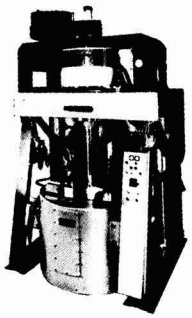
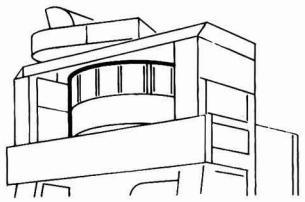
International Sugar Journal

AUGUST 1977



The Build Up



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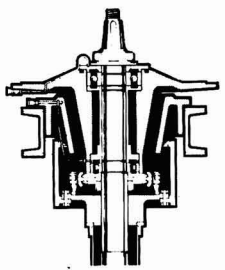

Suspension

Plough

Broadbent—
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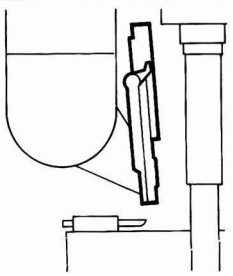
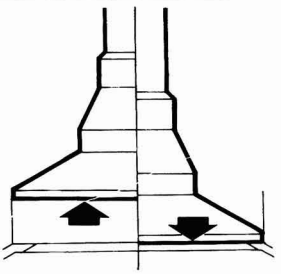
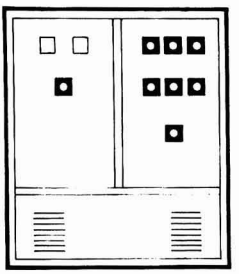


Feed Valve



Discharge Valve



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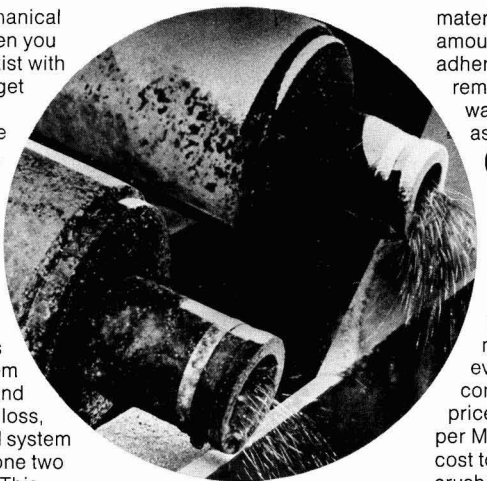

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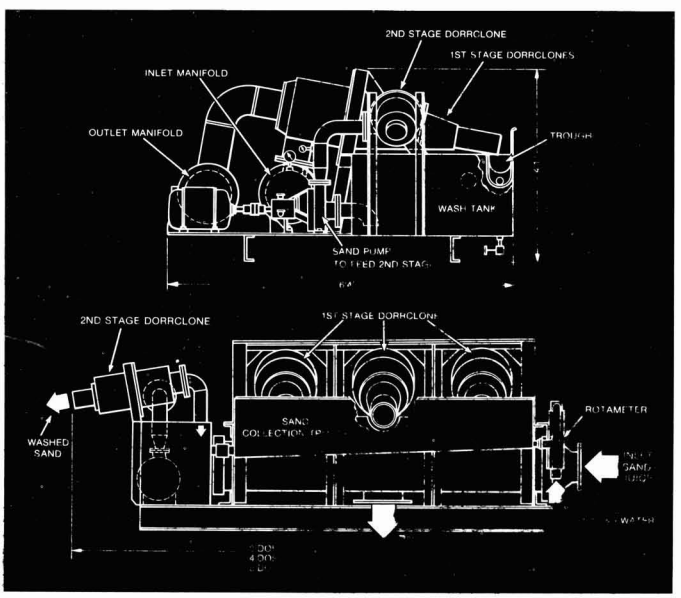
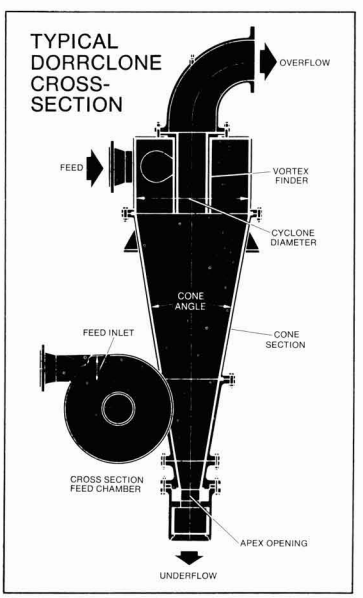
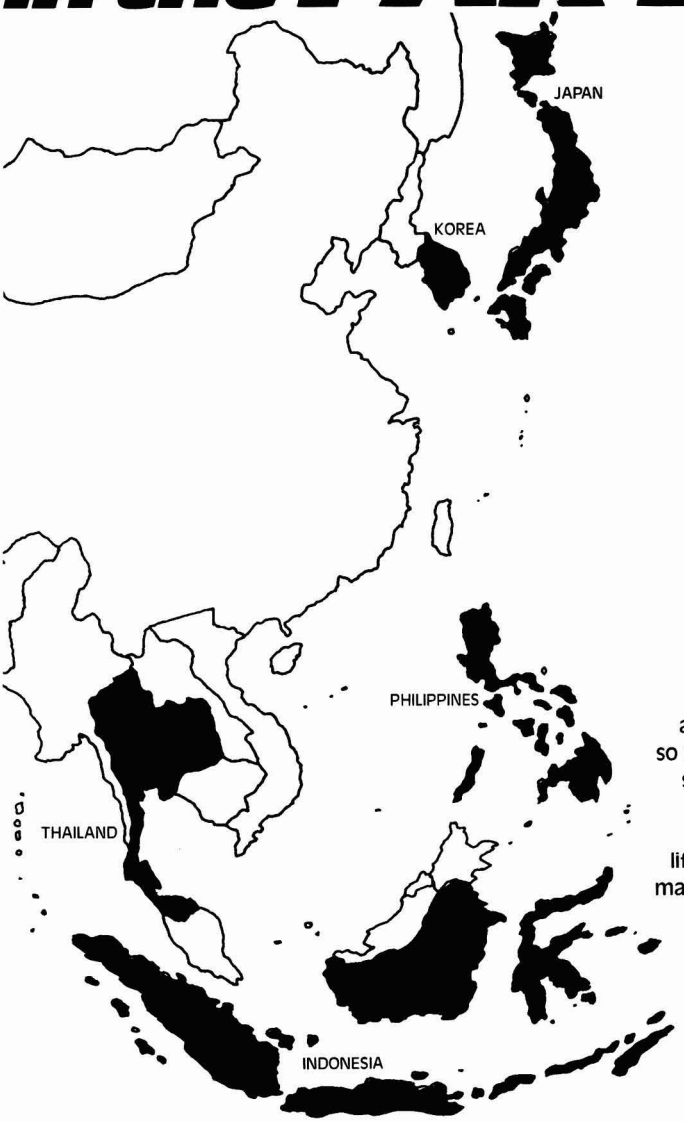




A new battery of 54 x 40 " A & B " Centrifugals at Binalbagan Isabela Sugar Company, Philippines.

WESTERN STATES in the FAR EAST



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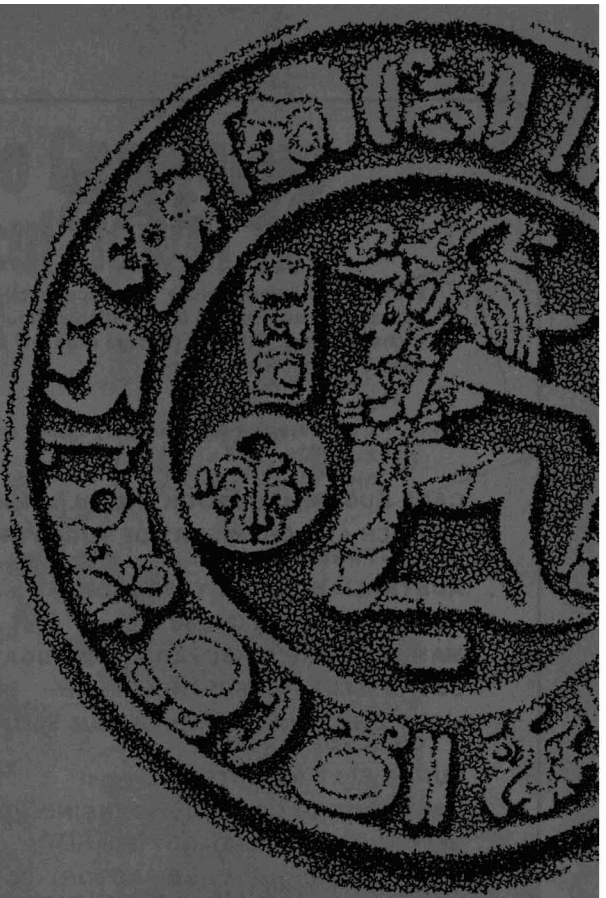

A new and exciting feature has emerged in the landscape at the foot of Chinchontepeque, a volcano near San Vicente in El Salvador.

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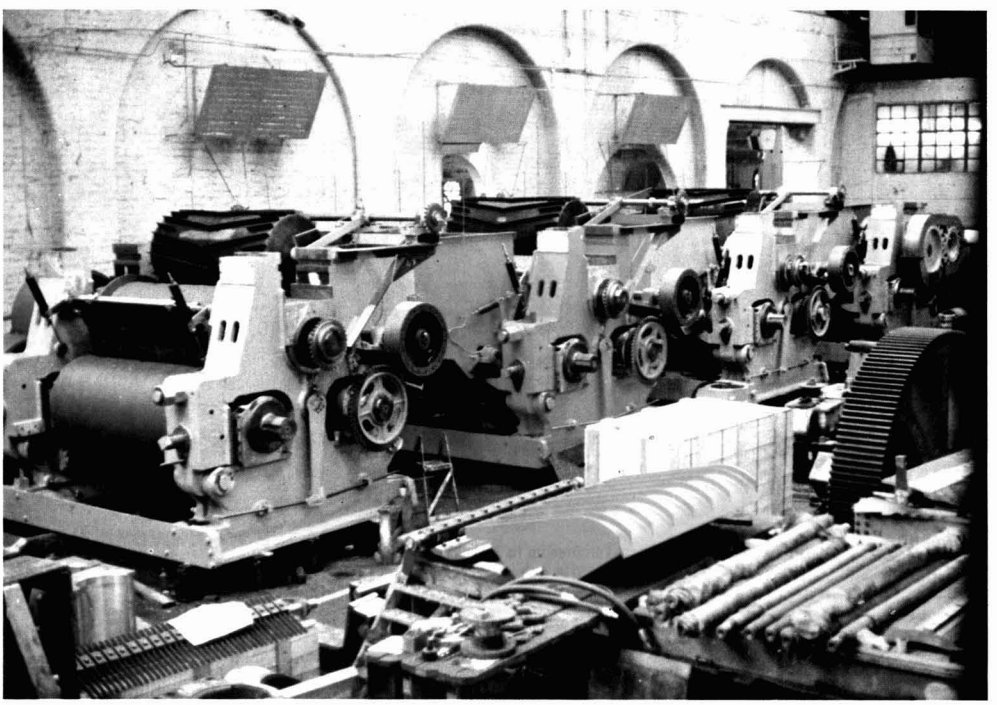

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Contents

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SOMMARES : ZUSAMMENFASSUNGEN : SUMARIOS

Traitement des eaux residuaires et problèmes y relatifs. 1ère partie. H. BRUNNER. *p.* 213–216

L'état de la pollution de l'eau en Suisse est brièvement rapporté et l'historique du traitement des eaux résiduaires à la sucrerie-raffinerie de Aarberg est décrit. L'effet des substances dissoutes dans l'effluent sur son comportement au cours de la percolation et par suite sur la nappe aquifère est indiqué, des équations étant données pour les diverses réactions de dissolution et illustrant comment le potentiel d'oxydo-réduction d'une étendue d'eau peut être modifié par les contaminants organiques. Les propriétés chimiques d'une eau potable normale sont comparées à celles de l'eau potable dans la zone de décharge de l'effluent d'une usine. Des détails sont donnés concernant le schéma de traitement des eaux résiduaires à Aarberg, qui a été l'une des premières usines au monde ayant installé des moyens d'épuration biologique. Certaines données d'exploitation sont citées pour 1974/75 et 1975/76.

* * *

La 28ème Démonstration Nationale de Printemps de la Betterave Sucrière du Royaume Uni, 1977. *p.* 217–219

On présente un reportage illustré concernant la 28ème démonstration de printemps tenue à Waddingham, Lincolnshire, le 2 juin 1977. Des machines agricoles destinées à la culture de la betterave étaient présentées tant en exposition statique qu'en travail normal sur champ. Divers autres aspects des travaux sur champ y étaient également inclus, y compris l'irrigation, les performances des semoirs (en termes d'émergence), le contrôle chimique des plants adventices, la prévention de l'érosion par le vent, etc.

* * *

Assemblée 1977 des Technologues de l'Industrie du Sucre. *p.* 220–222

On présente un rapport concernant la 36ème assemblée annuelle des Sugar Industry Technologists Inc., tenue à San Francisco du 15 au 19 mai 1977, avec mention des sujets présentés. Ensuite on décrit le matérial et les procédés de la raffinerie de Crockett de la California and Hawaiian Sugar Co., ainsi que de la sucrerie de betterave de Manteca, de la Division Spreckels de l'Amstar Corporation, usines qui ont été visitées par les membres des S.I.T.

Abwasseraufbereitung und damit zusammenhängende Probleme. Teil I. H. BRUNNER. *S.* 213–216

Die Situation der Gewässerverunreinigung in der Schweiz wird kurz geschildert und die historische Entwicklung der Abwasserbehandlung in der Zuckerfabrik + Raffinerie Aarberg beschrieben. Der Einfluss gelöster Substanzen im abfliessenden Wasser auf sein Verhalten während der Perkolation und damit auf das Grundwasser wird erläutert. Der Verfasser gibt Gleichungen für die verschiedenen Lösungsreaktionen an und zeigt auf, wie das Redoxpotential eines Wasserlaufs durch organische Verunreinigungen verändert werden kann. Die chemischen Eigenschaften von normalem Trinkwasser werden mit denen von Trinkwasser im Abwassergelände einer Fabrik verglichen. Weiter werden Einzelheiten über das Abwasseraufbereitungsschema von Aarberg angegeben, die eine der ersten Fabriken in der Welt war, welche eine biologische Reinigungsanlage installierten. Für 1974/75 und 1975/76 gibt der Verfasser einige Leistungszahlen an.

* * *

Die 28. Nationale Frühjahrsvorführung über Zuckerrüben im Vereinigten Königreich 1977. *S.* 217–219

Der vorliegende illustrierte Bericht bezieht sich auf die 28. Nationale Frühjahrsvorführung über Zuckerrüben im Vereinigten Königreich, die am 2. Juni 1977 in Waddingham, Lincolnshire, stattfand. Bei dieser Veranstaltung waren Maschinen für den Zuckerrübenanbau sowohl stationär als auch bei der normalen Feldarbeit zu sehen. Ausserdem wurden verschiedene andere Aspekte der Feldarbeit beleuchtet wie Bewässerung, Leistung von Pflanzvorrichtungen (auf den Pflanzenaufgang bezogen), chemische Unkrautbekämpfung, Verhinderung der Winderosion usw.

* * *

Jahresversammlung 1977 der Zuckertechnologen. *S.* 220–222

Es wird über die 36. Jahresversammlung der Gesellschaft der Zuckertechnologen berichtet, die vom 15. bis zum 19. Mai 1977 in San Francisco stattfand, und ein Überblick über die dort vorgelegten Arbeiten gegeben. In dem Bericht findet sich weiter eine illustrierte Beschreibung der in der Raffinerie Crockett der California and Hawaiian Sugar Co. sowie in der Rübenzuckerfabrik Manteca der Spreckels Division der Amstar Corporation verwendeten Apparate und Verfahren. Beide Fabriken wurden von den Tagungsteilnehmern besichtigt.

Tratamiento de agua sucia y problemas conexas. Parte I. H. BRUNNER. *Pág.* 213–216

La situación en la Suiza respecto a la contaminación de agua se discute brevemente y la historia del tratamiento de agua sucia a la azucarera-refinería Aarberg es describido. El efecto de sustancias disueltas en efluente sobre su comportamiento durante percolación, y entonces sobre agua del suelo es indicado. Ecuaciones se presentan para las varias reacciones de disolución que demuestran como contaminación orgánica puede cambiar el potencial de oxidación-reducción de un tramo de agua. Las propriedades químicas de agua potable normal se comparan con ellas de agua potable en el área de disposición del efluente de una fábrica. Se presentan detalles del esquema de tratamiento de agua sucia en Aarberg, que estuvo una de las primeras fábricas del mundo donde habían instalados medios para purificación biológica. Se registran dados de cumplimiento para las campañas 1974/75 y 1975/76.

* * *

La 28a Demostración Nacional de Primavera de Remolacha de Azúcar del Reino Unido, 1977. *Pág.* 217–219

Se presenta un informe ilustrado del 28a Demostración Nacional de Primavera de Remolacha de Azúcar, en Waddingham, Lincolnshire, Inglaterra, el 2 junio de 1977, en que estuvo expuesto maquinaria agrícola para remolacha como equipo estático y demostrado en operación en los campos. Varios otros aspectos de operaciones del campo estuvieron incorporado y incluieron irrigación, complimiento de equipo de sembrar (en términos de aparición), control químico de malas hierbas, prevención de erosión por la venta, etc.

* * *

Asemblea 1977 de los Sugar Industry Technologists. *Pág.* 220–222

Se presenta un informe sobre la 36a Asemblea Anual de Sugar Industry Technologists Inc., celebrada en la ciudad de San Francisco, E.U.A., el 15 a 19 mayo de 1977, con mención de los varios papeles presentados. Descripciones ilustradas se incluyen del equipo y procesos de la refinería Crockett de la California & Hawaiian Sugar Co. y la azucarera remolachera de Manteca (que pertenece a la División Spreckels de Amstar Corporation) que han visitado los miembros de S.I.T.

INTERNATIONAL SUGAR JOURNAL

VOL. LXXIX AUGUST, 1977 No. 944

Notes & Comments

International Sugar Conference talks

At a meeting in London on 14th June, representatives of 17 major sugar importing and exporting countries met to discuss the agenda for a proposed 10-day session to begin on the 20th July in order to discuss the problems which led to failure of the Geneva Conference of April/May and to conclude whether a new Conference should be called.

Although emphasis was given to the roles of stocks and their financing and of quotas in a new agreement, a number of countries wanted the July talks to cover all the problems which arose in Geneva, and it was agreed that they should be based on the final paper given, which provided an outline of a possible basis for a new Agreement.

This revised basic working paper, presented by the Chairman, Mr. ERNEST JONES-PARRY, at a private meeting of the future Executive Committee, proposed the setting of a realistic initial global quota with basic export tonnages fixed for two years and provisional for a third year. Revision of quotas in the third and subsequent years of the agreement would be based on statistics of actual exports and imports during the second and subsequent years. A price range proposed is from 11 to 21 cents per pound; over 16 cents quotas would be suspended, to be re-established when the price falls to below 14 cents. Between 13 and 16 cents per pound the Council would have the authority to adjust the global quota to maintain prices in this middle band, with mandatory increases when the price rose above 14 cents. Below 13 cents there would be mandatory decreases in the global quota. When the price was below 21 cents importing members would not buy more than 75% of the average of the previous three years' imports from non-members.

Minimum stocks would be required in proportion to basic export tonnages, to be made available in one-third stages when the price rises above 19, 20 and 21 cents, respectively. Stocks should be replenished as soon as possible when the price goes below 16 cents per pound. Special stocks would be established in stages of 3% of basic export tonnages when the quotas in effect were cut from 100% to 95% and from 95% to 90%; they would be available when quotas were increased again. Financing of the stocks would be assisted by an I.S.O. fund derived from contributions by members.

We look forward to publishing details of the July meetings in our next issue.

Soviet sugar production 1976/77[1]

The US Department of Agriculture recently released a new estimate of sugar production in the USSR in 1976/77. This estimate is substantially below earlier expectations and does not exceed 6·72 million metric tons, white value, or 7·3 million metric tons, raw value. USDA sources emphasized that production data for 1976 were made available by the USSR Central Statistical Administration under the US-USSR agreement on agricultural cooperation. USDA sources are convinced that this information is accurate. If the figures released by the USDA are in line with reality (and the likelihood seems to be very great), the USSR sugar economy will have suffered a major setback in 1976/77.

Although it was obvious that the USSR encountered substantial harvesting and storage difficulties owing to early autumnal frosts in 1976 it was widely assumed that overall sugar production in 1976/77 would be in the region of 9 million metric tons, raw value. Official Soviet sources even suggested that this estimate was too pessimistic. State purchases in 1976 reached 85 million tons, up 37·36% on 1975 and up 24·11% on the average for 1970 to 1975. Assuming a normal extraction rate this would have yielded sugar production of more than 10 million metric tons, raw value. A production of not more than 7·3 million tons indicates that a substantial quantity of the beets purchased for sugar production, estimated by the USDA at probably some 5–10 million tons, was not processed. If it is assumed that the higher figure of this range was not processed, sugar production of 7·3 million tons corresponds to an extraction rate of 10·27% which, although far below normal levels, does not seem to be unrealistic. The really surprising factor in 1976/77 is that apparently a substantial quantity of the beets purchased by the State was lost. A loss of 10 million tons cannot be explained only by adverse weather conditions; it must be assumed that organizational difficulties played a major role in 1976/77.

* * *

World sugar prices

Raw sugar prices were somewhat volatile during June but the underlying trend was downwards and from £119 per ton at the beginning of the month, the LDP had fallen to £113 by the end of the month, reflecting the large surplus of sugar overhanging the market. The LDP(W) was even more affected,

[1] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (13), 9–10.

probably as a result of the large amounts of white sugar to be disposed of by the EEC, and fell steadily during the month from £131 to £120 per ton.

Concerning the future, E. D. & F. Man wrote[1] at the end of June: "The 1977/78 season, which starts on the 1st September, will open with a higher initial stock level than any season on record, though of course as a proportion of consumption, it has not yet reached the extremely high ratios of 1965–67. The 1977/78 season itself promises another surplus of at least 3 million tons and possibly 5 million, depending on European weather conditions and the United States reductions in domestic production. Weather conditions in both West and East Europe are extremely favourable at present, with heavy rains followed by periods of sunshine, which have resulted in rapid root growth and a very low incidence of disease. There is little doubt that the European crop will be a record and it is merely a question of the extent of that record.

"The new season will have an additional supply (initial stock plus production) some 6 million tons above the season of 1976/77, whilst consumption will only rise by around 2½ million tons to offset this. There can, therefore, be no doubt that prices will be under constant pressure from now on, with it highly unlikely that the New York spot average for 1977/78 will be anywhere near as good as the 1976/77 level of 8 cents.

"From this very gloomy backdrop we can only wish that the ISO meetings to be held from the 20th July in London will have greater success than those in Geneva two months ago, and that some form of artificial restriction on supply/demand will enable the market to avoid what will otherwise be a disastrous season for almost all producers".

* * *

Japan-Australian sugar price talks

A Japanese mission went to Sydney in June to continue talks on their request for reduction in the fixed price of the long-term contract for supply of Australian raws to the Japanese refiners. The talks broke down, however, with the CSR representatives rejecting a new Japanese proposal and withdrawing their April offer which coupled an extension of the contract by three years with a reduction of the current price but an increase over the remaining term.

It was reported[2] that the Japanese Government might help their negotiators reach an amicable agreement to amend the agreement but that it would await their return before disclosing any plans. It has always been the view of CSR that the Japanese Government would have to become involved to alter sugar import regulations, so making Japanese refined sugar more competitive with other sweeteners, and this had been a condition of the April offer.

Talks were resumed but broke down again with neither side prepared to compromise. Industry sources in Japan are reported[3] to have said that refiners are considering refusing to take delivery of any cargoes which are now shipped; but the CSR plans to continue with the contract as it stands, feeling that the buyers have no lawful right to breach the signed agreement.

Mexico sugar supplies[4]

Mexico's official sugar crop target was 2,750,000 metric tons but unusually heavy rains in many areas have already cut the crop estimate to 2,580,000 tons, according to JESUS GONZÁLEZ CORTAZAR, President of the National Union of Small Cane Growers. Demand is expected to be between 7 and 11% higher than last year and is currently set at 2,500,000 tons. Thus, not only will Mexico be unable to export any sugar, but if there was any further variation in the harvest before July, through weather or strikes, production will be slowed and imports of sugar may be necessary. There might also be milling hold-ups since the country's 66 sugar factories work at a maximum of 70% of capacity owing to obsolete equipment.

Sugar was once one of Mexico's top exports but it has not been sold overseas since late 1975, owing to rising domestic demand and static acreage following lower world prices. Last year a Mexican Government organization borrowed 170 million dollars from US banks towards a $400 million project to build six new mills and expand another. Government officials estimated that Mexico will then resume exports in 1978/79.

* * *

Peru sugar industry emergency

The Peruvian Government has taken control of five sugar cooperatives and introduced a package of measures which radically transform this sector[5]. Four days after the Sugar Cooperatives Central Authority (CECOAAP) asked the Government for aid in coping with the economic and financial crisis facing the industry, a Decree-Law was issued on 17th March, declaring a state of emergency in the industry, intervening five cooperatives and placing Government supervisors in eight others, banning all strikes and stoppages in the cooperatives for a year, limiting social investments except where strictly necessary, and restricting overtime payments and hiring of new workers to what has been specifically approved by the Government.

In an effort to alleviate the industry's economic plight, the Government also lifted the sugar cooperatives' June 1976 tax of 15% on the f.o.b. value of exported sugar, and authorized a 15% increase in the domestic price. In addition, the Government granted CECOAAP an endorsement of $20 million to guarantee their financial transactions.

CECOAAP argued that the industry's main problem was the low domestic price of sugar which aggravated the problem of the low international price. A report by the Ministry of Agriculture, on the other hand, argued that the major causes of the industry's financial crisis were wage increases which bore no relation to those of workers in other sectors of the economy, unwarranted overtime pay, too many long-term interest-free loans granted to cooperative members, and heavy social expenditure.

It was later announced[6] that sugar exports would be controlled by the State to avoid losses due to improper policies and bad management.

[1] *The Sugar Situation*, 1977, (313).
[2] *Public Ledger*, 18th June 1977.
[3] *ibid.*, 2nd July 1977.
[4] *Reuters Sugar Rpt.*, 21st February 1977.
[5] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (10), 9–10.
[6] *ibid.*, (11), 19.

Waste water treatment and related problems

By H. R. BRUNNER

(Zuckerfabrik Raffinerie Aarberg AG, Switzerland)

Paper presented to the 23rd Tech. Conf., British Sugar Corp. Ltd., 1976

PART I

Introduction

WATER is the most necessary element on this earth. Mankind has needed many centuries to realise that it is not because of this fact alone that it becomes vital to preserve the waters and groundwaters of the world for future generations, but rather because of the compelling urgency of the matter. Even just a few years ago there were still many industries that never gave a thought to water supply or sewage treatment.

The following facts should especially be borne in mind when considering water supply and sewage disposal:

constantly rising pollution of surface water,

constantly rising fresh water demands and correspondingly high water costs, and

constantly stricter laws governing the supply and disposal of water in highly industrialized countries.

In searching for a solution, one must, however, attempt to reconcile the justifiable measures of the authorities with industrial and economic possibilities.

It is certain that, in the near future, the sugar industry must undertake an intensive effort to eliminate its waste products to the satisfaction of the authorities, industry, agriculture and nature.

It is equally clear that the expenses incurred in obtaining sugar as an end-product thereby must be met by the consumer.

General observations and historical perspectives

Switzerland has become aware of its position as the surge chamber of Europe and has undertaken to preserve water purity. Consumption of fresh water amounts to 490 litres per head per day and 92% of all domestic and industrial waste water flows through communal or municipal sewage disposal plants. The level of water pollution reached a peak in 1965; since then rivers and lakes have noticeably improved, and we are convinced that all the waters of Switzerland will be cleansed within a few years.

On the basis of the example set by the Aarberg sugar factory, an attempt is made in this paper to prove how it is possible to run a sugar factory more or less emission-free.

Aarberg is situated in the Bernese lakeland, between the Jura and the Alpine foothills. The river leaves the valley at Aarberg to cross a wide plain. As a result of a slight drop in water flow, and particularly because of the backwaters of other river-mouths, the area north of Aarberg was overrun and devastated by massive floods up to the 19th century. Seeking a course, the river formed a great delta in which its passage was continually obstructed by silting. In 1878 the river Aare was channelled and diverted into the lake of Bienne which, together with the lakes of Neuchatel and Morat, served the purpose of a reservoir.

In 1898 the site of the Aarberg Sugar Factory was chosen with the intention, in the course of time, of reclaiming the delta (which had eroded on to the gravel land) for cultivation of beet. Silting in the desolate plains gradually gave rise to an arable land with many picturesque villages. From the beginning the factory has concerned itself with the question of sewage purification and, from 1940, experiments have been conducted with bio-filters and bio-aeration, the application of which has been delayed by reasons of costs, owing to the enormous rate of flow—ca. 40,000 m^3 per day (9 million gallons/day).

In the post-war years, these experiments were continued, the main concern being the possibility of bringing the flow of water under control by means of closed recirculation processes. In 1965, the change-over from one-way water usage to a recirculation system was successfully achieved. The determining modifications in procedure involved:

recirculation systems for beet transport and washer water after the insertion of sewage disposal plants in order to segregate unremoved contaminants,

recirculation systems for condenser water, and

continuous extraction with recirculated press water.

This recirculation has led to drastic changes in the quantity of effluent per unit weight of beet processed. Referring to specific amounts of organic contaminants in the waste waters, noticeable improvements have been made. Until the change-over, there was a greater volume of relatively unpolluted water whereas, after the change-over, there was considerably less but more highly concentrated effluent.

The solid matter content of a sugar factory's waste water is comprised of a large number of inorganic and organic, dissolved and undissolved compounds, that can be classified with reference to their significance in the problem of the pollution of subterranean waters (Table I).

Sewage disposal from sugar refineries as effluent producers has always been an extremely serious problem, which has been given far too little attention, on the one hand because of the large quantities of water and, on the other, because of the high concentration of undecomposed organic matter. The sole satisfactory solution is a complete aerobic, biological purification plant to eliminate dissolved organic contaminants. This has repeatedly been rejected, for lack of adequate technical knowledge and, more recently, for economic reasons.

In 1967, Aarberg was one of the first factories in the world to install a biological sewage system, and has undertaken extensive aerobic biological purification of its waste water.

Hydrochemical results of human influences in groundwater areas

The chemistry of groundwater, i.e. its content of mineral components is, above all, influenced by the

Table I

Substance group	*Behaviour of water during percolation*	*Effect on groundwater*
Undissolved		
Inorganic: sand, humus-particles, lime silt *Organic:* beet tissue, separated protein, etc.	Formation of a sandy-earthy sediment on the soil surface Gradual microbiological decomposition of the organic constituents on the spot	None or only little
Dissolved		
Sugar and its by-products, soluble material from beet tissue (saponin, amino-acids, inorganic ions)	Infiltration into the ground water. Microbiological decomposition during infiltration and in the ground water	Oxygen depletion, CO_2 replenishment. Solution of minerals. Replenishment of incompletely decomposed organic compounds

nature of the minerals over which it flows and their solubility.

This solubility depends on the pH and the oxidation-reduction potential of the waters passing over them. Different factors influence the properties of the water.

Table II gives a summary of some of the typical dissolving reactions and Table III illustrates how the oxidation-reduction potential of a stretch of water can be changed by organic contaminants.

Table II. Dissolving reactions

$$2NaAlSi_3O_8(c) + 2CO_2 + 11H_2O = 2Na^+ + 2HCO_3^- + 4H_4SiO_4 + Al_2Si_2O_5(OH)_4(c) \quad (1)$$

$$CaCO_3(c) + CO_2 + H_2O = Ca^{2+} + 2HCO_3^- \quad (2)$$

$$FeCO_3(c) + CO_2 + H_2O = Fe^{2+} + 2HCO_3^- \quad (3)$$

If organic matter infiltrates the groundwater, then the CO_2 content is raised owing to the oxidation of the organic substances (Table III) and, because of this, the dissolving reactions are intensified. With a progressive organic substance load the following sequence is observed:

The oxygen concentration decreases.

Parallel to this, the concentration of dissolved CO_2 increases.

As a result the hardness and carbonate hardness is raised.

After the oxygen is completely used up, a further reaction with organic matter leads to a reduction in manganese oxide, whereby bivalent manganese goes into solution.

Nitrate is reduced to elementary nitrogen and to ammonium ions.

Insoluble ferric iron oxide is reduced to soluble ferrous iron.

If very low oxidization-reduction potentials are reached, then the constantly present organic matter can reduce sulphate to hydrogen sulphide.

Table III. Progressive decrease in the oxidation-reduction potential of groundwater by organic substances. Sequences of reaction with carbohydrate (simplified to CH_2O)

Oxygen consumption

$$CH_2O + O_2 = CO_2 + H_2O \quad (1)$$

Denitrification

$$5\,CH_2O + 4NO_3^- + 4\,H^+ = 5\,CO_2 + 2\,N_2 + 7\,H_2O \quad (2)$$

Nitrate reduction

$$2\,CH_2O + NO_3^- + 2\,H^+ = 2\,CO_2 + NH_4^+ + H_2O \quad (3)$$

Formation of soluble manganese by reduction of manganese oxide

$$2CH_2O + 4MnO_2(c) + 8H^+ = 2\,CO_2 + 4\,Mn^{2+} + 6\,H_2O \quad (4)$$

Fermentation reactions

$$3\,CH_2O + H_2O = CO_2 + 2CH_3OH \quad (5)$$

Formation of soluble iron by reduction of ferric oxides

$$CH_2O + 4\,Fe\,O(OH)(c) + 8\,H^+ = CO_2 + 7\,H_2O + 4\,Fe^{2+} \quad (6)$$

Sulphate reduction, formation of hydrogen sulphide

$$2\,CH_2O + SO_4^{2-} + H^+ = HS^- + 2\,CO_2 + 2\,H_2O \quad (7)$$

Formation of methane

$$2\,CH_2O = CH_4 + CO_2 \quad (8)$$

As a significant consequence of loading the groundwater with organic substances, the following must be observed: hardening (increase in both calcium and carbonate hardness), the decrease in content of dissolved oxygen and the appearance of soluble iron and manganese.

Table IV shows comparative measurements of normal drinking water and the same water in the influx area of a sugar refinery.

Table IV

Chemical properties	*Normal drinking water*	*Loaded drinking water*
Carbonate hardness, frz.	<25	>40
Chloride, $\mu g.cm^{-3}$	<10	>30
Nitrate, $\mu g.cm^{-3}$	<10	>45
Oxidation, $\mu g\ KMnO_4.cm^{-3}$ ..	< 2	> 6
Iron, $\mu g.cm^{-3}$	$< 0{\cdot}1$	> 1
Oxygen saturation, $\mu g.cm^{-3}$ ..	> 6	< 2

The chemical composition of the groundwater is predominantly influenced by the following three particular factors associated with human activity.

Normal influence of agriculture and the usual fertilization of the soil.

Influence of stronger local contaminants, especially the percolation of domestic sewage and silage water.

Influence of massive percolation of industrial sewage.

Specific pollution can be detected, for instance, by evidence obtained from the hydrochemical structure of the groundwater flow or from a specific tracer like Cl.

Waste Water Treatment

Water balance

In a closed recirculation process, with strict limitations on the use of fresh water, lies the basis for an economical water balance. Separation of polluted from unpolluted waters should therefore be taken into consideration in order not to overload the biological sewage treatment works hydraulically (Fig. 1).

The primary treatment (sedimentation)

During primary treatment, undissolved substances such as soil, sand, etc., are removed from the waste water. Aarberg sugar factory brought the sedimentation process into service, in 1965, as the initial stage

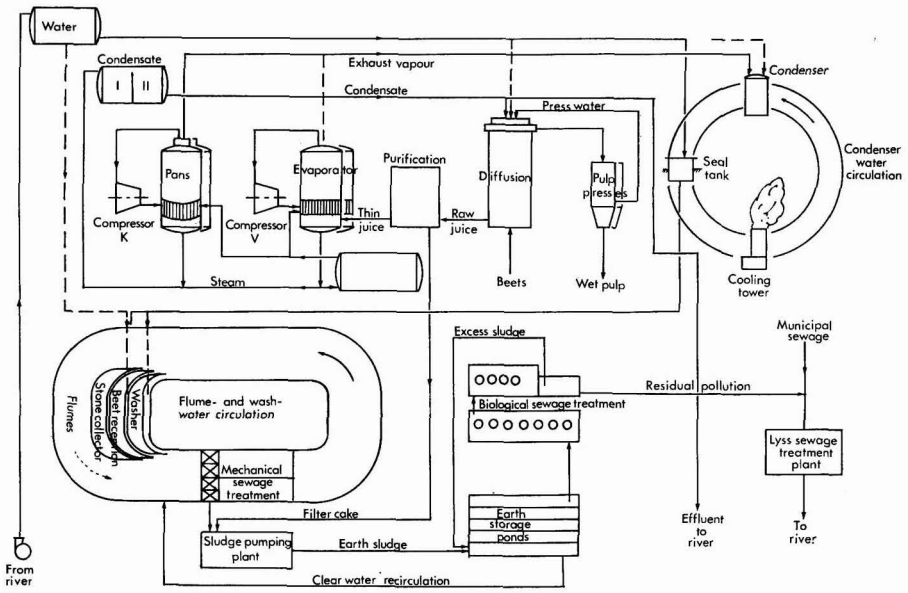

Fig. 1

of a water purification campaign. After passage through a vibrating sieve (aperture 2 mm), the high density substances settle in two sedimentation tanks, each with a capacity of 1250 m³, during a retention time of about 2 hours and are slowly pushed by the sludge scrapers into silting points. The mud, concentrated into the silting points, is forced into sludge bunkers, where filter cake is added. This mixture of water, sand, earth and beet tails, etc. is pumped at a rate of 30,000–35,000 $cm^3.sec^{-1}$, at pressures of between 3 and 6 $kg.cm^{-2}$ through a 150 mm-diameter pipe for a distance of 1·5 to 2·5 km to the storage ponds. Clear water from the primary treatment is sent to clarification basins, from which 14–16 $m^3.min^{-1}$ is pumped back into the flume water network at pressures of 3 to 4 $kg.cm^{-2}$.

Storage ponds

The suspension, after being pumped to the storage area, is settled. Part of the clear overflow is brought back into the flume water cycle and the remainder injected into the biological sewage treatment works to be decomposed, after undergoing 36 hours of anaerobic stabilization.

Biological purification process

Of the various processes—with the exception of direct irrigation, or use of the Emscher tank, carp ponds, and bio-oxidation channels—the two kinds chosen, in the main, for larger systems are the bio-filter process and the biological sludge process.

The bio-filter is mostly a round basin, filled with fist-sized slag cakes (these days, also made of plastic), over which the waste water is sprinkled. After a certain time, a biological bacterial slime forms on the surface, which decomposes the polluting matter in the sewage. To provide sufficient air, slits are made in the bio-filter. The filter effluent is then transferred to a sedimentation tank, where it is separated from the silt that has been drawn in with it.

The biological sludge process involves the purification of waste water with a "bio-mass", predominantly composed of flake-forming micro-organisms (mainly bacteria) which, together with dissolved oxygen, is intensively mixed with the sewage. The micro-organisms of the biological sludge come into constant contact with the organic contaminants of the sewage and with oxygen. SEIDEL's experiments, using *Scirpus lacustris*, are based on the principle of decomposing the organic load of the sewage through the growth of higher plant life.

The processes of biological purification of sewage thus take place under aerobic conditions, i.e under the condition that free oxygen be present in the waste waters.

The aim of the biological process of sewage purification consists of preventing putrescence of the organic substances through the activity of the organism. There are two approaches: oxidization of the putrescible organic substances, leading to a mineralized end-product such as CO_2, N_2O, N_2O_5 or P_2O_5; and admission of the organic substance into the inner compound and conversion to a specific compound.

Technical conditions should be striven for, by which only the necessary minimum of oxidation is undertaken in reaching an optimal assimilation result. The removal of the organic substances from the sewage is only guaranteed when they have been transformed into a bacterial growth.

Oxidized substances (mineralized end-products) are water-soluble and reach the receiving water together with the purified sewage and there cause secondary pollution.

Fundamentally, such substances can only be removed through the activity of the organisms, which have a biological importance, in that they form specific compounds or produce energy. The organic substances on which the organisms (heterotrophe forms) survive are carbohydrates, fat and albuminous matter, which is sufficiently present in domestic sewage. For such organisms that form organic substances from inorganic substances, there are not normally enough nutrients to be found in domestic sewage. Moreover, the environmental factors are generally unfavourable.

Apart from the demand for nutrient, the maintenance of optimal physical and chemical conditions (pH, temperature, etc.) is also required. As the environmental needs of each organism are different, various biological communities (biocoenoses) in various environments (biotopes) must be met with. The biochemical reactions that lead to the oxidization or metamorphosis into specific compounds are basically the same for all heterotrophic organisms.

The cell walls (and also the body casing of the bacteria) have a selective capacity and can hinder the passage of substances in both directions. The passage of organic substances is only possible if the molecule does not exceed a certain size. For a carbohydrate chain, this is about 8–12 C-atoms, depending on the nature of the substance. Large formations must be split open by the action of hydrolytic enzymes outside the cell.

Oxygen is only required for the reaction inside the cell. A closed cycle between the formation and decomposition of organic substances is provided in a natural, uninfluenced environment. By the activity of autotrophic organisms, organic substances are formed from inorganic substances, and serve the heterotrophic organisms as an energy source, being changed through oxidation back to their original inorganic form. Autotrophic substances, thereby, free the oxygen, which is then reused by the heterotrophic organisms. In technical processes only the heterotrophic compounds of the nutrient cycle are present. The decomposition of the putrefiable organic substances found in the sewage is performed by bacteria. All remaining types of organisms (e.g. protozoa) are able to survive only through a series of reactions.

The oxygen needed for the preservation of an aerobic environment can be brought into the sewage by compressors and ventilators using open tubes and diffused air aeration or by rotating equipment such as paddles, centrifugal or brush aeration (surface aeration).

Aarberg biological sewage treatment plant

Since its campaign in 1967/68 the Aarberg sugar factory and refinery has used a biological sewage treatment system for the purification of its factory waste water. This includes a biological sludge plant with surface aeration and secondary switched right-angle clarification basins with swinging shield scrapers. This plant was designed for a BOD decomposition of 85% at a load of 8·6 tons BOD/day (Lurgi System, Frankfurt). The available aeration space consists of 4200 m³. The secondary clarification basin has a volume of 690 m³.

The oxygen required for biological decomposition is brought in by 11 "Vortair" surface aerators. The oxygen intake is about 1000 kg/day per aerator. The aerators simultaneously ensure complete mixing and prevent sludge sedimentation on the floor of the basins by means of the resulting turbulence. The oxygen intake can be adjusted to the polluting load by altering the depth of immersion. The aerators are installed on mobile steel bridges and are served by the central control board.

The water-sludge mixture flowing out of the aeration basin is brought into the secondary clarification basin under a downflow baffle and streams through it longitudinally. The downflow baffle ensures an equal distribution of the intake over the whole width of the basin. The silt flakes sink, on account of their high density, and are pushed into collecting troughs situated in the central basin by the movable swinging shield scrapers. From here, the falling silt is continuously sucked up by submersible pumps mounted on the scraper beams, and dispatched into a return-sludge trough in the basin wall. Most of the biological sludge is taken back into aerator basins, in order to maintain constantly the correct level of biological sludge concentration. The surplus sludge is sucked out of a sump, situated at the end of the collecting troughs, by a pump and is then dispatched to open storage ponds.

The clear water that has now been freed of solid matter overflows into an outlet trough and from there along an outlet channel to the sewage treatment works in Lyss.

With sugar factory sewage, we are concerned with a waste water that offers a very one-sided nutrient value for the micro-organism. There is practically no phosphorus and nitrogen is only present in insufficient quantities, so that addition of those elements is essential and these and trace elements such as iron are best added in the form of a solution. Results of the treatment are indicated in Table V.

Table V

	1974/75	1975/76
Processed beet quantity, tons	286,034	237,400
Average daily processing, tons	3442	3734
Sewage quantity, % on beets	16·4	13·1
Load		
inflow, kg COD on beet	0·89	1·07
outflow, kg COD on beet	0·02	0·02
Decomposition, %	97·7	98·1
Energy consumption		
aeration alone, kWh/kg COD ..	0·76	0·87
total biological sewage treatment works, kWh/kg COD.....	1·56	1·78
Chemical consumption		
g N / kg COD	31·7	29·4
g P / kg COD	8·1	7·8
g Fe / kg COD	1·6	1·5
COD / BOD	1·7	1·7

The following investments were made for sanitation in the sewage department:

		Swiss Fr.
Mechanical sewage treatment works	1964/65	2,300,000
Cooling tower	1967	350,000
Biological sewage treatment works	1967/68	1,300,000
Improvement of the sewage balance	1968/75	*ca.* 1,500,000
Total		Swiss Fr. 5,450,000

The burden on sugar through external costs is about S.Fr. 0.03/kg.

(To be continued)

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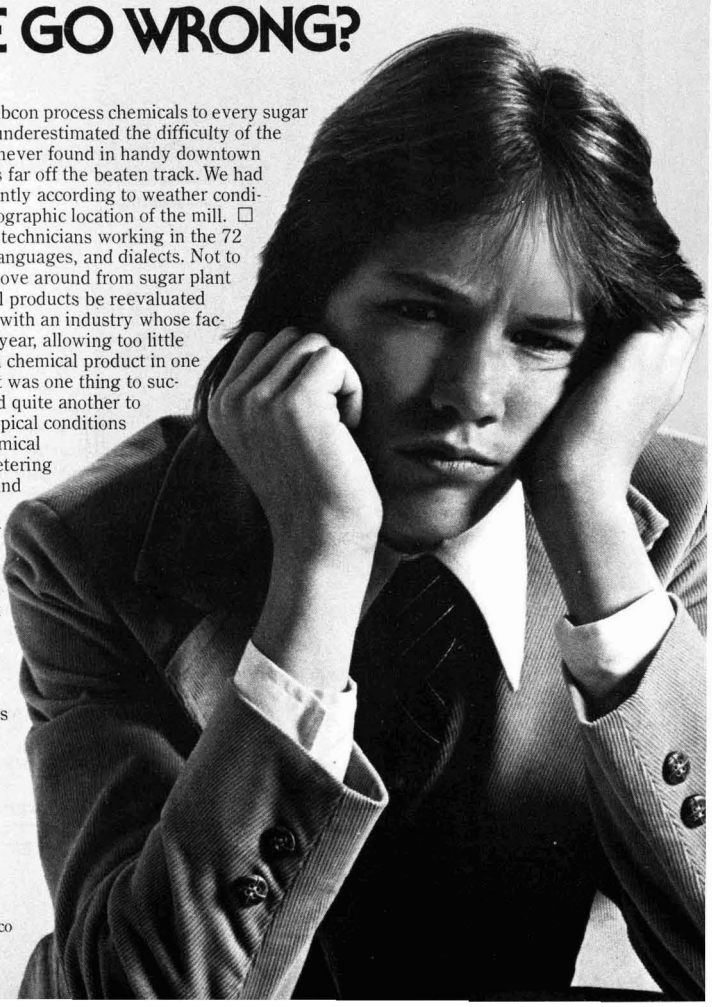

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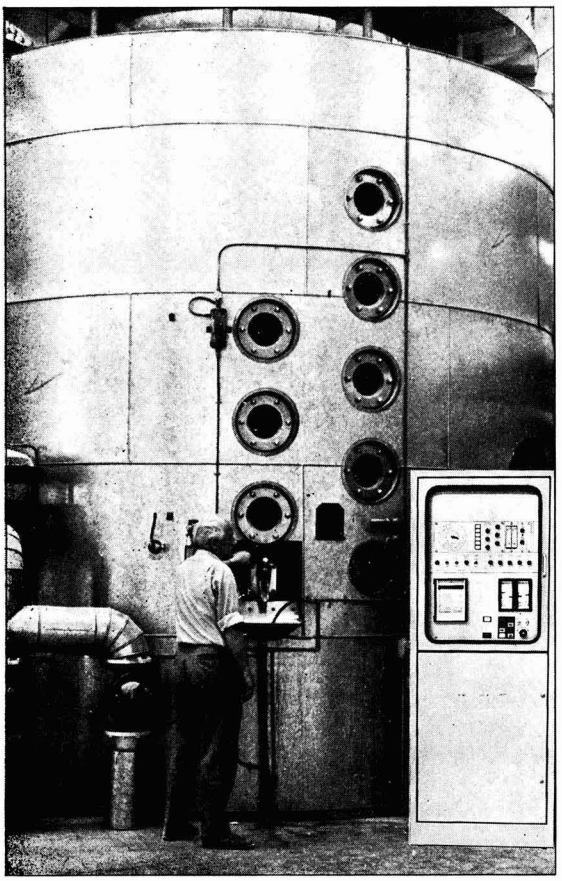

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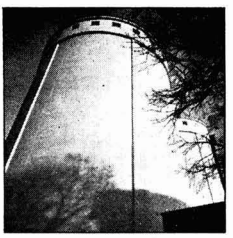
Sugar boiled in the DDS Vacuum Pan contains less than 5% conglomerates as compared to 30-50% from conventional pans. Get detailed information, use the coupon.



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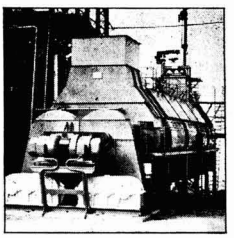
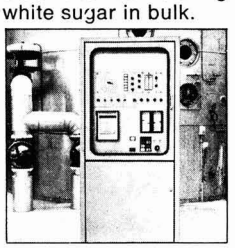


DDS Diffuser.



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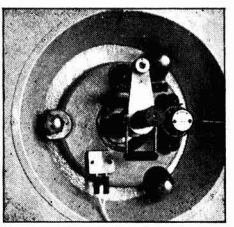

The direct view DDS Pan Microscope.

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- ☐ DDS Beet Diffuser
- ☐ DDS Silo
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The 28th UK National Sugar Beet Spring Demonstration, 1977

THE 28th UK National Sugar Beet Spring Demonstration was held at Waddingham, near Brigg, Lincolnshire, on 2nd June 1977. The Spring Demonstration (like its sister event, the Autumn Demonstration) is an annual event organized by the British Sugar Corporation and the Agricultural Development and Advisory Service under the auspices of the Sugar Beet Research and Education Committee of the Ministry of Agriculture, Fisheries and Food, and is financed by means of a levy paid by growers and processors. It offers visitors the opportunity to see beet agricultural machinery in operation as well as the latest equipment available to growers, and provides information on various aspects of beet agriculture and research.

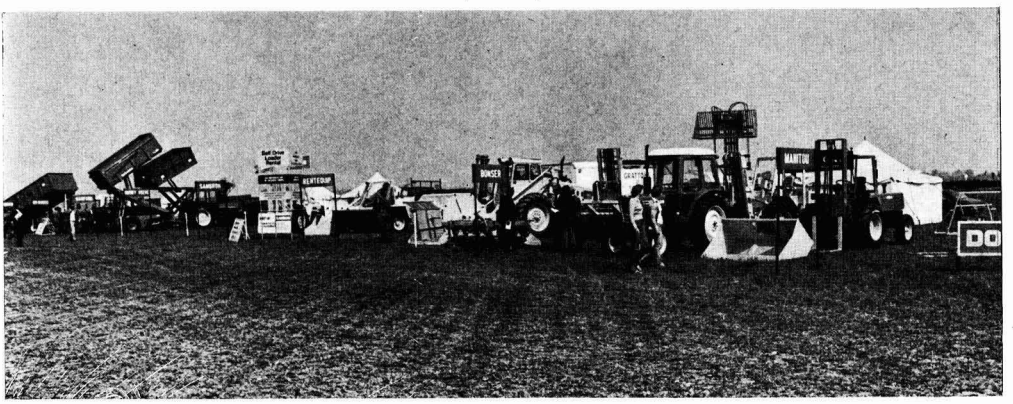

Fig. 1. Static exhibits at Sugar Beet Spring Demonstration

There was a record entry of 65 operating machines and more than 100 static exhibits at Waddingham, and an estimated 4500 visitors were present at the show, including 120 members of the Institut International de Recherches Betteravières (IIRB). The farm has about 131 ha under beet and is one of four owned by the same group which supplies beet from 287 ha to three sugar factories. Most of the 10 ha of the trial and demonstration area was laid out and drilled by the agricultural staff of Brigg sugar factory using a 5-row drill on a row width of 50 cm, while the main crop areas were sown with pelleted monogerm seed by members of the BSC Agricultural Development Field Station using a self-propelled 15-row precision drill on a row width of 50·8 cm, drilling being completed by 14th April. Application of a pre-emergence herbicide mixture of "Pyramin" and "Betanal" contributed to good beet emergence, as was clearly seen by the even rows with very few gaps, but the cold conditions applying in East Anglia have created problems with post-emergence herbicide treatment, according to a spokesman for the British Sugar Corporation.

A special exhibit on irrigation prepared by the Agricultural Development and Advisory Service and Broom's Barn Experimental Station attracted great interest, since it provided much information on the economics, effects, scheduling and future trends of irrigation as well as equipment and techniques. The advantages of irrigation will obviously depend greatly on the rainfall pattern in a particular area as well as the soil moisture retention properties, but from examination of the economics it has been found that even on light, drought-prone land it is most unlikely that a comprehensive irrigation scheme, with permanent mains, etc., would be profitable if it were installed only for beet; however, it has been demonstrated hypothetically that, if a scheme is planned for a high-value crop like potatoes, it can be profitably expanded to include beet irrigation.

The section of the demonstration concerned with drilling included twelve drills. Examples of commercial models are shown in Figs. 2, 3 and 4.

Illustrated in Fig. 5 is an experimental drill designed by the National Institute of Agriculture Engineering which has been used in research with various crops, including sugar beet, to investigate practical problems of crop establishment.

Fig. 2 Stanhay "Jumbo" 5-row precision drill

Fig. 3. Nodet "Pneumasem II" pneumatic 5-row precision drill

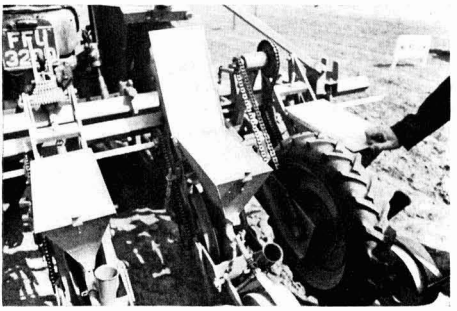

Fig. 4. Armersalmon "Unispace" 5-row precision drill

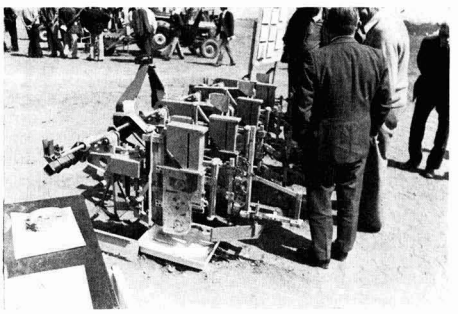

Fig. 5. NIAE experimental drill

Fig. 6. Edwards "Rotatilth" high-speed harrow

The drill incorporates means of highly-accurate seed metering and delivery, and allows for variations in the soil environment; provision is made for dry or cloddy surface soil to be moved aside so that a furrow can be opened with a non-smearing furrow opener in the moist underlying soil. A single-depth control wheel mounted adjacent to the cutting edge of the furrow opener gives accurate depth of opening even on undulating surfaces. A seed press wheel running inside the opener presses seeds into contact with moist soil and at the same time leaves them so that they will not be displaced by the soil moved in by the coverer. An angled coverer blade with its own depth control wheel or skid running in the track of the unit depth control wheel covers with moist soil only or with moist soil followed by dry soil; it gives accurate depth of covering, which, together with accurate depth of opening, ensures a precise sowing depth.

Fig. 7. Soil levelling

Fig. 8. Seedbed preparation machinery

Fig. 9. CTM Engineering beet cleaner/loader

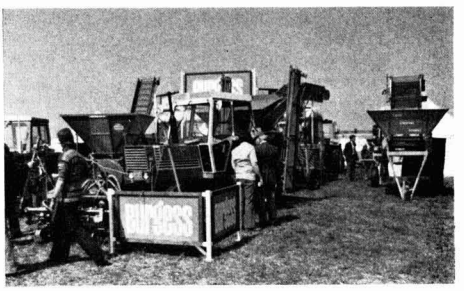

Fig. 10. Burgess beet cleaner/loaders

An assessment of drill performances on 4th April showed that at target speeds of 3·2 km.hr^{-1} (2 mph) and 4·8 km.hr^{-1} (3 mph) the experimental drill gave

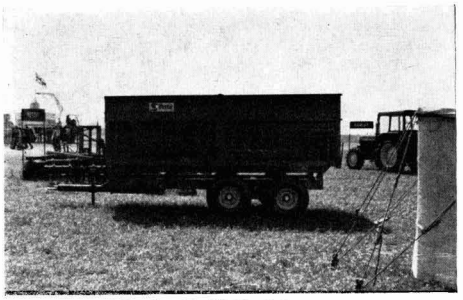

Fig. 11. F. W. Pettit beet cart

the highest seed rate (kg.ha^{-1}) of seven machines tested and the lowest number of seedlings per 100 seeds.

Nineteen pieces of seedbed preparation equipment were demonstrated. Generally, good results in levelling and size reduction were achieved on the very dry soil as demonstrated by the illustrations (Figs. 6 and 7).

Fig. 8 shows a number of the various pieces of seedbed preparation machinery demonstrated.

Although the demonstration was obviously concerned with beet spring work, a number of static exhibits comprised equipment more pertinent to the harvest end of the crop, e.g. beet cleaners (Figs. 9 and 10).

Beet transport equipment was in evidence (Fig. 11), as were some harvesters, including the fine Ransomes self-propelled 2-row machine shown in Fig. 12.

Fig. 12. Ransomes self-propelled 2-row beet harvester

Films on beet sugar manufacture ("Sun crystals" and "Sugar from beet"), produced by the British Sugar Corporation, were shown in the cinema tent, as was "The cooperative business", a film made jointly by the BSC and *Farmers Weekly*.

It will be interesting to see how the beets have fared throughout the season and how harvesters perform in the Autumn Demonstration which will be held at Waddingham towards the end of October 1977.

Correspondence

To the Editor,

The International Sugar Journal.

Sir:

Concerning the interesting paper, "Improvement in Molasses Exhaustion," by GENOTELLE, MOTTARD and BONNENFANT, which appeared in the March and April 1977 issues of this *Journal* (also in *Sucr. Belge*, 1976, **95**, 343) I would like to make the following comments:

(1) Part I, page 65, first sentence: "To ascertain the exhaustion of molasses, something other than the purity value of the molasses is needed". If the authors mean "completeness" of exhaustion, I am in agreement. Otherwise, molasses purity is a reliable measure of the weight of sucrose which leaves the factory with each weight of non-sucrose. The complexity of the axis-intercept method takes it out of the comprehension of the factory technician.

(2) Part II. 'Vertical crystallizers (mixers) apparently require massecuite of low viscosity (compacity), possibly because of the mechanical stress on the horizontal cooling grids from a very viscous massecuite. In my opinion, too-high massecuite viscosity can best be relieved by a higher temperature pattern, together with an increased dry substance content to maintain the desired supersaturation. If, owing to an unduly high massecuite purity, a very high crystal content makes increase of temperature pattern insufficient, it is better to return final molasses as a diluent, or to use pre-purging as is common with the vertical crystallizers.

The work of KARADZIC and TEREK [*Sekera*, 1973, (Dec.), 47–50] confirmed other information that, at constant supersaturation, the viscosity of the syrup phase changes very little with reasonable variations in temperature or dry substance.

SILINA (*Sakhar. Prom.*, 1966, **40**, (9), 15–18) has shown that water is by far the most melassigenic non-sucrose in molasses. Every amount of water added in cooling will be present in the final molasses, with sucrose dissolved in it. All crystallization should be done as far "upstream" as possible for more rapid crystallization rates, which GENOTELLE *et alia* state "increases to a maximum which seems to be 75/80°C", but which I believe is still higher.

The supersaturations carried in their crystallizers are unusually low; in the USA we try to keep these in the range 1·2–1·4, and more crystallization results. California factories have a standard goal of 57 purity (single-acid Clerget/1:1 diluted rds) and they are frequently in the 56–57 range. No water is added during cooling and the NS/W ratios are kept around 3·0.

If the massecuite viscosity must be reduced to meet equipment constraints, surely this can best be achieved using molasses from which air bubbles and fine grain have been removed, instead of water. The vertical crystallizers are apparently using both.

Data at hand from the Caro, Michigan, factory of Michigan Sugar Co., which dilutes with molasses between series-connected horizontal crystallizers, show that an average purity of about 55 was maintained through the major part of the 1975–76 campaign.

In any case, the addition of water during cooling cannot be practised without raising the "normal" molasses purity at the centrifugals.

Yours truly,

May 27, 1977. R. A. MCGINNIS.

Sugar Industry Technologists 1977 Meeting

THE 36th Annual Meeting of Sugar Industry Technologists Inc. took place in San Francisco during the 15th–19th May 1977. Over 200 members, many accompanied by their wives, gathered at the Golden Gateway Holiday Inn during the weekend. Countries represented included Brazil, Canada, Chile, India, Malaysia, South Korea, Taiwan and the UK as well as the host country, USA. After registration the ladies were able to learn of the programme devised for their entertainment by Mrs. ANN PATTERSON, wife of R. STUART PATTERSON, of C & H Sugar Co. Inc., who organized the local arrangements admirably.

Members were able to study their own programme before gathering for the annual "mixer" on the evening of 15th May; the programme itself started the following morning when Mr. PATTERSON introduced the President of S.I.T. for 1976/77, A. M. BARTOLO, of Imperial Sugar Co., Texas. The President welcomed members to the 36th Annual Meeting and called on Mr. S. GEORGE to chair the first session. This began with a paper by LEON ANHAISER describing the bulk handling of a variety of dry materials in the Imperial sugar refinery and the means used to overcome dust and other problems, for instance in the case of lime, starch and filter aid. MIGUEL A. MUÑIZ then provided a comprehensive view of packaging in polyethylene, a new and expanding form of container for retail quantities of brown and packaged sugars. The author described various equipment and packaging techniques used and emphasized the need for an open mind in considering such new concepts.

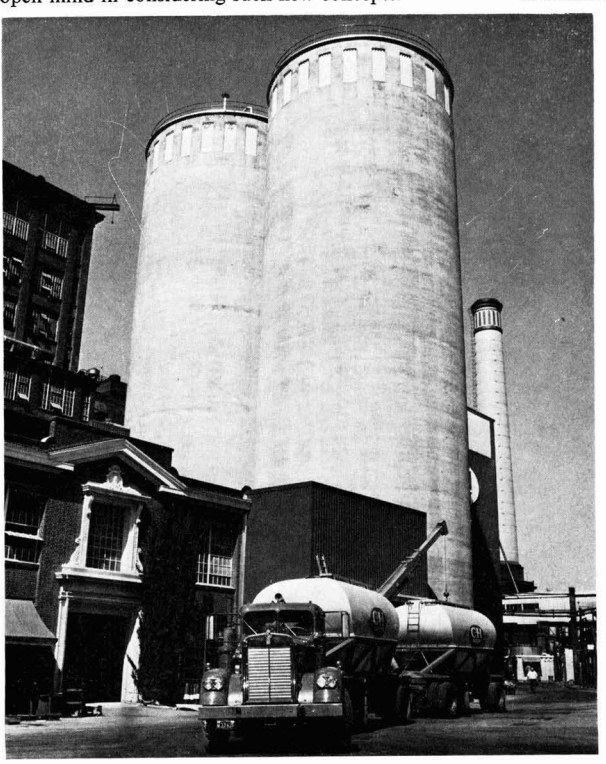

Fig. 1

After a coffee break, WILLIAM F. BARTON described experience at Atlantic Sugar Ltd., Canada, with the "Talofloc"–"Taloflote" system of liquor decolorization which was not successful when applied to the refinery's existing Williamson clarifiers. Trials then carried out using a 10 tons.hr^{-1} Talo-designed clarifier proved so successful, however, that a full-scale unit has been ordered. E. W. BECK and JAMES H. FISCHER then described the Beet Sugar Institute, established by the Beet Sugar Development Foundation in order to provide training of sugar industry personnel which would give them an improved technical background in either or both the "beet end" and the "sugar end" of factory processing to white sugar.

Luncheon followed, and FRED BRUDER of SuCrest Corporation then took the Chair, introducing ALLEN M. JAMES, of Tate & Lyle Ltd., who described arrangements as presently known for the 1978 meeting which is to be the first held outside North America. It will be centred on the London Hilton Hotel and will include visits to the Silvertown refinery and Tate & Lyle's Research Centre at Reading. Subsequently a description in three parts was given of a comparison of two types of automatic saccharimeter—the Schmidt & Haensch quartz wedge-type "Saccharomat I" instrument and the Rudolph Research rotating-analyser "Autopol" instrument. Dr. RICHARD SPANIER of Rudolph Research described the two instruments and their differences, WALTER F. ALTENBURG of the New York Sugar Trade Laboratory described the experiments conducted, using two instruments of each type, and JOHN LOPEZ-OÑA of the National Sugar Refining Co., Philadelphia, discussed the statistical evaluation of the results obtained. It was concluded that all four saccharimeters performed equally well and that there were no significant commercial differences between them.

In the evening the Banquet was held, with NEIL PENNINGTON of C & H Sugar Co. as Master of Ceremonies. The President, A. M. BARTOLO, gave an address of welcome to those assembled, and announced that two new Corporate members had joined the Society and seven associate corporate members, bringing the totals to 51 and 37, respectively. One hundred more individual members had joined, bringing the total to 584. He called upon KENNETH R. HANSEN, Chairman of the Award Committee, to present the George & Eleanore Meade Award to JOHN LOPEZ-OÑA and EVERETT JONES, and this he did for their paper, selected as the best of the 1976 Meeting.

President BARTOLO then presented the S.I.T. Achievement Award in Sugar Technology to R. STUART PATTERSON, in recognition of his work in sugar refining over many years. The function then closed with the passing of the gavel to the President-Elect for 1977/78, KENNETH R. HANSEN of Amstar Corporation, New York.

Under the Chairmanship of HARRY FITZGERALD, of C & H Sugar Co., the next morning's papers were all concerned with laboratory automation and the use of small programmable computers. The

Fig. 2

first, by WARREN L. REED, of Revere Sugar Refinery, described the use of a Hewlett Packard programmable calculator coupled with a printer, while the process computer at Crockett refinery, described by S. L. KETTLEWELL and A. O. MAYLOTT, provides analytical data calculated from signals produced by laboratory instruments and displays the results on television screens located at six important places in the refinery. BRYAN L. KARREN of British Columbia Sugar Refining Co. described the features of the Hewlett-Packard 9830 computer used to automate the technical record system at Vancouver refinery, while a similar description of the use of a Texas Instruments SR-52 pocket-size calculator with an adaptable printer at the Redpath Montreal refinery was presented by RICHARD CORMIER and SALOMON L. ASSAYAG.

Fig. 3

Fig. 4

After the reception and Official luncheon which followed, ROBERT GERSTENKORN of Southdown Sugars took the chair and introduced MICHAEL J. FOWLER of Amstar Corporation, Chalmette, La., who presented a paper on the continuous detection of sugar in refinery waste waters. The thymol colour monitor as used in other Amstar refineries was not applicable owing to high turbidity of the river water and a natural side reaction which would analyse as 50 ppm sucrose; consequently a Technicon Monitor IV "Auto-analyzer" has been applied which uses a colour reaction with cupric-neocuproine under alkaline conditions. Operational uses and problems of both types were described. The last paper of the meeting was presented by JOSE A. S. BEZERRA, of Amorim Primo S.A., Brazil, who described the substitution of part of the bone char at his refinery with Suchar 681 granular carbon, which was entirely successful.

Fig. 5

Fig. 6

Fig. 7

On the following morning buses took members to the Crockett refinery of California and Hawaiian Sugar Co. where they were given guided tours through the plant. The refinery (Figs. 1, 2) is cooperatively owned by the Hawaiian sugar companies and raws are received in bulk from the islands in shipments generally of 8000–24,000 short tons, although a new bulk vessel can carry a 31,000-ton cargo. The ships are discharged at a rate averaging 900 tons.hr^{-1} by four gantries, each with a back-hoe (Fig. 3), and conveyed to two 18-ton Parsons scales. After weighing and sampling, the sugar is sent to a series of 9 flat-bottomed storage bins, each of 80 ft diameter and 76½ ft high, holding about 12,000 tons to give a total capacity of just over 110,000 tons (Fig. 4).

Sugar is withdrawn from the bottom of the bins through a slide-gate and carried by a belt conveyor via a scale and electromagnetic tramp iron separator to a 1200-ton bin. From this bin raw sugar is carried by bucket elevators to minglers on the 8th floor of the refinery, and the magma is fed to affination centrifugals on the 7th floor. Affined sugar is discharged to premelters on the 6th floor fed with sweetwater and steam. The entire process is under the control of a Texas Instruments 960A Minicomputer, governing raw sugar rate, magma consistency, centrifugal cycle times, washed raw liquor Brix and premelter steam flow.

The melt liquor, at 65°Brix, is sent to four flotation clarifiers and the clear liquor sent to the char house, while the scums are sweetened-off by two-stage clarification and finally use of rotary vacuum filters. There are 83 char filters each holding 1600 ft^3, wet-filled, and the char is in three grades. Supplementary decolorization is provided by a granular carbon system, and the decolorized liquor is then sent to a triple-effect evaporator which brings it from about 62 to 76–77% solids. White sugar is boiled in four strikes and the final syrup, of about 92 purity, used for boiling three remelt strikes.

The wet white sugar from the centrifugals is dried, mingled, screened and sent to storage above the packing house, and to a bulk refined sugar storage system holding about 8000 tons. Soft sugars are made from special blends of granulated sugar and liquor, while a Buckau-Wolf installation uses the SSA system for pressed cube manufacture and packaging.

After their tour the visitors to the refinery were taken back to Fisherman's Wharf by boat (Fig. 5) and so by bus to the hotel. The following morning's programme started with the showing of a film, made by the Spreckels Division of Amstar Corporation and entitled "Sweetness and Light", and showing the growing and processing of sugar beets. The members then were taken by bus to fields near Manteca (Fig. 6) where a harvester was demonstrated and questions answered by STEWART ANDERSON, District Agricultural Manager (Fig. 7). He referred to the severe drought suffered by California which had, however, not caused so severe a loss in yield per acre as might have been expected.

At the Manteca factory (Figs. 8, 9) lunch was provided and members taken in small groups through the plant, which operated for no less than 300 days in 1976. It has an 80 tons.hr^{-1} BMA tower beet diffuser and two Oliver-Morton units of 60 tons.hr^{-1} each. The fuel used is half natural gas and half oil. The factory is quite conventional except that a C.A.P. system is used for colour removal. Pulp is dried but sold loose rather than pelleted. After an interesting visit the members then returned in buses to San Francisco before departing for home after an enjoyable and useful meeting.

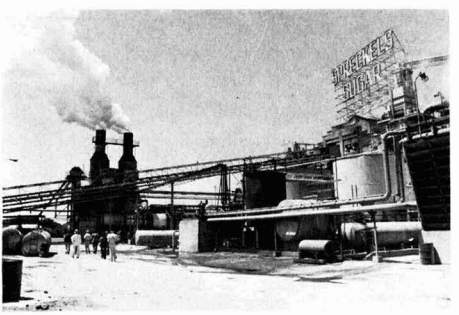

Fig. 8

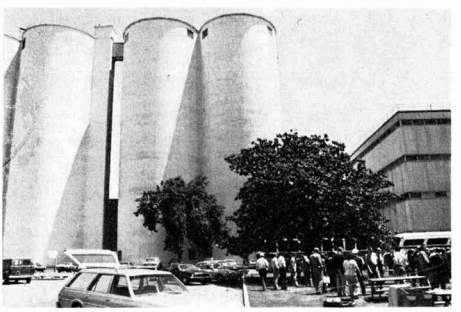

Fig. 9

Sugar cane agriculture

Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

Weed control in tropical areas: sugar cane. R. E. BISONÓ. *Shell in Agriculture*, 1976 (Nov.), 2–3.—A brief survey is presented of the herbicides used and weed species encountered in cane fields of the Dominican Republic. Heavy infestations (in some regions up to 50–60% of the total area) have been reported of *Panicum maximum* (guinea grass), *Rottboellia exaltata* (corn grass), *P. muticum* (para grass) and *Digitaria decumbens* (pangola grass). Considerable falls in cane yield have resulted. Suitable control of the first two weeds mentioned, together with a number of other grasses, has been achieved with "Bladex 50 S.C." + 2,4-D amine 72% (at 4·5 + 3 litres.ha^{-1}). "Bladex" + "Amitrole 24 EC" (3·5 + 3 litres.ha^{-1}) applied directly onto the weeds has satisfactorily controlled *P. muticum* between cane rows. A second application some weeks later is necessary to prevent re-growth of the rhizomes. In soils of "normal" organic matter content, "Bladex" + 2,4-D amine 72% + "Atrazine 50" (2 + 2½ + 2 litres.ha^{-1}) has given considerably increased residual action, while higher doses of "Atrazine" have been necessary where the organic content was high.

* * *

Intercropping cereals in sugar cane. S. H. GAWHANE and R. S. PATIL. *Indian Sugar*, 1976, **26**, 493–499. Intercropping of cane with maize had no significant effect on bud germination, but tillering and yield were reduced, while juice quality was improved by comparison with cane grown on its own. Soil N, P and K contents were unimpaired by intercropping, which was more profitable than cane alone.

* * *

Further spread of the sugar cane scale insect (*Melanaspis glomerata* Green) in Uttar Pradesh. K. M. GUPTA, B. N. PANDEY, R. A. SINGH, H. NATH and R. DAYAL. *Indian Sugar*, 1976, **26**, 505–506.—From examination of plant and ratoon cane deliveries in 11 sugar factory zones of U.P. during 1970-71 it was concluded that *M. glomerata* was spreading to new areas by comparison with a similar survey conducted in 1965–66. The average percentage of infested cane in each cartload inspected was also found to be greater.

* * *

Screening of sugar cane clones for resistance to smut (*Ustilago scitaminea* Syd.). H. D. LEWIN, S. NATARAJAN and S. D. RAJAN. *Sugarcane Pathologists' Newsletter*, 1976, (17), 1–3.—Details are given of the smut susceptibilities of 32 promising cane varieties screened in 1974–76 at Cuddalore Experiment Station in Tamil Nadu, India. None of the varieties was immune to the disease.

Pre-plant fungicidal dips—a long-term measure against smut. G. L. JAMES. *Sugarcane Pathologists' Newsletter*, 1976, (17), 4–5.—Treatment of 3-bud setts of N:Co 376 with one of a number of fungicides after dipping in a suspension of smut spores gave differing degrees of control (as expressed by the number of smut whips per ha in plant and ratoon cane) and varying tiller populations per ha after 44 days. The most effective fungicides were "Aretan" and G20072; both gave considerable reductions in the number of whips and appreciably increased the tiller population by comparison with the untreated control, "Aretan" being particularly favourable to early tiller growth and, hence, early canopy development. Both fungicides had a relatively persistent systemic effect against smut.

* * *

Smut reaction of non-Hawaiian sugar cane clones. S. L. LADD and D. J. HEINZ. *Sugarcane Pathologists' Newsletter*, 1976, (17), 6–14.—Details are given of the smut resistances of 526 cane varieties and species (as well as species hybrids) foreign to Hawaii. Of the total, 277 were resistant or tolerant, 66 showed intermediate response and 18 were susceptible. Most of the *S. officinarum* clones were susceptible, while *S. spontaneum* clones had considerable resistance.

* * *

Heat treatment and leaf scald. R. A. BAILEY. *Sugarcane Pathologists' Newsletter*, 1976, (17), 14–16.—Experiments were conducted on hot water treatment of single-bud setts to determine the effect on germination and leaf scald control. In all cases (1 or 2 hours at 50°C, 1 hour at 50°C followed by 1 hour at 52°C 24 hours later or 1 hour at 52°C followed by 1 hour at the same temperature 24 hours later) the treatment had no apparent effect on germination but also had almost no effect on infection compared with the untreated controls. Hot air treatment for 8 hours at 54°C completely failed to eliminate leaf scald.

* * *

Blady grass: a possible long-term source of infection for leaf scald. C. C. RYAN. *Sugarcane Pathologists' Newsletter*, 1976, (17), 16–17.—Evidence to date suggests that blady grass (*Imperata cylindrica* var. *major*), specimens of which have revealed infection by leaf scald in the Babinda area of Queensland, may serve as a long-term source of the disease; this would explain why the disease has reappeared in some cane areas after many years' absence.

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Control of sugar cane red rot (*Physalospora tucumanensis* Speg.) by chemotherapy. H. D. LEWIN, S. NATARAJAN and S. D. RAJAN. *Sugarcane Pathologists' Newsletter*, 1976, (17), 17–20.—While there was little difference in germination between the various fungicide treatments of 3-bud setts, as well as between treatment and non-treatment, there were marked differ-

ences in terms of red rot control and cane yield. The lowest disease incidence and highest yield were given by dipping in 0·5% "Agallol". Treatment with 0·025% "Bavistin" by pre-plant dipping gave the next lowest disease incidence, while spraying with the fungicide 40, 70 and 100 days after planting was almost as effective; however, the effect of "Bavistin" on cane yield was not as good as that of other treatments.

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Screening of sugar cane clones for field resistance to red rot (*Physalospora tucumanensis* Speg.). H. D. LEWIN, S. NATARAJAN and S. D. RAJAN. *Sugarcane Pathologists' Newsletter*, 1976, (17), 20–22.—Results are given of cane screening trials conducted in Tamil Nadu, India, in which 11 out of the 23 varieties were completely free from red rot while another three exhibited less than 5% incidence.

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Effect of some nematicides on sugar cane in a nematode-infested field. R. P. NATH, R. K. SINGH, M. G. HAIDER and H. M. ASHRAF. *Sugarcane Pathologists' Newsletter*, 1976, (17), 23–24.—The effects of three nematicides on cane parameters were investigated in two years. "Dasanit" at 25 kg.ha^{-1} gave maximum yield which was far greater than that given by treatment with "Nemagon" at 25 + 12 litres.ha^{-1} (the second dose being given 6 months later with irrigation water) and DD at 280 litres.ha^{-1} (both of which gave about the same yield), while "Nemagon" at 25 litres.ha^{-1} was least effective. The nematicides had no effect on tillering, millable cane or cane height, but "Dasanit" and "Nemagon" treatment provided stouter canes than did DD treatment or no treatment. There was no significant difference in juice sugar content between the various treatments. "Dasanit" had the longest-lasting nematicidal effect of the three chemicals.

* * *

Combined effect of *Fusarium moniliforme* and *Hoplolaimus indicus* on sugar cane plants. R. P. NATH, R. K. SINGH and M. G. HAIDER. *Sugarcane Pathologists' Newsletter*, 1976, (17), 24–25.—After most samples of rotted cane roots had revealed the presence of combinations of *F. moniliforme* fungus and *H. indicus* nematode, an experiment was conducted with pots containing sterilized soil in which cane was planted after inoculation with one or other organism or both. Examination of the roots nine months after inoculation showed that the individual organisms failed to produce root rot symptoms although each adversely affected shoot length and weight and root weight. On the other hand, when combined they caused root rot and increased the shoot and root deterioration. The nematode population resulting from the combined inoculation was about half of that produced by inoculation with *H. indicus*, suggesting that the fungus adversely affected nematode multiplication.

* * *

Infection by *Ceratocystis paradoxa* Moreau on standing canes of some sugar cane clones. S. NATARAJAN and K. T. S. RAJA. *Sugarcane Pathologists' Newsletter*, 1976, (17), 25–28.—Of 45 clones screened for their resistance to *C. paradoxa* (the pineapple disease pathogen), 7 were found to be resistant, 15 moderately resistant and the rest susceptible. In all but 6 clones, infection was greater above the inoculated internode than below it, the pattern being reversed in the exceptional cases. It is suggested that this was due to the ability of the fungus to utilize monosaccharides better than the disaccharides in the top portions of the canes, since growth of the fungus was greater in glucose and fructose than in sucrose (in both liquid and solid form), possibly because of the more rapid hydrolysis of the monosaccharides. Hence, sucrose in the bottom internodes would not promote growth of the pathogen and would thus minimize tissue damage; maximum rotting of the tissue was found in the susceptible varieties. Growth of the fungus *in vitro* was maximum in the pH range 6·0–7·5, while the pH in the top and bottom parts of canes was found to be 5·4 and 5·3, respectively (mean values for 50 canes).

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Antibiotic control of grassy shoot disease of sugar cane. M. A. SATTAR and S. ALI. *Sugarcane Pathologists' Newsletter*, 1976, (17), 29–30.—Because of difficulties in maintaining constant temperatures during hot water treatment of setts by farmers in Andhra Pradesh, antibiotics were tested for control of grassy shoot. Single-bud setts from infected canes of Co 419 variety were soaked in varying concentrations of antibiotic for 24 hours before planting, and periodical determinations were made of infected shoot emergence (secondary infection by insect transmission being prevented by weekly spraying with 0·16% "Malathion"). From incidence of the disease 12 months after planting it was found that ledermycin was the more effective of the two antibiotics tested—at 200 and 300 ppm it halved the incidence by comparison with untreated controls, while at 500 and 1000 ppm complete eradication of the disease occurred. Aureomycin reduced incidence by 80% at 1000 ppm, but at 200 and 500 ppm was only slightly effective.

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Comparison of grassy shoot disease (India) with the white leaf disease (Taiwan) of sugar cane. S. EDISON, K. RAMAKRISHNAN and P. NARAYANASAMY. *Sugarcane Pathologists' Newsletter*, 1976, (17), 30–35.—The literature on grassy shoot and white leaf diseases is surveyed (with 42 references). From investigations of symptomology, transmission means, control by heat and antibiotics, and etiology of the diseases it is concluded that the two diseases are similar. White leaf disease reported from Thailand also appears to be similar to them but detailed information on it has yet to be provided.

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Phase contrast microscopy: a potential method for screening sugar cane for resistance to RSD injury. A. G. GILLASPIE, G. FLAX and H. KOIKE. *Sugarcane Pathologists' Newsletter*, 1976, (17), 36–37.—See *I.S.J.*, 1977, **79**, 45.

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Presence of the RSD-associated bacterium in Mauritius. C. RICAUD, S. SULLIVAN and J. C. AUTREY. *Sugarcane Pathologists' Newsletter*, 1976, (17), 37–39.—Of several bacteria found in exudates from cane exhibiting classic symptoms of ratoon stunting disease, the most predominant had several of the characteristics attributed to the RSD bacterium in the literature, although no septum was observed. The bacterium in question was found in nodes and the middle of internodes of affected stalks, in the tissue just below the growing point, in leaves and in young tillers of infected stools, indicating that it is not a passive

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contaminant restricted to wounds and the leaf scar. It was not found in healthy plants. Exudates from stalks infected with chlorotic streak, gumming disease or leaf scald, all of which present nodal vascular discolorations which could be confused with RSD, did not reveal the presence of the particular bacterium, although numerous bacteria were found but differing in size, morphology and ultrastructure from the RSD-associated bacterium. Hence, suggestions that *Xanthomonas vasculorum* and *X. albilineans* are associated with RSD could not be substantiated. Electron micrographs of the bacterium are reproduced. (See also *I.S.J.*, 1977, **79**, 138.)

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Red stripe disease of sorghum in India and its relationship to sugar cane mosaic virus. N. RISHI and R. S. RAM. *Sugarcane Pathologists' Newsletter*, 1976, (17), 40–41.—Sap extracted from leaves of sorghum infected with red stripe was inoculated into various plants including Johnson grass and sugar cane, whereupon typical mosaic symptoms appeared. Serological investigations also showed that the isolate was related to cane mosaic virus.

* * *

Xanthomonas vasculorum **on maize and the importance of alternative hosts of the disease.** C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1976, (17), 42–44.—In view of the occurrence of gumming disease on maize and other plants apart from sugar cane in Mauritius, the question of the part played by alternative hosts in spread of the disease is of importance. However, examination of the question reveals that the only occasions of infection of plants other than cane occur when there is an epidemic in cane fields and under cyclone conditions; in such situations there is a high inoculum potential and the disease may be transmitted to certain grasses and palms, which nevertheless should be regarded as only temporary, accidental alternative hosts which would not normally harbour the disease in its absence on cane and should therefore play hardly any role in its perpetuation. A successful control programme would require strict selection of cane varieties having high resistance to the disease, drastic and rapid elimination of sources of infection in susceptible cane (to prevent new strains of the pathogen affecting selected varieties) and a long period of climatic conditions unfavourable for aerial spread of the disease.

* * *

The Fiji disease epidemic in South Queensland. B. T. EGAN. *Sugarcane Pathologists' Newsletter*, 1976, (17), 45–46.—Reference is made to the severe outbreak of Fiji disease in the Bundaberg area of Queensland. It is pointed out that while, in 1976, more than 1·5 million stools were diseased, yield losses were relatively light because of the tolerance of N:Co 310 (a moderately susceptible cane grown on almost 95% of the area). However, it is thought that this variety cannot continue to withstand the intense infection pressures in heavily diseased localities, and considerable increases in yield losses are expected. While Q 87 and CP 44-101 have greater resistance to the disease and could easily replace N:Co 310, they suffer from other problems which could limit their popularity. An outline is given of the programme implemented for control of the disease and of investigations carried out as a major contribution to the control policy.

Methods of field testing sugar cane clones for their resistance to Fiji disease. D. R. L. STEINDL. *Sugarcane Pathologists' Newsletter*, 1976, (17), 46–47.—Because of the unreliability of insectary trials as preliminary cane screening tests for Fiji disease, it has become necessary to carry out field tests on large numbers of clones. Details are given of trials to determine the most suitable planting and ratooning times for optimum infection and reliability of results as a quicker alternative to the system under which ratoons were rated for disease resistance $2\frac{1}{2}$ years after planting of the cane. Results of the trials indicated that the transmission rate was higher in spring-planted than in autumn-planted cane, that cane harvested late in the season developed more disease than earlier harvested cane, and that 2nd ratoon crops gave better results than 1st ratoons after a standover crop, both being better than 1st ratoons after a 1-year plant crop. On the basis of the trials, a standard practice has been adopted of planting in the spring, ratooning late the following season, inspecting the 1st ratoons and growing a 2nd ratoon crop for another inspection. Statistical evaluation of results from four trials indicated that it may be possible to obtain reliable evidence from 1st ratoons.

* * *

Brown stripe in Bangladesh. H. U. AHMED, M. A. KHAN and I. H. MIAN. *Sugarcane Pathologists' Newsletter*, 1976, (17), 48–50.—The first occurrence of brown stripe on cane in Bangladesh was discovered in December 1976; the initial outbreak was in cane intercropped with mustard and wheat, but the disease subsequently spread to plots of cane growing on its own. Descriptions are given of the external symptoms; the causal agent was isolated and found to be *Helminthosporium stenospilum*. The degrees of incidence of the disease on 176 varieties are indicated. Spraying with copper oxychloride at the rate of 3 lb in 100 gal water per acre reduced the incidence, satisfactory control being achieved with two more sprayings at 12-day intervals.

* * *

Eye spot outbreak in North Queensland. B. T. EGAN and C. C. RYAN. *Sugarcane Pathologists' Newsletter*, 1976, (17), 50–51.—Outbreaks of eye spot in North Queensland, which had been free of the disease since 1956, first occurred in July 1970, since when further outbreaks have been reported. In the worst cases the disease has caused the death of tops and 75% loss of leaves, while the cane sugar content has also been reduced. Spread of the disease is associated with increased growing of Q 101 cane variety.

* * *

Recurrence of rust in South Africa. R. A. BAILEY. *Sugarcane Pathologists' Newsletter*, 1976, (17), 51. Rust, present in South Africa for many years, has become increasingly common on the widely grown N 55/805 cane variety which is less resistant than many other varieties. The pathogen has been identified as *Puccinia erianthi*. The disease is conspicuous during the early growth stages, but leaf damage becomes progressively smaller with increasing plant development, and there is little loss in active leaf area after the early months. The disease has little effect on yield.

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Sugar cane diseases in Nigeria. N. ZUMMO. *Sugarcane Pathologists' Newsletter*, 1976, (17), 52–53.—A brief survey is presented of cane diseases in Nigeria, the

most important being smut which poses a serious threat to cane cultivation in the country. At present, the only means of control is roguing of infected plants in the grass stage, but this method is not satisfactory and the growing of resistant varieties is considered imperative.

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Latest report on *Eldana*. G. THOMPSON. *S. African Sugar J.*, 1977, **61,** 9.—Reports from seven factory areas indicate the incidences of the *Eldana* borer and compare them with values for 1975 (except in two cases). In only one area has there been a dramatic fall in infestation from 1975 to 1976, while at the rest the situation is regarded as cause for mounting concern.

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BO 70—an outstanding sugar cane variety of Bihar. M. J. ASRAF and P. K. BOSE. *Indian Sugar*, 1976, **26,** 549–550, 555.—The chief characteristics of BO 70 are described and results given of comparative trials in which its N uptake and yield were found to be greater than that of BO 17. Trench planting gave higher yields of both varieties than did furrow planting.

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Towards better sugar cane production in Tuni Taluk, East Godavari (A.P.). M. R. NAIDU and K. C. CHENNARAYUDU. *Indian Sugar*, 1976, **26,** 553–555. The total production costs and profits involved in growing Co 419 cane (which is susceptible to smut and red rot) are compared with those of a new mid-late-season variety, 69A37, which is moderately resistant to red rot and is more profitable. Suggested practices by means of which cane yield can be increased are listed.

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Drip irrigation: newest system takes over in Hawaii. E. D. DEREMER. *World Farming*, 1977, **19,** (1), 9–11, 30.—The author discusses the major advantages of drip irrigation as practised in Hawaii, describes the basic layout of a system and the economics involved, and gives information on the equipment used. An outline is given of irrigation scheduling based on Class A Pan evaporation and of fertilizer application through the irrigation tubing. Mention is also made of chlorine application to prevent growth of bacterial slime.

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Chemical weed control. ANON. *Cane Growers' Quarterly Bull.*, 1977, **40,** 68–116.—Details are given of weeds found in Queensland cane fields and of control means (a detailed list of which is given covering 54 treatments, each one numbered for ease of reference in a section containing descriptions of the weeds). In many instances, diagrams or photographs are given of the weed. A small section gives treatments for general weed control or for control of types of weeds under varying circumstances. Guidance is given on herbicide handling and application, and explanations are given of the actions of particular herbicides. A glossary of terms used in chemical weed control is followed by ready reckoners for calculation of the amount of herbicide to apply. Both botanical and common names of weeds are given.

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Removal of standing cane. Cane smut threat. L. L. LAUDEN. *Sugar Bull.*, 1977, **55,** (7), 4–5.—A number of methods are outlined for removal of standing cane from fields after adverse weather conditions have prevented further harvesting; since those described are rather slow or suitable only for small areas, the author calls for any information readers may have regarding handling of cane on large areas. The imminent threat of cane smut spread to the US mainland from Jamaica is mentioned. While Jamaica (where the disease was reported at the end of 1976) is 600 miles from Florida, it is only 100 miles from Cuba, which in turn is only a minimum of 100 miles from Florida. Screening of varieties is already being carried out in the USA. CP 48-103 and CP 61-37 seem to be more resistant than other varieties grown in Louisiana, while L 62-96 is moderately resistant.

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The Louisiana sugar cane variety census for 1976. R. J. MATHERNE, H. P. FANGUY and D. T. LOUPE. *Sugar Bull.*, 1977, **55,** (8), 14–16.—A breakdown is given of varieties grown in the three major cane areas of Louisiana in 1976, and changes in varietal pattern in the state over the period 1967–76 are indicated. It is stated that rapid changes have occurred in the acreages on which specific varieties are grown, some varieties needing to be replaced within a few years because of mosaic and ratoon stunting disease susceptibility. However, the area (21% of the total) on which the leading variety (CP 61-37) is grown is little different from that in 1972, whereas the next leading variety (CP 65-337) has made rapid increases since its release in 1973. No variety has dominated since 1969, when CP 52-68 was grown on 40% of the area but has since declined to only 8% of the area in 1976.

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Sugar cane ratooning. M. ANAND. *Sugar News* (India), 1976, **8,** (7), 16.—The author discusses reasons for the failure of Indian farmers to grow more than one ratoon crop and compares the situation in India with that in Mauritius.

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Effect of cultivation practices on yield and quality of sugar cane in U.P.—a review. M. L. AGARWAL, S. K. OJHA and K. DUTTA. *Sugar News* (India), 1976, **8,** (7), 17–22.—A survey is presented of agricultural practices and their effects on cane germination and yield, and results of various investigations are discussed.

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A practical approach for increasing the sugar cane yields in different soil types. G. K. ZENDE. *Sugar News* (India), 1976, **8,** (7), 23–26.—Mention is made of the catalytic action of P and Mn on soil organic matter decomposition. Trials are reported in which two forms of organic manure (farmyard manure and groundnut cake, the latter being easily degradable) at 0·25% C on soil weight, three sources of phosphate at 50 and 100 kg P_2O_5 per ha and manganese sulphate at 5 and 10 ppm plus K were applied and the average yields obtained with 27 different combinations (including no P and no Mn) determined. Conditions during the two seasons of the trials differed, the second season being characterized by severe drought. In the first season highest yield was given by application of groundnut cake, while farmyard manure gave a lower yield than without organic matter application. In the second season, the results with groundnut cake application were no better than without organic matter. In all cases of organic matter application, P and Mn increased the yield (by 6–8% in the first

season and by 15–30% in the second). Juice Brix and purity were highest and N content lowest without organic matter application, although Mn application caused improvement in all three parameters when organic matter was applied.

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The sugar cane breeding programme in Egypt. Z. A. MENSHAWI. *Sugar J.*, 1977, **39**, (9), 9–11.—A report is presented on activities carried out at the cane breeding centre set up at Hawamdieh in 1967, with mention of cane varieties used for crossing. Amongst items listed as part of a future programme is the possible use of natural flowering induction, in which the cane plants would grow in movable containers which could be rolled to a sheltered location at night for protection against low temperatures; frequent irrigation and spraying with a fine "mist" would be the only induction measures, unlike the techniques involving adjustment of photoperiod and temperature as well as air humidity as carried out at present. The question of suitable location for natural flowering induction is considered.

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Effect of soil-applied gamma-BHC on nitrogen and potassium nutrition and yield of sugar cane in a calcareous saline-alkaline soil. B. P. SAHI, P. K. BOSE and R. TIWARY. *Sugar News* (India), 1976, **8**, (8), 13–15. Application of 1 kg gamma-BHC insecticide per ha was found to increase the N content in cane resulting from application of 75 or 150 kg N per ha and to increase still further the rise in cane yield resulting from N fertilization. Since the gamma-BHC permitted both cane N content and yield resulting from application of 75 kg.ha^{-1} N to rise almost to the levels resulting from double the amount of N applied, use of half the normal N dosage combined with gamma-BHC is recommended in view of the high price of the fertilizer.

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The sugar cane stalk borer: recent advances in studies on control. A. N. KALRA, A. K. MEHROTRA and D. K. BANERJI. *Sugar News* (India), 1976, **8**, (8), 16–20.—Studies conducted at the Indian Institute of Sugarcane Research, Lucknow, on *Chilo auricilius* control by chemical and biological means are reviewed, covering the period 1960–73. Of the chemicals investigated, "Monocrotophos" has proved the most effective.

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Sugar cane CoS 718—a new variety for gur production in Uttar Pradesh. S. K. OJHA, K. M. BHARDWAJ, R. SINGH and B. N. DIXIT. *Sugar News* (India), 1976, **8**, (8), 21–25.—The characteristics of the variety are described and details given of its performance in varietal trials. The quality of gur which can be manufactured from it is also discussed.

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A seed cane handling system. R. SYMES. *Proc. Amer. Soc. Sugar Cane Tech.*, 1975, 23.—Traditional planting systems in Florida are reviewed. After it was found difficult to achieve high planting rates because of the inability to supply seed cane to the planting crews from fields many miles away, attempts were made to use dump trucks. Modifications to the trucks are discussed and the loading and unloading methods described. Advantages and disadvantages of the use of the dump trucks are examined, and a suggestion is offered regarding their off-season use.

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Developments in mechanical sugar cane planting in Florida. B. R. EILAND and J. E. CLAYTON. *Proc. Amer. Soc. Sugar Cane Tech.*, 1975, 24–27.—Mechanical cane planting developments in Florida are reviewed and various associated problems are discussed, including poor stands from short seed cane billets, the varietal effects on planter metering ability, and, the need for a 1–2 tons.acre^{-1} greater seed cane application rate than with manual planting in order to prevent significant gaps and to compensate for the relatively large number of eyes damaged by the planter mechanism. Despite certain advantages of short seed pieces, a preliminary field study has shown that germination is substantially reduced when the length is less than 17 inches; the germination rate appeared to increase linearly with length from 6 to 22 inches. The germination rate also fell with increase in the interval between planting and covering. Advice is given on choice of planter and on optimum operation.

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Growth, production and leaf N content of sugar cane in Texas. J. R. THOMAS and G. F. OERTHER. *Proc. Amer. Soc. Sugar Cane Tech.*, 1975, 28–36.—In fertilizer trials carried out in 1972–74 to determine the leaf N sufficiency level, i.e. minimum leaf N concentration to produce optimum cane growth, ammonium nitrate was applied at 50, 100, 150 and 200 lb.acre^{-1} per year to N:Co 310 cane, growth then being measured periodically and the moisture content and N concentration of leaves and sheaths Nos. 3–6 determined. Irrigation was applied when 60% of the available water in the upper 3 ft of the soil profile had been used. Daily growth rates were affected more by soil water availability than by N fertilization rates, although the latter factor did have a substantial effect on seasonal mean growth rates. Cane yields were significantly related to leaf N concentration in early June. The N sufficiency level fell from 2·3 to 1·5% during the growth period. Application of 100 lb.acre^{-1} N increased both cane and sugar yield considerably by comparison with untreated cane.

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The effect of fertilizers and soil variability on sugar cane yield and its components. L. E. GOLDEN. *Proc. Amer. Soc. Sugar Cane Tech.*, 1975, 37–43.—The effects of N, P, K and S application and of soil type on cane yield, number of millable stalks, stalk length, weight and diameter, were determined in trials on a 3% sloping site involving plant and 1st ratoon crops. The fertilizers had less effect than soil type, while P, K and S had no essential influence on plant cane yield, unlike N, while P application caused a significant increase in ratoon cane yield. Cane yield was greatest in the lower section of the area and lowest in the upper section, and was generally more related to depth of topsoil than to the soil chemical properties. Correlations between cane yield and each of the yield components mentioned above were highly significant except in the case of millable stalk mean diameter.

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Predicting delivery rates and economics of transporting sugar cane to the mill. B. J. COCHRAN and R. W. WHITNEY. *Proc. Amer. Soc. Sugar Cane Tech.*, 1975, 44–52.—See *I.S.J.*, 1976, **78**, 208.

Sugar beet agriculture

Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

Investigation on adaptation of the Olsen method of phosphorus determination to routine soil analysis. S. BARKER. *Şeker*, 1976, **26**, (101), 7–12 (*Turkish*). Tests were conducted on the OLSEN method of soil P determination to see if active carbon treatment of the extract could be omitted. (The method involves addition of 0·5M sodium bicarbonate to give a 1:20 w/v soil:bicarbonate mixture of pH 8·5 followed by active carbon addition and filtration to yield a colourless solution in which P is measured colorimetrically.) Results showed that active carbon treatment could be omitted only if the extract were light yellow, but not if the colour were darker. There was no significant difference (for routine purposes) between use of 50 cm^3 $NaHCO_3$ solution with 2·5 g of soil and 100 cm^3 solution with 5 g of soil nor did the stage at which the carbon was added (before or after filtration) have any effect on results. Further tests showed that the method with bicarbonate and carbon use gave higher P values than did extraction with water plus carbon treatment; this was attributed to considerable P adsorption on the carbon from the aqueous soil extract.

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Effect of topping and mechanical damage on the processing quality and storage properties of sugar beet. J. ZAHRADNÍČEK, O. ŠEBÍKOVÁ and V. BENDA. *Listy Cukr.*, 1976, **92**, 217–225 (*Czech*).—Investigations in 1974 and 1975 showed that only 27% of beet samples (100-root samples taken once, twice or three times a day between mid-October and mid-November) delivered to Postoloprty factory had been topped correctly in accordance with Czechoslovakian official instructions, while 31·6% and 23·0% (1974 and 1975) were topped too high, 36·7% and 42·0% were topped too low, and 5·0% and 8·0% were not topped at all. The beets which had been over-topped had only slightly lower sugar content than did the correctly topped beets, while the α-amino-N and ash contents were lower and the invert sugar content was slightly higher. The untopped beets were of poorest quality of the four categories, but only slightly worse than the under-topped beets. In storage tests, the highest losses occurred in the under-topped followed by the untopped beets while losses in the over-topped beets were still very much greater than in the correctly topped beets. The health of the untopped beets suffered more than did that of the other beets, the next worse being the under-topped beets. The effect of mechanical damage was investigated at two other factories, showing how the processing quality fell with increase in the extent of damage. The presence of leaves (especially those averaging 7–10 cm long) caused considerable sugar loss and reduction in beet quality. After examination of the adverse effect of bacterial infection on stored beet losses and quality, brief mention is made of the effects of temperature of the beets when first stored and the losses due to respiration, in which it is pointed out that respiration causes formation of 1·54 kg CO_2, 0·58 kg water and 3600 kcal heat from 1 kg of sugar, the heat raising the temperature of 1 ton of beet by 4·2°C, whereas a 5° reduction in temperature from 15°C requires removal of 8500 kcal heat per ton. The artificial ventilation requirements are discussed.

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A study of the pathogenicity to sugar beet of two heterothallic species of *Pythium*. J. NOVOTNÝ. *Listy Cukr.*, 1976, **92**, 260–262 (*Czech*).—Comparison of the pathogenicity in partially sterilized soil of *P. heterothallicum* and *P. sylvaticum* with regard to beet seedlings showed that the former pathogen generally did not attack the plants, while the latter species infected the seedlings to a considerable degree, causing marked rotting. However, *P. sylvaticum* was less pathogenic than was *P. ultimum*.

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Economic aspects of cultural and fertilization methods in sugar beet agriculture. K. MEINHOLD and P. HOLLMANN. *Zucker*, 1977, **30**, 16–22 (*German*).—With the aid of farm models, in which the variables were the proportion of land under beet and disposal of beet leaves (whether sold or used as fodder for milk cattle and bulls), the authors examine the economics of beet growing, with particular emphasis on the significance of rates of fertilizer (especially N) application.

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Root out a profit from sugar beet. A. K. ASTBURY. *Sugar News* (India), 1976, **8**, (6), 11–12.—The author outlines the basic features of three types of beet harvesters manufactured in England.

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Insecticides and herbicides: choice of products. ANON. *Le Betteravier Franç.*, 1977, **47**, (307), 23–26 (*French*). Advice is given on treatment against various beet pests, including aphids, cutworms, soil- and air-borne parasites and the beet moth, on fungicidal treatment against powdery mildew and on weed control with pre- and post-emergence herbicides. Indications are given of suitability of chemicals and their phytotoxicity towards beet.

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New approaches to and methods of control of sugar beet yellows. T. STROUTHOPOULOU and K. PASHALIDE. *Hellenic Sugar Ind. Quarterly Bull.*, 1976, (27), 271–284 (*Greek*).—The economic importance of beet virus yellows is discussed and means by which the disease spreads are indicated. It is stated that aphid

control is the major method by which the disease incidence can be reduced, and various commercially available aphicides are described. Other preventive measures recommended include isolation of seed beet fields, elimination of bolted beet and weed hosts, and early drilling. The need for greater research on the subject and breeding of resistant varieties is stressed.

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After-effect of "Triazine" residues. II. R. VANSTALLEN. *Le Betteravier*, 1977, **10,** (105), 11 (*French*).—A study of the after-effects of excessive amounts of "Triazine" applied as herbicide in maize fields showed that the arable layer of loam soil still contained 5–10% of the initial dose one year after application. Considerable phytotoxicity to beet and wheat occurred with doses greater than 1·5 kg a.i. per ha. It is suggested that the herbicide be used in large doses because it is relatively cheap and highly effective at the higher application rates. At 750 g.ha^{-1} "Triazine" has little or no adverse effect on subsequent crops and is still highly effective in most cases. It has not yet been established to what extent herbicides applied in beet fields could aggravate the adverse effect of residual "Triazine". It is suggested to incorporate the herbicide in the soil before sowing in order to avoid the need for repeat application when the initial dose is ineffective in dry weather.

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Spring 1977: priority to beet sowing. A. VIGOUREUX. *Le Betteravier*, 1977, **10,** (105), 14 (*French*).—Advice is given on beet drill maintenance, adjustment and use.

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Can we live with nematodes? W. C. VON KESSEL. *Die Zuckerrübe*, 1977, **26,** (1), 10–13 (*German*).—It is stated that many beet farms in West Germany have been experiencing falls in yields as a result of nematode attack. However, discussion of results achieved with "Temik 10G" indicates that the costs tend to outweigh any advantages, while its high toxicity to animals and birds is a major disadvantage. Fumigants have shown promise in trials, but again the economics justify their use only where nematode incidence is high. Hence, it is considered that most beet farmers will have to tolerate the existence of nematodes and adopt whatever agronomic measures are necessary to minimize losses, using chemical control sparingly. It is stressed that the nematode does not cause as much damage in cool, wet seasons.

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The post-emergence control of grasses in sugar beet. F. HERBOLD. *Die Zuckerrübe*, 1977, **26,** (1), 14 (*German*).—Mention is made of two herbicides produced by Hoechst AG. "Illoxan" (a member of the phenoxy-phenoxy propionic acid group) at 2·5 litres.ha^{-1} gave 91% control of wild oats (*Avena* sp.) and increased beet yield compared with untreated plots; 3 and 5 litres.ha^{-1} gave 92 and 94% control, respectively, but while 3 litres.ha^{-1} gave maximum yield of all treatments, the higher dose gave lowest yield. "Alopex", in the same group of derivatives as "Illoxan", is effective against black grass (*Alopecurus myosuroides*) and witch grass (*Panicum* sp.).

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Optimum beet spacing. C. WINNER. *Die Zuckerrübe*, 1977, **26,** (1), 18–20 (*German*).—See WINNER & MERKES: *I.S.J.*, 1976, **78,** 243; WINNER *et al.*, *ibid.*, 244.

Sugar beet harvesting demonstration at Üfingen. W. STIEGER. *Die Zuckerrübe*, 1977, **26,** (1), 21–23 (*German*).—The performances of a number of beet harvesters are compared in terms of topping, beet damage and dirt tare.

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Beet nematodes: experiences in the use of "Temik 10G". ANON. *Die Zuckerrübe*, 1977, **26,** (1), 24–26 (*German*).—Trials with "Temik 10G" are reported in which the chemical was effective in reducing the incidence of larvae and eggs and in increasing beet yield. The tests were conducted in beet following crops of cabbage and wheat, both of which tend to favour increase in nematode incidence. Further investigations to establish tolerance of the nematicide to beet showed that application of 10 kg.ha^{-1} reduced emergence by 6–9·2%, while 25 kg.ha^{-1} reduced it by 17%.

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New growers find beet profitable. G. HANSLIP. *The Furrow*, 1977, (Jan./Feb.), 14–15.—The profitability of sugar beet as a cash crop and the benefits it brings to the farmer as a break crop are demonstrated by examples from Wales; in the cases mentioned beet cultivation is a new departure.

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Mechanical harvesting and the storage properties of sugar beet. E. G. TOMILENKO. *Sakhar. Prom.*, 1977, (2), 45–51 (*Russian*).—Details are given of investigations on the extent of beet damage and the consequent storage losses after mechanical harvesting by various machines. Most beet damage and the highest storage losses were experienced with the use of six-row harvesters.

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Bacterial infections and deterioration of stored sugar beet. J. ZAHRADNÍČEK. *Listy Cukr.*, 1976, **92,** 285–287 (*Czech*).—Symptoms of slime rot (chiefly caused by *Erwinia serbinowi* and considered the most aggressive and most destructive of beet storage infections), root rot (caused by various bacteria), crown rot (caused by *Pseudomonas wieringae*) and wet rot (caused by *Erwinia carotovora*) are described and preventive means indicated.

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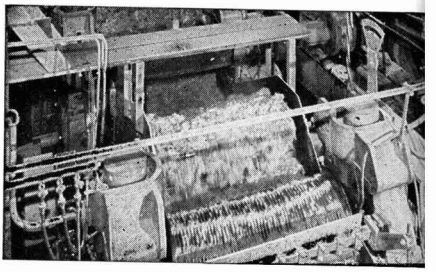
Insecticides applicable at beet sowing time. L. VAN STEYVOORT and E. SEUTIN. *Le Betteravier*, 1977, **11,** (106), 11 (*French*).—It is pointed out that application of the two most effective soil insecticides, "Heptachlor" and "Aldrin", is banned in Belgium and most European countries. However, "Temik 10G" at 10 kg.ha^{-1} has proved effective against aphids (and hence beet virus yellows) and the mangold fly; moreover, most precision drills are already equipped with micro-granulators for its application. "Curater 5G" at 12 kg.ha^{-1} is highly effective against the mangold fly, but not aphids. "Dacamox 10G" at 10 kg.ha^{-1} is similar in effectiveness to "Temik 10G" but has not yet been released for commercial use; moreover, a word of caution is given regarding excessive dosage rates, since it has been found to cause slight growth retardation at more than 12 kg.ha^{-1}. For control of soil insects such as millepedes, "Lindane" is recommended for application before drilling, since it has a relatively long persistence.

Cane sugar manufacture



Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

How the quality of plantation white sugar (SWC) has been improved during the past crushing season. T. W. TONG. *Taiwan Sugar*, 1976, **23**, 196–199.—Details are given of the steps taken by the Taiwan Sugar Corporation to raise the quality of plantation white sugar after inferior cane juice had caused the sugar to fall below standard requirements during recent years.

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The sugar mill expansion project of the Taiwan Sugar Corporation. C. S. LU. *Taiwan Sugar*, 1976, **23**, 200–202.—Information is given on the equipment installed and modified at six Taiwan sugar factories to permit an expansion in the total grinding capacity from 12,900 to 15,800 tons of cane a day.

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Further studies on the preventive measure to arrest the deterioration of harvested sugar cane in storage. S. BOSE, K. C. GUPTA and S. MUKHERJEE. *Sugarland* (Philippines), 1976, **13**, (3), 10-12, 16, 24–25.—See *I.S.J.*, 1976, **78**, 302.

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Improvements in mill feeding. D. WRIGHT. *Sugar News* (Philippines), 1976, **52**, 291–294.—See *I.S.J.*, 1977, **79**, 200.

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Extraction performance of a diffuser using a mathematical model. P. W. REIN. *Sugar J.*, 1976, **39**, (7), 15–22.—See *I.S.J.*, 1975, **77**, 120.

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Application of the continuous vacuum pan to third strikes. M. RIVIÈRE and P. PITHOIS. *Sugar y Azúcar*, 1976, **71**, (12), 48–58.—See *I.S.J.*, 1977, **79**, 81.

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Corrosion in the production of raw sugar. R. CARO. *ATAC*, 1976, **35**, (4), 55–65 (*Spanish*).—Electrolytic corrosion and factors affecting corrosion rate in the sugar industry are discussed, as is work in the field reported in the literature. Corrosion in milling tandems, evaporators, pumps and centrifugals is considered separately and it is thought that measurement of lineal polarization as a measure of corrosion velocity is more accurate than calculation from changes in the metal contents of liquids in contact with the corroding surface.

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Rehabilitation and modernization of a sugar factory. B. L. MITTAL. *Indian Sugar*, 1976, **26**, 281–285.—By rehabilitation is meant expansion of a sugar factory to its minimum economical capacity. The author discusses ways in which this can be done by both improvement in efficiency and by replacing old equipment with more modern units. The article includes sections on techniques for reduction of sugar losses, labour- and fuel-saving devices, preventive maintenance and by-products utilization.

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Preventive maintenance in the Indian sugar industry. L. SANYAL. *Indian Sugar*, 1976, **26**, 287–297.—Requirements of an efficient system of preventive maintenance are discussed, with particular mention being made of measures to prevent corrosion; a list is given of important spares (including instruments) which should be available, and the duties of technical staff in regard to preventive maintenance are briefly indicated.

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Using bagasse as fuel. B. BEYT. *Sugar J.*, 1977, **39**, (8), 19.—Factors affecting the fuel properties of bagasse are discussed and operation of a stoker furnace as used in Louisiana is described.

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Condensate extraction. P. MARIMUTHU and V. R. SUBRAMANIAM. *Sugar News* (India), 1976, **8**, (8), 9–11. Previously, at the authors' sugar factory, condensate from the evaporator and juice heaters had been transferred to individual tanks, one for each effect and for each juice heater. The system has been modified, so that the condensate is now taken by sealing legs to one of four tanks: one for the pans, one for the juice heaters, one for condensate from the last two evaporator effects and vapour cell, and one for the condensate from the 1st and 2nd effects. Advantages including a saving in steam, a reduction in the number of condensate pumps required, and higher evaporator syrup Brix (61–62° compared with 51–54° previously).

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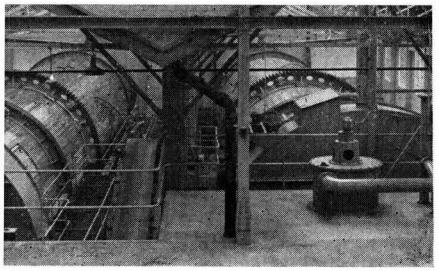
Electronic steam purity studies ensure clean, reliable cane mill energy. J. J. OPELKA, G. L. WHEELER and P. R. ARELLANO. *Proc. Amer. Soc. Sugar Cane Tech.*, 1975, 93–98.—The importance of an abundance of clean, high-quality steam in a sugar factory is discussed and details are given of a case history in which the purity of steam from four boilers was determined by means of an Na^+ analyser incorporating an ion-selective electrode, a standard calomel reference electrode and a continuous recorder. From the results it was concluded that poor operation was a consequence of an unsatisfactorily high steam solids content, and a modification to the chemical treatment system was recommended. Subsequent determinations of steam purity showed that steam solids fell, despite an increase in boiler feedwater total solids content. Apart from the rise in steam quality there were a number of other benefits arising from the improved operation.



Beet sugar manufacture

Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

The actual shapes of cossettes and their effect on diffusion. A. HAVLÍN and V. VALTER. *Listy Cukr.*, 1976, **92**, 248–254 (*Czech*).—From a 1·5-kg sample of cossettes taken from the conveyor belt carrying them to the diffuser, 100–150 individual cossettes were selected for evaluation of their profiles during the 1974/75 and 1975/76 campaigns at two factories. The cossettes were placed in parallel on glycerine-coated paper, put in a polystyrene tray and covered with paraffin. After hardening in a refrigerator, the individual cossettes were separated from one another by means of a saw, polished by buffing wheel, coloured with neutral red and photographed; the profiles were evaluated by a Zeiss "Dokumator". The percentage of groove-shaped cossettes and cossette distribution by thicknesses were determined. It was found that the thickness distribution conformed to the normal Rayleigh pattern. For purposes of diffusion simulation it is suitable to use a theoretical infinite laminar cossette for which an appropriate mathematical programme is set out. Comparison of sugar extraction from cossettes of various shapes using the mathematical procedure showed that while groove-shaped cossettes were the best, there was little difference in sugar extraction between them and rhomboidal cossettes, whereas there was very much greater difference between the latter and slab-shaped cossettes.

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Icing sugar conditioning. D. NAHLER. *Zucker*, 1977, **30**, 2–7 (*German*).—A method is described for determination of icing sugar caking potential under the effect of moisture, and details are given of a process for conditioning of the sugar. Icing sugar prepared under controlled conditions was packed in 250-g packets as well as 10-, 25- and 50-kg bags; polyethylene-lined paper or polyethylene inner bags acted as moisture barriers. Caking took place at irregular intervals and was of varying degrees. Tests were conducted on sugar of 0·108% initial moisture content stored for 13 days in gravity bottles in which the relative humidities were successively reduced in 10% intervals (absolute) by means of sulphuric acid concentration gradients; the change in moisture content (determined from the weight change) was established after one day, and the sample transferred to the bottle having the next lower R.H. Results indicated that R.H. in the range 20–70% had little effect on the sugar during the investigations. Attempts to accelerate caking so as to determine the possible tendency during storage were unsuccessful, although a direct relationship was established between caking and sugar moisture content. Sugar was packed tightly in a 50-cm³ plastic flask (to ensure good contact between the sugar particles), the flask sealed and treated for 2 hours in a drying cupboard at 65°C. Where the rubber bungs remained tight, the sugar exhibited caking, either overall or in part; on the other hand, where the bungs had loosened or even been pushed out by the pressure within the flask, the sugar remained soft. Explanations are offered regarding these findings. A successful sugar conditioning method is governed by thickness of the sugar bed, temperature and time. Allowing for these, an "open" system has been developed in which sugar is heated at 65°C for about 4 minutes in a moving bed dryer. At Uelzen factory, icing sugar from two sugar mills is heated to at least 60°C with steam of 0·3 bar; the unit comprises a system of screw conveyors which carry the sugar along a 400-mm diameter heating trough and discharge it at the rate of 1600 kg.hr^{-1} direct to the bagging plant without prior cooling. The sugar is stored in 10-, 25- and 50-kg bags on pallets up to a height of 1·4 m without any adverse effect of loading pressure on the quality of the sugar in the bottom layers. Not only is the icing sugar conveyed and stored in a manner hitherto entirely unpractical, but comparison between conditioned and unconditioned sugar showed that omission of conditioning led to caking of a bottom 30 cm layer within 1½ hours of storage in wooden boxes, while the conditioned sugar was sold without any complaints being received regarding caking.

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The quality of sugar factory effluent and its agricultural utilization. Z. IZSÁKI. *Cukoripar*, 1976, **29**, 207–212 (*Hungarian*).—A detailed analysis is given of the waste water at Sarkad factory as determined in 1972–75, showing the differences in magnitudes of the components and quality factors between effluent in September-December and in May-July (after prolonged storage). The chemical composition is discussed and greenhouse tests reported in which the fresh effluent was applied to white mustard seed in undiluted and diluted form. Results showed that germination was maximum with a 1:10 dilution, although the results obtained with 1:1 and 1:5 dilutions were still better than with the control (treated with distilled water), while undiluted effluent was slightly less effective than the control. The same pattern applied in the case of root length after three applications, whereas after ten applications maximum fresh weight was obtained with undiluted effluent; this was followed, with a marked interval between the values, by a 1:5 dilution which was slightly better than the identical results obtained with 1:1 and 1:10 dilutions, all of which proved superior to distilled water. The effluent had no phytotoxic effects.

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The diffusion flux of a substance in heater scale formation in sugar factories. YU. S. RAZLADIN and I. I. SAGAN'. *Izv. Vuzov, Pishch. Tekh.*, 1976, (5), 119–121 (*Russian*).—The formation of hard scale on the heat exchange surface of a juice heater is considered as a heterogeneous multi-stage conversion, in which a substance is presented to the surface, phase con-

version itself takes place, and the reaction products are separated. The diffusion flux of a substance j on the heater wall is calculated as a means of determining the limiting stage in the process and compared with experimental results. The calculation is based on the specific case of 1st carbonatation juice heating at a juice flow rate of 1, 2 and 3 m.sec^{-1}. Although juice heater scale has a highly complex composition, the major part comprises $CaCO_3$ in the form of calcite, and it is assumed for the calculation that the rate of scale formation is governed by the rate at which $CaCO_3$ comes out of solution. Comparison of the diffusion flux with rate of scale formation showed that the amount of substance presented to the crystallization surface considerably exceeds j, the difference increasing with juice flow rate. The crystallization theory shows that the rate of growth is determined either by the diffusion stage or by the rate of phase conversion. It is concluded that under conditions of intensive mixing, as in the case studied, it is the phase conversion rate which is the limiting factor.

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The new evaporator effect of 3200 m² heating surface at Platy sugar factory. P. HRISTODOULOU. *Hellenic Sugar Ind. Quarterly Bull.*, 1976, (27), 225–252 (*Greek*). With increase in the beet slicing rate of Platy factory from an initial 2000 tons/day when first operated in 1962, the evaporator station has gradually been expanded from the original triple-effect unit of 3900 m² heating surface. With the latest addition of a 3200 m² h.s. body, of Greek construction, which acts as 1st effect, the total h.s. is now 14,450 m². The quintuple-effect evaporator comprises three 2nd effect bodies (one of 2000 and the other two each of 1750 m² h.s.) and three 3rd effect bodies (one of 1400 and the other two each of 1250 m² h.s.). The latest addition will provide sufficient capacity when the slicing rate is eventually raised to 8000 tons/day; the present rated diffuser throughput is 5000 tons/day, although 6800 tons/day has been achieved. Problems associated with installation of the new evaporator effect are discussed. Advantages mentioned include a lower juice colour in 1976 (9–18°St compared with 18°St previously) because of a lower temperature (124–126 °C) than in the same period in 1975 (130-133°C) before installation of the new body. In addition, reduction in the back-pressure from 2·9–3·0 to 1·8–2·0 atm has led to increased turbo-generator and evaporator output while making more energy available for other uses.

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Application of organic clays to sugar solution purification. N. S. D'YACHENKO, A. A. IVANYUK and N. U. FISHCHUK. *Ukrain. Khim. Zhurn.*, 1977, **43**, 96-97 (*Russian*).—Laboratory experiments are reported in which syrup of 45·3% dry solids was treated with a variety of filter aids and the reduction in solid phase concentration (g.litre^{-1}) noted. The efficiencies of diatomaceous earth and perlite were considerably improved by adding 20% (w/w) montmorillonite treated with octadecylammonium chloride, after which the filter aids reduced the solid phase to almost negligible concentrations. Modification of the diatomaceous earth, perlite and tripolite with butylammonium chloride or dodecylammonium chloride improved the performance of the original filter aid but not to the same extent as did octadecylammonium chloride, which also considerably improved the performance of "Hyflo Super-Cel".

The development of the Greek sugar industry in the last 15 years. D. HATZEANTONIOU. *Hellenic Sugar Ind. Quarterly Bull.*, 1976, (27), 253–270 (*Greek*).—A survey is presented of the Greek sugar industry from the start-up of Larissa factory in 1961 and of development plans up to 1982. It is pointed out that the five white sugar factories can produce sufficient sugar to cover domestic needs. Information is given for each factory on the equipment and products; average beet, thin and thick juice and molasses analyses are given for the last five-year period.

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Prediction of sugar output. W. FORNALEK. *Gaz. Cukr.*, 1976, **84**, 265–270 (*Polish*).—A method is described for prediction of the volume of sugar produced in a campaign which is based on statistical treatment of data from the 1966–75 campaigns in Poland. The formulae derived permit determination of optimum campaign start and finish required for maximum sugar production as a function of processing capacity.

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Environmental protection and the sugar industry. H. P. HOFFMANN-WALBECK. *Zucker*, 1977, **30**, 61–64 (*German*).—The progress that has been made with waste water treatment and recycling in sugar factories in the Braunschweig district of West Germany in the period 1950–74 is surveyed. Tabulated data show a drop in effluent BOD_5 from 210 kg per 1000 metric tons of beet (the average from 20 factories) in 1950 to 24 kg per 1000 tons (the average for 7 factories processing the same quantity of beet as the 20 factories in 1954) in 1974. The techniques used for treatment and re-utilization of the waste water are indicated.

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The use of gas turbines in sugar factories. H. POHLERT. *Zucker*, 1977, **30**, 75–76 (*German*).—Potential applications of gas turbines in sugar factories are briefly surveyed, including power generation under normal, peak and emergency conditions (particularly in combination with a waste heat exchanger). Of particular interest is the connexion of a gas turbine to a pulp dryer for use of the waste gas as fuel. A diagram is presented of a typical gas turbine, and advantages of the radial-type turbine are listed.

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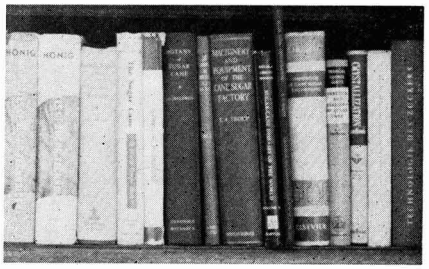
Features of a new method for biological treatment of sugar factory effluents. W. BALLONI, G. FLORENZANO and R. MATERASSI. *Ind. Sacc. Ital.*, 1976, **69**, 137–144 (*Italian*).—After a short account of the microbial ecology of sugar factory effluent stabilization ponds, the authors describe a 3-stage waste water treatment scheme. The 1st stage comprises the usual settling, aeration and final settling, with mud recycling to the first settling tank. The 2nd stage consists of treatment of the effluent (in three tanks in series) with a culture prepared from photosynthetic bacteria; the biomass from the third tank contains protein (tabulated data are given of the contents of nine amino-acids in three photosynthetic bacterial cultures, viz. *Rhodopseudomonas gelatinosa*, *Scenedesmus acutus* and *Spirulina platensis*) and can be used as animal fodder. In the 3rd stage, the effluent is treated with microalgal culture in two steps, after which the biomass (containing large quantities of C and N as well as some P) can be used as fertilizer. Laboratory-scale tests have shown that the BOD of effluent was reduced from 2500 ppm to about 20 ppm in approx. 20 days, the initial fall to 500 ppm taking less than 10 days.



New books

The Australian sugar year book. Volume 36, 1977. 398 pp; 18 × 25 cm. Ed. W. P. KERR. (Strand Publishing Pty. Ltd., 2nd Floor, 432 Queen St., Brisbane, Queensland, Australia.) 1977. Price: A$12.50.

The latest edition of this book is, as have been previous editions, a most valuable guide to the Australian sugar industry. The information includes a 16-page sugar industry directory which gives details of officials in the various organizations, a summary of facts about the sugar industry, a collection of sugar industry statistics, reports from conferences and field days of the various cane agricultural and sugar organizations, brief notes on sugar industry pioneers condensed from a series published in the *Australian Sugar Journal*, and a detailed index to Australian sugar factories and cane-growing districts. Readers interested in the Australian sugar industry should not be without this book.

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Questions and answers on sugar. 20 pp; 9½ × 19½ cm. (British Sugar Bureau, 140 Park Lane, London, England W1Y 3AA.) 1977.

The aim of this small booklet is to provide members of the public and information media with the answers to fourteen major questions. The questions which are discussed (with references given to the literature where appropriate) and answered mostly relate to the role of sugar in the human diet and its possible effects on health, although some questions concern the nature of sucrose, differences between white, brown and raw sugar, and sugar consumption in the UK. The booklet appears at a time when sugar as a foodstuff is very much under attack for its alleged adverse effects on health, and it is to be hoped that it will help to allay the fears that have been expressed in certain quarters.

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Structural and institutional aspects of the sugar industry in developing countries. G. B. HAGELBERG. 69 pp; 15 × 21 cm. (Institut für Zuckerindustrie, Amrumer Strasse 32, Berlin 65, Germany D-1000.) 1976. Price: DM 10.00.

The author of this monograph, No. 5 in the series of research reports published by the Institut für Zuckerindustrie, examines the development of sugar industries and their possible future trends in Third World countries. The subject is discussed in considerable depth under four major sections: the duality of centrifugal and non-centrifugal sugar production; the organization of centrifugal sugar production; geographical patterns of Third World sugar production, trade and consumption; and some development implications (including the role of by-products utilization). The tangle of inter-related factors, most of them of an economic nature, influencing the viability of sugar production in the developing countries is deftly unravelled, expansion of one theme of discussion leading to another in a very clear manner. There is no attempt to assess the pros and cons of patterns of production, merely statement of facts backed up by tabulated data and references to the literature. This is a highly readable book which is recommended to all those interested in the international situation.

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Physics and chemistry of sugar beet in sugar manufacture. K. VUKOV. Transl. A. FALVAY. 595 pp; 17 × 24·5 cm. (Elsevier Scientific Publishing Co., P.O. Box 211, Amsterdam, Holland.) 1977. Price: $59.25.

This is an enlarged English version of "Physik und Chemie der Zuckerrübe" which was published in 1972[1]. It is not just a translation of the original (although an initial glance at random chapters and paragraphs in the original German text and the new English version might convey that impression), since references to more recent work are incorporated where desirable, and tabulated and graphed material has been updated wherever possible.

The book is divided into four main sections: physical and chemical properties of sugar beet; effect of various factors on the physical and chemical properties of sugar beet; effect of physical and chemical beet properties on processing; and selected physical and chemical tests. An important improvement on the earlier version is the location of references at the end of each major sub-section instead of all at the end of the book, and an author index has now been incorporated.

While the author, who is Scientific Advisor to the Research Institute of the Hungarian Sugar Industry, relies heavily on work carried out in East European countries, this is not without its value, since most of our readers would not be able to read the original works to which reference is made, and the author does provide a neat summary of the work conducted in specific fields in both the Western and Eastern Hemispheres. The printing is clear and the contents well set out; the standard of translation is adequate.

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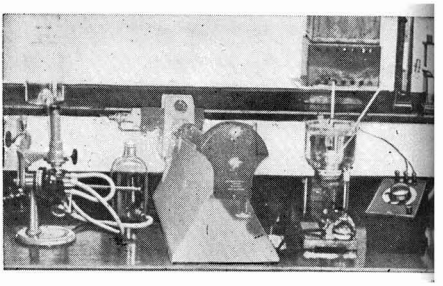
Queensland Canegrowers Association 50th Annual Report 1977. 36 pp; 20 × 27 cm. (Queensland Canegrowers Association, Canegrowers Building, Edward St., Brisbane, Queensland, Australia.) 1977.

This beautifully produced report gives information on the 1976 cane season in Queensland and New South Wales as well as describing the various services available to cane growers and discussing the world and Australian sugar economies. It is lavishly provided with clear, well-printed colour photographs illustrating various aspects of the sugar industry.

[1] *I.S.J.*, 1973, **75**, 56.

Laboratory methods & Chemical reports



Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

Separation and identification of some compounds present in sugar cane wax. L. CUERVO, O. CHAO and T. RÍOS. *Rev. Soc. Quim. Mexico*, 1975, **19**, (6), 283–295; through *S.I.A.*, 1976, **38**, Abs. 76–1600. When cane is milled, about 40% of the wax enters the juice to be precipitated in clarification mud; recovery of the 60% remaining in bagasse is impracticable because its concentration is so low, about 0·1% on bagasse. Mud taken from Oliver filters at El Portero factory in 1971 was dried, giving a 950-g sample; double extraction with refluxing ethyl acetate yielded 115 g crude wax, i.e. 12·1% on dry solids, compared with 19·3% by the Soxhlet method, which gave 12·7–24% wax on dry solids for muds from five factories. The wax was fractionated by solvent extraction with hexane and methanol, followed by column chromatography on alumina, and fractional crystallization and/or thin-layer chromatography. Mass spectra, infra-red spectra and melting points of fractions obtained are indicated, and empirical formulae of components are deduced; two components were identified as β-sitosterol and the methyl ester of the 5-ring triterpene sawamillitin.

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Biodeterioration of sweet-waters in sugar refining. R. H. TILBURY, C. J. ORBELL, J. W. OWEN and M. HUTCHINSON. *Proc. 3rd Int. Biodegradation Symposium*, 1976, 533–543; through *S.I.A.*, 1976, **38**, Abs. 76–1610.—A microbiological survey was made of sweet-waters in a sugar refinery. Dust collectors ("Rotoclones") and dirty sweet-water ("housewater") were the most heavily contaminated sites. Mesophilic and osmotolerant yeasts and mesophilic bacteria were the predominant flora; 82 bacterial isolates and 97 yeast isolates were identified. The principal bacterial genera were *Bacillus*, *Leuconostoc*, *Streptococcus* and *Lactobacillus*, while predominant yeast genera were *Torulopsis*, *Saccharomyces* and *Hansenula*. Sugar loss due to biodeterioration of sweet-waters was estimated by a simulated system in the laboratory to be about 0·5% of refined solids output at one refinery. Formaldehyde and sodium metabisulphite were the most effective preservatives for sweet-waters stored over weekends. Continuous addition of a quaternary ammonium compound to a simulated housewater system gave promising results.

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Preparation of trimethylsilyl ethers of the kestose isomers in aqueous solution. D. NUROK. *J. Chromat. Sci.*, 1976, **14**, (6), 305–308; through *Anal. Abs.*, 1977, **32**, Abs. 1F4.—A partially inverted sucrose solution was concentrated to 90% dry solids (containing a few % of the kestoses) and diluted to contain between 11 and 95% water. To the sample (10± 0·5 mg) was added the silylating reagent [trimethylsilylimidazole-anhydrous pyridine (4:1)] (0·25–0·60 cm^3) and, after centrifuging, the mixture was set aside at room temperature for several hours. A portion (0·5–8·5 μ litre) was injected onto a stainless steel open-tubular column (190 m × 0·5 mm) coated with OV-17; the carrier gas was hydrogen. The identity of the peaks was established by the use of "pure" 6- and neo-kestose. The kestoses can be determined by the addition of melezitose as internal standard before silylation. (See also *I.S.J.*, 1974, **76**, 305–307; 1976, **78**, 189.)

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Carbon dioxide absorption by alkaline sugar solutions. L. P. REVA, Z. I. LOGVIN and V. M. LOGVIN. *Izv. Vuzov, Pishch. Tekh.*, 1976, (5), 115–118 (*Russian*). Laboratory investigations were conducted on the relationship between the rate of CO_2 absorption by 15% sugar solutions containing NaOH or $Ca(OH)_2$ and the height of the bubbling gas layer and partial pressure of the gas; the rate constants were also calculated for the CO_2-lime reaction. The CO_2 was bubbled into the solution at a constant rate of $6{\cdot}96 \times 10^{-5}$ mole.sec^{-1}; above this rate, the gas bubbles merged and formed complex spatial profiles which disrupted the experiments. The solution was fed into a constant-temperature glass column 2 m high and 56 mm in diameter; the CO_2-air mixture was bubbled through a 0·3 mm capillary at the bottom of the column. Carbonate formation was sufficiently low as to have negligible effect on CO_2 absorption, the extent of which was determined from changes in the alkali concentration as found by acid titration. The rate of absorption rose with increase in the height of the bubbling layer but was considerably lower for the limed solutions than for the NaOH-containing solutions under otherwise identical conditions. The diffusion coefficients of the NaOH and lime were so close that they could not have exerted any influence on the absorption rate. However, calculation of the rate constant for the CO_2-lime reaction gave a value of 2750 litres per mole.sec^{-1} compared with a value of 5293 litres per mole.sec^{-1} for the CO_2-NaOH reaction.

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Determination of total lead in clarifying agents based on lead acetate. G. RENS. *Sucr. Belge*, 1977, **96**, 3–7 (*French*).—Details are given of a method for total lead determination in solid or liquid clarifying agents in which acetic acid is added to give a clear solution at a pH in the range 5–6. Sufficient hexamethylenetetramine is then added to give a pH of 5·6. Titration is then carried out with 0·05M EDTA, 1 cm^3 of which corresponds to 10·3595 mg Pb. Xylene orange screened with methylene blue is used as indicator, and the end-point is that at which the final colour of the test

solution is green. Results for various clarifying agents are compared with those obtained earlier[1] using EDTA. The new method is described as being simple, rapid and precise and within the scope of any laboratory.

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Determination of Kjeldahl nitrogen in sugar beet and sugar factory intermediate products. N. KUBADINOW and G. RÖSNER. *Sucr. Belge*, 1977, **96**, 9–16 (*French*). Comparison was made between Kjeldahl N determination by (1) a discontinuous distillation method using the Technicon BD40 automatic digester system (for 40 samples) which has the advantage over a continuous system of allowing maintenance of a constant temperature and prolonging the reaction if required, and (2) a colorimetric method using the "Auto-Analyzer" in which the N is determined as indophenol green[2]. It was found that after 45 minutes method (1) gave betaine-N values which were close to the theoretical, whereas with method (2) only 60% of the betaine-N had been converted to ammonia by the sulphuric acid, and the N value after 2 hours was still below the theoretical value. Gas-liquid chromatography had previously indicated that in the reaction betaine liberates trimethylamine by cleavage under pyrolysis conditions; however, while the distillate in method (1) was found to contain trimethylamine which was determined together with the betaine-N by acid titration, method (2) did not reveal the presence of trimethylamine. Attempts were made to adjust reaction conditions so that the two methods would give comparable results. Studies showed that hydrogen peroxide or perchloric acid used as oxidizing agent gave N values for various beet products which differed according to the amount of oxidizing agent added, the discrepancy varying with the test solution and being governed by the catalyst used. Investigations were conducted on the effect of specific catalysts on the reaction time required for satisfactory betaine and trimethylamine determination. All results indicated that more than 2 hours was required; the least satisfactory results were obtained with sulphuric acid + potassium sulphate and sulphuric acid + potassium sulphate + copper sulphate, while best results were given by a mixture comprising 1000 cm³ sulphuric acid + 500 g potassium sulphate + 25 g mercuric oxide. Using the HgO-containing mixture it was possible to raise the accuracy of the colorimetric method to give results no more than 2·9% below those of the distillation method. Since hydrogen peroxide had no negative effect, its use is recommended for reduction of floc formation in the test solution. Unsatisfactory results were given by use of zirconium dioxide as catalyst[3].

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Sucrose nucleation. II. Validity of a general equation for nucleation rate in sucrose solutions. R. BRETSCHNEIDER and M. SVOBODOVÁ. *Zucker*, 1977, **30**, 65–72 (*German*).—See *I.S.J.*, 1976, **78**, 27.

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Investigations of colorant formation during the formaldehyde condensation reaction in alkaline medium. IV. V. PREY, H. ANDRES and H. GUSBETH. *Zeitsch. Zuckerind.*, 1977, **102**, 84–85 (*German*).—Model juices containing 15% sucrose and 0·15% invert sugar (corresponding to the 100:1 ratio usual for factory raw juices) or 15% sucrose and 0·30% invert sugar were subjected to laboratory purification. Before preliming, pre-determined quantities of formaldehyde were added as 35% aqueous solution. The 2nd carbonatation juice colour was measured at 420 nm and expressed as ICE units, the mean of four values being given for each measurement. Results showed that colour rose linearly with increase in formalin; 100 ppm formaldehyde caused the colour to rise by 130–140 ICE_{420} compared with absence of formaldehyde. In the absence of formaldehyde but in the presence of 100 ppm hexose (the glucose-fructose ratio was 2:1 as in factory juices), the colour was 40 ICE_{420}, indicating that under identical purification conditions formaldehyde produces 3½–4 times as much colour as does the same quantity of invert sugar.

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Rapid electrochemical determination of reducing saccharides. E. W. KRAUSE. *Zeitsch. Zuckerind.*, 1977, **102**, 85–86 (*German*).—A description is given of the TÖDT method for invert sugar determination[4] based on oxidation by periodate, the consumption of which is found by means of a special electronic polarograph. A newly developed patented measuring electrode is used for the periodate determination in conjunction with an anode of alloy steel and a "Thalamide" reference electrode. Improvements in the technique have permitted a reduction of the measuring error to ±1·5% periodate consumption. Determination of invert sugar and glucose in factory intermediate products using the rapid method was compared with results obtained using the copper reduction method and an enzymatic analysis (the last being used as reference method). A significant correlation was found between the sets of values at 1% probability error. The new method has the advantage over the copper reduction method of much greater rapidity, lower costs of chemicals and the possibility of introducing the method into an automatic analysis system.

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Mechanical properties of sugar beet roots. I. Shearing strength and its distribution. W. NOWICKI, P. KOLODZIEJCZYK, P. BANASI and H. GASIOROWSKI. *Gaz. Cukr.*, 1977, **85**, 8–10 (*Polish*).—Investigations were made of the shearing strength of beet sections cut parallel to the root cross-section in the horizontal plane representing the greatest width of the root and one section cut on the centre axis at a point midway between the bottom of the root and the widest section. The beets (all of the same variety) were taken from three different locations and had different mean lengths and diameters. Results showed that shearing strength was greatest towards the outer surface of the root and fell towards the centre core, while it was greater in the lower middle section, i.e. towards the root taper, than in the upper middle section. A dependence was found between root shape and shearing strength; roots 190 mm long and 95 mm in diameter had much greater strength than did those having a greater length: diameter ratio, while differences occurred between roots of similar proportions, whereby those of greater diameter had greater strength. The findings are also discussed in relation to the anatomical structure of the beet.

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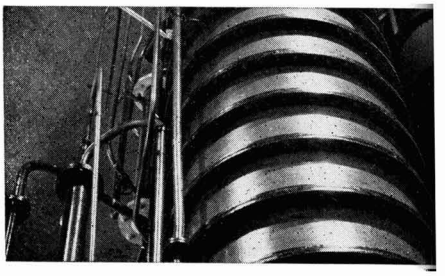
[1] RENS: *I.S.J.*, 1974, **76**, 280.
[2] HOLZ: *Landw. Forschung, Sonderheft* 26/I, 177–191.
[3] GLOWA: *J.A.O.A.C.*, 1974, **57**, 1228–1230.
[4] *I.S.J.*, 1967, **69**, 282.

By-products



Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

The use of fibrous sugar cane by-products by ruminants. II. Effect of the NaOH-pressure combination on the digestibility and chemical composition of bagasse and bagasse pith. P. C. MARTÍN, A. CABELLO and A. ELÍAS. *Cuban J. Agric. Sci.*, 1976, **10**, 19–28.—Following an earlier study on the effect of NaOH treatment of bagasse and bagasse pith on its digestibility[1], further investigations were conducted on the interaction between NaOH concentration and pressure and their effects on digestibility, enzymatic degradation and chemical composition of the bagasse. Results showed that *in vitro* digestibility of the bagasse dry matter was significantly increased by the treatment, the digestibility rising with increase in the NaOH quantity (4, 5 and 6% w/w) and increase in pressure at each NaOH level (2, 4 and 6 atm). Enzymatic degradation was also increased by NaOH treatment but reached a maximum for bagasse at 5% NaOH and 6 atm pressure, after which there was a slight fall; in the case of bagasse pith, maximum degradation was obtained at 6% NaOH and 6 atm pressure. The contents of ash, soluble carbohydrates, pentosans, cellulose and lignin varied according to treatment. It is suggested that decrease in the lignin content and increase in the soluble carbohydrate content accounted for the increase in digestibility.

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A note on the use of different levels of forage and sodium bentonite on the performance of calves fed high levels of molasses/urea. H. LOSADA, A. SANTOS and A. ELÍAS. *Cuban J. Agric. Sci.*, 1976, **10**, 29–33.—In a random block design, calves were fed on a restricted forage diet of 1·5% and 4·5% on live weight and allowed free access to a 2% molasses-urea diet also containing mineral and fish meal to which 2% or 4% sodium bentonite had been added. Daily weight gain and total dry matter consumption were greater with the 4·5% than with the 1·5% forage diet, while addition of 4% sodium bentonite increased the values of both factors still further in both stages of the experiment. There was no significant difference in molasses consumption between the various treatments.

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Effect of different proportions of high-test and final molasses in diets for growing pigs. I. Performance and carcass composition. L. MARRERO and J. LY. *Cuban J. Agric. Sci.*, 1976, **10**, 41–56.—Pigs were fed five diets containing different proportions of high-test molasses and final molasses which were supplemented with fish meal, minerals and vitamins. Results showed that maximum average daily weight gain was obtained with the ration containing 75% high-test but no final molasses, that maximum daily mean consumption of dry matter was obtained with the ration containing 45% high-test and 30% final molasses, and that maximum dry matter conversion occurred with the ration containing 15% high-test and 60% final molasses. Fresh weight of the caecum (% live weight) was maximum with the ration containing 15% high-test and 60% final molasses. No effects of treatment on carcass properties could be found. It is concluded that where high-test molasses is used as the only energy source, a restricted feeding system is the most suitable, while there is doubt on the value of high-test and final molasses fed to pigs *ad libitum*.

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Ecological constraints of anaerobic fermentation of cane molasses with rumen inocula. E. J. P. PÉREZ-GAVILÁN, M. CARDOSO and G. VINIEGRA-GONZÁLEZ. *Cuban J. Agric. Sci.*, 1976, **10**, 63–80.—Experiments are reported in which semi-continuous fermentation of cane molasses, maize starch and urea was used to simulate the fermentation processes that take place in the rumen. From the results of volatile fatty acid production with various substrates it is assumed that in the presence of reducing sugars, butyric acid-producing microbes predominate, perhaps because they have a faster metabolic rate than the propionic acid-producing microbes; the latter might bring some advantages in the presence of oligosaccharides and polysaccharides, since most butyric acid-producing microbes cannot use the substrates directly but are dependent on propionic acid-producing microbes. A double fermentation system for ruminal digestion is thus suggested; preliminary experiments with cows fed on molasses and urea fermented with manure have tended to confirm this. The possibility of manipulation and control of rumen fermentation based on the continuous anaerobic fermentation of molasses/urea is, however, rejected because of the high levels of butyric acid present.

* * *

New process for citric acid production from deionized cane molasses and refined cane sugar. P. NANDI and A. K. MISHRA. *Proc. 4th Int. Fermentation Symposium* (Kyoto, Japan), 1972, 209–213; through *S.I.A.*, 1976, **38**, Abs. 76–1585.—*Aspergillus niger* strain C/319:4 was used in submerged fermentation experiments in 2·5- and 100-litre fermenters, whose design is described. Media were based on cane molasses, which was diluted to 14–16% sugars, deionized with "Amberlite IR-100" and "Amberlite IR-45" resins to decrease the iron content to ≥ 2 ppm, and supplemented with mineral nutrients. Citric acid yields from untreated molasses ranged from 15·7% to 50·0% on available sugars; after deionization they were up to 68·8%. Yields from media based on refined cane sugar, without and with deionization, were 68·5% and 70·0%, respectively.

[1] MARTÍN *et al.*: *I.S.J.*, 1975, **77**, 186.

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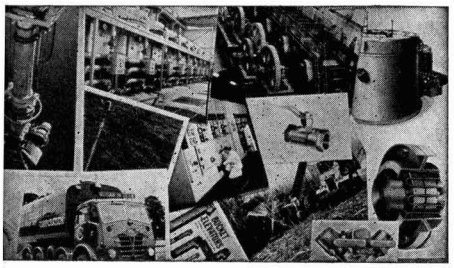

Trade notices

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

PUBLICATIONS RECEIVED

CHEMICALS INFORMATION HANDBOOK 1976-7. Shell International Chemical Co. Ltd., Shell Centre, London, England SE1 7PG.

This 108-page booklet gives information on the world chemical industry, with details of the major companies involved, and describes the organization of the Royal Dutch/Shell Group of companies and the business conducted, with data on the chemicals produced, chemical plants and their capacities, and research work. The products mentioned include a number of chemicals of application in sugar beet and cane agriculture.

* * *

"DUOLITE" ION EXCHANGE RESINS IN THE TREATMENT OF SUGAR SOLUTIONS. Diamond Shamrock Chemical Co., 1901 Spring St., Redwood City, CA, USA 94063.

The 56 pages of this brochure are separated into 10 chapters covering: types of sugar solutions treated by deionization; ion exchange systems for sugar juice treatment; deionization of thin juices and diluted machine syrups; cost of cooling to prevent sucrose inversion; starch hydrolysates; waste sugar solutions; other uses of ion exchange in sugar refining; by-product recovery; economics of sucrose recovery by deionization; and properties of "Duolite" ion exchange resins used in refining sugar. Two pages of appendix notes are followed by a page of references to the literature. The text is interspersed with tabulated results obtained with "Duolite" resins in various sugar factories and with diagrams of the different schemes used. Leaflet No. 2 gives a list of "Duolite" ion exchange and adsorbent resins with details of their properties and applications.

* * *

THE "LIMBEROLLER" IDLER. Joy S.A., 209 rue de Bercy, Paris, France 75585; C.M.T. Industrial Supplies Ltd., Halesowen Rd., Dudley, England DY2 9NR.

The "Limberoller" idler is made of "Neoprene" and is resistant to chemicals and unaffected by temperature in the range —35° to +120°C; the discs are threaded on a wire rope, the continual flexing of which prevents material adhering and building-up on the discs, so prolonging belt life. This flexibility also prevents damage where off-centre loading or overloading takes place. The "Limberoller" can be quickly installed and removed, and is fitted with sealed bearings which are positioned away from the moving belt. A brochure gives information on the idler, which has been installed on belt conveyors at the British Sugar Corporation, Irish Sugar Co. and Tate & Lyle Ltd.

* * *

BOOKER AGRICULTURE INTERNATIONAL LTD. Booker Agriculture International Ltd., Bloomsbury House, 74/77 Gt. Russell St., London, England WC1B 3DF.

Booker Agriculture International (BAI), formerly Bookers Agricultural & Technical Services Ltd., has been operating since 1964, and in the last 7 years has undertaken over 80 projects in 43 countries. A coloured, 24-page brochure outlines the work of BAI as a consultancy and management firm, covering all the stages from investigation and feasibility studies to personnel training for projects once they have been completed. Included are details of the Bacita factory/refinery of the Nigerian Sugar Co. Ltd. and the Mumias Sugar Co. plant in Kenya, while mention is also made of a scheme in the Middle Juba region of the Somali Republic; in addition, BAI manages Chemelil Sugar Co. in Kenya. BAI services in the Caribbean are also described.

* * *

CONVEYING AND TRANSMISSION CHAINS. Ewart Chainbelt Co. Ltd., Derby, England DE3 8LX.

A new 4-language quick-reference brochure from Ewart Chainbelt gives essential information on chains for a wide variety of conveying, elevating and power transmission tasks. Neat "stepping" of page sizes and imaginative use of colour permits the reader to turn straight to the page in the language (English, French, German or Spanish) of his choice. Diagrams of the chain types accompany the information, and lists are given of typical industries served and literature available from Ewart concerning their equipment.

* * *

THE STEUMA REFRACTOMETER. Steuma Fuchs & Cie. KG, Hohenbercha 6, Germany D-8051; Bran & Luebbe (GB) Ltd., Scaldwell Rd., Brixworth, Northants, England NN6 9EN.

A recent brochure gives details of the Steuma electro-optical process refractometer which has an accuracy of $\pm 0{\cdot}5\%$ of the measuring range and a maximum measuring sensitivity of $0{\cdot}1\%$ ($0{\cdot}01$°Bx over a range of 5°Bx). The high reliability of the instrument is assured by the absence of moving parts in both the optical and electrical systems. The light is reflected at the liquid-prism interface and, since it does not pass through the liquid, is not affected by its colour. It is possible to compensate for interference caused by light diffusion from turbid matter, and the instrument is free from hysteresis. The 5-cm^3 measuring chamber through which the liquid passes continuously in bypass flow is easily accessible at all times. All the internal surfaces, of glass and stainless steel, are completely smooth, permitting easy cleaning and sterilization of the instrument *in situ*.

* * *

INDUSTRIAL MALODOURS AND THEIR CONTROL. May & Baker Ltd., Essex House, 15 Station Rd., Upminster, Essex, England RM14 2JT.

Information is given on the May & Baker "Alamask" range of odour control compounds in a recent 8-page brochure. "Alamask" CPM-D can be applied to beet flume water and waste water lagoons, while "Alamask" REQ-M2-X is intended for aerial spraying to reduce the odours arising from mud lagoons during drying out.

* * *

VACUUM PAN INSTRUMENTATION. Ziegler & Associates, 27 Carmello Rd., Walnut Creek, CA, USA 94596.

A leaflet available from Ziegler & Associates describes the Model 970-C consistency monitor which is designed primarily to measure continuously the massecuite consistency, although the narrow viscosity range that can be covered makes it also useful for measurement of liquor concentration in sugar melters, evaporator syrups, milk-of-lime and molasses in dilution tanks. Another leaflet gives details of the Model 970 M supersaturation monitor which is calibrated for a range of 1·0–2·0 supersaturation and which provides a signal for use with standard recorders, controllers or alarm units. A hand microscope for massecuite (Model 970-S) makes newly formed nuclei visible within seconds of formation, i.e. before syrup on the slide has cooled sufficiently to increase its supersaturation beyond that in the pan. It is thus invaluable for determining, in conjunction with the 970 M supersaturation monitor, the exact upper limit of the metastable zone. A leaflet describes its features and operation.

Commission Internationale Technique de Sucrerie

Scientific Committee Meeting, 1977

FOLLOWING an invitation from the Faculty of Chemical Technology of the Technical University of Slovakia, members of the Scientific Committee of the Commission Internationale Technique de Sucrerie (C.I.T.S.) met in Bratislava, Czechoslovakia, during the 1st–2nd June 1977. About 50 members participated, some 30 coming from other countries.

At the opening session, under the presidency of Prof. Dr. F. SCHNEIDER, participants were welcomed by the Dean of the Faculty, Mr. A. LODES, by the Director of the Saccharides Department of the Faculty, Mr. L. SORMAN, and by the Director-General of the Slovakian sugar industry, Mr. A. SAKAC. During the working sessions 16 brief communications were presented and discussed by the various members or their collaborators.

On the evening of the 1st June a reception was given at the Hall of Residence for the students in the Technical University where participants had the pleasure of being able to greet, among others, Mme. VASATKO, widow of their late colleague, Dr. J. VASATKO.

The next day the group was received at the Town Hall by the mayor of Bratislava after which a visit was organized to the Juhcukor sugar factory at Dunajska Streda, in which participated executives from all the Czechoslovakian sugar industry as well as representatives of the research institutes.

Texas 1976/77 cane sugar crop.—The Rio Grande Valley Sugar Growers, Inc. ended Texas' 244-day campaign on 15th June, a full 2½ months later than scheduled. Above-average rainfall in the period October 1976–January 1977 was the culprit causing the extended harvest. Fortunately, mild freezes in January caused only slight cane deterioration and injury. The delay in harvesting of early-season varieties resulted in some reduction in yield % cane, but cane quality held up surprisingly well as spring temperatures escalated. When it became obvious that all the acreage could not be harvested soon enough to give an early start to next season's crop the decision was made to expedite throughput in order to harvest more acreage. Maceration water was greatly reduced to cut the boiling house load. In effect, dry milling was practised for 2½ months. Rains returned in June, forcing an end to harvesting. As a result 5759 acres will stand-over for harvest next season. An additional 2823 acres were abandoned or discarded during the season owing to wet conditions or poor juice quality. Several production or prototype cane harvesters were on trial under Texas conditions. These included a Claas, a Massey-Ferguson 205, Thomson 2-row Duncana, Toft 354, Cameco, J & L, and J & L tracked 2-row machines. Near the end of the season a Toft 364 full-track and Toft 10-ton tracked transloader were put into operation. The total area harvested amounted to 27,055 acres (35,061 acres in 1975/76) and yielded 1,074,837 gross tons (1,411,732 tons in 1975/76) or 39·7 gross tons per acre (40·3) equivalent to 35·8 net tons per acre (35·7). Sugar produced was 90,982 tons 96° as against 126,164 tons in 1975/76, a yield of 3·36 tons of sugar per acre (3·60), and 9·38% on cane (10·08).

* * *

Lonrho Ltd. loss of Sudan sugar project management[1].—Lonrho Ltd. have lost their contract for management of the Kenana sugar project in the Sudan. No reason was given when the decision was announced but it came after major cost escalations from $180 million in late 1974 to $600 million. Originally scheduled to begin production in November 1977, there are now fears that the revised target of November 1978 will not be reached. The project is to produce 350,000 tons of sugar per year eventually and is half-owned by the Sudan Government with 42¼% held by Arab interests, 5½% by Lonrho and 2¼% by Nissho Iwai.

Belgium/Luxembourg sugar imports and exports[2]

	1976	1975
Imports	*(metric tons, tel quel)*	
Colombia	85	1,156
France	43,484	9,957
Germany, East	168	963
Germany, West	10,581	1,062
Holland	15,489	3,247
El Salvador	0	5,244
UK	44	455
USA	10	4,960
Other countries	48	977
	69,909	28,021
Exports		
Algeria	4,378	8,626
Angola	4,500	0
Bahrain	2,000	0
Benin	722	1,424
Cape Verde Is.	1,420	0
Denmark	530	0
France	15,163	1,062
Germany, West	59,310	34,131
Holland	67,636	19,889
Hong Kong	1,200	0
Iceland	1,258	250
Iran	2,516	0
Ireland	5,385	19,220
Israel	5,284	170
Italy	48	10,834
Ivory Coast	1,000	0
Kenya	1,352	0
Kuwait	1,501	0
Lebanon	2,703	0
Malta	2,121	0
Mauritania	2,196	495
Nigeria	30,595	200
Norway	7,709	1,413
Oman	1,700	0
Quatar	5,250	0
Senegal	448	2,564
Syria	4,503	0
Tunisia	5,500	0
UK	17,403	100,142
United Arab Emirates	1,559	0
USSR	47,150	0
Yemen, North	1,500	0
Yemen, South	8,250	0
Zaire	3,717	0
Other countries	8,161	2,764
	325,668	203,184

New York sugar market move[3].—On 5th July the trading floor of the New York Coffee & Sugar Exchange moved to new quarters at the Four World Trade Center, New York, NY, U.S.A. 10048. The Coffee & Sugar Exchange is being joined by the Commodity Exchange, the New York Cotton Exchange and the New York Mercantile Exchange at the new location. The new facility will be known as the Commodity Exchange Center and will incorporate the latest communications technology.

* * *

Guatemala sugar expansion.—Sugar statistics from Guatemala, recently published by C. Czarnikow Ltd.[4], illustrate the remarkable expansion in production and exports of sugar during the period 1968–76. From a crop of 160,604 metric tons, raw value, in 1968, production has grown to 517,312 tons by 1976—an increase of 222%—while consumption has just less than doubled, from 109,924 tons in 1968 to 204,135 tons in 1976. This has permitted an increase of 469% in exports —from 56,470 tons to 321,475 tons last year. A further substantial expansion in production and exports is expected to take place in 1977.

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[1] *The Times*, 24th May 1977.
[2] C. Czarnikow Ltd., *Sugar Review*, 1977, (1329), 52.
[3] *Lamborn*, 1977, **55**, 113.
[4] *Sugar Review*, 1977, (1336), 80.

Philippines sugar statistics[1]

	1976	1975	1974
	(metric tons, raw value)		
Initial stocks	1,108,186	294,184	223,069
Production	2,983,982	2,672.316	2,655,810
	4,092,168	2,966,500	2,878,879
Exports	1,514,573	1,005,664	1,635,637
	2,577,595	1,960,836	1,243,242
Consumption	840,743	852,650	949,058
Final stocks	1,736,852	1,108,186	294,184
Exports –			
Algeria	37,939	—	—
China	81,104	11,016	—
Finland	—	—	32,315
France	—	—	23,817
Iran	—	57,031	—
Japan	93,446	377,039	214,846
Morocco	—	27,909	—
New Zealand	13,011	—	—
Portugal	—	11,376	—
Rumania	31,907	—	—
Switzerland	—	—	5,613
UK	33,521	181,882	11,360
USA	992,415	339,411	1,347,686
USSR	231,230	—	—
	1,514,573	1,005,664	1,635,637

New Philippines sugar administration body[2].—The Philippines Government has centralized its control over the sugar industry in a new body, the Philippine Sugar Commission, to which the functions of the other sugar agencies will be transferred. The Commission was expected to be organized formally in June and will absorb the functions of the Philippine Exchange (which is the sugar trading wing of the Government-owned Philippine National Bank), the Price Stabilizing Council, the Philippine Sugar Institute (a research body) and the Sugar Quota Administration. The Stabilization Council fixed floor and ceiling prices for the domestic sugar market. The Commission was created by a Presidential Decree in 1974 which was never implemented, and provides for the establishment of a fund from planters' and millers' contributions to finance the growth and development of the industry and to stabilize prices.

* * *

HFCS levy opposition.—The Dutch manufacturer of HFCS, Koninklijke Scholten-Honig, appealed to the European Court of Justice in Luxembourg to have the subsidy on starch produced from imported maize restored by the EEC; the farm ministers of the nine member countries had agreed to abolish it last August. This appeal was unsuccessful but the company was then expected to appeal against the levy to be imposed from July as agreed recently by the ministers[3]. Scholten-Honig claims that this levy of nearly £30 per metric ton makes HFCS production uneconomical and will kill its planned production facility at Tilbury, in England, and its existing Dutch plant. Tunnel Glucose, a UK manufacturer with a plant in Greenwich almost completed, also states that the levy means that it cannot now make an adequate return on the £8,000,000 investment and it will have to look for other uses.

* * *

Renold mechanical handling plant in the Sudan.—A £100,000 order for mechanical handling equipment to be installed in a new sugar processing plant in the Sudan has been secured by Renold Ltd. through its Belgian subsidiary. It covers equipment, to be made in the UK, for the Melut sugar factory on the White Nile in Upper Nile Province. When completed in 1978, the factory will be able to process 6500 tons of cane per day. Contractors for the plant are A.B.R. Engineering, of Belgium. Under the contract Renold will equip the two cane feeder tables, main and auxiliary carriers and four elecators and conveyors for bagasse. The bagasse system incorporates a section dealing with surplus bagasse storage and reclamation. Altogether over a mile of heavy conveyor chain of three different types is involved.

Cuban sugar statistics[4]

	1976	1975	1974
	(metric tons, raw value)		
Initial stocks	557,429	373,071	460,630
Production	6,150,797	6,427,382	5,925,850
	6,708,226	6,800,453	6,386,480
Consumption	531,919	499,313	522,162
	6,176,307	6,301,140	5,864,318
Exports	5,763,652	5,743,711	5,491,247
Final stocks	412,655	557,429	373,071
Exports			
Albania	13,169	14,171	12,850
Algeria	35,191	46,495	7,182
Angola	31,881	—	—
Bulgaria	232,042	185,728	190,144
Canada	149,041	156,192	115,669
China	254,315	182,877	358,670
Czechoslovakia	109,172	55,745	160,484
Denmark	21,739	21,089	—
Egypt	23,006	13,699	—
Finland	71,111	95,978	82,702
France	15,100	12,127	—
Germany, East	194,868	169,195	276,003
Hong Kong	13,332	—	—
Hungary	70,007	41,762	51,369
Iraq	83,003	78,395	65,162
Ireland	10,591	—	—
Jamaica	—	4,468	—
Japan	149,941	338,825	1,151,981
Korea, North	21,999	50,441	55,305
Lebanon	—	22,035	10,920
Malaysia	18,861	—	64,222
Mali	—	22,143	—
Malta	4,096	—	—
Morocco	108,777	100,280	40,793
New Zealand	34,990	93,673	38,736
Poland	16,642	43,100	28,278
Portugal	92,001	115,656	51,502
Rumania	39,303	11,224	77,953
Senegal	46,175	31,831	—
Spain	114,519	326,523	363,127
Sudan	—	27,260	—
Sweden	108,291	35,252	50,818
Syria	106,222	52,794	41,311
Trinidad	—	4,073	—
Tunisia	—	12,442	—
Turkey	—	22,828	11,925
United Kingdom	138,756	16,671	70,951
USSR	3,035,566	3,186,724	1,974,761
Vietnam	124,538	86,918	78,018
Yugoslavia	266,360	60,767	50,371
Other countries	9,047	4,330	10,040
	5,763,652	5,743,711	5,491,247

Benin sugar complex.—A contract was signed in Lagos, Nigeria, in May 1977 by A.B.R. Engineering and Société Sucrière de Save (a joint Beninan-Nigerian company) relating to the setting up of an agro-industrial complex in Save, People's Republic of Benin, close to the Nigerian border. This new complex will allow Benin to cover its sugar needs while exporting a large part of the production to the adjacent Nigerian districts. The contract signed by A.B.R. Engineering is divided into three parts: infrastructure (comprising the construction of a dam, roads and paths, railway siding, land clearance and preparation, drainage network, administrative buildings, warehouses and garages, water supply for the factory and villages and supply of rolling stock), irrigation for the 4000 ha to be planted, and the industrial part consisting of the supply of engineering, equipment, civil engineering, erection and commissioning of a sugar factory and refinery capable of processing 3750 tons of cane per 24 hours. The total investment cost amounts to about 6,000,000,000 Belgian francs.

[1] C. Czarnikow Ltd., *Sugar Review*, 1977, (1337), 85.
[2] *Public Ledger*, 18th June 1977.
[3] *I.S.J.*, 1977, **79**, 182.
[4] C. Czarnikow Ltd., *Sugar Review*, 1977, (1336), 81.
[5] See *I.S.J.*, 1975, **77**, 352.

Canada sugar statistics[1]

	1976		1975	
	(*metric tons, raw value*)			
Initial stocks		356,353		340,775
Production		156,310		120,269
Imports:				
Australia	412,223		380,744	
Cuba	139,907		154,784	
Dominican Republic	20		11,061	
Guatemala	0		10,762	
Guyana	5,860		0	
Mauritius	4,316		88,865	
South Africa	336,384		324,590	
Swaziland	0		9,823	
Trinidad	11,278		2,556	
USA	30,711		55,133	
Other countries	79		383	
		940,778		1,038,701
		1,453,441		1,499,745
Less Consumption*		964,182		1,057,253
Exports:				
Bahamas	6,155		4,013	
Belgium/Luxembourg	0		256	
Bermuda	824		1,100	
Dutch West Indies	352		98	
France	0		7,746	
Greece	0		16,305	
Holland	0		326	
Israel	109		5,297	
Jamaica	160		56	
Kenya	543		1,087	
Leeward & Windward Is.	737		1,179	
Libya	0		5,978	
Malta	4,881		0	
Nigeria	1,306		9,761	
St. Pierre	176		131	
Trinidad	4		1,904	
USA	37,719		30,125	
US Oceania	324		334	
Other countries	266		443	
		53,556		86,139
Final stocks		435,703		356,353

* Corrected.

Leeds University open day for the food industry.—Leeds University's Department of Food Science is putting itself on show to the food industry on Thursday, 15th September 1977 in a programme which includes displays, demonstrations and seminars.

* * *

Nepal sugar factory expansion[2].—Birganj sugar factory in Nepal is to be expanded, increasing production capacity by 50%. Production will then reach 70% of domestic sugar requirements.

* * *

Florida sugar factory sale[3].—Glades County Sugar Growers Cooperative has sold its Moore Haven, Florida, cane sugar factory and refinery to Gulf and Western Food Products Co. It is expected that the factory will be dismantled and the cane processed at Gulf and Western's Okeelanta sugar factory in nearby South Bay. No plans for the future operation of the refinery have been announced.

* * *

Thailand bulk sugar terminal[4].—The first bulk sugar terminal in Thailand is currently under construction in Damut Prakarn, south of Bangkok, and is to be completed by the end of this year. The cost of the project will amount to some $7,500,000. Vessels of 20,000 tons capacity will be able to be loaded compared with the present limit of 10,000 tons at the existing river ports. The new plant will be able to load at a rate of 400 tons of sugar per hour.

* * *

Fiji sugar exports[5].—Exports of sugar from Fiji were almost the same in 1976 at 256,676 metric tons, raw value, as in 1975 (254,828 tons). As before, there were only four destinations, of which the UK was the principal one, with 178,458 tons in 1976 against 180,194 tons in 1975. Next was New Zealand with 42,029 tons in 1976 and 36,216 tons in 1975, followed by Singapore (18,095 tons in 1976 and 19,209 tons in 1975) and Malaysia (18,094 tons and 19,209 tons, respectively).

Barbados sugar statistics[6]

	1976	1975
	(*metric tons, raw value*)	
Initial stocks	6,540	3,544
Production	106,486	100,750
	113,026	104,304
Consumption*	14,894	14,860
Exports		
Antigua	0	52
Canada	6,076	4,977
Dominica	80	1
Germany, West	206	0
Grenada	0	62
Ireland	48,835	0
New Zealand	0	624
St. Lucia	949	3
St. Vincent	808	1,033
UK	0	52,077
US	36,279	24,075
	93,233	82,904
Final stocks	4,899	6,540

* Adjusted.

Colombia/Venezuela sugar complex[7].—The Ministers of Agriculture and Industrial Development of Colombia and Venezuela met at the frontier between the two countries on the 14th March to establish a sugar complex. This 45-million dollar complex will be part of a programme for the economic integration of the two countries. It will include the Zulia sugar factory in Colombia and the Urena refinery in Venezuela. Each country will provide 45% of the investment, the balance being financed by a loan from the Andean Common Market by the intermediary of its agency, the Andean Development Corporation. Venezuela is also to expand the distillery at Urena, and Colombia will make improvements in its agricultural and cane transport services in Zulia.

* * *

Japan beet sugar factory closure[8].—The 2000 tons/day Obihiro sugar factory of Nippon Tensai Seito Co. Ltd. was closed on March 31st, as part of a rationalization scheme. It was the oldest beet sugar factory in Japan. The nearby Memuro factory of the same company is being expanded from 3500 to 5600 tons slicing capacity for the next campaign when it will receive the beet formerly sent to Obihiro.

* * *

Yugoslavia beet sugar production 1976/77[9].—From 4·6 million tons domestic beet and 19,500 tons of imported beet, a record outturn of 675,000 tons of sugar was obtained in 1976/77. Consumption in 1977 is estimated at 610,000 ton.

* * *

West German sugar exports[10].—Exports of sugar by West Germany in 1976 totalled 292,265 metric tons, white value, compared with 229,193 tons in 1975 and 385,225 tons in 1974. Exports to the UK were considerably lower, at 42,808 tons as against 110,135 tons in 1975 and 95,085 tons in 1974, but those to Belgium-Luxembourg were 11,157 tons against 866 tons in 1975 and 785 tons in 1974, and those to Denmark were raised from nil in 1974 and 661 tons in 1975 to 29,359 tons in 1976. Exports to Switzerland were 31,143 tons (4150 in 1975 and 14,678 in 1974) while Yugoslavia received 12,476 tons (nil in 1975 and 1974). The other major outlet was Nigeria with 13,313 tons in 1976, compared with 1735 tons in 1975 and 820 tons in 1974.

[1] *I.S.O. Stat. Bull.*, 1977, **36**, (4), 26–27.
[2] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (12), 19.
[3] *Sugar y Azúcar*, 1977, **72**, (5), 9.
[4] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (13), 17.
[5] *I.S.O. Stat. Bull.*, 1977, **36**, (4), 44.
[6] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (11), xii.
[7] *Amerop Noticias*, 1977, (41), 12.
[8] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (13), 18; *Zeitsch. Zuckerind.*, 1977, **102**, 228.
[9] *Zeitsch. Zuckerind.*, 1977, **102**, 169.
[10] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (11), ii–iii.

Index to Advertisers

Kenana Sugar Company Limited
Sudan

Applications are urgently invited for the following senior positions on the Kenana Sugar Estate, situated close to the White Nile, 180 miles south of Khartoum.

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Responsible to the Agricultural Manager for the control and monitoring of 45 m^3 per sec of water (lifted 40 metres from the White Nile by four main pumping stations over a distance of 29 kilometres of main canal) to irrigate ultimately a total of 82,000 acres of sugar cane, through a system of primary and secondary canals.

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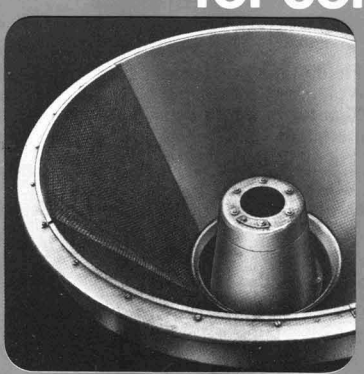

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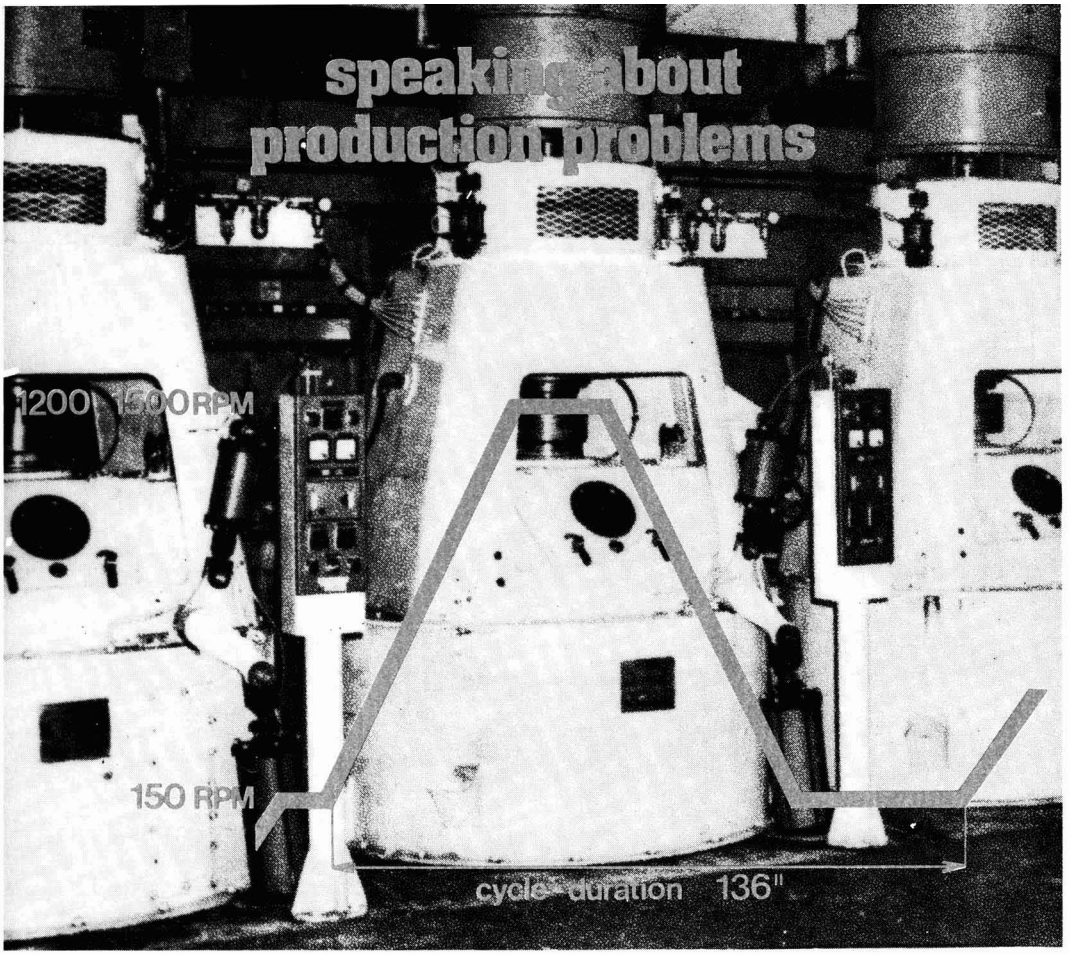

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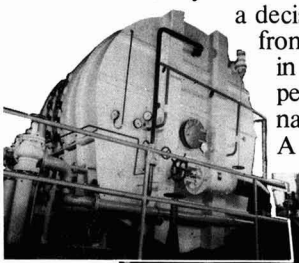

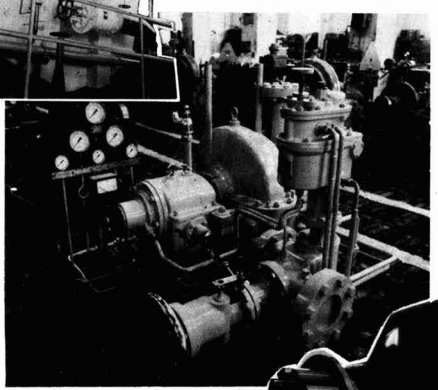

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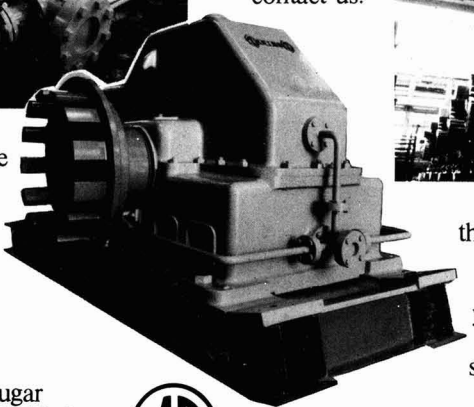

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