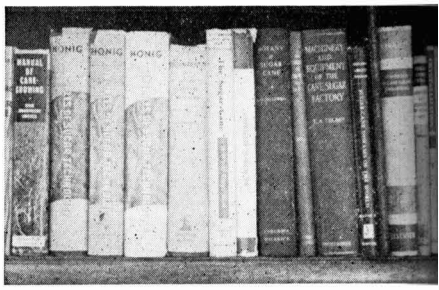
Vacuum filter with separating filter cloth. G. I. STASEEV. *Sakhar. Prom.*, 1973, (7), 19–22.—On the basis of successful results achieved with an "Eimco-belt" filter at Yagotinsk experimental factory, modification of existing Soviet vacuum filters along the same lines has been initiated for 1st carbonatation juice treatment. The modified filters at Korenovsk factory have performed better than the original filters, with 50–100% increase in throughput and losses of 0·03% on weight of beet compared with 0·10% previously.

New books



F. O. Licht's Atlas der Welt-Rübenzuckerindustrie. (Atlas of the world beet sugar industry.) Ed. H. AHLFELD. xxiv + 103 pp; 21 × 29·5 cm. (F. O. Licht K.G., 2418 Ratzeburg, Postfach 1220, Germany). 1973. DM 72·50.

Many changes have taken place in the world beet sugar industry in the 16 years since the first edition of this Atlas appeared; new industries have appeared in various countries and new factories in older industries while other factories have ceased production. A new publication which illustrates the new situation is therefore to be welcomed, especially one as well printed and as clear as the present book.

There are inaccuracies, of course; in the UK, for instance, the Plaistow Wharf refinery operations were transferred to Thames refinery some time ago, but errors seem to be more concentrated in the map showing world beet and cane growing areas. Here no cane areas are shown in Spain, West Africa, Sudan, Ethiopia or Rhodesia, while Argentina is indicated as a beet growing country.

But the bulk of the book is concerned with individual countries and areas within countries and here the Licht organization has brought its information-gathering facilities into full effect to provide most useful maps showing the locations of the individual plants, indicating whether they are raw or white sugar factories or refineries, railways, roads and principal cities. No other publication provides this information and Licht are to be congratulated on providing this unique and most useful book.

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The manufacture of sugar from sugar cane. C. G. M. PERK. 212 pp; 13·5 × 21·5 cm. (Sugar Milling Research Institute, University Private Bag, King George V Avenue, Durban, Natal, South Africa.) 1973. Price: R 5.20.

This work is the fruit of the author's many years of experience in the sugar industry, the last twenty years having been devoted by Mr. PERK to work at the S.M.R.I. after some 37 years in Indonesia. After an introduction, the progress of sucrose through the factory is followed with chapters on juice extraction, generation and consumption of steam, juice clarification, evaporation, condensation, sugar boiling, centrifugalling and finishing operations and sugar quality, while a final chapter deals with methods of factory control and has an appendix of definitions. Each chapter is divided into sections and is provided with a bibliography.

The subtitle to the book is "A guide for students of sugar technology" and it is admirable for this purpose, providing the basic information required (although the reader is assumed to have some knowledge of chemistry and engineering) and indicating the current practice in South Africa as well as previous methods there and elsewhere. Provided that the reader bears in mind that the book was written with South African students in mind, those from other areas will find it of great help in their own studies. One failing, however, is the lack of indications as to literature sources for more detailed study of individual points.

The book was edited by Dr. K. DOUWES DEKKER, former Director of the S.M.R.I. and colleague of Mr. PERK, who was also largely responsible for the chapters on juice extraction and factory control and who also converted the imperial units to the SI system.

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The industrial utilization of sugar and mill by-products. A literature survey. M. J. KORT. 112 pp; 21 × 30 cm. (Sugar Milling Research Institute, University of Natal, Durban, South Africa.) 1973.

This is the eleventh in an annual series of surveys which have covered ever-increasing numbers of literature references, the 1973 volume noting a record of 1080 papers, patents, etc. The survey is in the form of duplicated sheets, collected into a number of chapters dealing with "By-products from sugar manufacture", "Livestock feeding", "Industrial uses of refined sugar", "Recent developments in sucrochemistry", "Nutrition and toxicology", "Artificial sweeteners and other sweeteners" and "Summary and conclusions". The first four chapters show a decrease in the literature but this is more than made up by the next two, indicating the great activity in the nutritional and non-sucrose sweetener fields of research. Molasses, bagasse, cane tops, etc. continue to find application in a variety of ways other than as animal fodder, while a new awareness of toxicity problems in livestock feeding has become apparent. Refined sugar usage in food and other outlets are the subject of 170 references, while a new technology is emerging with the application of sucrose as a chemical raw material for production of esters and other chemical derivatives useful in a wide range of products from antifoams and detergents to paints and textiles.

The work is a very useful and convenient compilation which could save a great deal of time and trouble to research workers needing to study the literature in the field of by-products and sugar utilization.

A hundred years of sugar refining—The story of Love Lane Refinery 1872-1972. J. A. WATSON. 155 pp; 14 – 21 cm. (Tate & Lyle Refineries Ltd., Liverpool.) 1973.

A few months ago workers from the Love Lane refinery of Tate & Lyle Ltd. came from Liverpool to London to demonstrate before Parliament, then debating the consequences of Britain's membership of the EEC on the refining industry. Their demand was for protection of their jobs against the threatened closure following contraction of raw sugar imports; a demand which has not been met while the future of the British refining industry is still unresolved.

It is timely, therefore, that this book should have been published since it provides an interesting account of the origins and development of Love Lane and the people involved through the 100 years of its history. One of the strange things described is the search to discover exactly when the refinery opened; various indications were found to 1872, 1873 or even 1874; it was by chance that a letter from Henry Tate to the local canal company was found which indicated that August 1872 was the starting date.

A chapter describes the bounty system which prevailed at the time, by which foreign sugars were imported at below cost price, and the hazards of establishing a refinery in England at the time are explained. Tate, previously in the retail grocery trade, had entered the sugar refining business in 1861 and, after describing his initial ventures, the author—Chief Chemist at Love Lane, and sharing 90 years of service with his father—gives an account of the establishment of the plant and the changes brought about by both technical and social progress. Surprisingly the chapter on "The Process" is relatively short, perhaps because of the relatively slow changes which have occurred since 1872.

Another chapter refers to people who were involved with Love Lane and mention may be made of the Carsons, with four generations totalling 180 years' service, still unfinished since the newest member is still employed at the refinery. Entries over six months in 1876 are reproduced of a diary kept by James Blake, an engineer at Liverpool and subsequently chief engineer of Thames refinery and a Director of Henry Tate & Sons Ltd. The last chapter describes contemporary history with a note of the events of 1872 in Liverpool and elsewhere, while appendices refer to the occasion of the presentation of the honorary freedom of the city of Liverpool to Henry Tate, the words of an old Liverpool song, and a list of dates and events in the refinery's history. The end-papers provide plans of the refinery as it was in 1872 and in 1972.

The book has the fascination of bringing the past to life and provides pleasure for both the historian of technology and the general reader. The reviewer can think of only one criticism; with the quotation of so many place names around the refinery it would have helped the non-Liverpudlian if a map could have been included to show their whereabouts.

Planalsucar Relatório Anual 1972. G. M. AZZI. 32 pp; 20·5 × 28·0 cm. (Instituto do Açúcar e do Alcool, Praça 15 de Novembro, 42, 20000 Rio de Janeiro, Guanabara, Brazil.) 1973.

The I.A.A. created in July 1971 its Programa Nacional de Melhoramento de Cana de Açúcar (Planalsucar) which was approved by the Government of Brazil in the following month. The organization was created with administrative and technical facilities for originating and execution of integrated research projects in sugar cane genetics, plant health and agronomy, aiming at the development of new varieties, specially adapted to the environment and with high agricultural and industrial yields. The programme was started in 1972 as the first phase of a three-stage project to occupy the period up to 1974, 1974–76 and 1976–78.

The present volume is a record of the achievements of the programme during its first year, prepared by the General Superintendent, and in both Portuguese and English, with numerous drawings, tables and colour photographs. An analysis is given of the varieties currently grown in the two main cane areas of the country, and the various research and quarantine stations listed.

Genetic aspects of cane breeding and production of true seed from flowering cane are briefly discussed, as is the process of selection employed by Planalsucar. Varietal tests are summarized and a note made on the establishment of a parental germ plasm pool. 86 varieties have been imported from the World Collection at Canal Point, Florida, and after quarantine are to be sent to the hybridization station at Serra do Ouro, Murici, Alagoas. An account is given of the disease resistance testing and control studies, with special reference to pineapple disease, leaf scald, eye spot, brown stripe, brown spot, mosaic and ratoon stunting, while work is also reported on the extent of infestation with pests, particularly borers.

Other agronomic matters reported include studies on herbicides, the control of purple nutsedge, experiments with chemical ripeners, nutrition and fertilizers, and irrigation, while other facets of Planalsucar's programme include saccharimetry and the variation of sugar and non-sugars in cane with burning, etc., the extraneous matter in cane arising from mechanization and burning, as well as climatological studies.

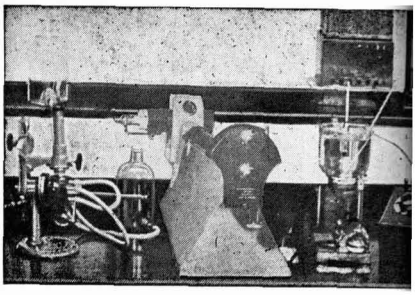
Rumania beet crop expansion[1].—Production of sugar beets in Rumania is to be increased by 2·5 million tons in 1974 compared with 1973 in order to provide a greater supply to the sugar factories; in 1973 the planned quantity was not reached. The total sugar beet area in the country is some 200,000 hectares, of which 60,000 ha are to be irrigated.

* * *

Danish beet sugar campaign, 1973/74[2].—The average campaign length for the six sugar factories in Denmark was 87 days, or about 15 days longer than in the previous year. A total of 2,593,400 metric tons were sliced (2,127,444 tons in 1972/73) and yielded 338,400 tons of white sugar (314,436 tons).

[1] *Zeitsch. Zuckerind.*, 1974, **99**, 95.
[2] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (4), 7.

Laboratory methods & Chemical reports



Determination and balance of iron, calcium, magnesium, silicon and copper in juices during evaporation. P. DEVILLERS, C. CORNET and R. DETAVERNIER. *Sucr. Franç.*, 1973, **114**, 387–394.—Results are tabulated of the content of the different elements in juice before and after evaporation and taken from the 2nd evaporator effect at six French sugar factories, as determined by atomic absorption spectrophotometry. For iron, determination of which was found to be affected by Brix, the maximum advisable juice concentration is 10°Bx and the iron content should not exceed 4 ppm. At four factories considerable increase in the iron content in the samples from the 2nd effect was ascribed to contamination by the sampling cock, and stainless steel is thus recommended (it would also, it is suggested, facilitate sampling). While iron is dissolved rather quickly and most of the copper in juice is deposited, the results indicated considerable variation in the contents of the other elements both between factories and between the different stages in the same factory, the pattern showing a fall from before to after evaporation in one factory and an increase to the 2nd effect and then a slight fall in another, and so on.

* * *

Standards for calibration of industrial conductimeters. V. VALTER and M. NOVÁKOVÁ. *Listy Cukr.*, 1973, **89**, 130–135.—A method is described for calculation of KCl solution conductivity for conductimeter calibration over a sufficiently wide range of values. Guidance is given on preparation of the aqueous solutions and corrections are given for water conductivity.

* * *

The crystallization rate of sucrose and the magnitudes which influence it. F. SCHNEIDER. *Bol. Azuc. Mex.*, 1973, (270), 4–8.—See *I.S.J.*, 1972, **74**, 57.

* * *

Model studies on the browning reaction in technical sugar juices. E. REINEFELD. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Gel filtration used to fractionate browning products in sugar juices also revealed that in low molecular fractions the browning reaction occurs even under very mild conditions, an increase in extinction always being accompanied by the formation of higher molecular melanoidins. Since only very small quantities of browning products were obtainable by gel filtration and separation from substances of similar particle weight was not possible, model systems of the carbonyl-amino reaction (invert sugar or its decomposition products with amino-acids or their mixtures) were used to yield browning products of almost identical behaviour. Acid hydrolysis showed that most amino-acids are reversibly converted or incorporated. Sugar components are not recoverable, but structural elements can be detected which still have adjacent hydroxylic groups. Sucrose crystallization rate is markedly reduced by browning products, the effect increasing with rise in particle weight and temperature.

* * *

Relationships between juice purification and colour in solution. V. PREY. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—See *I.S.J.*, 1974, **76**, 123.

* * *

Sucrose destruction in aqueous solutions as a consecutive reaction and its practical application. V. A. GOLYBIN and S. S. IVANOV. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—With prolonged heating, sucrose destruction in aqueous solutions conforms to the laws of consecutive autocatalytic reactions. The autocatalytic nature is a result of the initial action of H^+ ions in the water from the sucrose, which thus acts as a weak acid. The reaction is accelerated by the glucose and fructose, formed by sucrose hydrolysis, the dissociation constants of which are 3–6 times greater than that of sucrose. Further acceleration is caused by acids formed by destruction of the mono-saccharides. The initial stage of auto-inversion is of greatest importance for factory processing, since it causes destruction of a definite proportion of the sucrose and determines the point at which the destruction is accelerated. The successive nature of the reaction is observed under given conditions even in the initial stages, as shown by spectrophotometric measurements in U.V. light, which is of practical importance for the production of pure invert sugar solutions. The length of the induction period can be used as a measure of thermal stability and buffering of the homogeneous products in sugar manufacture (juices, syrups and run-offs).

* * *

Determination of the granulometric composition of massecuite by a percolation method. A. I. GROMKOVSKII and N. A. REMISOVA. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—See *I.S.J.*, 1973, **75**, 289.

* * *

Habit modification of sucrose crystals. G. MANTOVANI and C. A. ACCORSI. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—The influence of raffinose and dextran on changes in sucrose crystal habit at

15°, 25° and 45°C is examined, data being obtained by measuring crystallographic parameters, shape factors and habit modifications of single sucrose crystals grown in unstirred solutions at 1·10 supersaturation. Habit modifications observed in the presence of the same non-sugar at the different temperatures are discussed on the basis of the sucrose crystal structure and diffusion phenomena in the solutions. The effects of potassium, sodium and calcium chlorides on the habit of the sucrose crystal in the presence of raffinose, noted by some authors, were not confirmed.

* * *

Physico-chemical study of causes of molasses formation in the sugar factory. N. P. SILINA. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—The physical properties of 3-component systems were studied, showing that sucrose forms partly dissociated compounds with calcium and sodium chlorides and potassium carbonate. No new compounds were found in sucrose solutions containing potassium chloride and acetate. The additive nature of the effect of two salts on sucrose solubility and solution viscosity was examined. Analysis of the phase diagram of the 3-component system sucrose:water:non-sugar showed that (i) final molasses is not an equilibrium solution but that its composition is governed by the type of process, and (ii) final molasses cannot contain only double compounds of sucrose and non-sugars. A new method for standardization of factory molasses is proposed which is based on the SILIN method.

* * *

***Tests of gas chromatography application to determination* of the sucrose content in sugar juices.** T. PIETRZYKOWSKI, A. S. BORYS and H. GRUSZECKA. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973. A method has been developed for simultaneous determination of mono-, di- and trisaccharides in juices which is based on conversion of the sugars into silyl ethers using a mixture of pyridine, hexamethyldisilazane and trimethylchlorsilane. The effects of time of contact between sugar and reaction mixture, reaction temperature, quantity of reaction mixture and of the ultrasonic field were examined in order to establish optimum conditions for formation and dissolution of the silyl ethers and their separation on a column of 100/120-mesh "Gas Chrom Q" coated with 1% methylated silicone oil, at a programmed temperature in the range 100–320°C. Quantitative and qualitative determination was carried out by the internal standard technique. Results were compared with parallel polarimetric measurements.

* * *

The application of radio-active tracer techniques to the determination of sugar losses on carbonaceous adsorbents. D. GROSS and J. COOMBS. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar.*, 1973.—The techniques in conjunction with ^{14}C-labelled sucrose have been applied to investigation of possible sugar losses on carbon adsorbents (bone char and "CAL" granular carbon) as used in refining. Three different methods were devised for measurement of the sugar irreversibly adsorbed and retained on the adsorbents. Results agreed reasonably well with one another and showed, as expected, a much lower sugar loss on bone char than on "CAL" which has higher adsorptive capacity and correspondingly greater sugar binding power. The information obtained indicates that sugar retention is due to irreversible adsorption at active sites rather than to formation of true chemical bonds between sucrose and carbon. A powdered carbon may thus be expected to retain a substantially greater amount of sugar. There may also be a correlation between irreversible sucrose adsorption and decolorizing power of the adsorbent. The effect of inorganic anions and cations on sucrose retained may be a significant factor and worth investigating. The findings could have an important bearing on the optimum conditions for adsorbent washing before regeneration, on the quality of recycled adsorbent stock and the reduction of sugar loss.

* * *

Model studies on sucrose crystallization in circulating solutions. D. SCHLIEPHAKE. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—See *I.S.J.*, 1972, **74**, 57.

* * *

Dissociation constants of sucrose, glucose and fructose at different temperatures. S. Z. IVANOV and E. S. LYGIN. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Measurements of the electrolytic dissociation constants of the three sugars as a function of temperature showed that the value for sucrose rose 23-fold with temperature rise from 20° to 90°C, that for glucose increased 10-fold with temperature rise from 20° to 70°C and that for fructose 7-fold with rise from 20° to 50°C. The values could not be determined at higher temperatures because of the commencement of sugar degradation. The ratios between the values and the changes with temperature rise explain the autocatalytic nature of the kinetics of sucrose auto-inversion with prolonged heating of aqueous solutions.

* * *

Sugar-titanium coloured complexes for (detection of sugars by) paper chromatography. L. REICHEL and H. SCHIWECK. *Pharmazie*, 1973, **28**, (1), 39–41; through *Anal. Abs.*, 1973, **25**, Abs. 912.—Reducing sugars were detected on paper chromatograms by spraying either with a solution of urea (2 g), $TiCl_4$ (1 ml), piperidine (1 ml) and acetic acid (2 ml) in methanol (10 ml) or with a filtered solution of *p*-phenylenediamine (0·5 g), $TiCl_4$ (1 ml), piperidine (2 ml) and acetic acid (4 ml) in warm methanol (20 ml). The colour was developed by heating the paper at 120°C for 3·5 to 4 min with an infra-red heater. Different sugars gave different-coloured spots under U.V. radiation. Neither reagent detected reduced sugars (alditols). Non-reducing sugar (e.g. sucrose) also gave coloured complexes, owing to cleavage occurring under the reaction conditions used.

Patents

UNITED STATES

Electrodialysis of sugar solutions. M. SUGIYAMA, Y. TAKATORI, R. TOUYAMA, A. NAKAMURA, T. YAMAUCHI, M. KATO and Y. NAKASHIBA, *assrs.* TAITO CO. LTD. and ASAHI KASEI KOGYO K.K. **3,718,560.** 30th May 1972; 27th February 1973.—(At least 30% of the) Salt in a sugar solution is removed by an electrodialysis process in which the cation exchange membrane is placed at the cathode side and an ion-permeable membrane [a polyvinyl alcohol membrane (having at least 10 mole % of $-CH_2-CH(OH)-$ groups in the polymer)], having an anion or cation exchange capacity less than about 0·3 meq/g of dry membrane, is placed at the anode side. A third, anion-exchange, membrane may be placed between the second membrane above and the anode. The desalination is carried out in conjunction with carbonatation or phosphatation of the sugar solution or adsorption of non-sugar organic matter using a solid, particulate adsorbent.

* * *

Prevention of caking of powdered sugar. T. TANAKA and H. HAYASHI, of Tokyo, Japan, *assrs.* SANKYO CO. LTD. **3,720,521.** 9th February 1971; 13th March 1973.—See U.K. Patent 1,276,474[1].

* * *

Production of livestock feed from sugar cane. R. B. MILLER and C. K. LAURIE, *assrs.* CANADIAN CANE EQUIPMENT LTD., of Montreal, Quebec, Canada. **3,721,567.** 8th April 1970; 20th March 1973.—Sugar cane stalk is split parallel to its longitudinal axis while retaining substantially all the juice in its pith. The latter is scraped away from the outer fibrous rind and a dietary supplement added [a nitrogenous protein substitute (1–20% urea), a leguminous meal (10–90% of soybean, clover, peas, peanut, beans or alfalfa) and (5–50% of) a mineral mixture] to give an animal fodder.

* * *

Method of preparing a sugar product for refining. J. B. ALEXANDER, of Westville, Natal, South Africa. *assr.* SOUTH AFRICAN SUGAR ASSOCIATION. **3,723,179,** 28th January 1971; 27th March 1973.—See UK Patent 1,300,693[2].

Rigid foams from sucrose polyols. G. P. SPERANZA and P. H. MOSS, of Austin, Texas, USA, *assrs.* JEFFERSON CHEMICAL CO. INC. **3,723,365.** 2nd April 1971; 27th March 1973.—Rigid polyurethane foams are prepared by using a polyaryl *iso*-cyanate and sucrose-based polyols prepared by reacting sucrose with alkylene oxides of 2–4 C atoms and subsequently reacting these conventional polyols with higher molecular weight alkylene oxides.

* * *

Continuous crystallization control system. R. RETALI, F. DAMBRINE, J. C. GIORGI and G. WINDAL, *assrs.* FIVES LILLE-CAIL, of Paris, France. **3,725,127.** 16th March 1971; 3rd April 1973.—See UK Patent 1,316,706[3].

* * *

Diffusion apparatus. F. MUSHACK, of Wolfenbüttel, Germany, *assr.* BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT. **3,726,715.** 13th April 1971; 10th April 1973.

The diffusion tower 1 contains a central supporting tubular shaft 3 and is sealed by a cover 2 and oil drip pan located on a hollow shaft 6 supported on a driven wheel 5 carried by a bearing 62 mounted on the smaller diameter upper section 4 of shaft 3. Rotation of shaft 6 is achieved by motors 7 carried on support cover 10 and driving cogs 8 which engage with wheel 5. The shaft 6 divides the space between support shaft 3 and tower housing 1 into two concentric annular spaces 63, 64 which are connected by spaces 11 at the bottom of the tower. An annular screen 9 covers space 11 and drain outlets 12 are provided for diffusion juice.

Cossettes or cane particles for diffusion are suspended in juice and admitted to the tower through pipes 16, 17 feeding the spaces 63 and 64, and are carried upwards by the cooperative action of interrupted scroll blades 18, 19 mounted on the rotating shaft 6 and interruptor blades 20, 30 mounted on the tower wall 1 and support shaft 3. The scrolls extend all the way up the tower and carry the diffusion material against a countercurrent of juice admitted initially as water through port 65. Exhausted material

[1] *I.S.J.*, 1973, **75**, 257.
[2] *ibid.*, 1974, **76**, 94.
[3] *ibid.*, 125.

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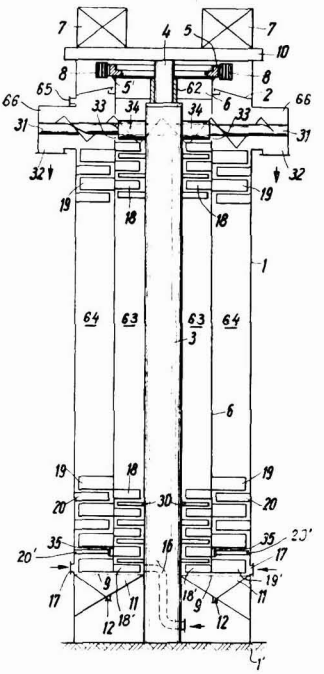


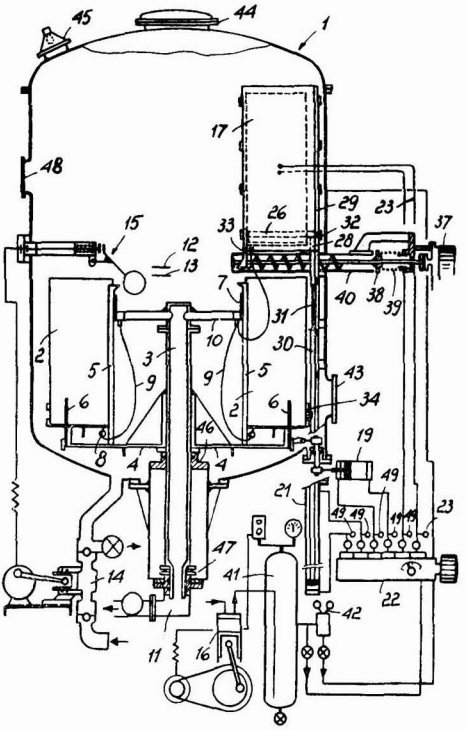
is directed by blades 34 at the top of shaft 3 and scrolls 33 into the side passages 32 from which it is discharged. The scrolls and interruptor blades ensure good mixing for efficient extraction and this is also subject to control of temperature and residence time (by adjustment of liquid level and speed of rotation of shaft 6).

* * *

Continuous pressure filter. G. PADOVAN, of Conegliano, Italy. **3,727,762.** 30th August 1971; 17th April 1973.

The filter housing 1 contains a set of radial leaves or bags 2 mounted on rectangular frames and carried on a central hollow shaft 3 by means of a support disc 4 and guides 5, 6. The guides 5 are connected by a fixed retaining plate 7 to a manifold 10 which is connected by flexible tubes 9 to drains 8 from the interiors of the leaves 2. The manifold leads into the interior of shaft 3 so that the latter serves for the discharge of filtrate as well as a support for the leaves. Material to be filtered is fed by pump 14 into the housing, under the control of level regulator 15 so as to maintain the level between limits 12 and 13. The pressure delivered by pump 14 is greater than the pressure of a gas, such as air, maintained within the top of the housing (which causes the separation of the filtrate through the leaf surface).

A pneumatic mechanism operating through a piston 19 rotates the set of leaves and the shaft 3 by increments corresponding to the space between one leaf and the next. Each leaf is raised in turn by a slide 28 moving in guides 29, 33, 34 and raised between two plates 17 fitted with membranes. This lifting action automatically closes the drain 8. A pneumatic control system sequentially supplies pressure to the membranes which squeeze the cake on the leaf to express its liquid content; the membranes are then



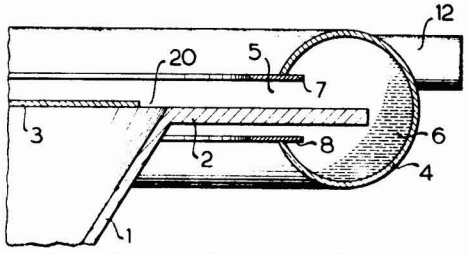
retracted and the leaf lowered into the liquid to be altered. During its downward passage scraper blades 26 pivot so that they engage with the leaf surface, removing the cake which falls into a conveyor 40 with two driven parallel screws 36. The exit is controlled by a plug 38 which prevents loss of compressed gas; alternatively a sealed chamber can be provided with interlocking arrangements whereby the cake is discharged intermittently without loss of pressure.

* * *

Screen for a batch centrifugal. K. PAUSE, of Grevenbroich, Germany, *assr.* MASCHINENFABRIK BUCKAU R. WOLF A.G. **3,730,768.** 14th June 1971; 1st May 1973.—To minimize the harmful effects of stresses developed during operation of a batch centrifugal, the perforations of the screen employed are arranged so that any four adjacent apertures are located at the corners of a rectangular pattern in which the aperture diameter and the distance between apertures in the circumferential direction are smaller than, or at most equal to, the distance between apertures in the axial direction, and the diagonal distance between apertures forming the rectangle are less than 1 mm.

Remelting of sugar crystals. B. FIEDLER, of Grevenbroich, Germany, *assr.* MASCHINENFABRIK BUCKAU R. WOLF A.G. **3,730,769.** 26th May 1971; 1st May 1973.

Crystals of sugar to be remelted, e.g. *B*-sugar, affined sugar, etc. are separated from their mother-liquor in a continuous conical-basket centrifugal[1] from which they are discharged over the rim[2] of a screen into an annular tubular chamber 4 containing the liquid in which they are to be dissolved; this liquid also rotates as a result of air friction between



its surface and the rim of the screen, which protrudes through a slot 5 on the inner side of the annular tube (and may also be arranged to dip into the dissolving liquid). A tangential outlet 12 is located above the axes of the tube so that only dissolved sugar is withdrawn, while tangential inlets for fresh liquid are arranged around the tube.

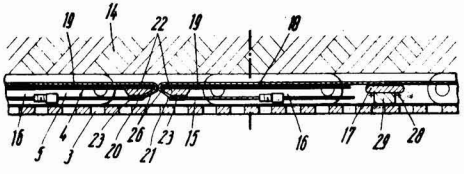
* * *

Sugar recovery method. J. F. ZIEVERS and C. J. NOVOTNY, *assrs.* INDUSTRIAL FILTER & PUMP MFG. CO., of Cicero, Ill., USA. **3,730,770.** 7th April 1971; 1st May 1973.—An impure sugar solution (molasses) is [heated to at least 130°F, mixed with a dilute aqueous sugar solution of 26°Bx (resin wash water) and] mixed with once-used active carbon and filtered. The filtrate is treated with ion exchange resins (anion and cation exchange columns) to remove monovalent ions and then passed through an ion exclusion resin to separate sugar from the larger molecules in the solution. Water is passed through the column to give a purified sugar solution which is mixed with fresh active carbon, filtered and evaporated to a higher Brix.

* * *

Beet and cane diffuser. R. WOLFF and W. DIETZEL, of Braunschweig, Germany, *assrs.* BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT. **3,731,613.** 19th January 1972; 8th May 1973.

The trough-type diffuser, originally designed for use with cane, is made suitable for the extraction of



sugar from beet cossettes by inclusion in the conveyor system of a belt of fabric or netting 18 which separates the beet 14 from the stationary perforated bottom 3 of the diffuser trough over which it is carried by the conveyor 4. The belt may be continuous or in the form of sections spanning the distance between carrier elements 17; by retaining the cossettes and prevention of shearing against the bottom 3, destruction of pulp is prevented.

* * *

Beet thinner. F. W. FIELD and D. W. CAYON, *assrs.* DEERE & CO., of Moline, Ill., USA. **3,732,931.** 22nd October 1970; 15th May 1973.

* * *

Animal fodder for ruminants. D. M. STEEN, of Morrill, Nebr., USA, *assr.* ALLIED CHEMICAL CORP. **3,733,203.** 5th March 1970; 15th May 1973.—To molasses is added 0·245 parts of urea by weight, 0·1 parts of Na_2SO_4 and 0·135 parts of ammoniated phosphoric acid, the last being obtained by mixing phosphoric acid and ammonium phosphate in a 1:4 molecular ratio to give a product of average composition $(NH_4)_{1.6}H_{1.4}PO_4$. The feed pH is between 5·8 and 7·0 (about 6·1).

* * *

Beet harvester. E. P. MOLNAU, deceased, by M. L. MOLNAU, of Excelsior, Minn., USA. **3,734,193.** 20th September 1971; 22nd May 1973.

* * *

Bagasse fibre product and process. R. BOTZ, of San Juan, Puerto Rico, *assr.* PLASTI-FIBER FORMULATIONS INC. **3,734,766.** 2nd November 1970; 22nd May 1973. Bagasse is treated with an aqueous solution of alum and defibrated to give a fibrous product (having a coating of 0·1–0·4% alum by weight of dry fibre) suitable for reinforcement of resin bodies. The fibre may also be pulverized to give a flour suitable as a resin filler. The treatment also yields a clean, sugar-free, moisture-resistant, low-density cellular pith suitable for use in making insulation or acoustic material or as a filler for synthetic foam products or in animal fodder.

* * *

Beet juice purification. B. E. HALEY, of West Haven, Conn., USA. **3,734,773.** 2nd August 1971; 22nd May 1973.—(After adjusting to pH $>6·5$ and heating to 85–100°F) Colloidal and particulate impurities are removed from beet juice (by centrifuging at 10,000–100,000 *g*) and 0·1–3% of lime on juice weight added to form the insoluble Ca salt(s) of organic acid impurit(y)(ies). This insoluble precipitate is removed and treated with water and CO_2 to give $CaCO_3$ and a solution of the organic acid which is then further processed to remove any remaining Ca.

* * *

Animal fodder from beet juice purification. B. E. HALEY, of Moses Lake, Wash., USA. **3,745,016.** 22nd July 1971; 10th July 1973.—Diffusion juice is adjusted to pH 6·5–7·0, heated to 75–95°C and subjected to centrifugation to separate the colloidal and suspended matter. This is re-centrifuged (at 10,000–100,000 *g*) to give $<50\%$ (ca. 30%) moisture by weight, and the product heated to evaporate sufficient water to give a high-protein feed of 5–12% moisture by weight.

Portugal sugar imports[1]

	1973	1972
	(*metric tons, raw value*)	
Angola	500	6,486
Argentina	9,573	0
Belgium	67	146
France	0	5,155
Germany, West	24	46
Holland	50	28
Macao	0	646
Malawi	4,029	3,560
Mozambique	170,419	196,471
UK	8,001	950
Other countries	3,443	28,645
	243,105	251,791

* * *

Australia sugar exports[2]

	1973	1972	1971
	(*metric tons, raw value*)		
Algeria	0	23,810	0
Canada	354,023	436,270	323,120
Chile	0	19,327	0
China	66,220	37,157	0
EEC—Belgium/Lux.	0	12,712	0
France	0	0	42,555
UK	358,395	450,904	495,864
Finland	42,354	50,919	34,693
Hong Kong	0	0	12,924
India	0	0	5,555
Japan	601,907	646,981	516,959
Korea, South	64,502	17,971	0
Malaysia	104,472	66,115	13,565
Morocco	0	22,247	0
New Zealand	112,118	104,724	86,861
Oceania*	8,950	10,022	12,224
Singapore	77,695	39,479	3,565
Tunisia	0	13,043	0
USSR	64,768	142,381	0
USA	244,749	201,872	198,322
Other countries*	193	1,685	5,586
	2,100,346	2,297,619	1,761,793

* Exported as refined sugar

* * *

Beet molasses sugar recovery by ion exchange.—Robert Reichling & Co. K.G., of Krefeld, Germany, have concluded orders for their 50th and 51st installations of plant for application of the Quentin process of sugar recovery from beet molasses. One of the plants is at a sugar factory slicing 14,000 tons of beet per day, and the total slice of the factories where the 51 plants are located is approximately 17 million tons per day. The process uses a special "Nekrolith" ion exchange resin and recovers an additional 0·35–0·4% of sugar on beet.

* * *

International Sugar Research Foundation publications.—Two new booklets have been issued by the ISRF, the first a survey of research projects up to No. 316, under the title "Sugar Research 1943–72". The identifying number, title, project director, location of the work, and the years in which the work was done are given. Scientific papers or other publications resulting from the research are listed in the Appendix. The second book is "A research profile of sugar", the Proceedings of the Seventh International Sugar Research Symposium held in London in September 1973. It contains an overall review and evaluation of ISRF projects, divided into the three main categories—public health, food technology and sucrochemistry —by Professor J. V. O. REID, Dr. R. JOHNSON and Professor A. J. VLITOS, respectively. It includes an address by Dr. W. J. H. BUTTERFIELD on "The age of our genes *versus* modern technology" and reports on a number of research projects including "Further exploration in sucrose chemicals" and "Sucrose derivatives in surface coatings". The books are available at a price of $5.00 each from the Foundation at 7316 Wisconsin Avenue, Bethesda, Maryland, 20014 USA.

Brevities

Australia sugar crop, 1973[3].—The 1973 season in Australia ended on the 29th January with 18,272,498 metric tons crushed by Queensland mills to give 2,409,062 tons 94 N.T. sugar. The three mills in New South Wales crushed 999,485 tons of cane to produce an outturn of 121,158 tons[4], making an aggregate 2,530,220 tons of sugar from 19,271,983 tons of cane. The Queensland cane crop was the second highest on record but the overall average sugar content was down compared with the 1972 season when 2,817,047 tons of sugar was made from 18,927,379 tons of cane. The average sugar cane yield in Queensland was 84·48 tons per hectare, a record, and sugar production averaged 11·14 tons per hectare, corresponding to a cane:sugar ratio of 7·58. Of the 31 mills in Queensland, 18 exceeded their peaks, 8 by more than 20%. The sugar production in New South Wales, although considerably improved over that of 1972, is some 8–9% short of the peak equivalent. It is estimated that almost 1,500,000 tons of available cane could not be harvested because of the very adverse weather conditions, particularly in the closing stages of the season, and it is hoped that it will still be acceptable for milling after standing-over until the start of the 1974 season.

* * *

The late S. C. Gupta.—The death is reported of S. C. GUPTA, ex-Director of the National Sugar Institute, Kanpur, India, while on a technical assignment in Tanzania. GUPTA, an ex-student of the Institute, became an Associate in 1935 and later a Fellow, serving in the sugar industry for nearly 23 years. In 1958 he returned to the Institute as Chief Technologist and became Director in 1964 which post he held until retirement in 1971, subsequently acting as a consultant. He was well-known outside India, having represented his country at meetings of ICUMSA and he attended a number of the Congresses of the ISSCT. He was a prolific writer and contributed many technical papers to publications and to sugar technologists' association meetings in India and elsewhere.

* * *

Agricultural administration.—The first issue of a new international journal having the title "Agricultural Administration" was published in January 1974. To appear quarterly, it is published by Applied Science Publishers Ltd., of Ripple Road, Barking, Essex, England, and is edited by Professor A. N. DUCKHAM and Dr. J. PEARCE of the Department of Agriculture, University of Reading. It will include research papers, review articles and case studies, etc., and is intended to concentrate on the nature and solution of problems created by farm management, economics, sociology or policy rather than these subjects themselves. The subscription cost is £10.00 or $25.00 per volume of approximately 320 pages.

* * *

Jamaica sugar crop, 1973[5].—The final production of 1973 crop sugar amounted to 337,087 tons compared with 377,765 tons for the 1972 crop. The average sucrose content for the 1973 crop was slightly higher, 10·47 tons of cane being crushed per ton of 96° sugar compared with 10·52 tons for the 1972 crop.

* * *

New Brazilian sugar factory.—Kaiser Engineers, of Oakland, California, USA, a subsidiary of Kaiser Industrial Corporation, has announced that it has received a contract from Usina Central do Parana, a Brazilian sugar producer, for engineering services in the construction of a $50,000,000 sugar mill in Precatu, Brazil.

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[1] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (9), vi.
[2] *I.S.O. Stat. Bull.*, 1974, **33**, (3), 19.
[3] *Australian Sugar J.*, 1974, **65**, 475.
[4] *Producers' Review*, 1974, **64**, (2), 3.
[5] *Willett & Gray*, 1974, **98**, 22.

Brevities

Smith sugar machinery orders.—Recent contracts received by A. & W. Smith & Co. Ltd. include one for the extension and modernization of the Marromeu factory of Sena Sugar Estates Ltd. in Portuguese East Africa, where capacity is to be raised from 4300 to 6000 t.c.d. with future extension to 8000 t.c.d. by provision for two mills additional to the new 12-roller 44 × 90 inch tandem which will be complete with individual 1500 h.p. turbines and gearing, and preceded by two cane knife sets, each driven by 1000 h.p. electric motors, and a 60 × 84 inch 1200 r.p.m. Tongaat shredder with a 2000 h.p. turbine. Among equipment to be supplied to TPC Ltd., at Moshi, Tanzania, to raise capacity from 2000 to 3500 t.c.d will be equipment to extend and modernize all the main stations, including two 36 × 78 inch mills, a new boiler and four "Konti 10" continuous centrifugals. Six 1000 h.p. mill drive turbines are to be supplied to Ingenio La Fronterita in Argentina, a further 37 "Konti 10" continuous centrifugals for Cuba and four for the British Sugar Corporation, additional mills and turbines to extend the capacity of Central Rio Yaracuy, Venezuela, from 4000 to 7000 t.c.d., two Tongaat shredders for Thailand, and five "Rota filters" of which two are for Thailand and three for South Africa.

* * *

Mauritius 1973 sugar crop[1].—The 1973 crop started on the 11th June and ended on the 20th December 1973. The 21 mills crushed 6,144,044 long tons of cane, i.e. about 71,000 tons less than the record figure of 1972. Total sugar output amounted to 707,150 tons and represents an all-time record. Average cane yield reached the figure of 30·7 tons per acre as against the record figure of 31·3 tons in 1972. Average sugar recovery was 11·51% (10·87% in 1972) and the yield of sugar per acre amounted to 3·54 tons as against 3·41 tons in 1972. Exports in 1973 of 686,603 long tons represents a new record following the one achieved in the previous year; the suspension of quota restrictions on the free market together with a record crop made this export performance possible. Destinations were: the UK 380,000 tons (387,951 in 1972), Canada 189,669 (128,389), USA 38,600 (27,500), Malaysia 12,600 (13,125), South Vietnam 12,599 (—), Indonesia 12,402 (—), Iran 12,364 (12,402), USSR 12,200 (24,790), Iraq 11,368 (—), Yemen 4781 (—) and Seychelles 20 (—).

* * *

Malawi sugar expansion[2].—The sugar cane area of the Nchalo estate of Sucoma (Sugar Corporation of Malawi) was increased from 8000 acres in 1972 to about 12,000 acres in 1973 while sugar production rose from 40,000 tons to 55,000 tons. By 1980 it is anticipated that production will reach 110,000 tons from the maximum area of 22,000 acres. Sucoma produces both raw and refined sugar, and 15,000 tons of the 55,000 tons 1973 output is being exported by Malawi.

* * *

Gabon sugar project[3].—An agreement between the Governments of Taiwan and the West African state of Gabon provides for the building of a 300 t.c.d. sugar factory in Franceville and establishment of a cane plantation. Production in this first stage, at 4000 tons of sugar per annum, will cover domestic requirements.

* * *

New factory for France[4].—The company Beghin-Say S.A. intends to erect a factory in Connantre (Marne), with a daily capacity of 12,000 metric tons. It is to start operations from 1975/76.

* * *

Switzerland sugar production 1973[5].—In the 1973 Swiss beet campaign a total of 539,619 metric tons of beet were sliced and gave a total of 71,578 tons of white sugar.

Norway sugar exports[6]

	1973	1972
	(*metric tons, white value*)	
Belgium/Luxembourg	234	216
Czechoslovakia	13,603	11,098
Denmark	57,435	61,278
Finland	6,352	4,882
France	10	50
Germany, East	19	39
Germany, West	12,150	13,925
Holland	3,722	440
Italy	19	0
Poland	10,323	12,964
Portugal	0	25
Spain	2	0
Sweden	1,160	3,746
Switzerland	19	0
UK	49,992	62,142
Other countries	0	6
Total	155,040	170,811
Total, raw value	172,267	189,790

* * *

Switzerland sugar imports[7]

	1973	1972
	(*metric tons, tel quel*)	
Belgium	654	255
Cuba	1,119	1,577
Czechoslovakia	11,671	13,155
France	118,276	138,225
Germany, West	12,144	23,027
Holland	2,819	11,618
Mauritius	932	0
UK	59,016	37,602
Other countries	0	27
	206,631	225,486

* * *

East Germany beet crop, 1973[8].—According to reports from East Germany, beet yields in 1973 amounted to 29·2 metric tons per hectare, compared with 32·6 tons in 1972. The area under beet in 1973 was 229,900 hectares as against 121,653 hectares in 1972. Sugar content is said to have been lower than in the 1972/73 campaign.

* * *

Barbados cane crop reduction[9].—A substantial fall is expected for the 1974 cane crop which will probably realize approximately 100,000 tons, a 16,000 tons reduction compared with 1973. The reduction is attributed mainly to poor weather but a further factor is that approximately 11,000 acres of land have been taken out of sugar production over the past ten years.

* * *

Argentina sugar crop, 1973/74[10].—The 1973/74 crushing season just finished yielded about 1,630,000 metric tons, a figure which exceeded even the most optimistic forecasts previously made. The 1972/73 output totalled 1,294,000 tons. The bumper 1973/74 crop would permit exports to reach 650,000 tons.

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[1] *Mauritius Sugar News Bull.*, 1973, (12).
[2] *Barclays International Review*, 1974, (2), 20.
[3] *Zeitsch. Zuckerind.*, 1974, **99**, 46.
[4] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (3), 7.
[5] *Zeitsch. Zuckerind.*, 1974, **99**, 44.
[6] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (6), vi.
[7] C. Czarnikow Ltd., *Sugar Review*, 1974, (1170), 47.
[8] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (3), 6.
[9] *Barclays International Review*, 1974, (2), 48.
[10] *Public Ledger*, 7th February 1974.

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