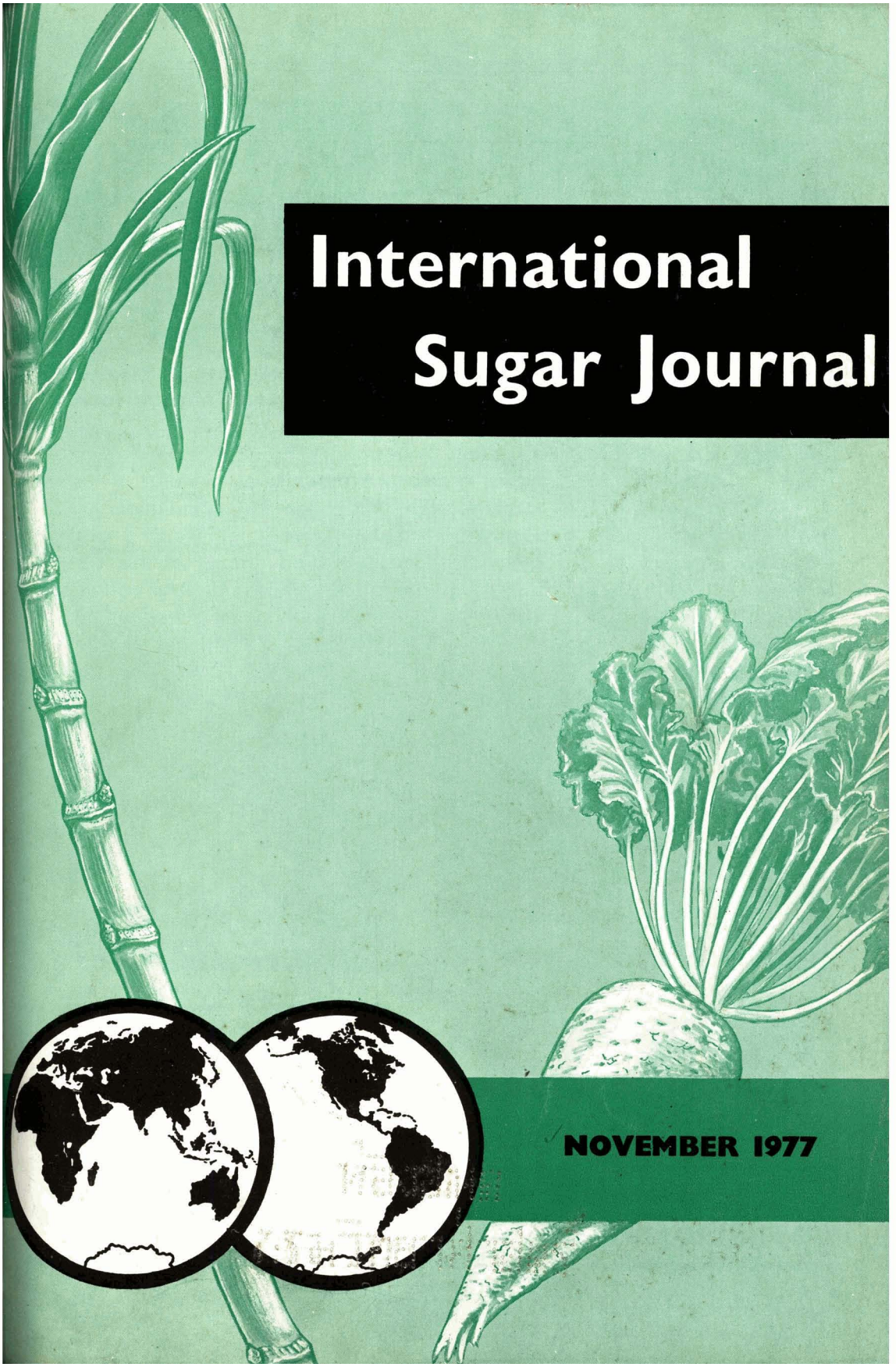

International Sugar Journal

NOVEMBER 1977

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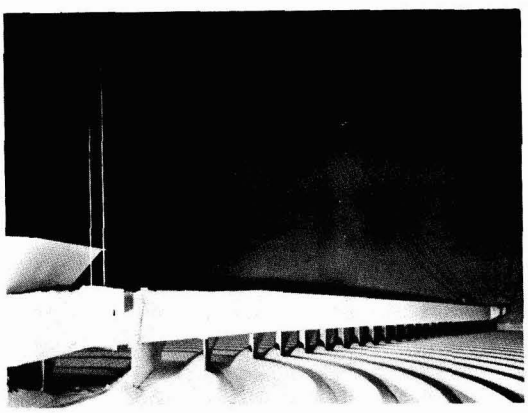
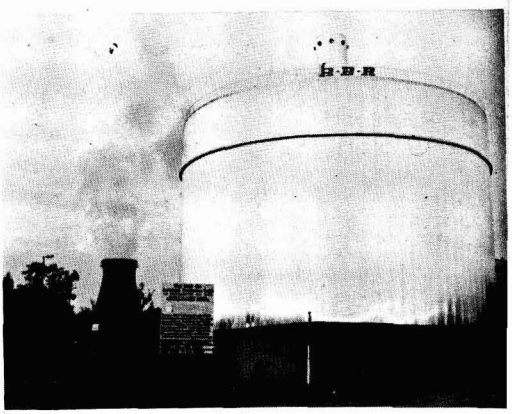


Rotating beam with spreading plates.



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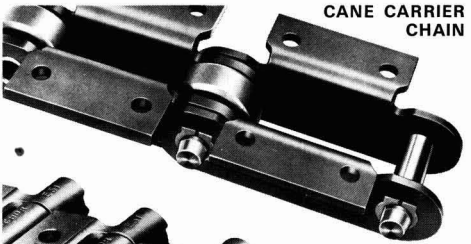

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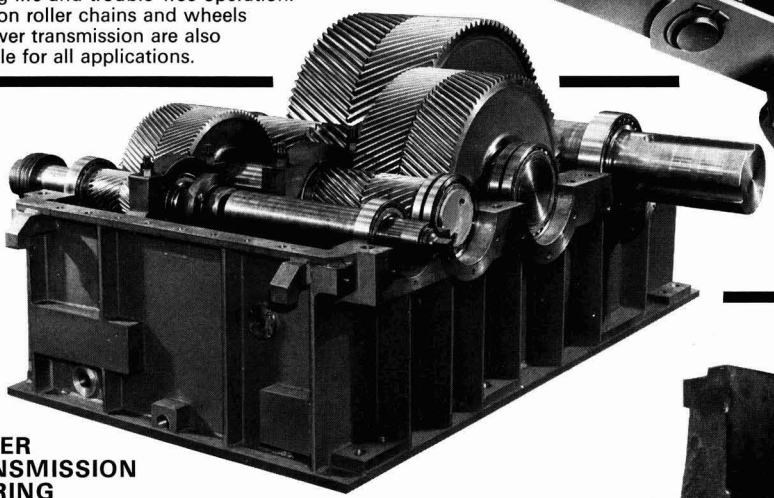

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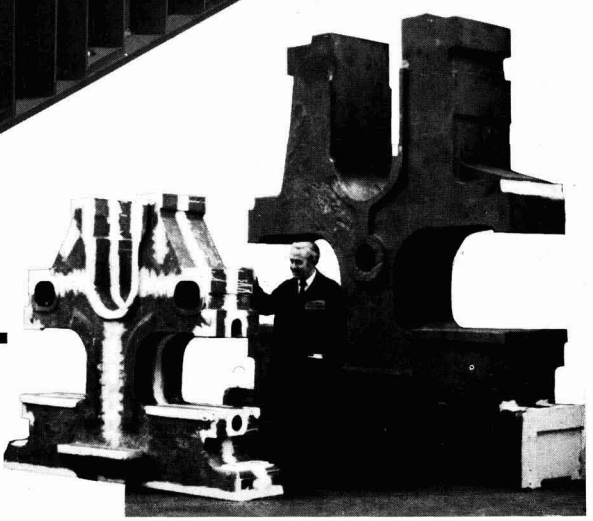

CASTINGS AND FORGINGS

Holcroft Castings and Forgings, a Renold subsidiary company, supplies steel, iron and bronze castings and steel forgings. The photograph shows a 13½ tonne headstock casting for a 12 roll tandem employing 90 inch (2290mm) long, 44 inch (1120mm) diameter rolls with a smaller casting for comparison.

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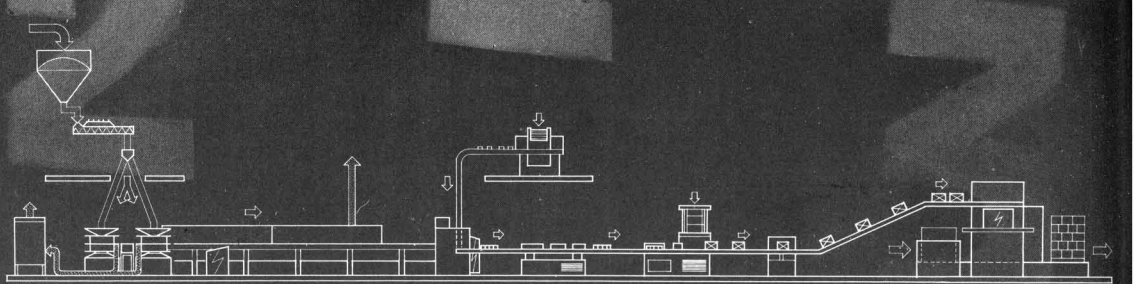

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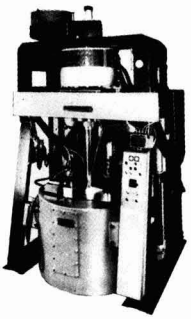
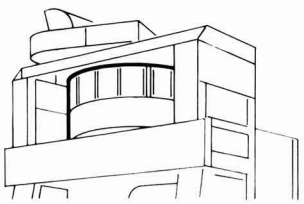
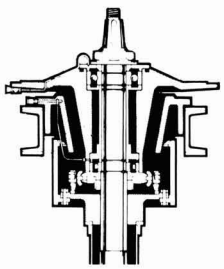


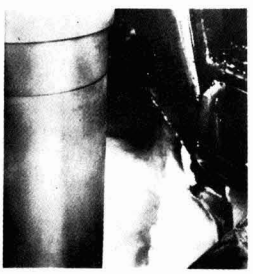
The Build Up



Motor



Suspension



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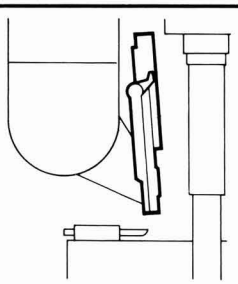
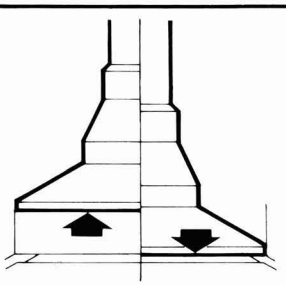
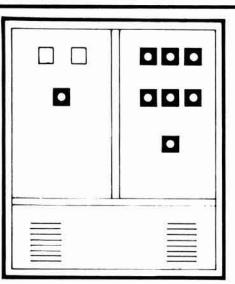


Feed Valve



Discharge Valve



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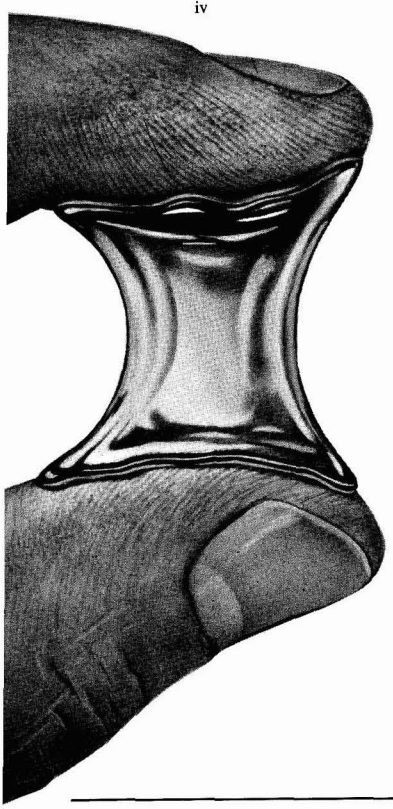

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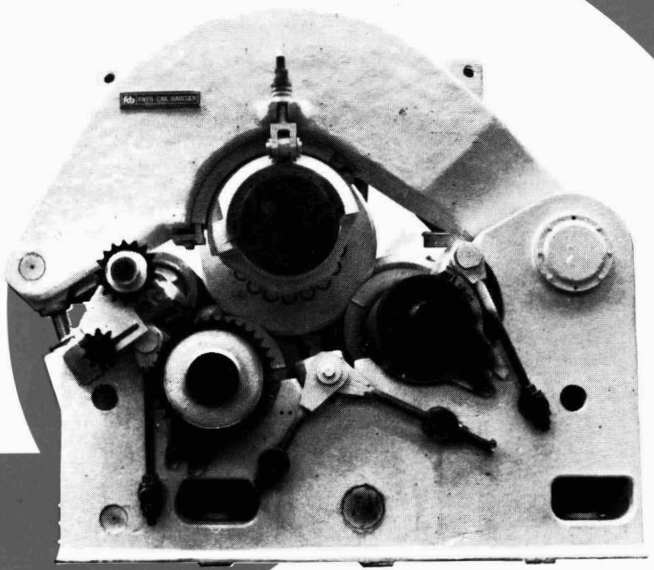

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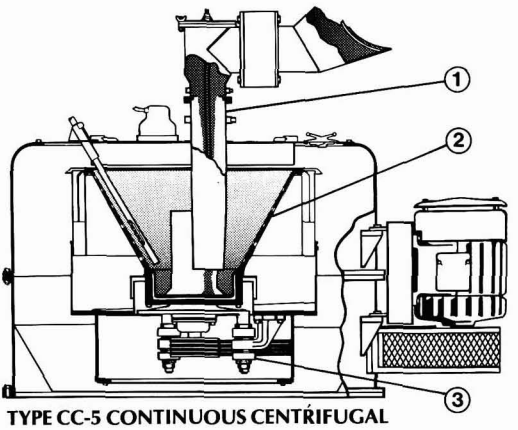

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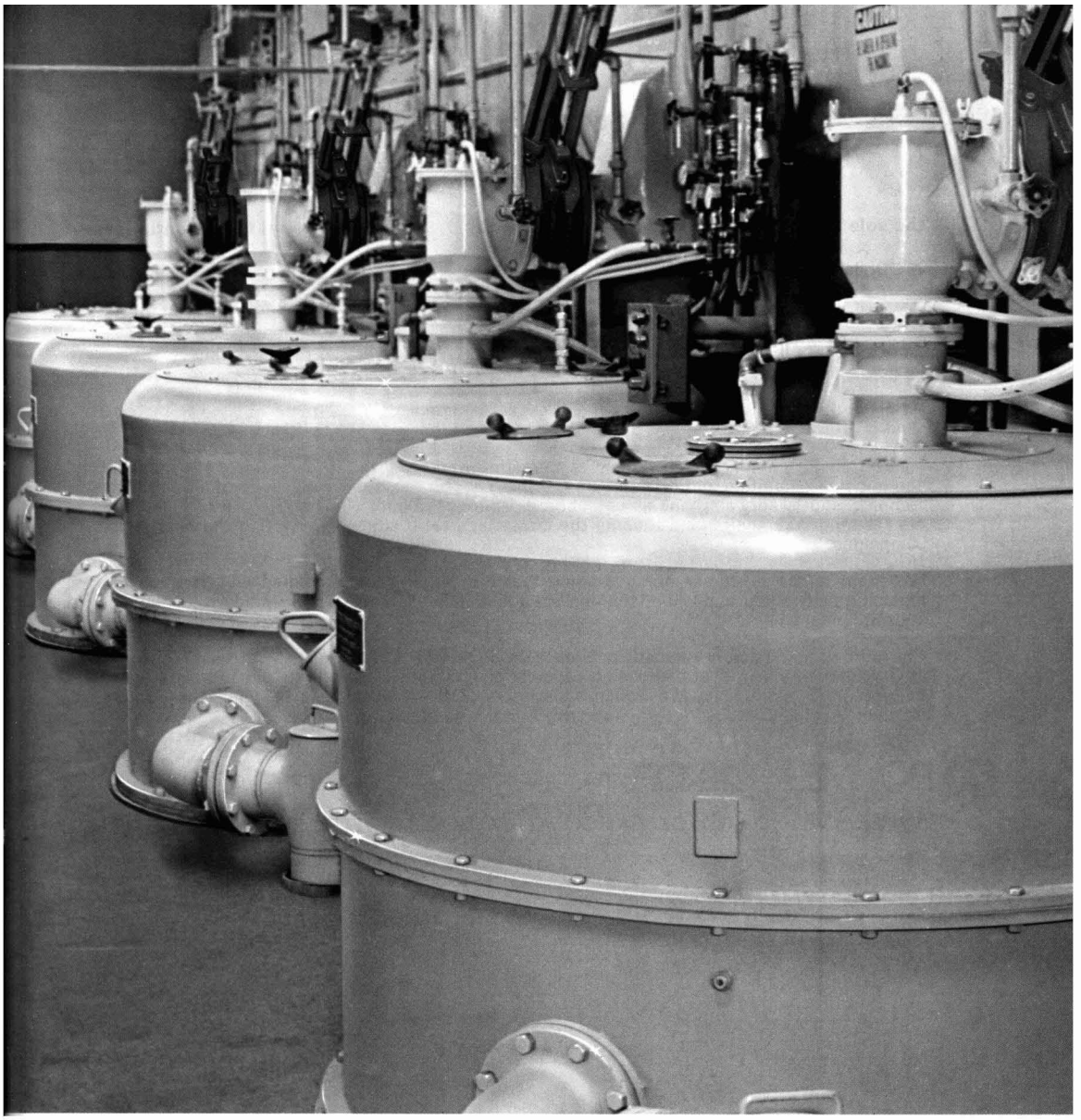

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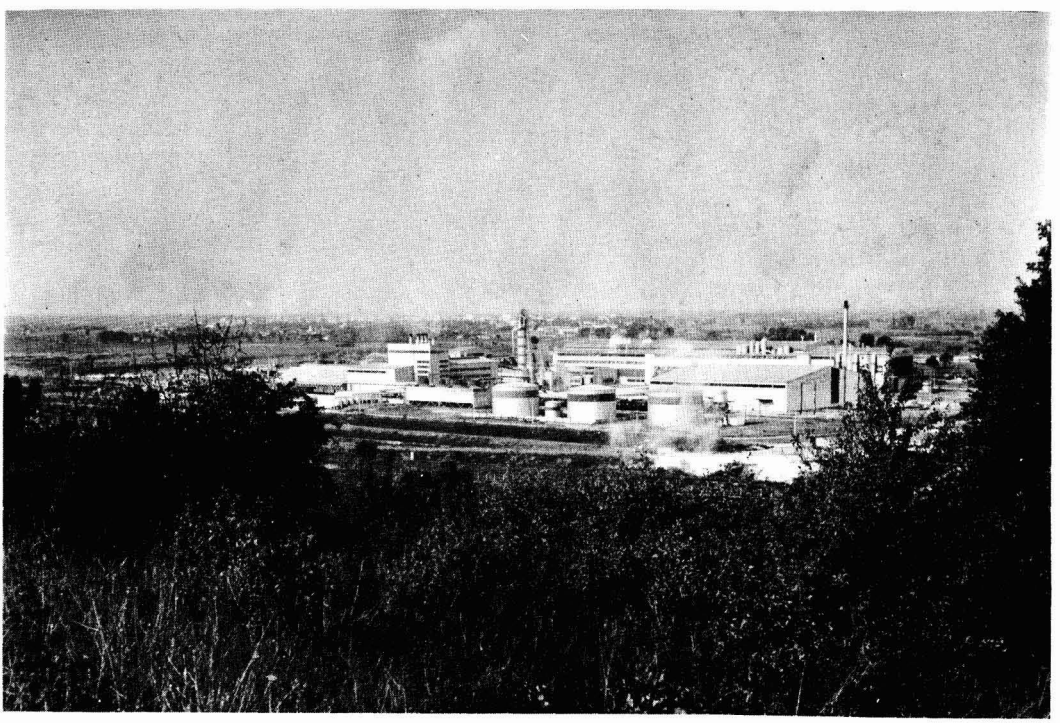

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November 1977

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SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Le 2,4-dinitrophénol—un inhibiteur du virus de la mosaïque de la canne à sucre. J. PRAKASH et R. D. JOSHI. *p.* 303–304

On donne un bref compte rendu d'essais au cours desquels le 2,4-dinitrophénol (DNP) à une concentration de 1000 ppm a réduit l'incidence de la souche A du virus de la mosaïque de la canne sur des plantules de maïs. On a obtenu l'inhibition maximum (80%) quand le DNP était appliqué sur les plantules 8 heures après l'inoculation avec le virus. Une application de DNP aux plantules avant inoculation ou l'immersion de leurs racines dans une solution de DNP était moins efficace qu'une application après inoculation.

* * *

Le développement de la polarimétrie dans l'industrie sucrière. 3me partie. J. A. WATSON. *p.* 304–307

On discute de la préparation de la solution d'acétate basique de plomb utilisée comme agent de défécation et on donne un bref historique de la situation qui a conduit à l'acceptation officielle de la polarimétrie comme méthode de détermination des taxes payables sur le sucre. En conclusion, l'auteur examine le rôle de l'ICUMSA en particulier en ce qui concerne les développements futurs possibles de la polarimétrie.

* * *

L'industrie sucrière de la Jamaïque. K. MAXWELL. *p.* 307–308

On présente un bref aperçu de l'industrie sucrière de la Jamaïque qui, les deux dernières années, a souffert de la forte dioinution du prix mondial du sucre et de la plus grande sécheresse qui ait sévi en Jamaïque de mémoire d'homme.

* * *

Copersucar et l'industrie sucrière brésilienne. J. WOLNEY ATALLA. *p.* 308–310

Le président de Copersucar (Coopérative Centrale des Producteurs de Sucre et d'Alcool de l'Etat de São Paulo) explique le rôle joué par cette société dans l'industrie brésilienne du sucre et de l'alcool.

* * *

Résultats préliminaires obtenus avec l'appareil à cuire en continu de Langreney. F. LANGRENEY. *p.* 310–314

On donne des informations sur un appareil à cuire en continu du type évaporateur/cristallisoir, mis au point par l'auteur. On donne des renseignements sur le fonctionnement d'un appareil prototype qui a fonctionné dans une sucrerie de l'île Maurice en 1974 et 1975 et on décrit une version améliorée qui a été installée à la sucrerie de Stella, Réunion.

2,4-Dinitrophenol—Ein Inhibitor für das Zuckerrohr-Mosaikvirus. J. PRAKASH und R. D. JOSHI. *S.* 303–304

Es wird kurz über Versuche berichtet, bei welchen 2,4-Dinitrophenol (DNP) in einer Konzentration von 1000 mg/kg den Befall von Maiskeimpflanzen mit dem Stamm A des Zuckerrohr-Mosaikvirus reduzierte. Die stärkste Inhibition (80%) wurde erreicht, wenn DNP 8 Stunden nach der Inokulation mit dem Virus appliziert wurde. Eine Applikation von DNP bei Keimpflanzen vor der Inokulation oder das Eintauchen von deren Wurzeln in DNP-Lösung zeigte eine geringere Wirkung als die Applikation nach der Inokulation.

* * *

Die Entwicklung der Polarimetrie in der Zuckerindustrie. Teil III. J. A. WATSON. *S.* 304–307

Die Herstellung einer Lösung von basischem Bleiacetat zur Verwendung als Klärmittel wird diskutiert, und anschliessend wird eine kurze geschichtliche Darstellung der Entwicklungen gegeben, die zur offiziellen Annahme der Polarimetrie als Mittel zur Festsetzung der auf Zucker zu zahlenden Abgaben führten. Zum Schluss weist der Verfasser auf die Bedeutung der ICUMSA, besonders im Hinblick auf die mögliche Weiterentwicklung auf dem Gebiete der Polarimetrie, hin.

* * *

Die Zuckerindustrie auf Jamaika. K. MAXWELL *S.* 307–308

Es wird ein kurzer Überblick über die Zuckerindustrie auf Jamaika gegeben, die unter dem drastischen Rückgang des Weltzuckerpreises und den Auswirkungen der grössten Dürreperiode auf Jamaika seit Menschengedenken zu leiden hat.

* * *

Copersucar und die brasilianische Zuckerindustrie. J. WOLNEY ATALLA. *S.* 308–310

Die Rolle, die Copersucar (das zentrale Cooperativ der Zucker- und Alkoholproduzenten im Staate São Paulo) innerhalb der brasilianischen Zucker- und Alkoholindustrie spielt, wird vom Präsidenten des Copersucar erläutert.

* * *

Vorläufige Ergebnisse mit dem kontinuierlichen Langreney-Kochapparat. F. LANGRENEY. *S.* 310–314

Es werden Einzelheiten über den kontinuierlichen Verdampfungskristallisator mitgeteilt, der vom Verfasser entwickelt wurde. Ferner wird über den Prototyp berichtet, der 1974 und 1975 in einer Zuckerfabrik auf Mauritius arbeitete, und eine modifizierte, verbesserte Ausführung beschrieben, die in der Zuckerfabrik Stella (Réunion) installiert wurde.

2,4-dinitrofenol—un inhibidor del virus de mosaico de caña de azúcar. J. PRAKASH y R. D. JOSHI. *Pág.* 303–304

Se presenta un informe breve sobre ensayos en que 2,4-dinitrofenol (DNF) en una concentración de 1000 ppm ha reducido la incidencia de Raza A del virus de mosaico de caña de azúcar en plantas de semilla de maíz. Máxima inhibición (80%) se obtuvo cuando DNF se ha aplicado a las plantas de semilla 8 horas después de inoculación con el virus. Aplicación de DNF a las plantas de semilla antés de inoculatión o sumersión de las raíces en una solución de DNF tuvieron menos effecto que aplicación después de inoculatión.

* * *

Desarrollo de polarimetría en la industria azucarera. Parte III. J. M. WATSON. *Pág.* 304–307

Se discute preparación de la solución de acetato básico de plomo que es usado como agente clarificador y, en seguida, una breve historia de la situacíon que ha conducido al aceptación oficial de polarimetría como método para asesar el impuesto pagadero sobre azúcar. En conclusión, el autor considera el papel de ICUMSA, en particular con respecto a desarrollos posibles en polarimetría del futuro.

* * *

La industria azucarera en Jamaica. K. MAXWELL. *Pág.* 307–308

Se presenta un breve examen de la industria azucarera de Jamaica que ha sufrido en los dos años pasados de la caída severa del precio mundial de azúcar y de la más grave sequía que ha ocurido en el país de que hay memoría.

* * *

Copersucar y la industria azucarera de Brasil. J. WOLNEY ATALLA. *Pág.* 308–310

El papel de Copersucar (Cooperativa Central de los Productores de Azúcar y de Alcohol del Estado de San Pablo) in la industria de azúcar y álcohol de Brasil es discutido por el Presidente de la Cooperativa.

* * *

Resultas preliminarias con el tacho contínuo del tipo Langreney. F. LANGRENEY. *Pág.* 310–314

Se presentan detalles de un tacho contínuo del tipo evaporador/cristalizador, desarrollado por el autor. Información es dado sobre operación de un prototipo que operaba en un ingenio azucarero en Mauricio en 1974 y 1975, y se describe unej emplo, modificado y mejorado, que se ha instalado en el ingenio de Stella en la isla de Réunion.

INTERNATIONAL SUGAR JOURNAL

VOL. LXXIX NOVEMBER 1977 No. 947

Notes & Comments

World sugar prices

Raw sugar prices on the London Terminal Market have declined slowly over the two months from £113 at the beginning of August to £102 on the 30th September, with extremes slightly above and below this range. Trading conditions have been dull during the run up to the International Sugar Conference in Geneva and while the talks have been in progress. The London Daily Price for white sugar has also declined in the period from £119 to £103 per ton, but from 11th August to 27th September was actually below the L.D.P. for raw sugar, this premium ranging as high as £8 per ton and usually being about half this. The large quantities of EEC whites available and supplies from other sources tended to push the L.D.P.(W) low, while there has been a certain amount of optimism about a successful outcome to the Geneva talks which has kept the raw sugar price more buoyant than the statistical picture would warrant.

* * *

US sugar legislation

On 9th September the Senate passed the Food and Agriculture Act of 1977 (the "Farm Bill") and it was passed by the House of Representatives on 16th September. The bill was drafted to replace a support programme which had been ruled illegal by the US Dept. of Justice[1] and the revised programme has had its legality confirmed. Since quick action was required and the wording had been agreed by those Congressmen conferring on the bill, the Administration have started the support programme knowing that a Presidential veto is unlikely.

The Secretary of Agriculture announced on 15th September that a payments programme had been instituted to support the 1977 sugar beet and cane crops, at not less than 52·5% of the parity prices for the two commodities as of July 1977. The Secretary, Mr. BERGLAND, has "determined that the support prices will be $22.84 per ton of average quality sugar beets and $17.48 per ton of average quality sugar cane. Processors of sugar beets and sugar cane who assure us that producers will be paid not less than the applicable support price will receive government payments for the difference in the national market price per pound of sugar and 13·5 cents, the computed raw sugar equivalent price required to yield 52·5% of parity to producers. Through this system, in their words, compensatory payments will be made to processors who pay the support price to producers at a time when processors could not otherwise afford to do so in view of low sugar prices.

"Payments will be made on the processed product (refined, beet sugar and raw cane sugar) marketed from the 1977 crop from today forward until all 1977 crop sugar has been marketed or to the date of actual implementation of the price support loan or purchase programme which would be mandated by the pending 1977 Farm Bill."

Mr. BERGLAND added that ways of covering the 1977 crop already marketed, including 1977 output, are still being explored. Subsequently he is reported to have stated that the support programme provided for in the Bill would not be implemented if a new International Sugar Agreement were to emerge; he also added that the current budget would be able to support the domestic price of 13·5 cents per pound for up to six months if necessary.

* * *

Commonwealth Caribbean sugar production 1977

With the 1977 sugar harvests completed in Barbados, St. Kitts and Trinidad, and the Jamaica calendar year figure almost complete except for a small addition in December, it is possible to provide fairly accurate figures for 1977 production as follows (excluding Belize):

Barbados	118,000	long tons,	tel quel
Guyana	330,000	,,	,,
Jamaica	292,750	,,	,,
St. Kitts	41,000	,,	,,
Trinidad	173,200	,,	,,
	954,950	,,	,,

F. O. Licht KG comment[2] that even this low official figure must be taken with reserve for it includes an over-optimistic estimate of 330,000 long tons for Guyana. The spring crop was much lower than in 1976 and it is difficult to believe that the back-log can be made up during the autumn crop. A more realistic figure for Guyana would be 310,000 tons. According to the Guyana Sugar Corporation Ltd., a total of 332,457 tons of sugar was produced by the ten estates from a 1976 crop of 4,037,314 tons of cane, which compares with 300,350 tons of sugar from 3,474,596 tons of cane in 1975.

It seems, therefore, that total production for the area in 1977 will be in the vicinity of 935,000 tons. With local consumption and local exports for the year at around 205,000 tons, this would leave some 730,000 tons available for export outside the area—say 750,000 tons when account is taken of stocks carried over from 1976.

A production of 935,000 long tons would be the lowest since 1952 (excluding 1973 when production reached only 926,000 tons). The peak year was 1965

[1] *I.S.J.*, 1977, **79**, 272.
[2] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (23), 12–13.

when 1,300,802 tons of sugar were produced and 1977 looks like seeing a reduction of 28% on this figure in twelve years. The situation must give cause for considerable concern about the future of the Caribbean Commonwealth sugar industry, particularly when one looks at the trend of production over the past 25 years. In that period, production rose from 800,000 tons fairly steadily to the peak of 1,300,000 tons in 1965 and since then has dropped almost as steadily as it rose.

As is to be expected, exports show a similarly depressing pattern with a decline from 1,110,000 tons in 1965 to a low of 723,000 tons in 1973 which is likely to be matched in 1977. Falling exports, coupled with present low prices, will have an extremely adverse effect on the economies of the countries concerned, particularly those where sugar is the major, or one of the major, earners of foreign exchange.

One encouraging sign is the opposite direction in which production is moving in St. Kitts. Production in that country fell steadily from a peak of 51,000 long tons in 1953 to a low of 23,000 tons in 1973. Since that year there has been an encouraging upward curve to the production graph, rising to 25,000 tons in 1974, nearly 35,000 tons in 1976 and just over 41,000 tons in 1977.

* * *

South African Sugar Association 1976/77 report

According to the annual report of the South African Sugar Association[1], weather conditions during the 1976/77 season were generally favourable and this factor, together with the continuing gradual increase in area of land under cane, resulted in an all-time record sugar crop of 2,041,520 metric tons, which constituted a 13% increase over the previous season's crop and was achieved in spite of an abnormally high cane:sugar ratio. The quantity was produced from a harvest of 19,220,623 tons from an area of 201,400 hectares. This compares with 1,801,088 tons of sugar produced in 1976 from 16,813,531 tons harvested from 186,569 hectares. The sucrose yield in 1977 was 12·43% (12·60% in 1976) and 9·41 tons of cane was necessary to produce 1 ton of sugar (9·34 tons).

More sugar was available for export than in the previous season but, owing to the sharp drop in export prices, the income from exports decreased by approximately R19 million to R187 million. The availability for exports during the year 1976/77 was 946,249 tons, compared with 749,583 tons in the previous season. Actual exports during the season were 912,693 tons, of which 464,716 tons went to Japan, 218,792 tons to Canada, 146,810 tons to the USA, 11,251 tons to Portugal, 3893 tons to Hong Kong and 5231 tons to other markets.

With the export price of sugar no longer capable of subsidizing the local market price, and with the effect of continuing inflation, the financial position of the industry deteriorated dramatically. The Government granted a local market price rise of R18 per ton in September and a further increase of R60 per ton in November 1976. In spite of these increases, a withdrawal of R34·7 million had to be made from the price stabilization fund to meet industrial requirements, leaving a balance of R30·9 million in the fund at the end of the season. Total sugar offtake during the 1976/77 season amounted to 1,145,640 metric tons, compared with 1,121,431 tons in 1975/76, an increase of 2·16%.

European beet sugar production

Several countries published the results of beet tests during August and these show, in general, that the crops, while increasing in sugar content as expected, are behind in their development as compared with normal at this time. In the UK no results have been published although it was reported in August that rain had swelled the roots and sunshine was required to raise the sugar content before harvesting commences at the beginning of October. Very little has been announced in respect of crops in East Europe although very heavy rainfall has been reported.

F. O. Licht KG have published[2] their first estimate of sugar production next campaign in Europe and the figures are reproduced below, with comparative values for the previous two campaigns.

	1977/78	1976/77	1975/76
	metric tons, raw value		
Belgium/Luxembourg	740,000	732,000	716,000
Denmark	490,000	416,000	423,000
France	3,800,000	2,962,000	3,239,000
Germany, West	2,772,000	2,733,000	2,540,000
Holland	790,000	945,000	915,000
Ireland	195,000	189,000	203,000
Italy	1,360,000	1,747,000	1,467,000
UK	1,000,000	756,000	597,000
Total EEC	*11,147,000*	*10,480,000*	*10,200,000*
Austria	435,000	416,000	512,000
Finland	87,000	77,000	88,000
Greece	326,000	386,000	313,000
Spain	1,200,000	1,407,000	917,000
Sweden	324,000	302,000	277,000
Turkey	1,260,000	1,284,000	986,000
Yugoslavia	728,000	650,000	483,000
Total West Europe	15,589,000	15,085,000	13,841,000
Albania	20,000	20,000	18,000
Bulgaria	290,000	240,000	157,000
Czechoslovakia	790,000	620,000	780,000
Germany, East	680,000	560,000	665,000
Hungary	410,000	400,000	331,000
Poland	2,100,000	1,801,000	1,840,000
Rumania	720,000	670,000	561,000
USSR	9,100,000	7,350,000	7,702,000
Total East Europe	14,110,000	11,661,000	12,054,000
Total Europe	29,699,000	26,746,000	22,895,000

The improved figures in West Europe are largely the consequence of much improved weather by comparison with the previous two campaigns; France, for example, is expected to increase production by 20% in spite of an area under beet which has been reduced by 4·79%. In Italy, however, a 10% drop in beet area has been compounded by the effects of heavy rainfall at seedbed preparation and planting time, to give a considerable fall in the crop estimate. Spain and Turkey are also expected to have smaller crops, largely the result of reduced beet areas.

In East Europe, the overall increase is at a very high rate but this arises mostly from a sharply raised crop forecast for the USSR from the low figure of last campaign when there were considerable losses in storage and transport. The total figure shows an increase of about three million tons or 11·04%, and Licht add that, should conditions improve during the rest of the growing season, output could be even higher.

[1] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (22), 16.
[2] *International Sugar Rpt.*, 1977, **109**, (24), 1–2.

2,4-Dinitrophenol—an inhibitor of sugar cane mosaic virus

By J. PRAKASH and R. D. JOSHI

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Introduction

DIFFERENT strains of mosaic virus have been reported prevalent in the sugar cane crop in Uttar Pradesh[1]. While screening some chemicals for their utility as antiviral compounds against sugar cane mosaic virus strain A (SCMV-A), 2,4-dinitrophenol (DNP) gave some encouraging results. Strain A was selected for its wide prevalence in this state and results of the study are the subject of this paper.

Materials and methods

Inoculum was obtained by macerating SCMV-A-infected sugar cane leaves in a meat-mincer. Maize (*Zea mays* L.cv. Ganga 2) was used as a test plant. Inoculum and the chemical were mixed in equal proportion and incubated for 5 minutes at 20°C before inoculation. Inoculum mixed with equal amounts of demineralized water served as control.

Results

(*i*) *Effect of different dilutions of DNP on the infectivity of SCMV-A* in vitro:

Four different dilutions of DNP, viz. 1, 10, 100 and 1000 ppm were tested. DNP was found to inhibit SCMV-A to a level of 65% at the concentration of 1000 ppm. However, its inhibitory activity decreased with increasing dilution (Table I).

Table I. Effect of different dilutions of DNP on the infectivity of SCMV-A

Conc., ppm	*No. of plants infected out of 25 inoculated*		*% infectivity*	*% inhibition*
	Control	*Treated*		
1	20	16	80	20
10	20	12	60	40
100	20	10	50	50
1000	20	7	35	65

(*ii*) *Effect of pre-inoculation application of DNP:* One group of maize seedlings was treated with 1000 ppm DNP while another group of seedlings was treated with distilled water. 25-seedling sets from both groups were then inoculated with the virus at various intervals, viz. 2, 4, 8, 16, 24 and 32 hr after the application of DNP. The inhibitory activity of DNP was found to increase with increasing time of its pre-inoculation application, and a maximum of 70% inhibition was obtained when DNP was applied 16 hr prior to inoculation (Fig. 1).

(*iii*) *Effect of post-inoculation application of DNP:* Maize plants were first inoculated with the virus and then 25-plant sets from one group of plants were treated with DNP 2, 4, 8, 16, 24 and 32 hr after virus inoculation, while 25-plant sets from another control group were treated with distilled water. A maximum of 80% inhibition was obtained when DNP was applied 8 hr after the inoculation of the virus. Beyond this period the inhibitory activity of DNP decreased with increasing interval before the post-inoculation application (Fig. 1).

(*iv*) *Effectiveness of root-dip treatment:* One hundred maize seedlings were uprooted gently and washed in slow-running water to remove soil particles. Three

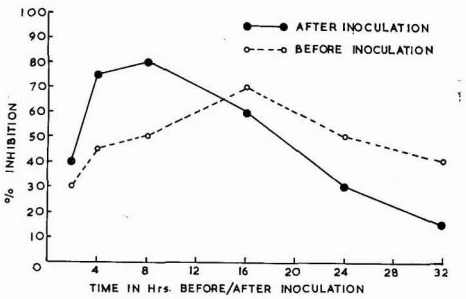

Fig. 1

groups of 25 maize seedlings were allowed to stand in 1, 10 and 100 ppm concentration of DNP. A fourth group of 25 maize seedlings was kept in distilled water to serve as control. At the conclusion of 12-hr root-dip treatment the plants were re-potted and, after 3 days of the treatment, the plants were inoculated with the virus. At a concentration of 100 ppm, DNP was found to inhibit the virus by 35%. It proved ineffective at the lower concentration and phytotoxic at the higher concentration.

Discussion

Virus infection always diverts the metabolic activities of the host. Earlier workers have suggested a relationship between photosynthesis and virus increase. SPIKE & STOUT[2] have recorded a decrease in photosynthesis during virus multiplication. Contrary to this, GOFFEAU & BOVE[3] have reported an increase in the Hill reaction and photophosphorylation during the active phase of virus multiplication. DOKE & HIRAI[4] have also reported an increase in photosynthesis during the early stage of tobacco mosaic virus infection.

An increase in phosphorylation shows increased ATP synthesis during virus infection and multiplication. DNP causes uncoupling of phosphorylation, i.e. electron transport continues to function, leading to oxygen consumption, but ATP synthesis is inhibited. Besides this, DNP also stimulates the activity of ATP-ases[5]. Thus, DNP inhibits the virus not only by blocking ATP synthesis but also by stimulating the hydrolysis ATP, the biological currency. In the present study it was found that the inhibitory effect of DNP increases with increasing time of its pre-inoculation application up to 16 hr and thereafter decreases; this shows that DNP inhibits the virus during the establishment phase of virus infection. DNP has been reported earlier to inhibit tobacco mosaic virus[6,7].

[1] BHARGAVA: *Final Technical Rpt., P.L.480, Research Project*, 1971, 203.
[2] *Science*, 1965, **199**, 375–376.
[3] *Virology*, 1965, **27**, 243–252.
[4] *ibid.*, 1970, **42**, 68–77.
[5] "A Text Book of Biochemistry", (W. B. Saunders Co., Philadelphia), 1971, p. 727.
[6] ESANU: *Rev. roum. Biol. Ser., Bot. B.*, 1968, 227–229.
[7] PUROHIT & TREGUNNA: *Indian J. Plant Physiol.*, 1976, **21**, 66–70.

The development of polarimetry in the sugar industry

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PART III

It has not proved possible to discover the basis on which the composition of the basic lead acetate solution used was originally decided. A text book of the mid-nineteenth century gives the following method: 6·7 litres of distilled water are added to 1·5 kg of sugar of lead and 1 kg of litharge in a large porcelain dish which is heated with repeated stirring for half a day, the evaporated water being replaced. The liquid to be used is poured out into a flask; it does not matter whether or not it is poured off from the small amount of residue which is usually still present. It is expedient to prepare a diluted basic lead acetate solution (2 parts of water, 1 part of the above solution) for the precipitation of dilute solutions. The "Manual of Sugar Analysis" by J. H. TUCKER, published in 1881, gives a slightly different method but is rather more precise. It says "The basic lead acetate solution is prepared by boiling for half an hour 440 grams of neutral lead acetate with 264 grams of lead oxide and 1·5 litres of water, and diluting when cool to two litres; after standing some time the clear liquid may be syphoned off from the insoluble residue. The solution has a density of 1·267".

ICUMSA, in 1900, laid down that the lead acetate solution was to be prepared according to the method of the German Pharmacopoeia. This was to dissolve three parts by weight of acetate of lead and one part by weight of oxide of lead in ten parts by weight of water, the final solution to have a specific gravity of 1·25. This method seems to have been accepted as the standard method of preparation for many years. It was not until 1958 that the next serious effort was made to produce an ICUMSA specification for this most important reagent; the session of 1949 had merely proposed that basic lead acetate solution should be prepared by dissolving lead sub-acetate of American Chemical Society specification and adjusting the solution to a specific gravity of 1·25, and this proposal was recommended for adoption in 1954. Appendix 2 of the referee's report for 1958 gives specifications both for Horne's dry lead and the solution prepared from it. These were drawn up by R. W. RUTLEDGE after he had compared polarization practices throughout the world and, for the sake of completeness, are repeated here.

For dry lead: Water not more than 1·5%
Total lead (as PbO): Not less than 76%
Basic lead (as PbO): Not less than 33%

Basic lead acetate solution was to be prepared from this by dissolving 560 grams in a litre of distilled water, boiling for 30 minutes, decanting the supernatant liquor and diluting to s.g. 1·25. In this solution the quantity of basic lead, expressed as PbO, was to lie in the range of 9·5 to 10·5 grams per 100 ml of solution. If the quantity found was too high, the reagent was to be adjusted by adding glacial acetic acid.

This appears to be the first reference within ICUMSA to the restriction that the basic lead content should be within fixed limits. However, there is no evidence that this is the optimum figure; it appears to be one based on long-established custom and practice with no evidence to show whether it originated on experimental evidence or practical convenience. If this is so, it seems most likely that the 1958 restriction was agreed as a means of removing one more variable in the measurement of polarization.

However, it is doubtless true that the important property of the lead acetate is this restriction on the amount of basic lead acetate, and in 1958 it was considered possible to achieve this by going through the recommended procedures. By 1970 this was known not to be true, as at s.g. 1·25 the amount of basic lead was found to be too high, 10·7–11·0 grams per 100 cm^3. Accordingly, it was agreed that the s.g. be reduced to 1·24; there the matter presently and, it is to be hoped, for a long time, rests.

Acceptance

In writing about the introduction of polarimetry into the sugar industry one must be careful to distinguish between its unofficial and its official acceptance. Certainly, so far as the former is concerned, sugar chemists were making use of the new technique early in its development. In 1851 it was reported that "the majority of refiners, who today are fortunate enough to have such an apparatus already, buy their raw sugar exclusively according to its unbiassed advice, this includes not only Schickler Brothers in Berlin, but also Herr von Rath & Sons and others". Certainly, by the 1870's most sugar laboratories seem to have been equipped with the necessary apparatus, but it must be appreciated that this was probably used only for the purchase of sugar from the suppliers and for control and experimental work. Official acceptance of polarimetry as a means of assessing the duty payable on sugar came later.

In November a convention was signed between the Governments of Great Britain, France, Holland and Belgium which had as its objective "the abolition of all bounties which might be given to the refiners of any country in the amount of drawback allowed on the exportation of refined sugar". Such bounties were not new, but by 1864 their use and misuse had increased to such an extent that serious difficulties were arising in those countries which had no indigenous beet sugar industry, notably the United Kingdom which was being flooded with heavily subsidized continental sugar. The trouble was that at that time it was possible to obtain the payment of a duty drawback far in excess of that officially allowable by using a variety of means. For example, we read that one Belgian manufacturer confessed "he pressed his roots in the presence of the Government official, but he pressed lightly and when the official work and record was over for the day the roots were pressed again in private and found still to contain a large amount of juice on which no duty was paid, though a drawback was received on the sugar made from it". Again we read "in many instances a drawback is obtained on sugar made out of molasses on which no duty has been paid . . . and instances are far too common of gross and wholesale adulteration of the finished article, earthy and vegetable matter obtaining the same drawback as if pure sugar".

The task of the convention of 1864 was to establish a more equitable system by standardizing the relationship between duties and drawback in the four contracting countries. At that time duties on raw sugar were payable according to colour measurements made against the so-called Dutch standards. It was agreed that raw sugar should be classified in four colour groups, and that immediately after the ratification of the convention steps should be taken to estimate the yields obtainable from each group as accurately as possible by experimentation. This was done by refining 400 tons of sugar of each class and measuring the yield of white sugar from each. The work was carried out in a refinery at Cologne specially hired for the purpose; the analyses required were carried out by no less a person than LANDOLT.

The convention, though sound in theory, had unexpected and, for Great Britain, disastrous results. On the European continent, the amount of beet sugar being used by the refiners was steadily increasing and the quality of this was not accurately assessed by its colour according to the Dutch standards. It was, in fact, easily possible to get sugars classified in lower grade than they actually were. Thus, if the duty was high the refiner obtained a large bonus of export sugar, part of which could be utilized to sell abroad below the cost of production. By 1872 the British market was receiving an even greater tonnage of cheap imported sugar than it was before the convention was proposed. Though this was welcomed by firms such as jam makers, to whom a source of cheap sugar was no problem, the refiners were in very grave difficulties. By 1872 the importation of loaf sugar had increased to such an extent that most firms producing them had gone out of business. Those left pressed the Government to work for a rectification of the abuses of the terms of the convention of 1864, and further conferences were held in 1873, 1874 and 1875. Possibly in preparation for the first meeting, the Belgian Ministry of Finance in 1872 circulated a letter instituting an enquiry into the value of the saccharimeter as an instrument of analysis for raw sugars. The letter was addressed to "the principal chemical experts" and its terms indicate the problem exactly:

Sir,

Allow me to avail myself of your knowledge and experience to elucidate certain questions which belong to the collection of the sugar tax.

You are aware that types based on colour serve at the present time for the determination of the class into which raw sugars are to be placed for the application of the export duties but experience has proved that in most cases the colour only is a very uncertain indication, and in commerce the saccharimeter, joined to chemical analysis, is at present the mode employed to determine the saccharine richness of raw beet sugars.

It happens that the powers between whom the convention of 8th November 1864, *was concluded, will be shortly led, by force of circumstances, to see if they cannot urge the substitution of this latter method of classification for that in use, and to apply it to cane sugar as well as to beet root. In view of this contingency I ask you to be kind enough to give me your advice upon the question contained in the note which I have the honour to send to you enclosed in this letter.*

The enclosed note contained 14 questions relevant to the use of the saccharimeter.

The replies received showed that the chemists consulted were unanimous in their opinion that polarimetry was the right way of assessing duty and, armed with this knowledge, the Belgian Minister of Finance no doubt attended the conference of 1873 and proposed that the saccharimeter should be used as a means of measuring the expected yield of white sugar from raw. Alas, any hopes he may have had were dashed. No agreement could be reached on a formula to calculate the yield, and the British delegation condemned the proposal as placing too much power in the hand of the chemists. However, the conference did recommend that in cases in which the yield of sugar should not appear to correspond with the colour, power should be given to the authorities and the trade to resort to saccharimetry.

It is somewhat disconcerting to find that one hundred years ago sugar chemists were not regarded with the same respect that we hope they are today. The opinion of the British government has already been quoted and it was not alone in its view. We read, for example, in a journal of 1879 that "for the purpose of levying duty on sugars the Dutch standard is bad enough, but the use of the polariscope will make matters infinitely worse, and furnish a vehicle for the safe practice of fraud indiscriminately upon the revenue, the importer, the buyer and the consumer, at the option of operators and their instigators". And again, "Professor C. F. CHANDLER says . . . this plan of classification by the polariscope will give the greatest opportunities for fraud and will, I fear, if adopted, make it impossible for honest men to carry on the business of refining sugar". And further "the conclusion is inevitable that . . . to adopt the instrument for the purpose of levying duties on sugars and for selling sugars without providing safeguards which do not now exist, will be to prostitute a beautiful and valuable scientific instrument and the science of chemistry to the base purpose of fraud".

To show how widespread were such feelings, it might be mentioned that the extracts just quoted are from American magazines of the time; however, similar sentiments were expressed in other places.

Meanwhile, in 1874, Great Britain had opted out of the argument by abolishing sugar duties in pursuit of her policy of a free breakfast table. However, in spite of rebuffs and the apparent victory of colour as a means of assessing duty, the plan of analysing sugar as a means of ascertaining its probable yield continued to gain ground and the use of the polariscope as a quick, easy and accurate way of determining the crystallizable sugar in samples submitted to test began to be recognized as the most satisfactory method that was attainable. France adopted its use in 1880 and Holland in 1884, using the yield formula:

$$Y = P - (2I + 4A)$$

From then on the instrument came into regular and statutory use as the means of assessing sugar duty by the customs authorities of sugar-importing countries. By 1890 it had been adopted as official by the United States, and when the sugar duties were reimposed in Great Britain in 1901, the method was at once adopted. In fact, customs officers were trained in the use of the instrument prior to the duties coming into force.

The Societies and the future

The International Commission for Uniform Methods of Sugar Analysis is now the major international body concerned with every aspect of sugar work and as such deals not only with analysis but with related matters such as sampling and calibration of basic standards. However, all the basic work on polarimetry had been completed long before ICUMSA held its first session in Hamburg on 12th June 1897, where it confined itself (so far as polarimetry was concerned) to discussing various matters concerning the choice and testing of quartz plates. There were, of course, various scientific bodies which had met before this to discuss matters relating to sugar analysis, but these were largely national, such as the German Beet Sugar Industry Association; international congresses such as the International Congress of Applied Chemistry tended to be rather more spacious affairs. This latter had in fact a section dealing with sugar, but it dealt largely with matters concerned with sugar manufacture. However, this was not always the case; in 1906, that is 9 years after the founding of ICUMSA, we find the persistent Dr. HORNE giving a paper on his dry lead defecation to the 6th Congress, then being held in Rome.

An account of a meeting of a big international congress in the late nineteenth century makes interesting reading, if only by showing how much more varied they were than our more staid meetings of today. Thus "The Congress commenced on 23rd July in the Grand Hall of the Sorbonne and was opened with a musical performance when the Marseillaise was played". The President (Professor MOISSAN) then delivered an address following which "A French military band played different items of music, alternated with some excellent vocal music".

Next there should have been an address by Professor BERTHELOT; he, however, was absent through illness and his paper was read for him. In it he showed "at great length that chemical science and chemical industry, which, in contrast to other industries, is guided only and simply by science, had, by a combination of science and practice attained a success reached by no other industry . . . he concluded by eulogizing universal science which brought all the civilized world nearer together, and brought about that unity and fraternity between all nations which is destined to be a guarantee of peace".

Great applause followed the reading of this paper. A short vocal and instrumental programme was then gone through and then the General Secretary read a report on the work of the committee. The President and the Secretary were then elected. As there is no reference to lunch it must be assumed that all the foregoing took place in the morning and, by any standards, adds up to a full and varied morning's work.

Later in the week the members attended the unveiling of the statue of the "celebrated chemist ANTOINE LAURENT LAVOISIER. This ceremony was the most impressive of the congress . . ." The proceedings were rounded off "in a most festive manner with a banquet".

Times change and scientific congresses are no longer introduced by vocal and instrumental music; indeed there is no evidence that the earliest meetings of ICUMSA were so graced. And the chance of unveiling a statue is generally pretty small; the banquet and the festive finish are the sole reminder of the earlier, more leisured days.

The first ICUMSA meeting was largely a German domestic affair; though other countries expressed their willingness to take part they did not actually send any delegates. Little was decided at that first session and it was not until the third meeting in 1900 that polarization was discussed. At this important session, the sugar scale was re-defined on a basis of 26·00 grams normal weight in 100 cm^3 at a temperature of 20°C (it had previously been 17·5°C) using a 200-mm tube; thus was born the International Sugar Scale, so called to avoid confusion with the earlier definition. The same session defined the type of instrument to be used, the source of illumination and the method of carrying out the test, including the preparation of the lead acetate solution.

From then on, for many years, the work of the commission, so far as polarimetry is concerned, was almost exclusively concerned with matters relating to the calibration of quartz control plates, and what had come to be called the lead error, both of which have been dealt with in earlier sections of these notes. It was in fact not until the 11th Session in 1958 that polarization, which is perhaps the most important figure measured in the sugar world, received the status of a separate subject. Even then it was confined to raw sugar and has been so ever since.

Since then the work of the commission has concerned itself with a variety of matters; different methods of clarification (of which more a little later) the standardization of quartz control plates, the recalibration of the 100° point, and the use of Faraday effect instruments. Unfortunately, the lead question has not been finally resolved, with the result that two results, both equally allowable, can be obtained from the same set of operations, a circumstance which cannot be considered a satisfactory one. One of the commission's most urgent tasks would appear to be finally to resolve this difficulty, so that all can accept one standard method and one standard answer. The urgency of this problem is made more so by the fact that new methods of clarification will be tested, and perhaps accepted in the future. Two methods are now under consideration, the substitution of centrifuging for filtration in the case of lead–defecated solutions and the reading of undefecated solutions in the newer instruments using short tube lengths. Though neither of these methods is likely to be substituted for the present method of filtration of defecated solutions for some considerable time, it might be well to consider some of the possible implications so at least one can be prepared for the possibility.

First, there is the possibility that the new method will give a result precisely similar to the present one. In that event no difficulty will arise and the method will be judged solely on the ease with which it can be carried out. What should be done, however, if, as seems likely, a new method proposed for use gives a result which differs from that obtained by the present standard procedure?

If it can be accepted that polarization has no absolute value and can only be defined in terms of a method, then it follows that the figure produced by any new or different method cannot be any more

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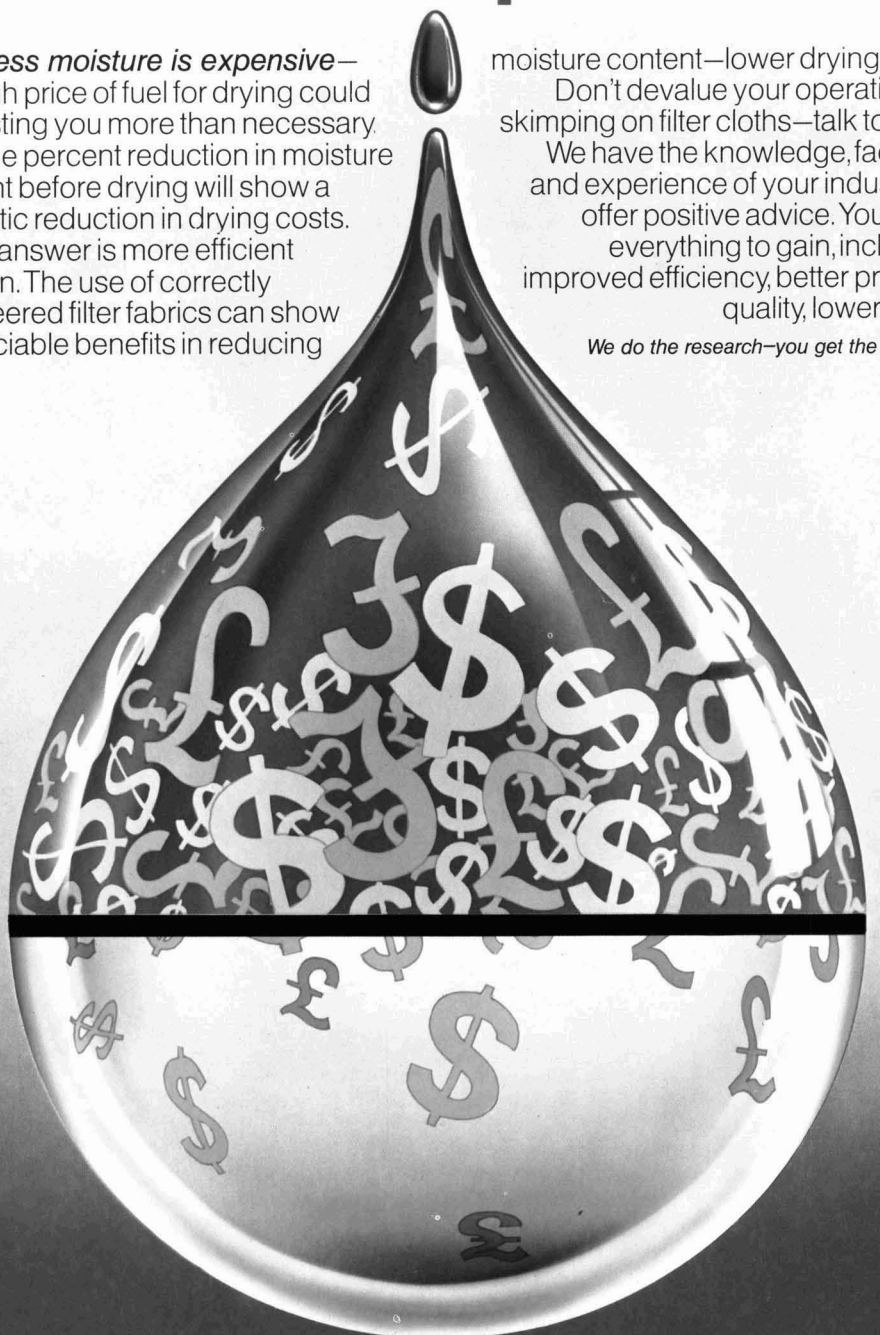

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"right" than that produced by the present practice. However, compelling reasons may emerge that make it desirable to adopt the new method. Of these ease of operation may be one, and in this context it must be remembered that any new method adopted must be such that it can be carried out in a normal refinery or factory laboratory.

There would seem to be two other criteria to be satisfied before any new method is accepted. First, the acceptance must be universal; it is no use compounding the difficulty which ICUMSA has got into by non-observance of this principle. Second, there must be no commercial implications. If the new method gives a different result, then prices must be adjusted so that neither the seller nor the buyer suffers. Similarly, any import duty levied must be neither more nor less. This means that ICUMSA cannot take the decision to change in isolation. Those who are concerned with the commercial operations of the sugar industry will need to be informed of the implications of the proposed change so that necessary financial adjustments can be made beforehand. If this cannot be agreed, then the change should not be made.

The difficulties aroused by the change of 1933 have still not been resolved 44 years later. It seems likely that if the proper precautions had been taken at the time they need never have arisen. It is essential that history is not allowed to repeat itself.

The sugar industry in Jamaica

By K. MAXWELL

Reprinted from *West Indies Chronicle*, 1977, **90**, (1538), 32-33.

THE Jamaican sugar industry has, over the past two years, suffered greatly from the rapid decline in the world price of sugar that followed the boom year 1975. And accompanying this rapid decline in price has been the production-depressing results of the most serious drought that the country has experienced within living memory.

The net result of the drought is that, though a crop marginally in excess of the approximately 360,000 tons recorded last year was forecast, this year's output is now expected to be only slightly over 320,000 tons. Meanwhile the drought has also adversely affected replanting programmes, with possible serious consequences to the 1977/78 cropping season.

Currently, the growing of sugar cane is concentrated among two main groups, the sugar workers' cooperatives, operated by former workers for the large sugar estates, and the private cane farmers, organized under the aegis of the All-Island Jamaica Cane Farmers Association.

The workers' cooperatives are a bold social-economic experiment introduced about two years ago by the present Government of the country. Essentially they comprise cooperative farms on land acquired from the West Indies Sugar Company by a previous administration and given over to communal control by the present Government.

The cooperatives are arranged in farms around the eight estates under Government control, preserving substantially the same geographical boundaries of the former privately-owned estates. Currently 16 cooperatives are located on nearly 30,000 acres of some of the island's best agricultural lands.

While the social aspect of the experiment has been a success, the economic viability of the cooperatives at existing sugar prices has not been clearly established. Beset by adverse climatic conditions in their infancy and inadequate technological and managerial skills, the co-operatives have had to receive substantial financial injections.

However, their problems in these respects have not been confined to them alone as the whole industry has had to receive rescue injections of new capital.

Now that the Government has acquired eight of the island's twelve central factories and is negotiating for additional control, the manufacturing as well as the production phase of the industry is coming under greater local control.

Manufacturing has also suffered from inadequate technical talent and efforts are now being made to increase the flow at both technician and graduate levels. To bolster a recruiting drive, a training programme, covering all levels of management, has been developed and is now being put into effect.

The technical side of the Jamaican sugar industry is serviced by two interconnected institutions. The Sugar Industry Authority administers the training programme and otherwise controls the export of sugar. It administers loan programmes for replanting, factory improvements and maintenance.

It also has a coercive responsibility which is exercised by imposing penalties for the supply of canes with excessive extraneous material, and for contravention of the minimum standards in factory operations.

The Sugar Industry Authority also administers the Price Stabilization Fund, which is financed by a levy and used to support a basic minimum price for sugar regardless of the world market condition.

The other agency is the Sugar Industry Research Institute. This is responsible for the screening and introduction of new sugar cane varieties and field extension work in both the agronomic, chemistry and irrigation aspects of sugar cultivation.

Recently, with the appearance of sugar cane smut disease in the island, the Institute has been intensifying its screening programme as well as maintaining a surveillance system to identify and treat new seats of infection.

Since the introduction of the disease the screening of new varieties has been considerably heightened as the search goes on for resistant varieties to replace the susceptible ones, which currently account for about 40% of the island's total commercial plantings.

There is little doubt that the Jamaican sugar industry is now in considerable straits. However, increased research into new by-products to widen the economic base of the crop is being stepped up.

And while it seems virtually certain that the industry will continue to live, there are growing signs of disenchantment with the obvious uncertainty to which the crop seems to be heir.

Copersucar and the Brazilian sugar industry

By JORGE WOLNEY ATALLA
(President, Copersucar, São Paulo, Brazil)

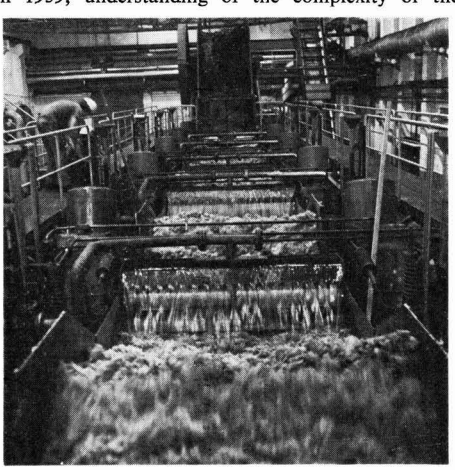
BRAZIL has been historically one of the biggest sugar cane producers in the entire world, and the country ranks today as the world's foremost grower of that agricultural crop, having a sugar production capacity of 6 to 7·5 million tons per season, obtained at 208 sugar mills.

The growing of sugar cane in Brazil goes back to 1516, in the early beginning of the Portuguese colonization, and two regions have been traditionally outstanding producers, the Northern-Northeastern area—which was in the past the country's main production area—and the Central-Southern region where, until recent years, coffee growing used to predominate.

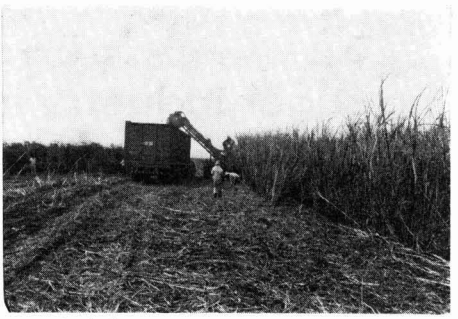
Planning for the nation's sugar expansion as it stands now foresees the achievement of 10 million tons of sugar by 1980, compared with 7·5 million tons today. Export of 4·5 million tons is forecast, almost twice the amount obtained in recent years. In the meantime, Brazil is attempting to intensify its export of high quality refined and crystal sugars. Concerning domestic consumption, one can also observe the accelerated replacement of lower quality types of sugar by better ones in line with the improving standard of living.

Copersucar

The increase of sugar cane production in the State of São Paulo was a direct result of the progressive growth of consumption during World War II. Aiming at the attainment of solutions to common problems, some cooperatives of regional producers were created. In 1959, understanding of the complexity of the problems that afflicted the sugar cane producers as a whole led to the uniting of the regional cooperatives into Copersucar—the Central Cooperative of the Sugar and Alcohol Producers of the State of São Paulo.



Mill tandem at one of Copersucar's affiliated sugar factories



Mechanical harvesting of cane at a Copersucar farm

These associated sugar mills total 73 plants. Although the majority of them are located in the State of São Paulo, they can also be found in the State of Rio de Janeiro, Minas Gerais, Mato Grosso, Goiás and Paraná. Copersucar accounts for about 50% of the sugar and 70% of the alcohol produced in Brazil. In the crop season June 1975/May 1976 the production reached by the mills affiliated to Copersucar was 43,667,076 60-kg bags of raw and plantation white sugar—equivalent to 2,620,024 metric tons—and 310,900,611 litres of alcohol—equivalent to 82,135,850 gallons.

Nowadays, Copersucar ranks as the top Brazilian organization in the sector of food products and is one of the biggest companies in Brazil, standing among the ten largest private enterprises in sales terms.

Copersucar plays a very important part in the regulation of production and distribution of sugar and alcohol in the Centre/South of Brazil. As a leader of the spread and development of technology, it is enabling the country to improve its productivity and sugar quality in order to achieve better conditions on the international market.

The national alcohol plan, set by the Brazilian government in 1975, embodies the ideas originally presented by Copersucar in 1973 and 1974, to expand the production of alcohol for its use in gasoline to minimize the effect of the increasing cost of imported oil. The aim is to expand today's 600 million litres annual production to 3000 million litres by 1980. This will benefit the economy on the whole by replacing 15 to 20% of the gasoline.

Cane reception at one of Copersucar's affiliated sugar factories

One of the most relevant features of this programme is the sugar alcohol price parity which was established. The parity price assures flexibility for the government and for the producers to process cane into sugar or alcohol according to prevailing international prices for sugar and for crude oil and its derivatives.

Brazil today can be characterized not only as the largest producer of sugar cane in the world, but also as a country which has good prospects to consolidate itself as a reliable exporter. The stability of the sugar economy in Brazil is greatly increased by the programme for the addition of alcohol to gasoline, to which Copersucar has contributed its share of effort.

Research and development programmes

Copersucar's share of the sugar and alcohol industry imposes the necessity for research and development. Significant efforts have been made in this field for the benefit of this particular sector and for the economy as a whole.

A comprehensive research and experimental programme is being developed by Copersucar for the technological improvement of our sugar and alcohol industry. The object of this programme is to reduce production costs by increasing productivity and rationalizing resource allocation, and to improve the quality of raw material (cane) as well as the final products. It is felt that this is the way to ensure the competitiveness of the Brazilian agro-industry in the short and long term.

Five cane research laboratories have been created, devoted to studies of varieties of sugar cane and soil, rationalization and improvement of productivity. A recent initiative was the sending of 19 young engineers to Mauritius, for a highly specialized training in sugar fields and sugar plants, where the student will be exposed to high-developed technology.

Copersucar's programmes for improvement and diffusion of technology cover practically all aspects—fields, factories, economic and human resources. The creativity and endeavours of Copersucar's collaborators are dedicated to obtain better cane varieties, to control cane diseases and pests, to improve the effectiveness of fertilizers, to increase extraction and factory recovery, and to train personnel and teach safety procedures.

In order to consolidate its Research and Development Programme, Copersucar is building a modern centre in Piracicaba, a city in the State of São Paulo. Such an enterprise will ensure confidence in all the work that has been done and it will be used as a focus of knowledge in all the branches of sugar and alcohol technology. The centre will be unique by comparison with the world's other research centres; it will bring together all the different fields of study of the sugar/alcohol sector. In this way, it will make possible an integral approach in the studies that will be developed.

In furtherance of the Research and Development Programme, Copersucar has gained the assistance of renowned experts such as ALBERT MANGELSDORF, Ph.D. (genetic area), JOHN PAYNE, Ph.D. (industrial area) and GEORGE SAMUELS, Ph.D. (field mechanization). Copersucar appreciates the benefits gained from the performance of the hundreds of technicians who work in its six experimental stations and laboratories. It is expected that present and future results will bring benefits even beyond our national limits by the exchange of information and experiences with other parties.

This was a good reason for Copersucar to co-sponsor the XVI Congress of the International Society of Sugar Cane Technologists, held in September 1977 in São Paulo, Brazil. It is hoped that ISSCT members will have had a good opportunity for closer contact with the reality of Brazil's agroindustry and that it has been of interest to all participants to learn more about Brazil's sugar and alcohol production expansion plans.

Expansion of Copersucar's activities

In 1973, Copersucar acquired the country's largest complex of sugar refineries, the Companhia União dos Refinadores, which also produces one of the leading brands of roasted and ground coffee. União is among the 50 largest Brazilian enterprises and, together, Copersucar and União have some 8000 employees, not including the workers at the affiliated sugar mills.

An event that caused international repercussion was the purchase by Companhia União dos Refinadores of the whole of the issued stock of Hills Bros.

Sugar cane seedlings being grown at one of Copersucar's Experiment Stations

Coffee Inc., an American company that controls approximately 10% of the United States coffee market. The acquisition involved the employment of US$38,500,000.

A further step in its international programme was to set up the Kuwait Sugar Company, which will refine in Kuwait substantial quantities of raw sugar to be imported from Brazil. Companhia União will hold 49% of the shares, the remaining 51% being left in the hands of local interests. In addition to the investment and the project, Copersucar will supervise the refinery construction, supply specialized equipment and technology, and provide technical assistance and training. Initial annual production is estimated at approximately one million 60-kg bags, the equivalent of 60,000 tons.

As a contribution to the community in general, and with the idea of demonstrating internationally something of Brazil's recent technological progress, Copersucar has sponsored for the last two years the Copersucar-Fittipaldi Formula I Racing Car. This car is driven by EMERSON FITTIPALDI, a Brazilian national who has twice been World Champion and twice runner-up. Copersucar has established as part of the contract that the car should be entirely Brazilian-made, and that the two drivers should be of Brazilian nationality.

Preliminary results with the continuous Langreney vacuum pan

By FRANÇOIS LANGRENEY

(Technical Director, Sucreries de Bourbon, Saint Denis, Réunion)

Reprinted from *Zeitsch. Zuckerind.*, 1976, **101**, 772-776

Introduction

DURING the 1st Congress of ARTAS (Association Réunionnaise de Technologie Agricole et Sucrière), which took place at Saint Denis (Réunion) during 13th–20th October 1973, I had the opportunity of explaining my concept of the design of a continuous boiling pan.

On the basis of this report, Forges Tardieu and Société Sucrière de Beau Champ (Mauritius) suggested to me that they should construct and test a prototype of industrial dimensions.

The experimental pan built in 1974 was the smallest in the industrial range which I envisaged at that time. It has an effective capacity of 10 m³, a heating surface of 100 m² and a length of 5 m, corresponding to a massecuite flow path of 10 m; it weights 11·5 metric tons. Because of delays in delivery of the pan in 1974 only about 4 weeks at the end of campaign were available for tests. Nevertheless, during this short span of time we were able to establish that the pan operated with *A*- and *C*-massecuites as expected and was much easier to operate than we had expected.

In 1975 working conditions were very difficult; as a consequence of cyclone "Gervaise", which caused devastation in Mauritius at the start of February, the campaign was very short and no factory could operate more than 18 hours a day because of restricted cane supplies. As a result, only part of the test programme that we had planned could be accomplished, and then only with *C*-massecuite which we were able to store without any problems during the daily shutdowns of the factory.

Despite these difficulties, we are of the opinion that the results achieved are sufficiently encouraging to be published at this early stage.

DESCRIPTION OF THE PAN

The original pan

I will not repeat here the considerations which led to the design of the pan—they have already been published twice[1,2]—but I will limit myself to a description of the experimental pan.

The original pan is shown in Fig. 1 and incorporates:

(*a*) two vertical external walls,
(*b*) two semi-cylindrical bottom sections,
(*c*) a semi-cylindrical upper section,
(*d*) a tubular calandria common to both circuits 1 and 2,
(*e*) a partition separating circuit 1 from circuit 2 longitudinally,
(*f*) two longitudinal gutters for feeding of syrup or run-off,
(*g*) two corrugated metal sheets tightly fixed to walls (*a*), which form a continuous series of vertical tubes, and
(*h*) cross beams.

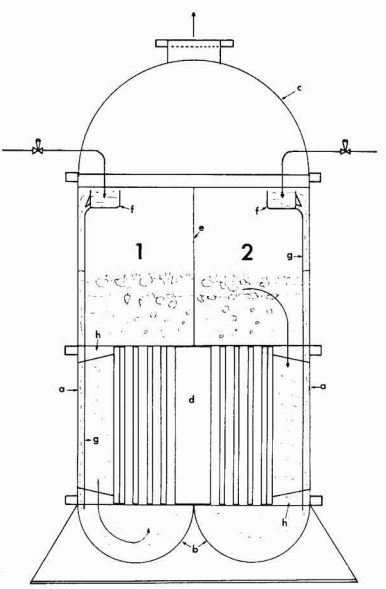


Fig. 1. Section through the original pan (1974)

[1] LANGRENEY: *Rev. Agric. Sucr. Maurice*, 1973, **52**, 298–301.
[2] HUGOT: *Proc. Sugar Tech. Assoc. India*, 1975.

Operation of the pan is easily understood. The prepared magma is introduced at a point in circuit 1 by means of a variable-capacity "Rota" pump. Supply of syrup or run-off takes place continuously throughout the entire length of the circuits via gutters (*f*) which are provided every 76 mm with overflows into the individual tubes formed by the corrugated sheets fixed to the walls (*a*). This ensures that the massecuite circulating in circuits 1 and 2 is fed continuously.

This feed system is simple and permits high dosing precision throughout the entire length of the path, since the angle of slope of the gutters (*f*) is adjustable longitudinally. Only one controller is needed (this receives its impulse at the end of the circuit) to ensure automatic feeding of both circuits.

Attention should be drawn to one very important aspect of the design: this is the independence of longitudinal and lateral movement of the massecuite.

In fact, the longitudinal movement is created by the increase in volume of the massecuite as a result of introduction of the syrup or run-off dry solids. A comparable process is the forward movement of a very long river flowing through a plain and dammed by a weir. The water flow causes the water gauge to rise, and a current forms which allows the water to flow over the weir, which corresponds to the discharge overflow in the crystallizer.

The lateral circulation, on the other hand, occurs as a result of the thermal syphon effect created by heating of the massecuite by the calandrias. It is governed only by the water evaporation which it is possible to effect—the pan cross-section has been so arranged that the pan can operate as a good evaporator and an intensive circulation of the massecuite achieved.

These two flow movements are independent of each other, as a result of design measures, and this independence imparts flexibility to the pan—a necessity where high-purity refined sugar massecuite is to be processed as well as low-grade products from raw sugar production.

In fact, it is completely feasible to think of obtaining a high-purity massecuite from syrup of high concentration, whereby the crystallization rate is very high, followed, in the same pan, by addition of pure water to a low-purity massecuite during a given passage to create very intensive circulation and improve the mother liquor exhaustion.

Modifications undertaken

(i) Installation of transverse partitions

In the initial tests conducted in 1974 it was found that the crystal regularity was not as good as had been hoped, and it was decided to install transverse partitions (2a in Fig. 2) in the upper section of the pan, in order to prevent splashing along the pan when steam bubbles reached the massecuite surface. It is clear that a swirling, haphazard flow of the massecuite occurs only in the upper part of the section above the calandrias, which causes mixing of the crystals. During longitudinal flow the stream is eddy-free and the massecuite climbs in a regular layer with a forward feed component which decreases from start to finish of the path. Its rise through the calandria tubes guarantees positive movement. It is because of this and because of the fact that the tube is the cheapest, most easily installed and maintained heating surface element, that we have chosen this type of heat exchanger.

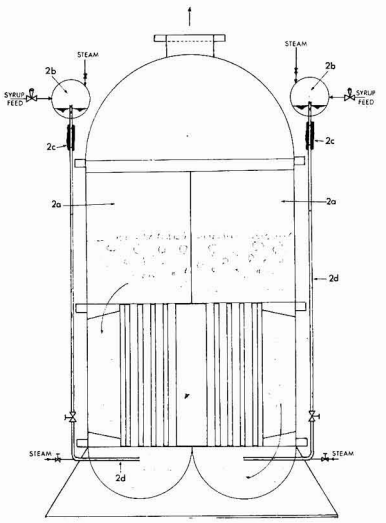


Fig. 2. Section through the modified pan (1975)

The partitions are 500 mm apart and extend 200 mm below the massecuite level.

(ii) Alteration to the design of the feed system

The concept of the feed system proved to be entirely correct, but failures occurred in 1974 for which we could find explanations only in 1975 and which were attributable to the design of the system.

If *C*-product, a highly viscous, high-density massecuite, is processed in the discharge section of the pan, irregularities in the dry solids content of the massecuite often occur despite excellent, regular feeding. These irregularities were found to be the result of one or more of the following effects:

(i) The feed (run-off) leaving the tubes formed by the corrugated sheeting *g* (Fig. 1) in a turbulence-free zone did not mix homogeneously with the concentrated massecuite. Pockets of run-off formed at the bottom ends of the tube and tended to rise to the surface of the massecuite, hindering the downward circulation; when they did reach the top, they formed layers on the surface.

(ii) The run-off distribution gutters were not high enough for their pressure head to permit introduction of a low-density solution into the massecuite.

(iii) Although the design of the system inside the pan had the advantage of imparting simplicity to the unit, it did not permit suitable operation control and prevented any operation without prior stoppage and opening of the crystallizer.

We therefore decided to alter the feed system in 1975, while retaining the principle, which is simple, precise and economical; the modified design (Fig. 2) shows the transverse partitions. The external feed, as shown in Fig. 2, was only installed for test purposes with circuit 2, since the breakdowns described never occurred in circuit 1 where the massecuite is more fluid. The following alterations are shown in Fig. 2:

2(*a*) transverse partitions,
2(*b*) closed feed manifolds with internal overflows,
2(*c*) flexible tubes (permitting the feed manifolds to be inclined), and
2(*d*) fixed tubes for feeding below the calandria.

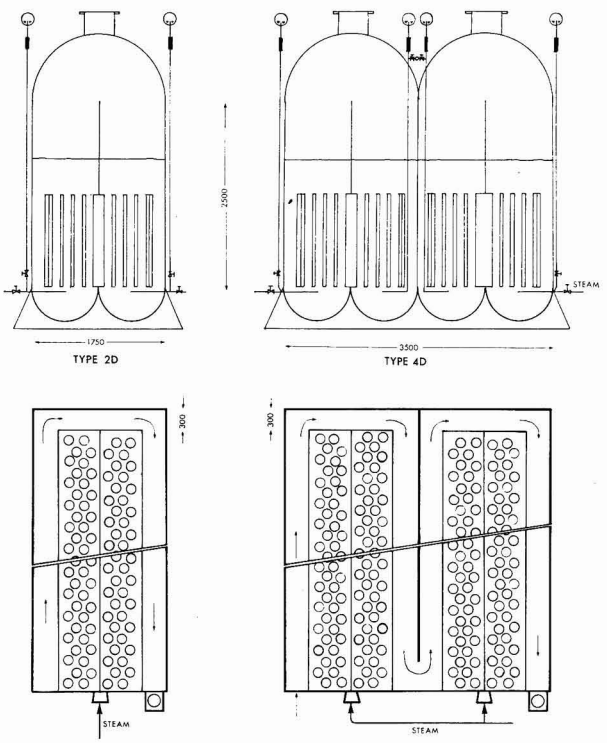


Fig. 3. Section through the continuous Langreney pan, Type D, with rectilinear elements

This assembly prevented the irregularities observed in 1974, and the same arrangement is to be applied also to the first circuit, since it permits suitable control of each feed tube operation.

Table I below gives the dimensions and heating surface areas which we propose for the different industrial capacities. Fig. 4 shows the schematic arrangement of the crystallization plant.

Table I. Dimensions and capacities of Type 2D and Type 4D pans (Fig. 3)

	Length, m	*Heating surface, m^2*	*Massecuite volume, m^3*
Type 2D	5	125	12,500
	6	150	15,000
	7	175	17,500
	8	200	20,000
	9	225	22,500
	10	250	25,000
Type 4D	5	250	25,000
	6	300	30,000
	7	350	35,000
	8	400	40,000
	9	450	45,000
	10	500	50,000

As regards control equipment, at Beau Champ we had only two MECI supersaturation controllers based on massecuite conductivity. Neither vacuum nor steam was controlled, and fluctuations occurred in both systems.

Results

(*i*) *Operation*

The most important fact confirmed by the tests in 1974 and 1975 is that the pan, as designed, functions well. Its operation is stable, circulation across the pan is highly effective and longitudinal circulation is well achieved, as was anticipated.

The pan is easy to handle. Despite the failure to control the vacuum and steam, which led to inevitable fluctuations in the values of both parameters, we were surprised to find that it is easy to control the pan manually when *C*-product is being processed. On the other hand, *A*-product, with its rapid reactions, needs a complete control system.

Since the complete unit is simple, it took only two days for panmen to familiarize themselves with the pan. On no occasion did we observe any irregularities in evaporation or condensate and incondensable gas extraction, nor did we find any entrainment in the condenser.

After installation of the transverse partitions to prevent crystal mixing, and alteration of the feedlines, we are now of the opinion that the pan can be used for any massecuite of below 86 purity. For higher purities means must be used to prevent caking on the cold walls.

(*ii*) *Production*

We do not have the means to determine the specific crystallization rate. Hence, we restrict ourselves to comparing massecuite production between our pan and the batch pans supplying it with magma, which is only possible with *C*-massecuite.

For *C*-massecuite of 55–62 purity the continuous pan gave approx. 50% greater production than a batch pan of the same volume. This increase in crystallization rate, which is evidently a result of the improved circulation throughout the entire length of the pan and hence throughout the entire process, relates only to the operating part of the batch pan cycle; if the remaining part of the batch cycle time is taken into consideration, the percentage production is even more favourable to the continuous pan.

Although we could not make any production comparisons for *A*- and *B*-massecuites, we believe that even with these an increase in the specific crystallization rate will be found. For *A*- and *B*-massecuites, which have much shorter cycles than do low-grade products, it is certain that the continuous pan will strengthen its advantage because of the absence of numerous standstill times for discharge purposes.

We intend also checking by how much the temperature of each product can be raised, since we noticed that the massecuites discharged from our pan were always properly "black" even when we operated at high steam pressures, in contrast to the results with most batch pans. It is highly probable that the crystallization rate can be still further increased, by raising the temperature of the massecuite without deterioration of the product, as a consequence of the favourable effect of good circulation in the pan.

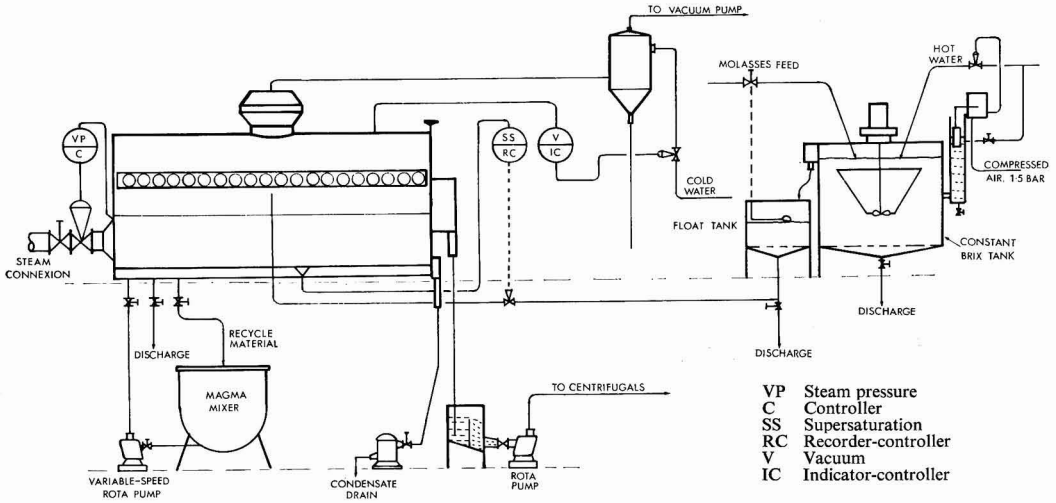


Fig. 4. Schematic arrangement of the continuous Langreney pan

(iii) Condition of the massecuite

The few tests which we were able to carry out in 1974 with *A*-massecuite gave us no further data. We can only say that the pan was able to produce a massecuite of good condition over a period of several hours, but it is difficult to handle the pan without vacuum and steam control and avoid formation of fine grain.

As regards *C*-massecuite, we can say that:

(1) it can be concentrated without any difficulty. Refractometric solids greater than 98% were obtained many times, and the target value of 96% dry solids, which we sought to maintain, was easily achieved. We carried out a general test to see if it is possible and desirable to produce "tight" massecuite in the pan.

(2) The exhaustion of strikes from the continuous pan is always better than from a batch-type pan. Although the same initial grain footing was used, the mother liquor purity was alawys 0–2 units lower than with the batch pan. Herein, we believe, lies the advantages of the continuous pan. We have, therefore, conducted tests with *C*-massecuites, since production capacity and exhaustion capacity by comparison with the batch pans is of interest.

We are also convinced that molasses exhaustion can be increased by combining the crystallization properties of our pan with proper handling in the crystallizer and suitably controlled centrifugal operation, all, of course, being continuous.

(3) Massecuites of lower and even very much lower purity can be boiled than is possible in batch pans; this also tends towards a better exhaustion.

(4) We did not have the necessary equipment for determination of the coefficient of variation (CV) and so cannot give any such values; but we hope to be able to do so after further trials.

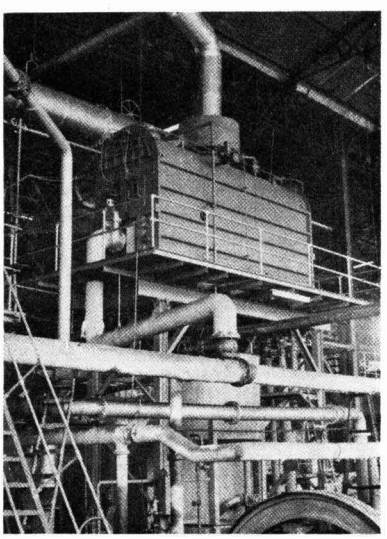


Fig. 5. View of the pan with old internal feed system at Beau Champ sugar factory

In practice, we encountered no difficulties in centrifugalling of the massecuites—not even in batch centrifugals—and the purity of the resultant sugar was comparable to that from other pans. The appearance of the crystals was good, and their regularity—considered with the naked eye—seemed very good.

However, it should be borne in mind that the pan can easily produce fine grain if it is not properly controlled; if it is manually operated, fine grain may not be noticed straight away. For this reason we regard automatic control as essential.

Conclusions

In spite of the short period of time we had at our disposal during the first two trial campaigns, we were

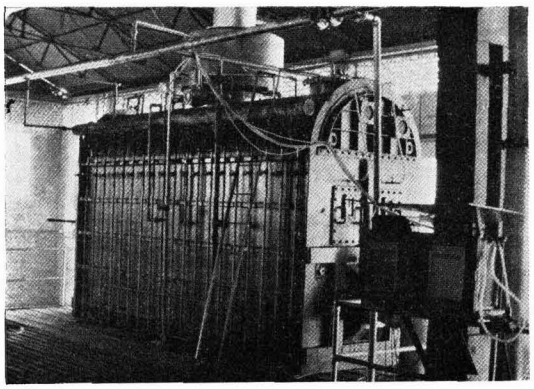


Fig. 6. View of the pan with the new feed system

able to verify that, with the slight modifications made to it, our pan operates as we had envisaged.

It is true that we were not able to achieve best possible results, but we will endeavour to obtain them during the next campaign, which will give us useful numerical values for the design of other pans. We are of the opinion that our pan is even now suitable for raw sugar factory massecuites of not more than 85–87 purity, which can be produced in factories where juice treatment is simple liming. It does seem, however, that the combination in the pan of factors favourable to crystallization will make its main field of application the production of *C*-massecuite.

It should not be forgotten that every unit drop in molasses purity corresponds to an approximate 0·4% increase in sugar yield, and that there is justification in hoping that the pan will pay for itself in less than a campaign with the results obtained.

For existing factories transferring to continuous boiling, it is of advantage to start with massecuites of lower purity and then proceed to higher purity massecuites with the aim of first raising sugar recovery and then expanding production in a sensible, modern and economical way. We believe that there should be no hesitation in installing continuous pans in a new factory for all products; a reduction in the initial investment costs, a saving in fuel as a result of smoothness of operation and the ease of operation are the chief factors in favour of this solution.

ACKNOWLEDGMENTS

We would like to thank Forges Tardieu for financing the prototype; Société Sucrière de Beau Champ, Mauritius, for installing the pan in their factory for tests in 1974 and 1975; the Mauritius Sugar Industry Research Institute for checks made during the 1975 campaign; and M. EMILE HUGOT, whose company, Sucreries de Bourbon, bought the modified prototype for installation in Stella sugar factory (Réunion) and operation as an industrial pan.

SUMMARY

The author has developed a continuous pan of the evaporator/crystallizer type. The prototype, 5 m long (massecuite run of 10 m), of 10 m³ effective capacity and 100 m² heating surface, operated for about 4 weeks in 1974 and in 1975 at Beau Champ sugar factory, Mauritius, after which a modified, improved version was installed in Stella sugar factory, Réunion. The Langreney vacuum pan has proved, from observations to date, outstanding for its favourable mechanical conditions during crystallization. Particularly good has been the introduction of syrup or run-off into the massecuite and the subsequent mixing. The basic modification to the prototype comprised improvement to the distribution means in the vacuum pan. Some tests have been carried out with *A*-product, but mostly with low-grade massecuite. As a consequence of unfavourable campaign conditions in 1975 (caused by Cyclone Gervaise), measurements could not be made which are needed for comprehensive determination of all factors (throughput, crystal content, crystal size distribution, mother liquor exhaustion, etc.), although the continuous pan proved, by comparison with batch pans of the evaporator/crystallizer type, to have a higher specific volumetric throughput, to be more flexible and to be easy to operate. The author is convinced that, with automatic control, massecuites of varying purity can be produced in the same pan and that a higher sugar yield and quality can be obtained. The new pan should, together with continuous crystallizers and continuous centrifugals, contribute to a marked progress in the sugar industry.

Brevities

Bulk handling terminal in Mauritius[1].—Australian consulting engineers Macdonald, Wagner & Priddle Pty. Ltd. are to provide design and supervision services for construction of a $A35,000,000 bulk sugar terminal at Port Louis, Mauritius. The project, due for commissioning in May 1980, includes a system for transportation of the raw sugar output of the island's 21 sugar factories to Port Louis and receiving and sampling the sugar there. Storage will be provided for 350,000 metric tons, making it the third largest bulk terminal in the world after Durban and Mackay. The project requires construction of a wharf and travelling gantry shiploader to cater for 40,000 d.w.t. bulk carriers, and ancillary structures such as workshop, laboratory, administration office, transfer tower, weightower, receiving station and conveyor galleries. The inloading and outloading conveying systems will be designed for 1400 tons per hour. When operational the terminal will allow loading of a 20,000-ton vessel in one day instead of the 3–4 weeks now required for loading by the present method of cutting open and bleeding bags of sugar brought by barge from warehouses near the port.

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Czechoslovakian sugar factory for Iran[2].—Under the terms of a contract concluded between Agronomic Co. Ltd. of Iran and Skodaexport Foreign Trade Corporation, a cane sugar factory is to be built at Karun. The factory will be provided with three cane mills and will have a daily crushing rate of 6680 tons of cane. During the past six years the Czechoslovakian concern has provided equipment for 13 cane sugar factories in various countries.

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Thailand bulk sugar terminal.—Thailand's first sugar terminal is under construction at Samut Prakarn, south of Bangkok, and should be completed by the end of this year, Mitr Phol Corporation sources have said. The terminal is owned by United Sugar Terminal Co. Ltd., in which Mitr Phol is a shareholder. It will cost $7,500,000. Vessels of 20,000 tons will be able to berth for loading, compared with only 10,000-ton vessels which can berth at Bangkok's river port at present, larger vessels having to berth at Koh Si Chang, about 100 km from Bangkok. The facilities will be able to handle 720,000 tons of sugar annually[3].

[1] *Producers Rev.*, 1977, **67**, (4), 82.
[2] *Skoda Rev.*, 1977, (2), 62.
[3] *Standard Chartered Review*, July 1977, 4.

Sugar cane agriculture

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

Influence of covering with trash on the industrial quality of stored sugar cane. F. A. FOGLIATA. *Rev. Ind. Agríc. Tucumán*, 1975, **52**, (2), 61–72 (*Spanish*). Comparison of cane cut and stored with and without a covering of trash showed that the uncovered cane showed a greater loss of weight, reduced juice purity, lower pol % cane, lower extractable sugar, lower juice volume and higher reducing sugar content by comparison with the cane which had been covered. It is clear, therefore, that covering with trash is of benefit if there is to be a delay between cutting and milling of the cane.

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Blight in sugar cane seedlings. N. E. V. DE RAMALLO. *Rev. Ind. Agríc. Tucumán*, 1975, **52**, (2), 77–81 (*Spanish*).—*Drechslera hawaiiensis*, *Curvularia senegalensis* and *C. lunata* were isolated from young blight-affected seedlings in greenhouse flats. "Benomyl" fungicide applications at sowing and "Tiuram" at sowing and as post-emergence treatment were effective in controlling the disease.

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Fertilizer and soil fertility practices for sugar cane production in Louisiana, 1977. ANON. *Sugar Bull.*, 1977, **55**, (9), 8–9.—General recommendations are given on fertilizer application and soil fertility improvement measures (liming and filter cake application) in cane fields of the four major Louisiana cane areas.

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Sugar cane variety outfield experiments in Louisiana during 1975. H. P. FANGUY and C. A. RICHARD. *Sugar Bull.*, 1977, **55**, (9), 14–19.—Results of outfield variety tests at 13 locations during 1975 are reported. Cane and sugar yield data are tabulated, and summaries are given of the performances of six experimental and six commercial varieties.

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Natural leaching effect on salt-affected soils in Taiwan. I. Land with open drainage system. S. C. YEN and Y. T. FANG. *Rpt. Taiwan Sugar Research Inst.*, 1976, (74), 15–25 (*Chinese*).—Studies on soil salinity fluctuation in a 180-cm profile in each 3-day period after rain had fallen showed, in combination with rainfall records and ground water table data, that high rainfall had a low leaching effect because of the high water table, high rainfall intensity and restricted external drainage. As regards leaching, the most effective rainfall would be 40–100 mm. Lowering of the water table is considered an important step towards improvement in natural leaching.

Culmicolous smut of sugar cane in Taiwan. IV. Resistance trial. L. S. LEU, W. S. TENG and Z. N. WANG. *Rpt. Taiwan Sugar Research Inst.*, 1976, (74), 37–46. A method of pricking the base of plantlets, 2–5 cm high, with a row of five needles and then brushing the injured tissue with heavy teliospore suspension was used to screen 367 varieties and clones for resistance to *Ustilago scitaminea*. Results showed that the degrees of resistance varied between the 164 Taiwan and 203 imported varieties, but that sometimes results also differed in the same variety after repeated inoculations. The pricking method gave a higher disease incidence than did a dipping method in which cuttings were soaked in teliospore suspension. Whips started to form 1–2 months after inoculation, most of them showing clearly within 2–5 months, when inoculation was carried out in late April-early May or early August; if inoculation was carried out in winter or early spring, however, symptoms took longer to appear. The possible effect of rain in late June and July on disease incidence is to be investigated. Most screening is for Strain 1 of the disease (the more prevalent strain in Taiwan), although some promising cane varieties are also tested for resistance to Strain 2.

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A new record of acarid mite *Caloglyphus mycophagus* Megnin (Acarina:Astigmata) from Taiwan. Y. H. TSENG and S. A. HSIEH. *Rpt. Taiwan Sugar Research Inst.*, 1976, (74), 47–52 (*Chinese*).—*C. mycophagus* has been newly recorded in Taiwan, where it was first found as hypopus attached in large numbers to the white grub *Alissonotum impressicolle* and wireworm *Melanotus tamsuyensis*; no adults or larvae were found attached to these pests. The morphology of the mite is described.

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Studies on *Eoeurysa flavocapitata* Muir, a new sugar cane plant hopper to Taiwan. B. H. JIANG. *Rpt. Taiwan Sugar Research Inst.*, 1976, (74), 53–62 (*Chinese*). The morphology and life cycle of *E. flavocapitata*, first found in a Taiwan cane field in 1973, are described, and details are given of the type of damage it inflicts on cane. The adults and nymphs hide in the spindle and suck the juice from the leaves. Yellow spots first appear on —2 to 0 leaves, and after a time some of these spots become purple-red. In severe cases, the damaged spindle leaves rot. Mildew forms on the surface of leaves, which become blackened with the sooty mould within a few days.

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Two new Erythraeid mites from Taiwan (Acarina: Prostigmata). Y. H. TSENG, S. L. YANG and Y. S. PAN. *Rpt. Taiwan Sugar Research Inst.*, 1976, (74), 63–74.—Larvae of *Callidosoma matsumuratettix* and *Erythraeus plumosus* were found in association with *Matsumuratettix hiroglyphicus* and a species of plant hopper on *Saccharum spontaneum* in southern Taiwan.

Details are given of the morphology of the larvae which are ectoparasitic on several families of insects.

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Cultural energy balance of the production of alcohol from sugar cane, manioc and sweet sorghum—agricultural and industrial phase. J. G. DA SILVA, G. E. SERRA, J. R. MOREIRA and J. C. GONÇALVES. *Brasil Açuc.*, 1976, **88**, 452–463 (*Portuguese*).—The energy balance of the title is the difference between the energy required for cultivation of the crop and the energy which it can produce, including e.g. products of fermentation of tops and the fuel value of bagasse. Standard equipment and conditions are assumed for the three crops and it is calculated that over a period of three crops (plant cane and two ratoons) sugar cane processed to alcohol provides 36,297 Mcal.ha^{-1} per year and requires 15,040 Mcal.ha^{-1} per year to grow and convert, giving a benefit of 21,257 Mcal.ha^{-1}, whereas for manioc the corresponding figures are 22,283, 12,925 and 9,358 Mcal.ha^{-1} per year, respectively, and for sweet sorghum 31,686, 16,550 and 15,136 Mcal.ha^{-1}.

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Nutrition and fertilization of sugar cane. J. O. FILHO. *Brasil Açuc.*, 1977, **89**, 10–16 (*Portuguese*).—While 1,929,641 ha of land is devoted to sugar cane in Brazil, either this will have to be expanded if more sugar is to be produced to meet increasing domestic consumption and export requirements, or the yield will have to be increased. The yield in Brazil, averaging 50 tons.ha^{-1}, is lower than in other countries such as Puerto Rico (77·5 tons.ha^{-1}), Venezuela (79 tons.ha^{-1}), etc. A number of factors govern yield, including variety, climate, cultural practices and soil physical and chemical properties. Application of fertilizers can raise yields; however, 63% of the fertilizers used in Brazil are applied to cane land and they already account for 20–25% of the cost of cane production. A survey is presented of literature data on the content of mineral elements in cane and cane leaves, together with an account of their function, levels required and general recommendations for fertilization of plant and ratoon cane in the State of São Paulo as well as the use of lime to bring soil pH to 6–6·5.

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Cane frost damage in Louisiana. L. L. LAUDEN. *Sugar Bull.*, 1977, **55**, (11), 6–9.—Reference is made to the serious damage suffered by Louisiana cane as a result of a severe frost on 29th–30th November 1976. Recommendations made by the American Sugar Cane League on handling of frost-damaged cane are listed. Losses, including more than 7000 tons of cane left in the field, represented 50,000 tons of sugar valued at about $10 million, although some of this loss would have resulted from the increase in extraneous matter accompanying cane as a result of heavy rain following the frost; cane from over 7500 acres could not be harvested because of the wet conditions.

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The weather history of the Louisiana sugar cane belt. J. E. IRVINE. *Sugar Bull.*, 1977, **55**, (11), 10–19.—A survey is presented of the monthly average temperatures and rainfalls as recorded at Houma, Louisiana, and for five other locations in the Louisiana cane belt, covering the period 1893–1976. Also recorded are soil temperatures, solar radiation, maximum daily wind speeds and tropical storm history.

Aerial photography used for estimation of crop condition. J. R. THOMAS and G. F. OERTHER. *Sugar J.*, 1977, **39**, (10), 35–38.—A third ratoon crop of N:Co 310 cane was treated with 0, 50, 100, 150 and 200 lb.acre^{-1} N as ammonium nitrate (with each treatment replicated four times), and the canopy reflectance measured aerially from a height of 1000 ft just before the cane lodged in the August (some of the cane being manually harvested in the following January for determination of the number of millable stalks and total yield). Colour-infra-red (CIR) film—Kodak "Aerochrome Infra-red 2443"—and Kodak "Ektachrome MS Aerographic 2448" (conventional colour film) were used, the former with an orange filter with and without blue filter, while a haze filter was used with the latter. (The orange filter excluded wavelengths shorter than 520 nm, while the blue filter enhanced the red colour of the foliage and increased the contrast between plants and the soil background.) The optical density of each plot in the randomized block design was obtained with a scanning microdensitometer, using blue, green and red band-pass filters. Variance analysis showed that N application significantly affected the optical densities of the images on the CIR film but not on the conventional colour film. Plant density was significantly correlated with optical density of the CIR film as measured with a red band-pass filter, and partial regression coefficients suggested that plant density had 34 times more effect than mean stalk weights in determining yield. The decrease in yield associated with N deficiency caused a change in canopy reflectance, the decrease in yield being directly related to the ratio between canopy reflectance in N-deficient and non-deficient areas. With all band-pass filters, yield of untreated cane was over-estimated, partly a result of reflectance from vegetation other than cane. With the CIR film, use of the blue filter increased the estimated yield values which were very close to measured values. At 150 lb.acre^{-1} N application all band-pass filters gave the same yield value, and this was identical with the measured value.

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Fertilizer and soil fertility practices for sugar cane production in Louisiana, 1977. ANON. *Sugar J.*, 1977, **39**, (10), 40.—See *I.S.J.*, 1977, **79**, 315.

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The modernization plan for the Réunion sugar economy. D. REYDELLET and J. C. SUBTIL. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 17–30 (*French*).—An official enquiry was carried out in 1972 to establish the causes of poor standards in cane agriculture and inadequate cane area replanting. Major reasons for the situation were found to include: the growing of old, disease-susceptible varieties; considerable partitioning of the land, with 87% of the farms each having less than 5 ha of land and yet representing a total of 37% of the entire cane area; and poor topography, with very stony soil and 20% of the cane land on slopes greater than 30%. Because of the poor agriculture, factory investment (although heavy) has brought no benefit, and sugar companies have found themselves in tight financial straits. The modernization plan based on the enquiry aims to re-establish the earlier area under cane and increase yields from 45 to 65–70 tons.ha^{-1}, improve cane transport, and raise the standard of farming through adequate training and organization. What has been achieved

in the first two years of the plan's existence is described. The results achieved are regarded as highly promising.

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Mechanization of sugar cane harvesting in Réunion in 1975. M. HOARAU and E. BOYER DE LA GIRODAY. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 96–121 (*French*). Descriptions are given of the McConnel whole-stalk harvester (of which there are four in Réunion) and of the Don Mizzi 741, Massey-Ferguson MF 102 and Toft "Robot CH 364", Mark II (full-track) chopper harvesters, of which there are one each on the island. Advantages and disadvantages of the machines are described. Information on the McConnel machine indicates that, with mechanical loading, it permits little reduction in harvesting costs compared with manual harvesting and loading, although it does facilitate manual work and will enable older men as well as women and youngsters to do the tasks, leaving the stronger workers to carry out the heavier jobs; there is little information on the Don Mizzi machine, except an indication of a saving in harvesting costs, even allowing for the extra labour required to remove stones in front of the harvester and to gather cane left on the ground. Much more information is available on the other two harvesters; from their performances in harvesting 7439 tons of cane (the MF 102) and 5441 tons (Toft machine), it was found that the latter had double the hourly capacity of the former, with slightly more time for stoppages; maintenance time was about the same for both harvesters, while repairs took longer with the MF 102. On the basis of the hourly capacity, the costs of harvesting with the MF 102 were much greater than with the Toft machine.

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Is the quality of cane affected by mechanical harvesting. A. CORNU. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 122–135 (*French*).—Investigations were conducted in Réunion in 1974 and 1975 on three varieties (S 17, R 526 and R 541) to determine the effects of preharvest burning and of mechanical harvesting on quality. The only advantage of burning was elimination of trash, whereas quality fell. In the winter, at the start of the season, S 17 exhibited signs of significant deterioration only after two days, while under summer conditions the other varieties deteriorated within 1 day. Cane which was harvested straight after burning deteriorated at a faster rate than did burnt cane which was left standing. Chopped burnt cane showed much greater fall in quality (lower purity, pol and extractable sugar % cane) than did whole-stalk cane. Gas-liquid chromatography revealed double the loss in sucrose caused by burning than did polarimetry; GLC also showed an increase in reducing sugars and dextrans in burnt cane. While in some cases, mechanically harvested cane showed a fall in Brix of up to 3° and in extractable sugar % cane of as much as 4% absolute by comparison with manually harvested cane, in other cases there was no significant difference; this was attributed to the presence of substantial quantities of shoots in the mechanically harvested cane loads which, however, should not exceed 3% by weight of the cane because, when crushed, they merely dilute the extracted juice. The presence of these shoots is associated with variety. On the basis of the investigations, it is recommended that varieties be selected which are suitable for mechanical harvesting; while conditions in Réunion are not ideal for mechanical harvesting, the results are considered promising.

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Field preparation for mechanical harvesting. L. PILOT and L. LI PI SHAN. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 136–138.—In view of the need for mechanical harvesting in Mauritius, the authors give advice on field layout, land preparation, cane planting and cultivation techniques which are most suitable. It is stressed that it takes a long time to bring fields to the right condition for mechanical harvesting, so that there should be no delay in introducing modifications.

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The effect of flowering on yield in sugar cane. M. H. R. JULIEN and G. C. SOOPRAMANIEN. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 151–158.—The effect of flowering on the yield of M 351/57 and S 17 cane (both of which flower profusely in May under local Mauritius conditions) was investigated with the intention of comparing naturally vegetative (*Vn*) and flowering stalks between themselves and with artificially vegetative (*Vp*) stalks from cane, flowering of which was inhibited by night breaks. In both varieties, flowering shoots were taller and had a greater number of internodes and leaves at emergence and anthesis; however, these characteristics increased gradually in vegetative shoots, so that the differences between vegetative and flowering shoots gradually decreased with sampling date (6, 12, 18 and 24 weeks after anthesis). The flowering shoots had lost all their leaves by 16–18 weeks after anthesis; these stalks produced an average of about three side shoots, however. The fresh weight of flowering stalks was significantly higher than of *Vp* stalks at anthesis, although the differences gradually diminished with sampling date until they were no longer significant. Although no significant differences were found between *Vn* and *Vp* shoots in terms of fresh weight at any particular harvest date, the overall mean fresh weight of the *Vn* shoots was significantly higher than of the *Vp* shoots. Recoverable sugar % cane increased steadily in both flowering and *Vp* shoots from anthesis to harvest, and there was no significant difference in the value for either variety at any of the sampling dates. In the case of M 351/57 cane, there were no significant differences in recoverable sugar between *Vn* and *Vp* shoots. On the other hand, the yield of sugar per stalk was significantly higher in flowering stalks of S 17 at emergence and anthesis than in *Vp* stalks, but these differences gradually diminished. This was also true of M 351/57, but throughout the crop season without any fall in difference. The sugar yields of *Vn* and *Vp* shoots were not significantly different at any sampling date, but the mean of all values was significantly higher for the *Vp* shoots. Total fibre content per stalk followed the same pattern as fresh weight. It is concluded that for a long-season crop, flowering may have a beneficial effect if the crop is harvested early, and should have no adverse effect if the harvest is delayed. A variety which has flowered heavily should not necessarily be harvested soon after anthesis, since it has been shown that dry matter accumulated in the flowering stalks mainly in the form of sucrose for several months after anthesis.

Sugar beet agriculture

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

Increased production and profitability. ANON. *Upbeet*, 1977, **65**, (1), 8–11.—After outline information on beet breeding and crop protection at The Great Western Agricultural Research Center in the USA, results from studies conducted in 1976 are discussed, including P and N fertilization recommendations. A relationship has been established between N fertilizer application and beet crown size, and between the latter factor and yield losses. Increase in soil N resulted in an increase in crown size, and large-crown beets presented problems in topping. While the amount of recoverable sugar per ton of beet rose with topping efficiency, it also increased as a result of reduction in the amount of N applied; however, when properly topped, a large-crown beet suffered higher yield losses than did a properly topped small-crown beet, while the large crowns of inefficiently topped beet contributed a higher amount of impurities. Soil crusting after heavy rain can prevent emergence of beet seedlings; normally, the seedlings will push through the cracks that develop as the crust dries, but cracks form in a random pattern and there is thus no guarantee of emergence. Studies have shown that "Coherex" and "Petroset SB" were the most effective of a number of soil cracking compounds; for best results, the material should be applied by a solid-stream nozzle directly over the seed at planting, and should penetrate to a depth of at least $\frac{1}{4}$ inch. In herbicide trials, "Nortron" was the most effective pre-drilling chemical against a wide range of weeds, particularly those that germinate later in the season. A number of mixtures of "Nortron" with other herbicides, including "HOE-23408", "Antor" and "Ro-Neet", proved successful without undue crop damage at dosages appropriate to local soil conditions; "HOE-23408" and "Antor" were highly effective against grasses. In many cases, excellent results were given by a subsequent application of "Betanal" and "Betanex".

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Beet purity—finding solutions for future growth. ANON. *Upbeet*, 1977, **65**, (1), 12–13.—It is stated that, although average beet yields per acre have increased in the past years in the Rocky Mountain states of the USA, there has been a steady decline in sugar yield of the order of 16 lb per ton of beet during 1970-75, representing a loss to The Great Western Sugar Co. (GWS) of 40,000 short tons of sugar per year. As a consequence, the company and beet growers have collaborated in the institution of a new scale of beet payments to include variances for purity and new agricultural management techniques aimed at increasing sugar yield. For beet purity monitoring, GWS has installed equipment in five major beet-growing areas; information is given on the sampling and testing procedures recommended by the special purity committee set up under the agreement between GWS and beet growers; the committee also had the task of establishing the average purity in the 1960–66 crops and developing a formula to adjust for differences between that average and the actual 1976 beet purity as a guide to the payment rates for 1977–78. Major factors found to affect beet purity included N fertilization rates, the crop rotation programmes and resulting soil N availability, date of germination and harvest, and irrigation (which also affects N availability).

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Winter sugar beet growing in Israel. A. COHEN. *Şeker*, 1977, **15**, (103), 26–31 (*Turkish*).—Information is given on beet agriculture in Israel, particularly irrigation requirements in both winter and spring, and typical beet yields and sugar contents are indicated, showing peak yield to be in the first half of July while maximum sugar content occurs at about the end of April (harvesting being carried out in the period from May to mid-July).

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The production and economic effects of sugar beet irrigation at different levels of mineral fertilization. J. DZIEZYC. *Gaz. Cukr.*, 1977, **85**, 36–39 (*Polish*). Trials over a number of years showed that overhead irrigation had favourable effects on the yield of beet grown in light soils without reducing the sugar content or altering the chemical composition, although stabilizing to a certain extent the adverse effects of high application rates of fertilizers. The maximum economical effect of irrigation was obtained at a fertilization rate of 600 kg 2:1:2 N:P:K. The recommended irrigation levels were 30 mm applied in five stages in a normal year and 35 mm applied in seven stages in a dry year, covering the period from mid-June to mid-August.

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Possibilities of increasing yield and processing quality of sugar beet in 1976–1980. L. SCHMIDT, R. ŽELEZNÝ and L. JELÍNKOVÁ. *Listy Cukr.*, 1977, **93**, 25–34 (*Czech*).—The effects of a number of agronomic factors on beet yield and quality in six factory areas of Czechoslovakia are discussed with the aid of tabulated data. It is stated that, while twenty years ago 32% of the beet grown were high-yielding varieties and 18% high-sugar varieties, there has been a gradual increase in the proportion of the former type, resulting in increased yields per ha; now, over 90% of the total beet grown is represented by Dobrovická A, a high-yielding variety. The factors affecting beet yield and quality which are discussed include type of pre-crop, soil type, autumn ploughing method and date and whether levelling is carried out or not, organic and

mineral fertilization, dates of sowing, thinning and harvesting, herbicide and irrigation application, harvesting (at which average losses totalled 10% in 1975) and storage. It is concluded from the results that there are good possibilities of increasing beet yield and quality by paying closer attention to the requirements in each particular sector of beet agriculture.

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Sugar beet irrigation. Effect of scientifically controlled sugar beet irrigation on its processing quality and post-harvest metabolism. V. ŠVACHULA, J. TORNIKIDU and J. ZAHRADNÍČEK. *Listy Cukr.*, 1977, **93**, 35–41 (*Czech*). Trials over a 3-year period included normal and excessive application of irrigation water in addition to annual rainfall of 240, 292 and 239 mm (in 1973, 1974 and 1975, respectively), with and without oxygen application to the top layer of soil through a flexible tube, omission of irrigation and restriction of the amount of rainwater reaching the plant (by means of open screens). Full details are given of the variants and sub-variants. The effects of the treatments on beet yield and quality were determined, whereby the irrigated beet yield was highest as was the total sugar yield per ha, although the sugar content was lower than in the unirrigated beet. By far the highest yield was obtained where irrigation plus soil oxygenation were used, and such beet had the lowest α-amino-N and ash contents and gave the lowest molasses yield. Without soil oxygenation, over-irrigation gave three times the yield of unirrigated beet and was much more effective in terms of yield than was "normal" irrigation. Irrigated beet also suffered lower storage losses than did unirrigated beet, particularly since its respiration rate was lower.

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Sugar beet irrigation in the world and Czechoslovakia. L. SCHMIDT and V. KEC. *Listy Cukr.*, 1977, **93**, 41–45 (*Czech*).—The state of beet irrigation in Czechoslovakia is compared with that in other beet-growing countries, and actual irrigation water applied in 1975 compared with requirements as calculated by a special mathematical method based on beet yields and weather conditions in 1968. It is concluded that irrigation has not been adequately used in Czechoslovakia, and that the evidence should convince those responsible for beet agriculture of the advantages of irrigation, especially when it is remembered that the most fertile beet areas of Czechoslovakia are fed by two major rivers.

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The influence on germination, emergence and early growth of the size of monogerm seed in successive processing stages. G. VENTURI and M. T. AMADUCCI. *Ind. Sacc. Ital.*, 1977, **70**, 5–14 (*Italian*).—Natural beet seed was divided into three size fractions, each of which was then processed, subsequently pelleted and a final fraction of commercial pelleted seed obtained. The seed was then manually sown in five types of soil (represented by clay, clay-sand mixtures and sand) in 1974 and 1975. It was found that the initial seed size appreciably affected germination and early growth: increase in the size caused greater germination, emergence % and root and leaf weight 45 days after emergence, while the time taken to emerge was reduced. On the other hand, in all cases pelleting reduced emergence % by comparison with that of the unpelleted seed, particularly in the case of small seed; pre-pelleting processing increased emergence of the small seed in contrast to that of the initial seed and reduced that of the larger seed, which also suffered a noticeable reduction in % monogermity. The effect of soil type was governed by weather conditions.

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Effect of different forms of nitrogenous fertilizers on the yield of sugar beet varieties. W. ZIÓŁEK. *Gaz. Cukr.*, 1977, **85**, 63–67 (*Polish*)—From N fertilizer trials involving four beet varieties, it was concluded that there was little difference in beet and leaf yield and sugar content between the various forms of fertilizer, although ammonium nitrate was the most suitable in terms of beet yield and sugar content, followed by urea and then ammonium sulphate. Of these three forms, ammonium nitrate gave the highest ash and noxious N content in beet, although none caused much increase in either parameter compared with untreated beet. Late-autumn application of N fertilizers, particularly of the ammonium type or urea, resulted in a slight fall in yield of spring-sown beet by comparison with N application at sowing. However, no leaching losses occurred, even with rainfall, although high temperatures can inhibit nitrification. Optimum conditions of N conversion were found to be a neutral pH, a temperature of 35°C and a soil moisture content 60% of capacity. On the other hand, greatest N uptake by the plant occurs at 10–25°C, while a drop to 5°C inhibits the process. While a slow-acting form of fertilizer such as a specially-treated urea would be ideal, tests have shown that additives to promote urea hydrolysis have blocked the N and prevented its uptake by the beet plant.

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Beet yellows. L. VAN STEYVOORT. *Le Betteravier*, 1977, **11**, (108), 11 (*French*).—While beet virus yellows was less widespread in 1976 than in the previous two years, and the incidence in 1977 was expected to be no greater than in 1976, the author warns against complacency and points out that it is possible to improve on the control measures already adopted. Stored fodder beet which have sprouted can act as sources of aphids, so that the piles should be broken up before emergence of sugar beet. Late-sown beet are always more susceptible than early-sown beet; any treatment, particularly spraying, poses problems, so that re-sowing should be carried out only where absolutely essential. Small plant populations favour aphid multiplication and hence suffer greater virus yellows attacks than do large populations, which should be 75,000–80,000 per ha. Although no spraying is generally required after "Temik" application, this is not the case after "Curater" has been applied. The farmer is recommended to spray liberally where the insecticide is one based on a phosphoric ester, since aphids have shown a certain degree of resistance to such chemicals and there will be need to reinforce applications made in the previous year. The first spraying should be made at the time of the warning of imminent attack and repeated every 12 days until the end of June.

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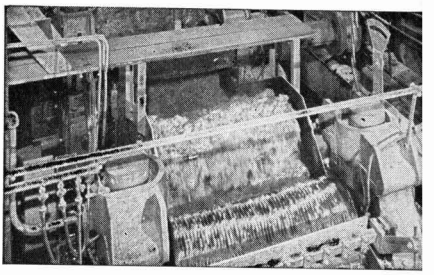
The major beet pests and diseases. ANON. *Le Betteravier Franç.*, 1977, **47**, (314), 15–18 (*French*).—Information is given on the major beet pests and diseases, with descriptions of the damage they cause and means of control.

Cane sugar manufacture



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

Influence of polyelectrolytes and earth on the sedimentation process in cane juices. S. CEPERO, M. DARIAS, R. FAJARDO, L. CARRAZANA and R. SARDIÑAS. *Centro Azúcar* (Rev. Consejo Cient. Azúcar y Deriv. Univ. Central Las Villas, Cuba), 1975, **2,** (1), 17–37 (*Spanish*). The effect of different polyelectrolytes in the presence and absence of soil on sedimentation velocity V_s, compaction velocity V_a and final mud volume V_c was determined on a laboratory scale using juice from B 4362 variety. The results are tabulated and shown in block diagrams, indicating that the soil improves sedimentation and that, in its presence or absence, the action of the polyelectrolytes depends on the juice composition. In order to select the most suitable polyelectrolyte and its concentration, preliminary laboratory tests are necessary.

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Behaviour of pH and acidity of juices as indicators of contamination of a milling tandem. M. T. HERNÁNDEZ and N. QUINTERO. *Centro Azúcar* (Rev. Consejo Cient. Azúcar y Deriv. Univ. Central Las Villas, Cuba), 1975, **2,** (1), 39–52 (*Spanish*).—Variations in pH and acidity of crusher and mixed juice from a pilot plant-scale milling tandem have been statistically studied and compared with microbial contamination as measured by the resazurine test; it is established that the variations in pH and acidity are not adequate as indicators of contamination.

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Heat transfer in deformed tubes. R. ESPINOSA P. *Centro Azúcar* (Rev. Consejo Cient. Azúcar y Deriv. Univ. Central Las Villas, Cuba), 1975, **2,** (1), 65–76 (*Spanish*).—A study is described on the influence on heat transfer of turbulence promotion induced by partial deformation of tube profile, produced by symmetrical collapsing at its periphery to give plane profiles within the tube. The studies compared results using deformed tubes with those given by smooth tubes, using two different diameters and flow of Reynolds number between 25,000 and 160,000. The investigations demonstrated the influence of the deformation on the film coefficient, which fell within the theoretically accepted range for this process and was approximately twice that for the smooth tubes.

* * *

Sedimentation in inclined boxes. P. M. FABREGAT P. and V. KHARAKOZ. *Centro Azúcar* (Rev. Consejo Cient. Azúcar y Deriv. Univ. Central Las Villas, Cuba), 1975, **2,** (1), 77–87 (*Spanish*).—Sedimentation experiments were made using a slurry of 2% slaked lime in water in a box having a sloping bottom, the angle of which was adjustable. It is concluded that, in respect of capacity, efficiency and residence time, the best angle of inclination of the sloping base was 60° to the horizontal.

* * *

Effects of moisture and microbial content on raw sugar stored in bulk. E. DUARTE. *ATAC*, 1976, **35,** (5), 30–39 (*Spanish*).—Samples were kept at different levels of relative humidity (85%, 75% and 60%, using salt solutions of different composition) and either at constant temperature (34° or 30°C) or at temperatures fluctuating between 45° and 20°C. Microbial examinations were made at the beginning and end of a 90-day period (mesophiles, sporulated thermophiles, moulds and yeasts), and measurements made at 30-day intervals of pH, conductimetric ash, colour, reducing sugars, moisture, amino-N and colloids. The only micro-organisms able to multiply at R.H. values of 75% were yeasts, when the initial contamination was as low as 25 per 10 g of sugar. For moulds to multiply there had to be a high initial number and absence or minimal proportion of yeasts. Colour increased in storage with higher R.H., temperature and yeast contamination, other contributing factors being amino-N and reducing sugars. The parameter most affected by increase in yeasts and moulds was the pol. High-pol and affined sugar were equally affected by microbial development, while ash appeared to be unaffected. Colloids increased with microbial development; this is important because it affects filtrability. The safety factor of a raw sugar is not a valid measure when the R.H. exceeds 75% and there is microbial development.

* * *

Control and calculation in sugar production. A. VALDES and R. MISCHUK. *ATAC*, 1976, **35,** (5), 48–65 (*Spanish*).—The importance of chemical technological control in the manufacture of sugar because of the interlinked effects of one part of the process on the others is emphasized, as is the need to use such control to seek improvements in the efficiency of all stages. A manual for such control has been produced in the USSR and an analogous manual also exists in Cuba. Standards and characteristics covered in control of raw material quality (beet in the USSR, cane in Cuba) are discussed as well as control of the manufacturing process.

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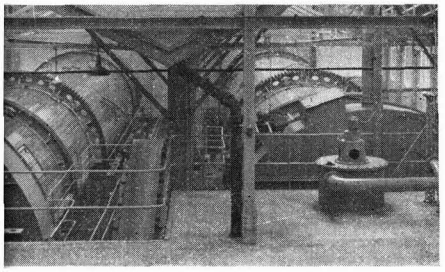
Chemical cleaning of evaporators. S. NANDAGOPAL and R. RAMAMURTHY. *Indian Sugar*, 1976, **26,** 607–612.—The use of alkaline and acid treatments to remove evaporator scale is discussed, details being given of the reactions involved in the case of individual components. The use of fluorides to remove silica is included. The importance of corrosion inhibitors is indicated.



Beet sugar manufacture

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

Pre-conditioning of white sugar before storage. A. F. ZABORSIN, L. K. KRSEK, A. P. FEDOROV and T. K. VASIL'EVA. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1975, **24**, 82–91 (*Russian*).—The literature on sugar conditioning before storage is briefly surveyed and pre-conditioning experiments are reported. In a fluidized bed dryer, the moisture content was reduced from 0·66–1·12% to 0·03–0·05% and the temperature reduced to 23–27°C in conformity with requirements for bulk storage. Dust was almost absent and the fines content minimal. The pre-conditioned sugar had a bound moisture content which was considerably lower than that from other types of dryer; bound moisture removal was complete after 4 days of storage, in contrast to 10 days where a drum dryer was used for pre-conditioning.

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Pneumatic dust removal from white sugar. A. F. ZABORSIN, L. K. KRSEK and K. U. BURLIEV. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1975, **24**, 109–114 (*Russian*).—Details are given of an experimental vertical dust collector in which a stream of air cuts across the descending sugar at a controlled rate and "sweeps" the lighter dust particles up into a pipe leading to a wet cyclone via a horizontal and a vertical Venturi tube; the heavier particles fall down an extension to the special-profile vertical chamber onto a horizontal conveyor. Tests showed that at a 2–6% average content of dust particles measuring 0·2–0·3 mm, 400–1200 kg of dust was removed per hr at an hourly sugar throughput of about 20 tons.hr^{-1}. Air requirements per kg of sugar and per hour are calculated as well as the power consumption by the blower according to dust particle size. Use of the system of Venturi tubes raised the final dust collection efficiency by 17–22%, so that the air discharged to the atmosphere was virtually dust-free.

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Results of investigations on new forms of sugar bags. S. A. BRENMAN, R. M. YASHCHUK and N. S. IVOLGA. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1975, **24**, 114–121 (*Russian*).—Results of investigations on sugar bags made from various materials are reported. All proved satisfactory as regards sugar keeping quality and freedom from contamination, but, while bags made of a jute mixture bonded or lined with polyethylene or with use of a cotton thread base or polypropylene for certain parts proved durable, normal paper bags were not sufficiently strong. However, reference is made to use in certain countries of crepe or micro-crepe paper such as "Clupak" extensible paper.

IRIS—its activities in 1976. P. GIRAULT and P. DEVILLERS. *Sucr. Franç.*, 1977, **118**, 93–95 (*French*). A brief report is given on the activities of the Institut de Recherches de l'Industrie Sucrière (IRIS) which carries out technical research on behalf of the Syndicat National des Fabricants de Sucre de France.

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Water treatment. J. P. LESCURE and P. BOURLET. *Sucr. Franç.*, 1977, **118**, 103–109 (*French*).—Lagooning as carried out by sugar factories gives generally good results as regards pollution removal, but has the disadvantages of problems concerning sealing of the basins in areas of very porous soil, odour and measuring the true treatment efficiency because of disappearance of pollutants through infiltration. Investigations have been conducted at IRIS on two promising means of effluent treatment, viz. methane fermentation by mesophiles and aerated lagooning. After highly encouraging laboratory results with methane fermentation, a 90m³ pilot plant was installed at Escaudoeuvres sugar factory. Electrical resistance heating is used for the water, but heat losses are considerable, so that a plate heat exchanger has been added and the resistance heating power increased. Agitation of the effluent is effected by a submerged propeller turning at 70 rpm. Total organic C removal is about 0·3 kg per m³ basin capacity, or 33·5 kg dissolved organic C per day, equivalent to a purification efficiency of about 70%. Methane gas production is about 1 m³.hr^{-1}. If the temperature of the effluent could be raised to 35°C (optimum for mesophilic activity) the purification efficiency would also be higher, it is thought. A latent acclimatization period of about 8 days elapses after mud seeding with the bacteria. A pilot plant of 1580 m³ capacity at Vauciennes has yet to be thoroughly tested. Preliminary tests with aerated lagooning at an experimental site at Thumeries sugar factory indicated a drop in COD from a maximum of >1500 to 218 mg per litre and a fall in BOD_5 from about 1000 to 36 mg per litre. Quantities of ammonium phosphate as nutrient proved insufficient for treatment of 100 m³.hr^{-1} and had to be increased. The chief disadvantage of the process is the high electricity consumption.

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Studies on industrial equipment. J. C. GIORGI, R. GONTIER and B. RICHARD. *Sucr. Franç.*, 1977, **118**, 110–115 (*French*).—Brief mention is made of experiments on an electrical reheater for massecuite in which remelting occurred when the reheating exceeded 10°C (at a massecuite flow rate of 5 cm.sec^{-1}), irrespective of the supersaturation (in the range 1·05–1·35). The difficulties are attributed to flow factors. In addition, electrical stability was not considered sufficient for industrial application of the reheater without installation of suitable control. For thick juice pH control, delimed juice is bypassed to a small

evaporator, for which the sample collector is located before the point at which sodium carbonate is added to thin juice for pH maintenance in evaporation. The pH of the juice from the miniature evaporator is measured, and the difference between the value and a target value is transmitted as a signal to the soda feed control. During a campaign, thick juice pH was maintained at a satisfactory level, whereas before installation of the control it had sometimes fallen to 7·5 compared with a target of pH 9·0.

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Purity control based on the SERES-IRIS interceptor. G. WINDAL. *Sucr. Franç.*, 1977, **118**, 127–128 (*French*). Results are reported of 3rd massecuite purity control in boiling at Toury sugar factory, where the equipment developed by PONANT & WINDAL[1] and manufactured by SERES S.A. permits the massecuite to be made up from 1st, 2nd and 3rd massecuite run-offs to within less than $\pm 0{\cdot}3$ units of the target purity of 75. Advantages of the control system include easy boiling of low-grade massecuite using conductivity measurements, high stabilization of the purity of various products, and possibility of improving exhaustion.

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Automation of 2nd and 3rd strikes by micro-computer at Toury sugar factory. G. WINDAL. *Sucr. Franç.*, 1977, **118**, 129–135 (*French*).—Details are given of the micro-processor automatic control system for pan boiling at Toury which was developed from the concept described earlier[2]. Applied to four 2nd/3rd massecuite pans, the system is based on conductivity and is divided into 12 stages from creation of vacuum to steaming out of the pan after the massecuite has been dropped. The software is divided into two parts: the boiling sequences, and a FARANDOLE universal system which has been developed as a series of nearly 100 elementary functions permitting complete sugar factory process control and grouping together operations requiring identical control processes, thus eliminating unnecessary duplication. A diagram indicates the pattern of sequential operations as a function of time and conductivity. Switches on the four identical control panels (one per pan) permit local override and conversion from 2nd to 3rd strike and *vice versa*.

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Lime recalcination in the US sugar industry. G. F. KRONEBERGER. *Sugar Technol. Rev.*, 1976, **4**, (1), 3–47.—A review is presented of lime recalcination equipment, economics and technology, with outlines of auxiliary systems such as pre-drying, cooling and increasing CaO availability by use of an appropriate re-utilization cycle.

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Faults in the operation of the juice purification plant at Elan'-Kolenovskii sugar factory. G. K. POSESSOR. *Sakhar. Prom.*, 1977, (4), 15–19 (*Russian*).—Details are given of various schemes introduced at Elan'-Kolenovskii in recent years for raw juice treatment; while good-to-excellent results have been obtained with high quality beet, processing of poor quality beet has involved difficulties, and results have been poorer than at neighbouring factories processing similar beet but using different processes than at Elan'-Kolenovskii. It is recommended to use a universal scheme incorporating combined cold and hot liming, hot pre-carbonatation and conventional 1st carbonatation, the cold-hot liming being particularly effective where the juice reducing sugars content is abnormally high.

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Effect of decolorizing means on the quality of beet sugar syrup. K. I. RYAZANTSEVA, P. E. SHCHEPETNEV and A. R. SAPRONOV. *Sakhar. Prom.*, 1977, (4), 29–35 (*Russian*).—The effect of treatment with sodium sulphite, active carbon or AV-17 × 2P resin in Cl^- form on the properties of evaporator thick juice was investigated, and the amino-acid composition before and after heating of the juice samples was established chromatographically by means of a special automatic analyser. Only treatment with Na_2SO_3 (added at the rate of 0·01 mole.litre^{-1}) decreased the reducing sugars alkaline degradation products after heating by comparison with the unheated juice, while heating after treatment with the adsorbents or after absence of treatment caused an increase in the degradation products content; the caramelan and melanoidin contents rose as a result of heating in all cases. The effect of heating on individual amino-acids varied, but in most cases their contents fell, as did that of total amino-acids. The amino-acid content in heated thick juice after treatment with sodium sulphite was 25–30% higher than in the other juices, whereas before heating the total amino-acid contents were practically identical; this is attributed to blocking of the carbonyl groups in the reducing compounds, which prevented some of the amino-acids participating in melanoidin formation.

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Microflora of waste waters at Nosovka beet sugar factory. V. M. UDOD, N. I. PODORVAN and M. N. ROTMISTROV. *Sakhar. Prom.*, 1977, (4), 35–36 (*Russian*).—Brief mention is made of the 42 bacterial strains isolated from condensate, condenser water and flume-wash water.

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A system of control of beet slicer and diffuser rotary speed. N. I. DOBROVOL'SKII, V. L. ZELEZETSKII, K. E. REZNIK and I. G. EL'KIN. *Sakhar. Prom.*, 1977, (4), 40–41 (*Russian*).—Details are given of a beet slicer rotation control system which is also applicable to any unit having a generator-motor drive, such as a diffuser.

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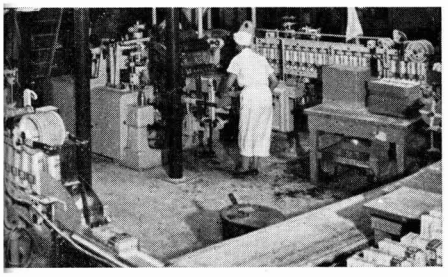
The effect of vibration on the rheological properties of undiluted carbonatation mud. Z. KEMBLOWSKI and A. PUSTELNIK. *Gaz. Cukr.*, 1977, **85**, 25–26, 31 (*Polish*). Laboratory tests were conducted on the use of vibration to facilitate flow of undiluted carbonatation mud along a pipeline. Graphed results showed that subjection of the mud in a 30-litre cylindrical tank to 2 minutes' vibration at an amplitude of 6·8 mm and a frequency of 47 Hz caused an 8-fold increase in the flow rate by comparison with that obtained with only 15 seconds' vibration at the same amplitude and frequency; without treatment, the centrifugal pump located after the vibratory unit was unable to induce any flow. The vibrations are considered to have a modifying effect on the mud structure and hence rheological properties.

[1] *I.S.J.*, 1976, **78**, 375.
[2] *ibid.*, 279.



Sugar refining

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

Recent progress in sugar centrifuging. J. O. SMITH. *Sugar Technol. Rev.*, 1976, **4**, (1), 49–87.—Developments in batch and continuous centrifugals since about 1960 are reviewed.

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Sugar refining research in South Africa. *Ann. Rpt. Sugar Milling Research Inst.* (University of Natal), 1976.

Decolorization of melt from VHP sugar by ion exchange: Tests were conducted on decolorization of raw melt without previous clarification. The melt, of 65°Bx, was heated to 70°C and passed through two columns of Rohm & Haas SDC 301 resin; the first column contained resin which had been used to decolorize carbonatated liquor, while the second column contained fresh resin. Over 50 cycles were carried out in the tests, in which the colour of the melt was reduced to below 450 colour units, considered to be the maximum acceptable for production of three commercial white strikes in a refinery. Cycle length was usually 48 hours at a flow rate initially set at 2 bed volumes per hr, although subsequent tests showed that operation was practical at 4 bed volumes per hr. It was found necessary to screen the melt (in order to remove bagacillo), while cloth filtration using a filter aid eliminates a faint haze not removed by resin treatment. Regeneration is by NaCl and there is only a small quantity of effluent which is of high colour and COD content. A rough estimate of decolorization costs based on a resin life of 15,000 bed volumes showed that the capital costs and labour requirements should be lower than those of a carbonatation melt clarification station for a typical South African refinery section, although the costs of the chemicals would be about 60% higher, mainly because of resin replacement. The true life of the resin investigated is not known, since it is still active.

Removal of colour in the carbonatation process by flocculant addition: Laboratory carbonatation experiments were conducted with American Cyanamid "Superfloc 577" flocculant and S. A. Wattle Industry "Floccotan" in order to assess their influence on colour removal during refining. Carbonatation was carried out in two stages, to pH 9·2 and 8·5, respectively, activity of both flocculants being pH-dependent. In the most successful experiments, however, the flocculants were added in three equal portions while the carbonatation was continued under steady state conditions at pH 8·5 for a further 1 hr. Under these conditions, the liquor colour was reduced by up to 44% after addition of 600 ppm "Superfloc 577".

Melt phosphatation: In tests on phosphatation-flotation with a laboratory unit, an average 25% colour removal was achieved as well as 10–15% gum removal and about 30% starch elimination; at a favourable air:solids ratio an almost turbidity-free liquor was produced, but ash removal was negligible in contrast to refinery carbonatation. The phosphate content of the clear liquor either remained the same as in the raw melt or even increased under the influence of starch; moreover, the filtrability of the clear liquor showed progressive deterioration with increasing phosphate contents, from which it appeared that starch is capable of preventing a small fraction of the phosphate particles formed in the process from participating in the coagulation reaction prior to flotation. Investigations in which varying amounts of amylose and amylopectin were added to a raw sugar melt indicated that the latter starch component is the compound responsible for the adverse effect of starch. It is suggested that the interaction between amylopectin and calcium phosphate particles involves chemical bonding between the particle surface and the phosphate ester groups on the long, branched-chain amylopectin molecule. Thus, amylopectin stabilizes the small crystallites in suspension, yielding a clear liquor of high phosphate content and low filtrability. The uncharged nature of amylose apparently makes it unsuitable as a protective colloid. Impurity removal by conventional phosphatation can be improved by using certain cationic surfactants such as "Talofloc", "Superfloc 577" and "Nalcolyte 4-WA-366", which increase colour and starch removal, improve filtrability and lower the phosphate content of the clear liquor. Addition of 400 ppm "Talafloc" to a raw melt immediately before phosphatation approximately halved the melt colour at 420 nm and increased the decolorization efficiency of normal phosphatation by a further 35%. It reduced the phosphate content from 40 ppm in the raw melt to 35 ppm compared with 50 ppm without surfactant use, halved the starch content (compared with only 25% reduction without "Talofloc") and gave a filtrability constant of 130 compared with 330 without surfactant.

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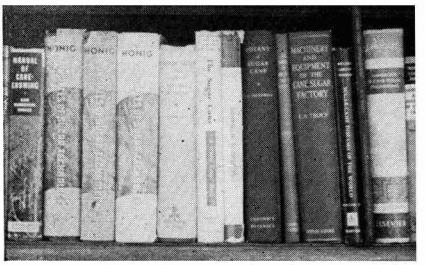
Affination of low-grade yellow sugar in centrifugals. A. R. SAPRONOV, A. I. GROMKOVSKII, V. E. APASOV and B. P. MIROSHNICHENKO. *Sakhar. Prom.*, 1977, (4), 19–22 (*Russian*).—At Ramon factory, mixing of low-grade sugar with 1st product raw syrup in the mingler before affination was unsatisfactory, so that trials were conducted on mingling direct in the centrifugals immediately after molasses separation from the low-grade sugar crystals. Results indicated that the modified process resulted in higher affined sugar purity of 98·2–99·0 and a higher Brix, while maximum colour content was 17°St and affination syrup purity was suitably reduced; other advantages of the scheme are also mentioned. However, the process was not without its difficulties, which are briefly mentioned.

New books



Giornate beticole italiane (Italian beet days). 679 pp; 16·5 × 24 cm. (Associazione Nazionale fra i Tecnici dello Zucchero e dell'Alcole, c/o Istituto Padano di Arti Grafiche, via Oberdan N.6, Rovigo, Italy 45100.) 1976. Price: 20,000 lire.

The Associazione Nazionale fra i Tecnici dello Zucchero e dell'Alcole (ANTZA) was formed in 1908 primarily to promote technical and scientific developments in the sugar and alcohol industries. A conference was held at Barga di Lucca on 9th–12th December 1975 which had beet agriculture as its main theme; financed by a beet seed firm represented in Italy, the conference was attended by more than 350 beet agriculturalists and representatives of the sugar industry. The proceedings are now available under the title "Giornate beticole italiane". The book is divided into nine sections: beet in the rotation in different Italian areas, soil treatment, beet fertilization, precision drilling and seed pelleting, chemical weed control, irrigation, future research in beet, diseases and pests, and mechanization. Each section concludes with a brief note on the subject written by the coordinator of the appropriate section. The total of 66 papers reproduced will undoubtedly make the volume a valuable contribution to the literature on beet agriculture; however, it is a pity that the papers were not provided with summaries in, say, English, French or German, since many of our readers may not be able to read Italian.

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The industrial utilization of sugar and mill by-products (a literature survey). M. J. KORT. 212 pp; 20×29 cm. (Sugar Milling Research Institute, University of Natal, Durban 4001, South Africa.) 1976.

This is the 14th annual report covering work published in various scientific journals during 1975 and follows the style adopted in the previous report. The chapters cover by-products; animal fodder; industrial uses of refined sugar; developments in sucrochemistry; nutrition and toxicology; other sweeteners, both natural and synthetic; and a summary and conclusions. The literature continues to expand, as indicated by the 23% increase on the number of references in the 1975 report, which again was 30% over that in the 1974 report.

Despite the increasing volume of work, the author points out that there is nothing new to report in the fields of by-product utilization and industrial refined sugar applications. While many papers and patents concern sucrose esters and ethers, which continue to find a large number of applications, no new directions of research have appeared. Arguments continue on the merits and demerits of sugar as part of the human diet and of its alleged role in certain disorders, but by far the biggest section in the report is that concerning sweeteners other than sugar. As the author points out, this is hardly surprising in view of the urgency given to the search for substitutes after the meteoric rise in world sugar prices in 1974 and the suggestion at that time that there would be a considerable future shortage.

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Problems and prospects of a new International Sugar Agreement. 51 pp; 21 × 30 cm. (F. O. Licht, P.O. Box 1220, Ratzeburg, Germany D-2418.) 1977. Price: DM 25.00.

This special edition of F.O. Licht's International Sugar Report is a collection of articles on world sugar marketing and International Sugar Agreements. G. B. HAGELBERG is author of "International Sugar Agreements 1864–1977", which is followed by "Need for a more flexible ISA" by I. S. MEHTA, "Outline of a possible new International Sugar Agreement" by Sir GUY SAUZIER, "Elements of an International Sugar Agreement" by I. SMITH, and "Problems of a new International Sugar Agreement" by A. VITON. The report concludes with "Prospects for a new International Sugar Agreement", "Change in the structure of the world sugar market" and "On the supply and demand situation".

Much of what is said demonstrates the complexity of the problems surrounding a new ISA as evidenced by the Geneva conference in September–October.

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Sucrochemistry. J. L. HICKSON. 381 pp; 15×24 cm. (American Chemical Society, 1155 Sixteenth St. N.W., Washington, D.C., USA 20036.) 1977. Price: $20.00.

No. 41 in the ACS Symposium Series, "Sucrochemistry" is a collection of papers presented at a symposium sponsored by The International Sugar Research Foundation Inc. and by the Division of Carbohydrate Chemistry of the ACS at the 172nd Meeting of the Society in San Francisco, 31st August-2nd September 1976. It is divided into five sections; the first, entitled "Concepts and basic discoveries", comprises five papers concerning the pure chemical aspects of sucrose derivatives and their preparation; the second contains six papers on sucrose surface-active esters and their various applications; the third consists of five papers on the subject of surface coatings and other sucrose esters; the fourth is a collection of seven papers on urethanes and fermentation sucrochemistry; while the fifth section is concerned with business aspects of sucrochemistry. Each paper is followed by biographical notes on the author(s) and by a discussion. The book is well laid out, and certainly offers a considerable quantity of material on a subject which is receiving increasing attention.

Cane sugar handbook: a manual for cane sugar manufacturers and their chemists. 10th Edn. G. P. MEADE and J. C. P. CHEN. 947 pp; 14 × 21 cm. (John Wiley & Sons; New York, London, Sydney and Toronto). Price: £35.00; $59.00.

The "Cane sugar handbook" first appeared in 1889; written by GUILFORD L. SPENCER, it contained 60 pages of text and the same number of pages devoted to tables. Subsequent editions appeared in 1905, 1916 and 1917, and in 1929 GEORGE P. MEADE took over authorship, SPENCER having died in 1925. Over the years, the Spencer-Meade "Cane sugar handbook" became a widely recognised title among the more important works on sugar technology. However, there was an 18-year gap between the appearances of the 8th and 9th Editions, during which time there were rapid developments in all fields of sugar factory practice; when, therefore, the 9th Edition was published in 1963, it was apparent that major changes had been brought about in the contents, reflecting the progress made in the industry. Eleven years after publication of the 9th Edition, the need for a new edition was strongly felt within the industry. However, at the age of 91, Dr. MEADE did not feel that he could prepare a revised edition alone, and in 1974 invited Dr. JAMES C. P. CHEN to be co-author; unfortunately, Dr. MEADE's health suddenly declined, and he died shortly after the draft of the new edition had been started. Dr. CHEN continued the task, and completed the first draft in February 1976.

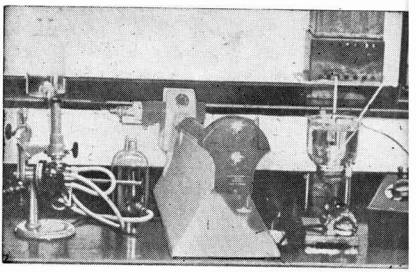
Dr. CHEN has had considerable experience in all phases of the cane sugar industry. Born in Fukien Province, China, in 1919, he was educated at the National Central University, China, and at the Audubon Sugar School of Louisiana State University; an honorary degree of Doctor of Science has been conferred on him by The China Academy. As manager of Cheluchien sugar factory and senior research technologist in Taiwan, he was co-developer of the well-known middle juice carbonatation process. He has had research and consulting experience in Taiwan, Thailand and Latin America (particularly Peru) as well as the USA, where he is at present Technical Director of Southdown Sugars Inc. in Louisiana. He has had more than 75 technical papers published in sugar journals.

The layout of the new edition is little different from that of the previous one, except for the change of order of the chapters in the first section, and the omission of the chapter on statistical treatment of measurements and errors. Most of the names of the contributing authors are new (their predecessors now, regrettably, being dead). The number of reference tables has been very much reduced, although the eight sections are as before.

For those readers unacquainted with it, the book is divided into five sections: "Sugar and sugar cane" contains three chapters by JAMES E. IRVINE entitled "Sugar cane" (a brief survey of cane agriculture), "Composition of cane and juice" and "Economic aspects of the sugar industry". The next section, "Raw sugar manufacture and refining" contains 17 chapters: "Outline of process for manufacturing raw cane sugar", "Extraction of the juice", "Bagasse and its uses", "Purification of the juice—clarification reactions and control", "Purification of the juice—clarification apparatus and special process", "Treatment of mud waters and clarified juice", "Chemical reagents in sugar processes", "Evaporation and heating" (by THOMAS W. BAKER), "The crystallization of sugar", "Crystallization in motion", "Purging, packing and warehousing the sugar", "Blackstrap molasses and edible syrups", "Keeping and refining qualities of raw sugar", "Microbiology of sugar manufacture and refining", "Cane sugar refining—introductory, affination, clarification" (by HENRY G. GERSTNER), "Cane sugar refining—decolorization" (by FRANK G. CARPENTER and MARGARET A. CLARKE) and "Cane sugar refining—crystallization and finishing" (by HENRY G. GERSTNER). The third section, "Analytical procedures", is also a collection of 17 chapters, viz. "Polarimetry in sugar analysis", "Double-polarization methods", "Chemical methods in sugar analysis", "Density and total solids determination", "Determination of ash", "pH", "Colour and turbidity in sugar products" (by PHILIP F. MEADS), "Sampling and averaging", "Analysis of the sugar cane", "Analysis of the juice", "Analysis of the syrup, massecuites and molasses", "Analysis of sugars", "Examination of refined sugar", "Analysis of bagasse and press cake", "Sugar industry waste water effluents and air emission", "Special laboratory reagents" and "Special techniques for analysis of sugars and non-sugars" (by MARGARET A. CLARKE and FRANK G. CARPENTER). Section Five, "Chemical control", contains four chapters: "Definitions and terms in sugar factory control", "Chemical control", "Sugar house calculations" and "Methods of cane purchase". The final section is a collection of reference tables under the headings "General", "Solubilities, etc.", "Brix, density, specific gravity, etc.", "Refractometer solids, etc.", "Sucrose (pol), purity and available sugar", "Invert sugar determination (reducing sugars)", "Weight per gallon of molasses; Clerget temperature corrections, etc." and "Evaporation; concentration; condenser water, etc." A bibliography is given of sugar publications with appropriate abbreviations. New to the book is material on continuous pan boiling (by PETER H. PETRI), microbiological standards for refined sugar (by HELEN M. LYNCH), production of cubes and tablets (by R. STUART PATTERSON) and on carbonatation and the "Talofloc" process (by MICHAEL C. BENNETT). A subject index appears at the end of the book.

The large proportion of the book which has been written by Dr. CHEN himself is clear from the above record of other contributions, and he is to be congratulated on a remarkable achievement. All the material has been updated, so that the 10th Edition can justifiably claim to be the latest definitive volume on cane sugar industry practices. The modernity of the book is evidenced by such examples as the 14-page section on cane diffusion compared with a mere 24 lines in the previous edition, a description of screw press operation for bagasse dewatering, and expansion of the material on ion exchange treatment and on waste water treatment and analysis. Moreover, the illustrations of equipment and processes are generally very modern in appearance, and their number seems to be much greater. The print is extremely clear, its legibility being somewhat enhanced by the whiteness of the matt paper in contrast to the cream paper used for the 9th Edition. Although published in the USA and obviously often reflecting the practices used in that country, the handbook does not restrict itself to US equipment and processes but gives ample mention of those from outside the Western Hemisphere. All in all, the handbook is an extremely useful publication and well worth what may seem to be a high price; no cane sugar library should be without it.

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.

Storage at high temperature and moisture of sugar packed in various bags. S. A. BRENMAN, N. S. IVOLGA and R. M. YASHCHUK. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1975, **24**, 122–125 (*Russian*). Tests were conducted at two stages to determine the keeping quality of white and refined sugar, in both granulated and tablet form, in bags or packets, stored under two different sets of conditions. In the first stage (lasting 18 days) the air temperature was held at 33–35°C and the relative humidity at 85–95% during daylight hours, and at 20–25°C and 90–95% during the rest of the day; these conditions simulated sea travel from a southern Soviet port to the tropics. None of the bagging/packeting materials prevented increase in sugar moisture and reducing sugars contents. In the second stage, the samples were exposed during daylight hours to a temperature of 43·5°C and 75–80% R.H., and during the rest of the day to a temperature of 25°C and 90–95% R.H., to simulate sea travel from the tropics to the Equator. Under these conditions, the only sugar to retain its original quality was that packed in jute-mixture bags lined with polyethylene or in packets placed in moisture-proof cardboard boxes (preferably after the packets had been wrapped in parchmentized food-quality paper).

* * *

Improving beet quality. P. GORY and M. LOILIER. *Sucr. Franç.*, 1977, **118**, 96–100 (*French*).—See DEVILLERS *et al.*: *I.S.J.*, 1977, **79**, 205.

* * *

Methods of analysis. R. DETAVERNIER, M. GROULT and J. ROGER. *Sucr. Franç.*, 1977, **118**, 118–124 (*French*).—Descriptions are given of analytical methods used at IRIS, including atomic absorption (chiefly used to determine the juice iron content and calcium and silicon levels before and after evaporation (as measures of corrosion and scale formation, respectively), as well as a number of other elements; gas-liquid chromatography (used for raffinose determination, although the possibility of determining molasses water content by this means is being studied); ammonium ion and amide determination by an automatic colorimetric method or by means of a selective-ion electrode; lactic acid determination in the presence of L-lactate dehydrogenase, with final colour measurement at 500 nm (tabulated results for raw and 2nd carbonatation juice, syrup and molasses in which the lactic acid was determined in three different weeks at five factories indicate almost no diffusion losses at three of them but sugar losses of 0·01–0·05% at the other two); and enzymatic determination of raw juice and molasses sucrose, which in 1975/76 always gave lower values than did polarization, whereas in the case of molasses the sucrose value was higher than the pol reading at the start of the campaign, after which the difference disappeared by mid-November, the sucrose value finally becoming much lower than the pol reading, representing an average undetermined loss in a campaign of 0·06–0·23% on beet.

* * *

An assessment of the downward trend in pol % cane in the South African industry. ANON. *S. African Sugar J.*, 1977, **61**, 67–62.—During the period 1957/58–1975/76, pol % cane in South Africa showed a gradual decline (from an average of 13·42% for the 5-year period 1957/58–1961/62 to an average of 13·01% for the 4-year period 1972/73–1975/76). If the average values for each year in the last 4-year period are considered, these show a considerably more marked decline from 13·26% to 12·60%. The long-term fall in cane pol is associated with an increase in cane moisture content and a fall in mixed juice purity, probably resulting from a decreasing crop age, increasing amounts of N:Co 376 cane grown at the expense of N:Co 310, and excessive N fertilization. The short-term decline is associated with a fall in mixed juice purity (for which no cause is clearly indicated) and an increase in fibre % dry matter which may be a result of increasing amounts of extraneous matter entering the factories. It is suggested that a fall in mixed juice purity could be a consequence of increase in the amount of tops delivered to the factories, but there is no substantial evidence of this. Excessive N fertilization during the 4-year period will have had an adverse effect on pol and juice purity, and the activity of the *Eldana* borer will have undoubtedly contributed to the fall in cane pol, but other factors such as weather, length of season, crop yield, disease and pests are rejected as causes of the deterioration.

* * *

Identification of the principal aldoses and polysaccharides by thin-layer chromatography on cellulose. M. HOTON-DORGE. *J. Pharmacie Belg.*, 1975, **30**, 405–414; through *S.I.A.*, 1977, **39**, Abs. 77–347.—Mixtures containing 8 monosaccharides and 5 oligosaccharides were separated by TLC. Of the solvent mixtures tested, ethyl acetate:pyridine:water:*n*-butanol:acetic acid (25:20:20:50:10) gave the best separation; 2 runs each lasting 2 hr were necessary. The spots were revealed by spraying with a new reagent, *p*-amino-hippuric acid + thiobarbituric acid + phosphoric acid in ethanol, and heating at 80–85°C; they appeared in 10 min for fructose and fructose-containing sugars (sucrose, raffinose, stachyose), and in 20 min for the other sugars. R_f values and colours of the spots in visible and U.V. light are tabulated.

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International Sugar Agreement

AFTER six weeks in April and May and another four weeks in September and October a new International Sugar Agreement with full economic terms has finally been negotiated. The Agreement was opened for signature on 28th October at the headquarters of the United Nations in New York and it will remain open until the end of the year. If by that date governments holding 55% of the votes of the exporting countries and 65% of the votes of the importing countries have deposited their instruments of ratification, acceptance, approval or accession, the Agreement will enter into force on 1st January 1978.

The Agreement has not been without pain, and labour was protracted. Indeed, if one may stretch the metaphor, there have been times when it seemed that the infant would be stillborn.

The world is currently suffering from a surfeit of sugar and it was obvious that if a successful Agreement were to be negotiated it would need to be one which severely limited production so that a balance between supply and demand in the world market could be restored. This posed the greatest problems. Several countries have expanded their production during the past few years while others are engaged in programmes which will shortly bring new ventures on stream. Consequently any cutback in current or projected output would certainly bring real hardships to those concerned. That this would not only be the case for the developing countries was made clear by the Deputy Prime Minister of Australia, when he referred to the Queensland cane-growing areas which would have to suffer considerable retrenchment.

At the beginning of the second session of the Conference the Chairman, Mr. ERNEST JONES-PARRY, who is also the Executive Director of the International Sugar Organization, submitted to delegates his proposed schedule of basic export tonnages. In a situation where cuts have to be made all round it was clear that few, if any, exporting countries could have been satisfied with what they were offered, and for some three weeks negotiations and representations continued until eventually a revised schedule was prepared covering each of the first two years. Individual basic export tonnages are given in Table I.

In addition there was a group of several countries which were not allotted basic export tonnages but each of which was entitled to export up to 70,000 tons. Though some of these might be expected to perform well, it is thought unlikely that many will do so and from the group as a whole no more than 325,000 tons is expected.

Exports by Cuba to China, North Korea, Vietnam, Yugoslavia and Albania as a group up to a limit of 650,000 tons are excluded from quota regulations for the first two years of the Agreement as are her entire exports to all of her other socialist partners.

At the beginning of the third year basic export tonnages are to be renegotiated; should it not be possible to reach agreement, a fallback formula has been agreed which will increasingly relate b.e.t.'s during the remainder of the Agreement to performance.

Quota holders have an obligation to inform the Council at least twice a year of their ability to fulfil their entitlements. The decision whether or not to reallocate shortfalls rests largely in the hands of the Council.

Table I.

	Metric tons, raw value
Argentina	450,000
Australia	2,350,000
Austria	80,000
Bolivia	90,000
Brazil	2,350,000
Colombia	75,000
Costa Rica	105,000
Cuba	2,500,000
Czechoslovakia	175,000
Dominican Republic	1,100,000
Ecuador	80,000
Fiji	125,000
Guatemala	300,000
Guyana	145,000
India	825,000
Jamaica	130,000
Mauritius	175,000
Mexico	75,000
Mozambique	100,000
Nicaragua	125,000
Panama	90,000
Peru	350,000
Philippines	1,400,000
Poland	300,000
Salvador	145,000
South Africa	875,000
Swaziland	105,000
Thailand	1,200,000
Trinidad and Tobago	85,000
	15,905,000

The USSR is accorded the status of an importing country, as is also the German Democratic Republic. Nevertheless, during each of the first two years of the Agreement these countries are permitted to export up to 500,000 tons and 75,000 tons, respectively.

A Hardship Reserve has been established which in the first quota year will amount to 200,000 tons and in subsequent years to 300,000 tons and applications for additional temporary relief may be made by developing countries with basic export tonnages or export entitlements up to 300,000 tons.

It was agreed that the new ISA would aim to bring prices within a range of 11–21 cents per lb. But the sum of all the above, together with whatever sugar may become available from non-members, is likely to be well in excess of outlets and, in order to help bring about a balanced market, provision has been made for cuts to be effected in basic export tonnages.

In the first instance they may be cut by up to 15% while, if this is considered inadequate, a further 2·5% reduction may eventually be made in the global total. However, this additional reduction may not be effected in the basic export tonnages of those countries whose net exports to the free market during the period 1974 to 1976 amounted to at least 60% of their production in those years and their share must be borne by other exporting countries, with the understanding that this does not cause any country to have an additional cut of more than 1%, while it is also understood that countries bearing such additional cuts will be the first to receive such increases and reallocations as may eventually become available so as to restore their quotas to 85% of the b.e.t. Furthermore, such cuts may in no case so reduce a quota that it falls below 70,000 tons.

There are also other provisions covering quota adjustments. The International Sugar Council is empowered to take certain steps to reduce supplies in a period of falling market prices. Unless it should decide otherwise, the global quota must be reduced by 5% when the prevailing price moves below 13 cents per pound. Similarly, further cuts each of 5% are designated whenever the prevailing price falls below respectively 12c and 11·5c. Conversely, whenever the prevailing price moves above 13c, 14c and 14·5c a pound increases of 5% in basic export tonnages are indicated.

Discretion is granted to the Council to suspend export limitations whenever the prevailing price is between 14c and 15c a pound, though their discretion is removed should the price exceed 15c a pound. Similarly, the Council has discretion as to the time at which it reimposes quotas in a falling market, though they become obligatory at below 14c per pound.

One of the new concepts of this Agreement is the establishment of special stocks to be held by exporting members amounting to 2·5 million tons. These will be held *pro rata* to basic export tonnages except that the first 70,000 tons need not be taken into account in the case of developing countries having basic export tonnages not exceeding 180,000 tons. Should any countries for which basic export tonnages have been indicated not join the Agreement the stock-carrying obligation of other exporters will be increased *pro rata*, with the proviso that they cannot be increased by more than 7%. At least 40% of the special stock must be established in the first year in which quotas are in effect, at least 80% by the end of the second year and the balance during the third year.

These stocks are to be utilized to help stabilize the market at the upper end of the price range and will be released in blocks of one third as and when the prevailing price rises above, respectively, 19c, 20c and 21c per pound.

In order to provide assistance with the carrying of these stocks, a fund will be established which will lend, free of interest, an amount equal to 1·5c a pound a year. The income of the fund will be secured by a levy to be made on all sugar exported from or imported into the customs territory of a member. Initially this will be set at 0·28c a pound for raw sugar with an appropriate conversion for white sugar, but this may be adjusted at any time from the beginning of 1979 onwards, with the understanding that it can under no circumstances exceed 0·33c a pound.

As in the past the ISA daily price will be the mean of the LDP and the New York spot price though, this time, whenever the two prices differ by more than ten points, the quotation will be arrived at by taking the lower of the two plus 5 points. The ISA prevailing price will be the average of 15 consecutive daily prices.

It is clear that the limitations which exporting members are undertaking could leave the way clear for non-members to reap benefits at their expense. In order to prevent this happening importing members have agreed to severe limitations on the tonnages they will import from non-members. If such provisions are strictly adhered to, non-member exporters may find themselves having to curtail production at least as stringently as members.

Towards the end of the Conference the EEC indicated that the Community would be prepared to join, accepting comparable obligations as to stock provisions. Other delegations felt this did not impose nearly enough constraints on EEC production, however, and it was therefore not possible on this occasion for any progress to be made towards EEC membership. Nevertheless, this first step may well lead, if not to full membership of the Agreement, then to some alignment of policies.

New Vietnam sugar factory[1].—According to the 1976/1980 Five-Year Plan, Duong Minh Chau will become the largest sugar industry centre in Vietnam, with 2000 hectares of land prepared for planting with cane from Cuba. The infrastructure is practically finished for construction of a sugar factory, to be the most modern and important in the country. It will begin operating in 1979 once the installation is complete, with a capacity of 4000 t.c.d. (almost three times that of the Hiep Hoa factory). The project is to be financed by Kuwait.

* * *

Kenya sugar by-products utilization[2].—The Kenya Chemical and Food Corporation Ltd. has been formed in Nairobi, the Kenya Government holding 51% of the shares. An investment of K£26 million is envisaged and a plant, utilizing molasses for the production of power alcohol, baker's yeast, vinegar and citric acid, is to be constructed in Kisumu. Initially the plant will require about 55,000 tons of molasses to produce 7400 tons per annum of power alcohol, 1000 tons of yeast, 1·7 million litres of vinegar and 2200 tons of citric acid monohydrate.

* * *

New Indian sugar factories[3].—Two sugar mills are to be erected by the Punjab Industrial Development Corporation, one at Jaitu in Faridkot District, and the other at Zira in Ferozepur District. Both are to be erected within two years, the sites having already been acquired. The cost will be five crores of rupees each (Rs. 50,000,000). Additionally, Punjab State plans to set up four more sugar mills in the cooperative sector in Patiala, Amritsar, Bhatinda and Faridkot Districts.

* * *

New Yugoslavia sugar factory[4].—UPI of Sarajevo is to construct a sugar factory at Obarska to process 400,000 tons of beet and to produce 56,000 tons of sugar per year. The investment will be 1500 million dinars, equivalent to $83,000,000.

* * *

New Polish sugar factory[5].—A new sugar factory is under construction at Ropczyce which will be the largest in the country with a capacity 2000 tons of beet per day more than the current largest factories at Lapy and Krasnystaw. With the introduction of new technology the factory will operate for six months in the year instead of three, and it is expected to come into operation in October 1978.

* * *

Japan sugar refiner liquidation[6].—The sugar refining company, Tokai Seito Co. Ltd., which has a 500 tons/day refinery at Mie Fa, has gone into liquidation with debts amounting to 8700–9500 million yen. The refinery has not operated since September 1976 since no bank guarantees or trade support could be provided to suppliers. The Japanese sugar refining industry is thus reduced to 19 companies, of which 10 belong to the Nihon Seito Kyokai. A total of 35 refineries have a capacity of 14,760 tons of raw sugar per day but individual capacities vary widely; two are of 1200 and 1000 tons/day capacity while 12 have a capacity of less than 250 tons/day, of these, 9 process less than 100 tons/day.

* * *

Spanish sugar production 1976/77[7].—Spain produced 1,276,100 metric tons of beet sugar and 20,447 tons of cane sugar in the 1976/77 season (July–June) which compares with 844,401 and 17,097 tons, respectively, in 1975/76. Domestic consumption in 1976/77 amounted to 993,984 tons against 938,495 tons in the previous season.

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[1] *Amerop Noticias*, 1977, (45), 14.
[2] *Standard Chartered Review*, August 1977, 10.
[3] F. O. Licht, *International Sugar Rpt.*, 1977, (23), 14.
[4] *Amerop Noticias*, 1977, (45), 14.
[5] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (24), 11.
[6] *Zeitsch. Zuckerind.*, 1977, **102**, 556.
[7] *Public Ledger*, 3rd September 1977.

USSR sugar imports and exports, 1976[1]

	1976*	1975	1974
	(metric tons, raw value)		
IMPORTS			
Australia	0	51,475	0
Brazil	0	95,494	0
Cuba	3,066,514	2,963,721	1,855,571
Czechoslovakia	31,364	1,081	0
France	267,383	0	0
Germany, East	18,385	0	0
Guyana	0	20,320	0
Peru	0	104,985	0
Philippines	223,927	0	0
Poland	114,639	0	0
UK	30,152	0	0
Other countries	7,347	0	0
	3,759,711	3,237,086	1,855,571
EXPORTS			
Afghanistan	19,896	21,826	54,079
Finland	0	0	30,024
Guinea-Bissau	1,082	0	0
Mali	462	2,109	0
Mongolia	18,892	24,603	18,860
Vietnam	10,892	8,651	8,652
Yemen	2,155	2,130	5,408
Other countries	25,936	0	0
	79,315	59,319	117,023

* Total from official sources; figures for individual countries are as reported by the USSR during January–October only, except "Other countries" which are calculated.

A/S De Danske Sukkerfabrikker 1976/77 report.—Growers delivered only 2,408,000 metric tons of beet to the DDS sugar factories, owing to poor growth during the summer of 1976. Sugar production reached 322,000 tons, compared with the production target—A and B-quota sugar under EEC regulations—of 381,000 tons. Processing was easier with purer juices than had been anticipated. The Assens factory has been expanded to 7700 tons/day capacity. A 10,000-ton cargo of cane raws was purchased for refining at Saxkjobing factory in May 1977 in order to fulfil export obligations. Beet reception and juice extraction facilities at Stege have been increased, and factory boilers have now been converted so that they can be switched at short notice from solid to liquid fuel and *vice-versa*. To meet Danish environmental laws the boilers have also been fitted with fly-ash arrestors. Work has also been carried out on separation of solid matter from beet transport water and the system of partial recycling of filtered water has been expanded. A new beet variety, Marimono, has been successfully introduced and export seed sales increased. Sugar machinery and beet processing plant sales have developed satisfactorily.

* * *

Tate & Lyle sale of South African investments.—Tate & Lyle Ltd. has sold its 49·25% shareholding in Illovo Sugar Estates Ltd. to C. G. Smith Sugar Ltd. under terms (309·5 cents per share) fairly reflecting Illovo's own standing and prospects, and its special potential to the purchaser, but substantially above the previous market value. C. G. Smith intend to submit proposals to other shareholders in order to acquire the remaining issued share capital.

* * *

Cane dextran study.—The USDA Agricultural Research Service is to fund a $30,000 two-year study on dextran in cane products at the Louisiana State University. Methods of detecting and measuring dextran will be studied as will the effects of differences in concentration and dextran molecular weight on the physical properties of juices, syrups and molasses. The effect of agronomic factors such as freezes, fire, mechanical injury, varieties and date of harvesting on dextran concentrations will be examined as will the effect of dextrans on raw sugar processing, especially crystallization rates and crystal shape, and modifying dextran effects with additives. It is hoped to establish a quantitative relationship between dextran content and sugar recovery.

Brevities

USSR sugar expansion plans[2].—Under the 10th 5-year plan for the period 1976–80, the Soviet Union plans to spend 1300 million roubles on increasing the beet slicing capacity of its factories by 140,000 tons a day to a total of 867,000 tons a day by 1980. This would allow the campaign length to be cut to 120 days compared with 157 days under the 8th 5-year plan. The increase in slicing capacity is to be brought about by building 10 new factories (to bring the total number to 330 in 1980) and rebuilding and re-equipping others. It is pointed out that, while some factories operate at 95–98% of their rated capacity, others fall well below their rated figures. It is planned to raise the average annual beet crop to 95–98 million tons; by 1980 some 92 million tons of beet should be delivered to the reception centres, from which 11,200,000 tons of sugar would be produced (a 150% increase on the 1975 output). However, under the 9th 5-year plan ending in 1975, average beet yield per ha was 1·5 tons lower at 19·3 tons.ha^{-1} than in the preceding 5-year plan period, while the processing quality of the beets was particularly low in Kazakhstan and Kirgiziya. While the beet yield rose to an average of 22·7 tons.ha^{-1} in 1976, considerable losses in beet and sugar resulted from the effects of frost and rotting. While an official standard sets a maximum permissible sugar colour of 0·8°St for direct sales, many factories have produced sugar of higher colour than this, paricularly in 1976.

* * *

US beet sugar technology school.—The Beet Sugar Institute, a school of beet sugar manufacturing technology, dealing with both theory and practice, has been providing courses for the past six years to students sponsored by member companies of the US Beet Sugar Foundation[3]. It has been announced that in 1978 the courses will be open to a limited number of other students. The course is in two parts, each lasting two weeks, and covering the "beet end" and "sugar end", respectively. There are no enrolment requirements except an interest in the subject, knowledge of the English language, payment of a moderate tuition fee and the cost of food and lodging in the student facilities of Colorado State University. Because of the concentrated nature of the courses, which occupy the full time of the student, it is recommended that only one course be taken in any one year. The beet end course deals with the process from beet reception at the factory to completion of juice purification, while the sugar end course covers the remainder from concentration of thin juice to packing and storage of the final sugar, as well as the control laboratory, ion exchange processes, activated carbon, the Steffen process, liquid sugars and environmental problems. Individuals interested in the 1978 courses, which will run from 18th to 30th June and 9th to 21st July, should write to J. H. FISCHER, Beet Sugar Development Foundation, P.O. Box 1546, Fort Collins, Colorado, U.S.A. 80522.

* * *

Australian sugar factories sale[4].—The New South Wales Cane Growers' Association has agreed to buy the three CSR Ltd. sugar mills in northern New South Wales, at Condong, Broadwater and Harwood, which are in danger of being closed. CSR Ltd. said that there was inadequate incentive for it to make further investments in the mills and lack of a regular and expanding cane supply had eroded mill profits seriously. CSR Ltd. owns four north Queensland mills—Hambledon, Goondi, Macknade and Victoria.

* * *

Stork-Werkspoor Sugar B.V. report 1976.—During 1976 the Kilombero II sugar factory was put into operation in collaboration with Wescon International (another VMF-Stork Group member) and in Indonesia, in collaboration with Boma-Stork the Kebon Agung factory extension was completed. A number' of potential orders were postponed because of financing problems in customer countries. A complete evaporation plant has been ordered and a test model of a continuous white sugar centrifugal under development has shown encouraging results in a sugar refinery.

[1] *I.S.O. Stat. Bull.*, 1977, **36**, (8), 107.
[2] *Sakhar. Prom.*, 1977, (8), 2–6.
[3] See *I.S.J.*, 1973, **75**, 31.
[4] *Queensland Newsletter*, 21st September 1977.

Brevities

New Hungarian sugar factory[1].—According to a report from the official Hungarian news agency MTI, the construction of the largest sugar factory in Hungary has now started. This new factory, at Kaba, in eastern Hungary, is to begin operation in 1979 with a daily slice of 6000 tons.

* * *

Thailand sugar production[2].—Thai sugar production in the 1976/77 season ,which ended in May, rose to a record 2,212,000 metric tons from 1,600,000 tons in 1975/76, according to Sugar Cane Bureau statistics. Raw and white sugar production increased to 1,594,000 and 617,876 tons, respectively, from 1,120,000 and 480,073 tons. Some 26,094,000 tons of cane were crushed, against 19,099,000 tons in 1975/76. The state-owned Krung Thai Bank has suggested that the government should persuade sugar cane planters to switch to other crops during the coming season; overproduction in 1976/77 caused many planters to burn their crops as millers refused to buy while world market prices fell.

* * *

St. Kitts sugar statistics[3].—Production of sugar in St. Kitts in 1976 amounted to 36,460 metric tons, raw value, as against 25,855 tons in 1975. Local consumption was 2519 tons (2461 tons in 1975) and exports 34,094 tons (23,110 tons in 1975). The largest destination was the UK in both years, at about 17,000 tons, while the US took nearly 16,000 tons in 1976 as against less than 6000 tons the previous year.

* * *

Red rot resistant sugar cane varieties[4].—The cane research station at Anakapalle in Andhra Pradesh, India, has developed two varieties of cane resistant to red rot which also have a higher sucrose content and better yield than existing varieties. The two varieties—CoA 7601 and CoA 602—have been found to be resistant to red rot over three trial seasons under inoculated conditions and have been released to farmers in the Visakhapatnam District. The average sucrose content of the two varieties at 20·3% and 18·73%, respectively, compared with 17·01% for recent high-yielding varieties and field trials showed CoA 7601 to give 15·36 metric tons of sugar per hectare compared with 11·79 tons for Co 997, another high-yielding cane. In another trial CoA 7602 yielded 12·88 tons.ha^{-1} against 10·96 tons.ha^{-1} for Co 575 and 10·26 tons.ha^{-1} for Co 412. The two new varieties also showed no incidence of rust during the three trial seasons but were susceptible to some pests.

* * *

Honduras sugar industry expansion[5].—According to press reports several expansion projects have been completed by the private sector at a cost of about US$25 million to increase sugar production capacity in the northern coastal area of the country. Expenditure of $12,300,000 at the Rio Lindo mill owned by Azucarera Yoja, and $10,400,000 at the Santa Mathilde mill will allow them to crush 2500 and 5000 tons of cane per day, respectively. The investments are part of an effort to reach the export target announced by the Government of not less than 300,000 metric tons of sugar by 1980.

* * *

Taiwan sugar crop cut-back[6].—The fall in prices on the world market has caused Taiwan to cut its 1977/78 sugar production target to 750,000 metric tons, some 30% lower than the 1,070,000 tons produced in the crop year ended 10th June 1977, which was an outturn 210,000 tons above the 1976/77 target. There should be no problem in selling the sugar since Taiwan already has long-term contracts with Japan, South Korea and the USA, with prices above current world market levels.

* * *

Sudan sugar project advisers.—Kenana Sugar Company Ltd. have retained Alexander & Baldwin Agribusiness Ltd. of Hawaii to provide technical assistance to the management and owners of their project. Assistance will be provided in five areas: factory engineering, cane harvesting and transportation, sugar cane agronomy and research, cost control and accounting, and financial planning. The advisory role is anticipated to last for perhaps four years, with a staff of several consultants based in Khartoum.

Argentina sugar exports[7]

	1976	1975	1974
	(*metric tons, tel quel*)		
Algeria	0	3,883	43,130
Chile	38,959	0	54,701
Egypt	31,040	5,863	32,410
Finland	0	0	4,241
France	12,192	7,767	22,249
Germany, East	5,900	0	0
Ghana	3,964	0	0
Greece	0	0	2,422
Holland	0	0	894
Iran	0	0	72,683
Iraq	0	0	15,745
Japan	0	6,020	4,874
Libya	9,500	50,000	30,000
Mauritania	6,600	0	0
Morocco	0	3,756	36,328
Portugal	10,817	0	0
Spain	3,253	3,464	49,612
Sri Lanka	0	0	9,900
Sudan	10,239	0	0
Syria	0	0	16,538
Tunisia	38,334	5,266	17,000
UK	0	830	91,780
Uruguay	0	0	8,000
USA	99,336	97,374	100,019
Venezuela	15,854	0	11,150
Yugoslavia	0	8,192	0
Zaire	0	0	9,344
Other countries	51	0	0
	286,039	192,415	633,020

Egyptian beet sugar company[8].—An Egyptian-Arab-French company, Société Delta pour les Sucreries, has been formed and is to erect a beet sugar factory at Kafr El Cheikh in the Nile Delta, about 130 km north of Cairo.

* * *

New sugar factory in Malaysia[9].—The State Government of Sabah has proposed the setting up of a sugar complex in Sandakan, to include a plantation and a refinery. It will be capable of meeting one-half of the State's sugar needs, currently some 27,000 tons a year, imported mainly from Peninsular Malaysia and the Philippines.

* * *

Cameroun sugar projects[10].—The Cameroun Sugar Company has decided to build a second sugar factory in the vicinity of Mbandjock to produce about 50,000 tons of raw sugar per year. The total cost of the project will be 16,500 million CFA francs, of which 11,500 million francs will be for the factory. It is to be expanded later to 80,000 tons/year and plans are being made for the erection of a third factory.

* * *

Philippine trade agreement with Algeria[11].—It is reported that the Philippines has entered a long-term contract with Algeria for the delivery of 80,000–120,000 tons of sugar per year for the next four years.

* * *

Belize sugar exports, 1976[12].—Sugar exports from Belize in 1976 totalled 58,294 metric tons, raw value, as against 81,310 tons in 1975. The UK received 45,176 tons against 39,158 but the 1976 figure for the USA was only 13,118 compared with 42,152 tons. The fall reflects a disappointing production level of 64,671 tons last year, against 85,684 tons in 1975.

[1] F. O. Licht, *International Sugar Rpt.*, 1977, **109,** (22), 13.
[2] *Public Ledger*, 20th July 1977; *Standard Chartered Review*, August 1977, 34.
[3] F. O. Licht, *International Sugar Rpt.*, 1977, **109,** (11), xii–xiv.
[4] *Indian Sugar*, 1977, **26,** 737.
[5] F. O. Licht, *International Sugar Rpt.*, 1977, **109,** (18), 9.
[6] *Public Ledger*, 18th June 1977.
[7] F. O. Licht, *International Sugar Rpt.*, 1977, **109,** (17), xi–xii.
[8] *Zeitsch. Zuckerind.*, 1977, **102,** 417.
[9] F. O. Licht, *International Sugar Rpt.*, 1977, **109,** (17), 10.
[10] *Zeitsch. Zuckerind.*, 1977, **102,** 417.
[11] F. O. Licht, *International Sugar Rpt.*, 1977, **109,** (10), 11.
[12] *I.S.O. Stat. Bull.*, 1977, **36,** 22.

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