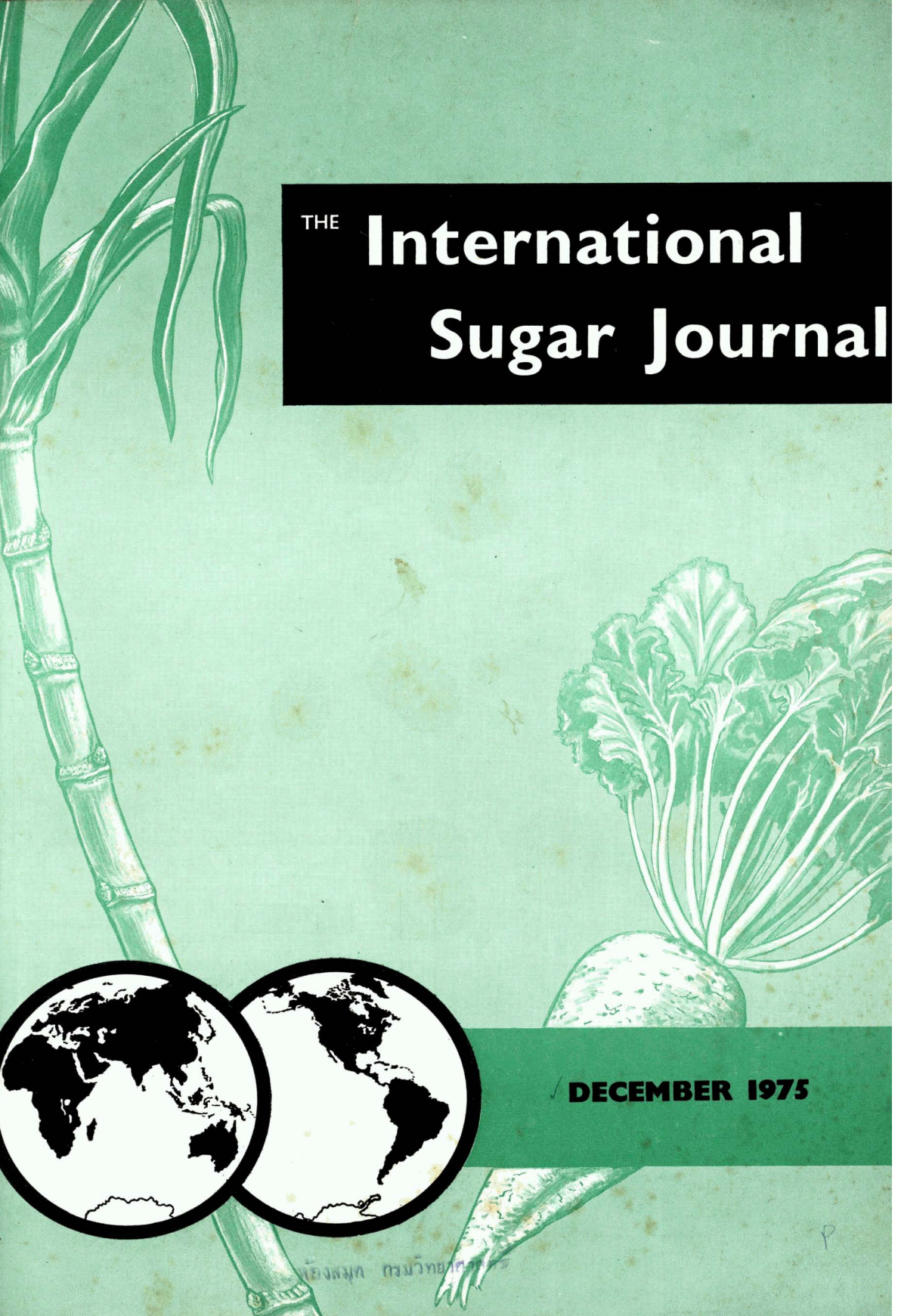

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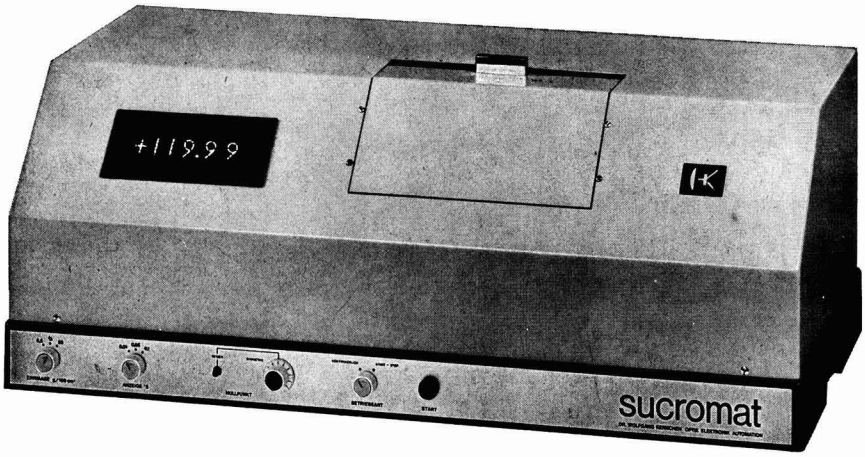

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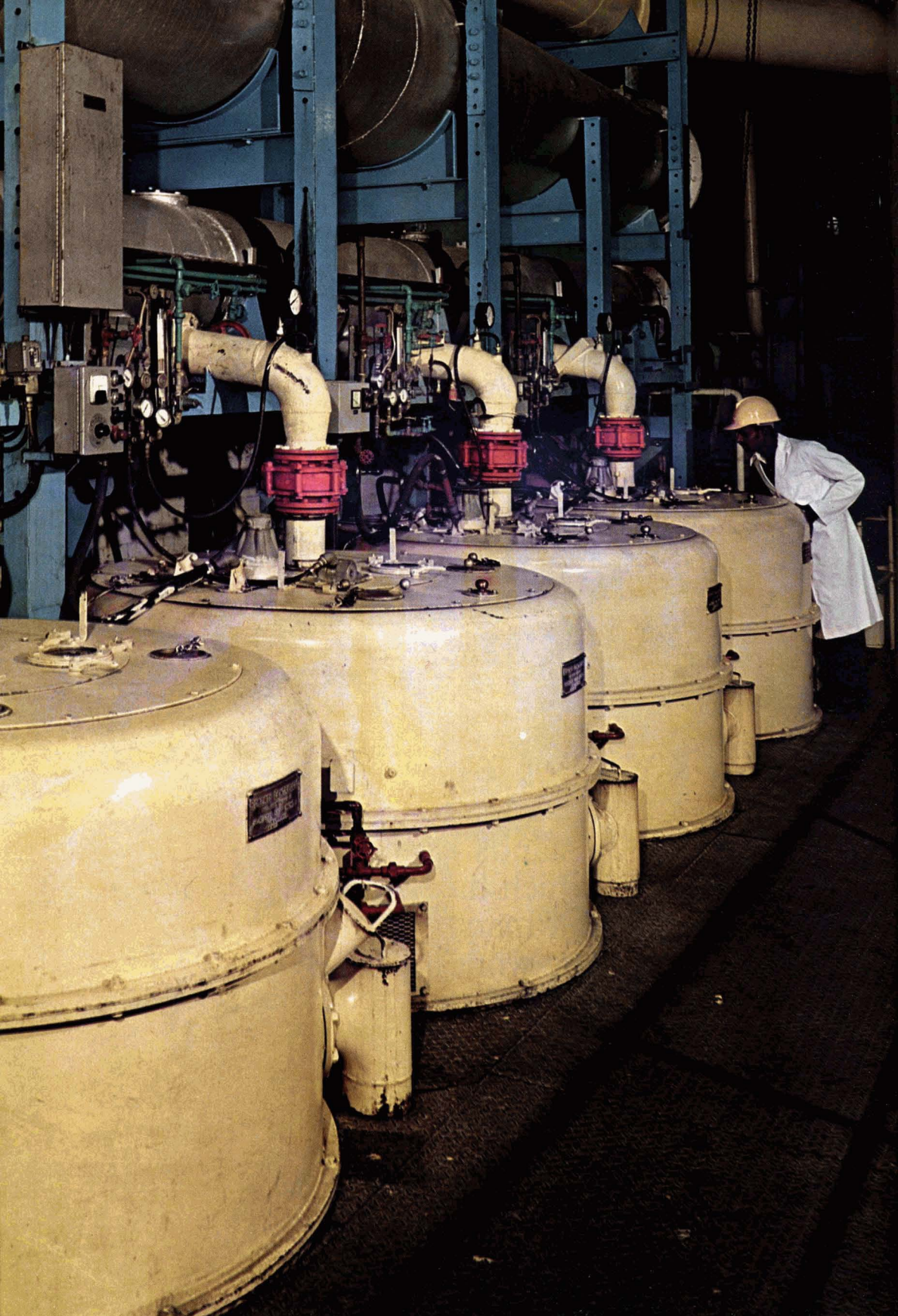

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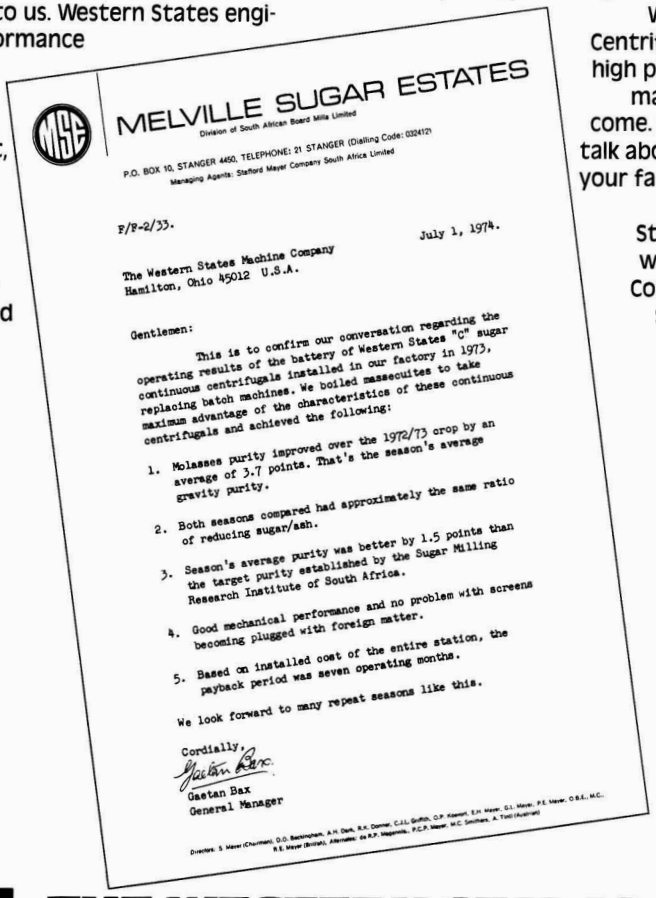

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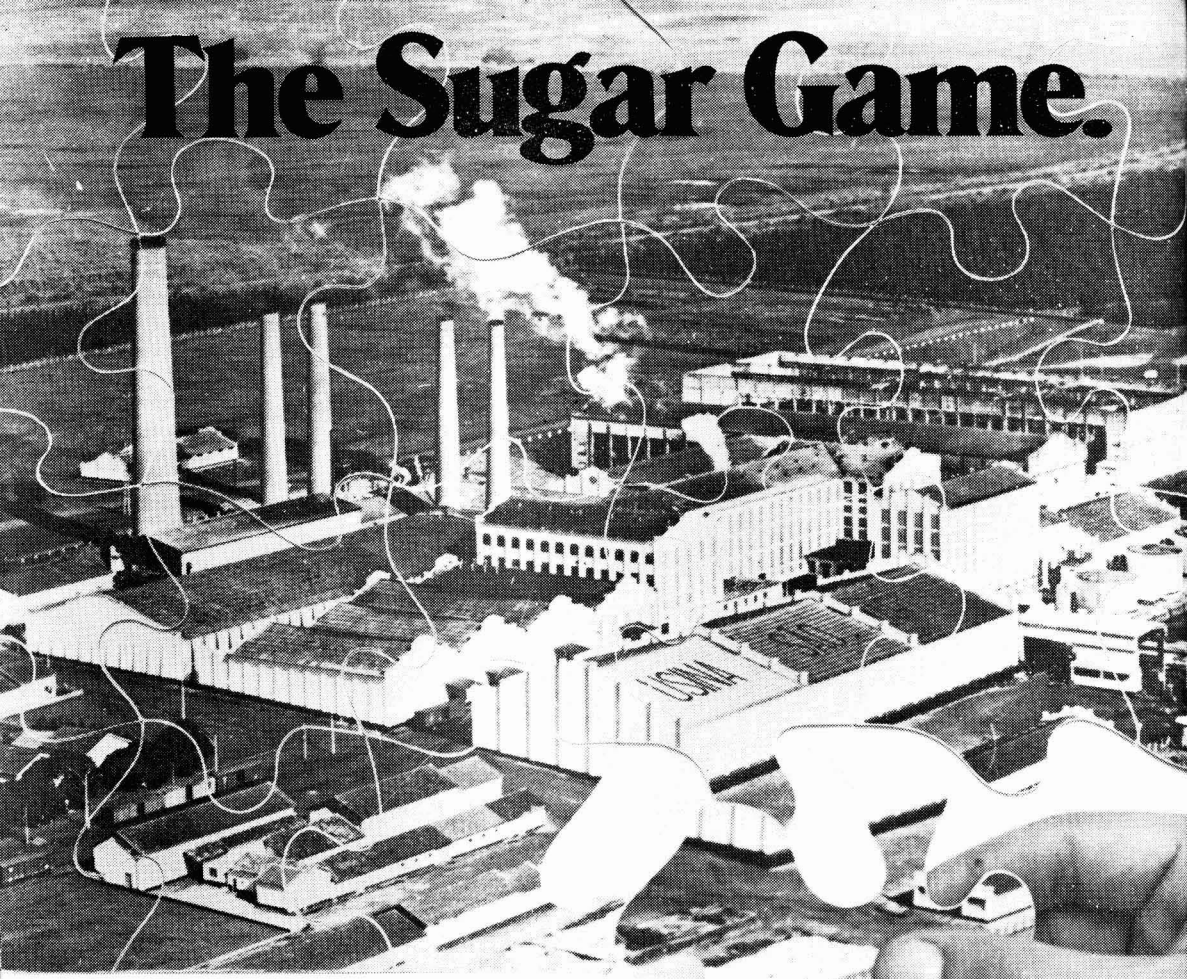

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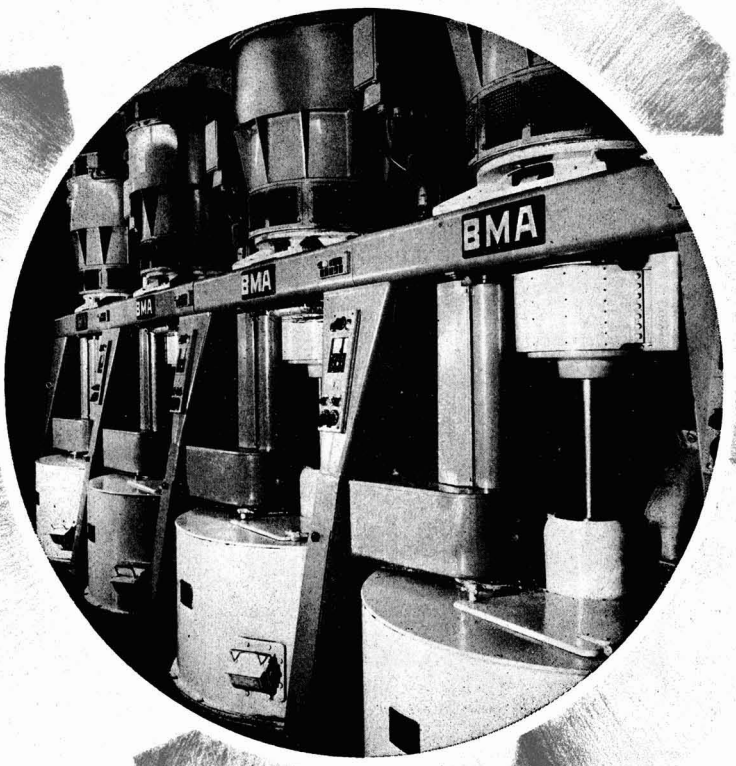

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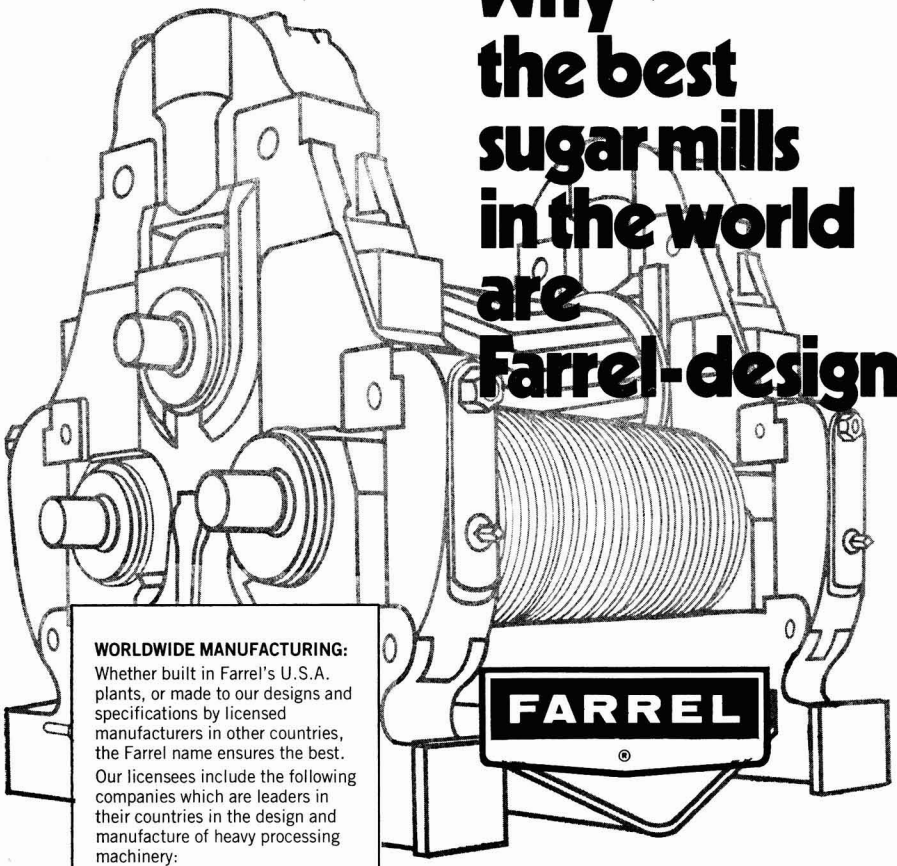

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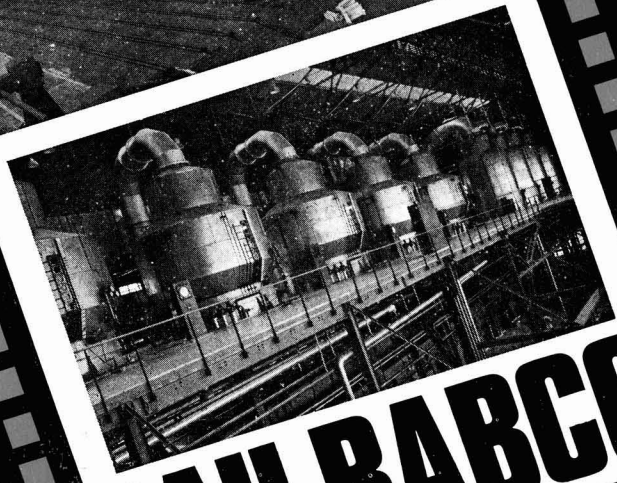

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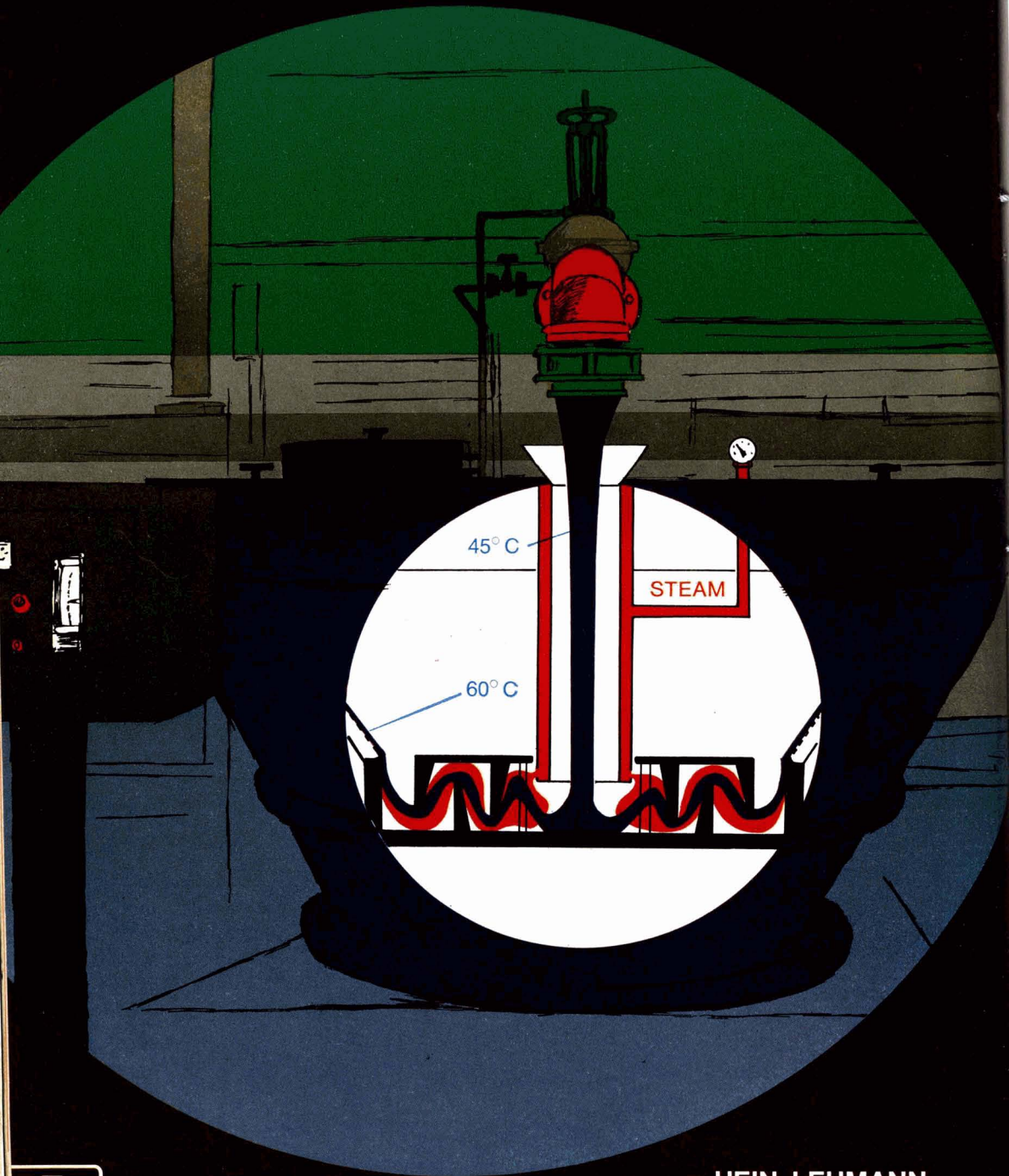

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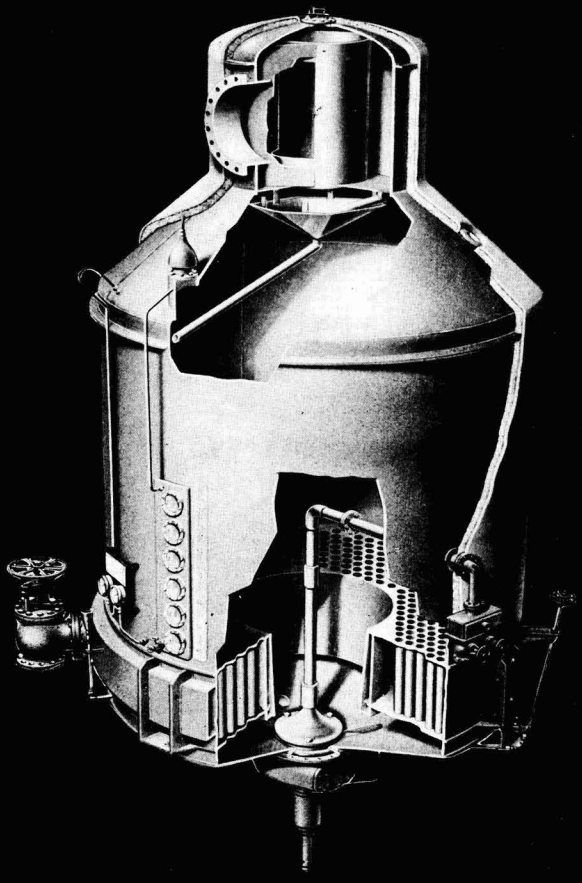

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Consultant and former Director, Sugar Milling Research Institute, South Africa.

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* * *

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December 1975

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Floraison de la betterave à sucre en Egypte. F. REDA et S. KHALIL. *p.* 355–356

On donne un compte rendu de recherches sur la possibilité de faire fleurir la betterave à sucre dans les conditions égyptiennes en faisant tremper les graines et/ou les plantules dans de l'eau ou une solution d'acide gibbérélique puis en les maintenant à basse température. Le seul des sept traitements (plus trempage des graines dans de l'eau) qui a conduit à une floraison consiste en un trempage des plantules suivi par séjour de 45 jours dans une chambre de culture contrôlée à 8°C avec une période d'illumination de 16 heures. Le traitement des graines ne conduit pas à une montée à graines.

* * *

Le procédé de fabrication de sucre blanc par défécation-refonte. O. D'HOTMAN DE VILLIERS et M. A. QURESHI. *p.* 357–359

On présente les résultats obtenus à la sucrerie de Khoski au Pakistan où on fabrique du sucre blanc par défécation-refonte au lieu du procédé avec double carbonatation et double sulfitation, habituellement utilisé dans ce pays. Le procédé utilisé à Khoski qui comprend une carbonatation de la refonte de sucre brut sans sulfitation, a donné un meilleur rendement en blanc et des pertes inférieures dans la mélasse malgré une extraction aux moulins supérieure à la moyenne pakistanaise.

* * *

Elévation du point d'ébullition et surchauffe des solutions impures de sucre de canne. R. J. BATTERHAM et T. E. NORGATE. p. 359–364

On donne des résultats précis sur l'élévation du point d'ébullition des solutions de sucre de canne dans lesquels on a tenu compte de l'effet des impuretés. On a utilisé une corrélation entre la surchauffe dans un appareil à cuire de laboratoire et dans un appareil à cuire industriel. On a trouvé que l'influence des facteurs était la même dans les deux cas.

* * *

Traitement électronique des informations au Sugar Research Institute. ANON. *p.* 364

On donne des informations sur un nouvel ordinateur installé au Sugar Research Institute de Mackay, Queensland, qui devra traiter des informations associées avec la mise au point d'un modèle mathématique d'une sucrerie de cannes complète. On donne un bref aperçu des travaux réalisés dans ce domaine à l'Institut.

Das Blühen der Zuckerrübe in Aegypten. F. REDA und S. KHALIL. *S.* 355–356

Es werden Einzelheiten mitgeteilt über die Untersuchung der Möglichkeit, unter ägyptischen Verhältnissen Zuckerrüben zum Blühen zu bringen, indem man Saatgut und/oder Keimlinge in Wasser oder Gibberellinsäurelösung legt und bei niedrigen Temperaturen hält. Die einzige Massnahme, die unter sieben Varianten (plus Einlegen des Saatgutes in Wasser allein) zum Blühen führte, war das Einlegen der Keimlinge mit einer anschliessenden 45tägigen Aufbewahrung in einer auf 8°C eingestellten Klimakammer bei einer Belichtungsdauer von 16 Stunden. Bei Saatgut konnte durch die Behandling keine Blütenbildung erreicht werden.

* * *

Das Scheidung-Einschmelzen-Verfahren bei der Weisszuckerherstellung. O. D'HOTMAN DE VILLIERS und M. A. QURESHI. *S.* 357–359

Die Verfasser teilen Einzelheiten über die in der Zuckerfabrik Khoski in Pakistan erzielten Ergebnisse mit. Hier wurde Weisszucker nach der Scheidung-Einschmelzen-Methode statt nach der zweifachen Carbonatation und der zweifachen Sulfitation—wie allgemein in Pakistan üblich—erzeugt. Das Verfahren in Khoski, bei dem Rohzuckerkläre ohne Sulfitation der Carbonatation unterworfen wird, hat eine bessere Kristallausbeute und niedrigere Zuckerverluste bei der Melasse erbracht, obwohl die Extraktion in den Mühlen höher ist als im Durchschnitt von Pakistan.

* * *

Siedepunktserhöhung und Ueberhitzung in unreinen Rohrzuckerlösungen. R. J. BATTERHAM und T. E. NORGATE. *S.* 359–364

Es werden exakte Werte für die Siedepunktserhöhung bei Rohrzuckerlösungen unter Berücksichtigung des Einflusses von Verunreinigungen vorgelegt. Eine Beziehung zwischen Ueberhitzung und Kochprozessparametern wurde dazu benutzt, den Einfluss dieser Parameter auf die Ueberhitzung in einem Laboratoriumskristallisator und einem technischen Kochapparat zu ermitteln. Es wurde festgestellt, dass die Abhängigkeit von den Parametern in beiden Fällen ähnlich ist.

* * *

Elektronische Datenverarbeitung im Sugar Research Institute. ANON. *S.* 364

Es wird über den neuen Elektronenrechner berichtet, der im Sugar Research Institute in Mackay (Queensland) zur Datenverarbeitung und gleichzeitig zur Entwicklung eines Modellrechners für eine vollständige Rohrzuckerfabrik installiert wurde. Ueber die Arbeiten des Instituts auf diesem Gebiete wird kurz informiert.

Floración de la remolacha azucarera en Egipto. F. REDA y S. KHALIL. *Pág.* 355–356

Se presentan detalles de investigaciones de la posibilidad de inducción a florecer de remolacha, sobre condiciones que obtienen en Egipto, por remojón de semillas y/o plantones en agua o una solución de ácido giberélico y entonces mantenemiento a baja temperatura. El sólo tratamiento de siete (más remojón de semillas en agua) que inducó floración fué remojón de plantones con, en seguido, un período de 45 días en una cámara para desarrollo controlado a 8°C con un fotoperíodo de 16 horas. Tratamiento de semilla no dió éxito.

* * *

El proceso de defecación-refundición para fabricación de azúcar blanco. O. D'HOTMAN DE VILLIERS y M. A. QURESHI. *Pág.* 357–359

Se presentan detalles de resultados obtenido en la azucarera de Khoski en Pakistán, donde se fabrica azúcar blanco por el proceso de defecación-refundición en lugar del proceso de doble-carbonatatación y doble-sulfitación que se usa generalmente en ese pais. El proceso de Khoski, que incluye carbonatación, sin uso de sulfitación, de un licor formado por disolución del azúcar crudo, ha dado una mejorada recuperación en la casa de calderas y menor pérdida en malaza a despecho de un extracción por los molinos que es más alta que el promedio para Pakistán.

* * *

Elevación del punto de ebullición y sobrecalefacción en soluciones impuras de azúcar de caña. R. J. BATTERHAM y T. E. NORGATE. *Pág.* 359–364

Se presentan valores exactos de la elevación del punto de ebullición de soluciones de azúcar de caña, para que se ha tomado en consideración el efecto de impurezas. Se ha usada una corelación entre el grado de sobrecalefacción y factores variables de ebullición para determinar el efecto de ésos sobre el grado de sobrecalefacción en tachos de escala del laboratorio y industrial. La dependiencia sobre los factores se halla semejante en ambos casos.

* * *

Tratamiento electrónico de dados en el Sugar Research Institute. ANON. *Pág.* 364

Este es un informe sobre un nuevo computador instalado al SRI en Mackay, Queensland, que tiene por fin el tratamiento de dados asociado con desarrollo de un modelo matemático de una fábrica completa para producción de azúcar de caña. Aspectos del trabajo al Instituto en este campo se discuten brevemente.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXVII DECEMBER 1975 No. 924

Notes & Comments

World sugar balance 1974/75

F. O. Licht have recently issued their third estimate of the world sugar balance for the crop year September 1974–August 1975[1], as follows:

	1974/75	1973/74
	— (*metric tons, raw value*) —	
Initial stocks	16,041,000	15,662,000
Production	79,134,000	80,673,000
Imports	24,206,000	24,823,000
	119,381,000	121,531,000
Exports	24,194,000	24,663,000
Consumption	78,755,000	80,827,000
Final stocks	16,432,000	16,041,000
Production difference	—1,539,000	+3,324,000
,, ,, %	—1·91	+4·30
Consumption difference	—2,069,000	+2,871,000
,, ,, %	—2·56	+3·68
Final stocks % consumption	20·86	19·85

These new figures show a sugar consumption estimate about 420,000 tons less than the second estimate which reflects the more accurate information available on the restrictions and changes in sugar usage which have resulted from the high prices obtaining during the period. Production, too, is set some 220,000 tons lower than the July estimate but nevertheless is sufficient to cover requirements. Licht explain that the overall figures conceal some major changes; for instance, consumption in Africa (particularly Egypt, Morocco and the Sudan) is set 155,000 tons higher which offsets a reduction of 450,000 tons in the consumption estimate for Asia, mainly due to the reduced offtake in Japan.

Stock figures are reduced for North and Central America, Africa and Oceania, while they are raised for Europe and Asia (especially the Philippines), by comparison with the second estimate. The net change indicates a new stock figure higher than the initial stock by some 400,000 tons which also represents a real increase in terms of consumption. The total, while a large amount, is still just about ten weeks' supply and is consequently less than what was the traditional proportion of 25% and cannot be considered excessive.

* * *

Latin America and Caribbean sugar exporters meeting

A third meeting took place during the 28th September–3rd October in Lima, Peru, between the 22 countries of Latin America and the Caribbean which have formed an association to protect their interests in the absence of an effective International Sugar Agreement. A representative of the Philippines was permitted to attend as an observer. The group represents 52% of world free exports (59% including the Philippines or 70% if long-term agreements are also included). However, a number of major exporters are excluded, such as Australia, the EEC, South Africa and the USSR.

The agenda had included consideration of measures on the part of member countries to defend sugar prices, and the Cuban chief delegate called for the introduction of a minimum price system, a question which will probably be raised at the next meeting of the group in Cali, Colombia, in March 1976.

Details of a plan (which although not binding had been applauded by all delegations) were released at the close of the meeting "in view of the absolutely unsatisfactory level of current prices". This calls for the declaration of the destination of sugar sold at auction, for a limitation of the notice period for auctions to 48 hours, for a limitation of block sales to intermediate buyers to 50,000 tons, for a ban on sales at prices below market quotations of the day, and for consideration of adopting minimum prices for long-term sales.

C. Czarnikow Ltd.[2] comment upon this plan: "It is possible, if the members of the group adhere to the plan, which in any case is not binding upon them, that they will from time to time be able to exert some influence on the course of prices, but it seems unlikely that they will be able to reap any long-term advantage, quite apart from the fact that, by its very nature, the group has to exclude many important sugar producers and exporters. It is nearly fifty years since Cuba endeavoured to improve prices by unilaterally restricting her crop size. This action, however, merely provided an umbrella beneath which other producers could expand their output and eventually Cuba had to abandon her scheme. It would be unfortunate for the members of the present group if their actions were to encourage production in other areas, particularly those countries which are at present net importers. No doubt the statistical office which has been established in Mexico will be constantly watching for any tendencies in this direction".

* * *

Cuban sugar industry rationalization[3]

Cuban sugar production costs have dropped by 14% in real terms since 1973 because of increased productivity while workers employed in the industry dropped to 91,000 this year from 94,000 in 1974,

[1] *International Sugar Rpt.*, 1975, **107**, (31), 1–4.
[2] *Sugar Review*, 1975, (1252), 165.
[3] *Public Ledger*, 11th October 1975

JORGE RISQUET, a member of the Secretariat of the Communist Party Central Committee, told a congress of sugar industry trade unions in Havana.

In his address, published in the official daily, *Granma*, he said the number of workers will be cut further to 88,500 under plans for the 1975/76 harvest starting in December. Meanwhile, production capacity use of sugar mills was 83% this year compared with 78% last year and 53% in 1972.

At the same time, mechanization is increasing and 30% of the cane in the coming harvest is expected to be cut by combine harvesters, mostly Australian and Soviet-Cuban KTP-1.

Targets for 1980 are for 80% mechanized cutting, with only 50,000 cane cutters employed in manual and mechanized cutting, allowing Cuba to fill labour shortages in other sectors. Cane cutters will number 150,000 during the next harvest, half of them professional, the other half volunteers.

* * *

World sugar prices

Although prices have been adjusted frequently by small amounts, the London Daily Price for raw sugar varied only between extremes of £158 and £172 per ton during October and the higher limit was only the result of further rumours of purchases by the USSR of sugar from the Philippines to make up for a poor beet sugar crop following bad weather in the Ukraine and acknowledged low grain production in the same region. Prices fell again when the rumours were strongly denied by Soviet spokesmen and November started with an LDP of £163.

The London Daily Price for white sugar was very steady for long periods during the month but rose from £165 to £180 near the end of the month. India sold several cargoes of white sugar at favourable prices and a number of purchase tenders were held which tended to keep the LDP(W) firm.

Discussing the renewed reports of Soviet purchases of Philippines sugar, C. Czarnikow Ltd.[1] note:

"It is strange how these rumours continue to circulate and even stranger to note the effect they have on market prices and the credence with which they are apparently received in some quarters. Indeed, it has even been suggested that Philippine sugar could be delivered to Vladivostok, which would appear to ignore the fact that the facilities in that region are not suitable to receive and handle substantial tonnages of sugar. One thing which appears to have been overlooked, however, is the large tonnage of Cuban sugar which has entered the Soviet Union from Cuba during the first six months of this year. The *Interim Monthly Statistics* published by the International Sugar Organization show that during January/June 1975 total imports by the USSR amounted to 2,526,000 metric tons, raw value, of which more than 2·25 million tons originated in Cuba. This is well above the normal quantity shipped from Cuba to the Soviet Union and, indeed, though covering only six months, exceeds annual imports from Cuba for any year since 1970. It would appear probable that, in addition to purchasing 270,000 tons of world market sugar in the closing months of last year for arrival during 1975, the Soviet authorities also purchased a substantial tonnage of Cuban sugar in excess of normal deliveries.

This puts an entirely new complexion on the outlook for purchases by the USSR to augment domestic supplies. For months great attention has been paid to possible purchases by the Soviet Union of world market sugar and weather reports have been examined avidly for any indication about the likely domestic output. It may well be, indeed, that the USSR will need to import sugar, but if further supplies may be obtained from Cuba it is possible that world market supplies will not be sought after all".

* * *

Further devaluation of the "green pound"

The earlier 5% devaluation[2] in the "green pound" (the nominal value of sterling against other European currencies used in calculations of prices) did not fully reflect the fall in the value of the real pound but was chosen to limit the consequent rise in the cost of agricultural products at retail in the UK. Farmers in the UK and Ireland have complained, however, at the low return they were getting for their crops, and a further devaluation of 5·8% has been agreed. This raises the sterling prices paid and reduces by about 50% the compensation payments applicable to UK imports and exports of products covered by the Common Agricultural Policy. From 27th October the price paid for 1975/76 beet was raised from £16.84 to £17.65 per ton.

Subsequently there was disagreement between the British Sugar Corporation and the National Farmers' Union on the payment terms of the 1976/77 beet contract but these were eventually settled with a guaranteed minimum price of £19.28 (£15 basic plus a pulp allowance of £1.88, a new additional fixed payment of £1 and £1.40 transport allowance). The NFU have agreed that farmers will be due no share of income from EEC price increases which affect the value of sugar stocks held by the Corporation.

* * *

UK sugar consumption

The Ministry of Agriculture, Fisheries and Food have stated in a National Food Survey covering the second quarter of 1975 that household purchases of sugar, at 10·1 oz per person per week, fell by nearly 30% compared with the corresponding period of 1974. They point out that during April/June 1975 the average price of sugar was 14·4p per pound compared with 5·3p per pound during the corresponding period of 1974. They go on to state that during the same period expenditure on artificial sweeteners rose to twice the level of the period April/June 1974.

C. Czarnikow Ltd.[3] comment that, "to some extent the fall in purchases must reflect the absorption of stocks acquired during the time when prices were rising last year. It will, therefore, not be possible to ascertain whether, and to what extent, there has been any permanent change in consumption habits until these supplies have been exhausted and the current world depression comes to an end".

* * *

Paraguay sugar expansion[4].—It is reported that Paraguay will produce 82,000 tons of sugar this year of which 32,000 tons will be for export, compared with 71,000 tons and 24,000 tons, respectively, in 1974. Production of 100,000 tons of sugar a year is expected from 1976 onwards.

[1] *Sugar Review*, 1975, (1255), 177.
[2] *I.S.J.*, 1975, **77**, 258.
[3] *Sugar Review*, 1975, (1251), 161.
[4] *Bank of London & S. America Review*, 1975, **9**, 477.

Flowering of sugar beet in Egypt

By FATMA REDA and SOHAIR KHALIL

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Introduction

IN Egypt, sugar beet has been newly introduced as a sugar crop in reclaimed sandy areas of the western region of the Nile delta. Biennial plants such as the various kinds of beet normally produce only a rosette of leaves in their first year, flowering in their second year after they have been vernalized by low temperature during the winter.

FOGG[1] and PURVIS[2] analysed the physiological aspect of vernalization of plants including sugar beet. MARGARA[3] found that treatment with gibberellin A^3 under controlled conditions could promote flowering of beet only when photothermal conditions are near the threshold of induction. MARGARA[4] also stated that floral induction of sugar beet was determined by vernalization and by the action of long photoperiods whereas gibberellic acid (GA) might only favour flower initiation when photothermal conditions were favourable.

In previous studies dealing with the growth and sucrose content of sugar beet in Egypt, no flower induction occurred under natural conditions even after GA treatment, seed vernalization or a combination of both treatments. The plants remained in a vegetative condition for three successive years[5]. Therefore, the flowering of sugar beet in Egypt is a problem needing to be solved in order to produce improved hybrids adapted for the agroclimatic conditions and in order to produce higher yields. The present paper reports the results of investigations into the possibility of inducing flowering of sugar beet in Egypt through vernalization and GA treatments.

Experimental

Clusters of *Beta vulgaris* L. (sugar beet) cultivar Poly AG-Poland were soaked, respectively, in water and in a 25 $\mu g.cm^{-3}$ solution of gibberellic acid (GA) for 24 hours. Batches of seeds which had been subjected to the two treatments were then vernalized at $5 \pm 0{\cdot}5°C$ for one month in an incubator following the classical conditions (vitality, aeration and moisture content of the seeds) of LYSENKO's method[6] for artificial vernalization described by REDA[7]. These two groups of vernalized seeds were sown under natural conditions together with a third group of water-soaked seeds and a fourth one of seeds soaked in the same concentration of GA for 24 hours. Sowing was carried out on 20th January 1974 in 40 cm-diameter pots filled with loamy soil. Fertilization was at a rate of 0·15 g N, 0·1 g P_2O_5 and 0·22 g K_2O per kg soil using calcium nitrate, superphosphate and potassium sulphate respectively. After five months

[1] "The Growth of Plants", 2nd Edn. (Penguin Books Ltd., England). 1970.
[2] "Encyclopedia of Plant Physiology", Vol. XVI, 1961, pp. 76–122.
[3] *J. Int. Inst. Sugar Beet Research*, 1967, **2**, 242–254.
[4] *ibid.*, 1968, **3**, 17–31.
[5] KHALIL & REDA: *Ann. Agric.* (Moshtoher, Egypt), 1975, **3**, 101–109.
[6] *Rpt. Central Expt. Plant Breeding Sta.* (Ganja, Azerbaijan), 1928, **3**, 210.
[7] Ph.D. Thesis (Faculty of Science, Cairo University, Egypt), 1967.

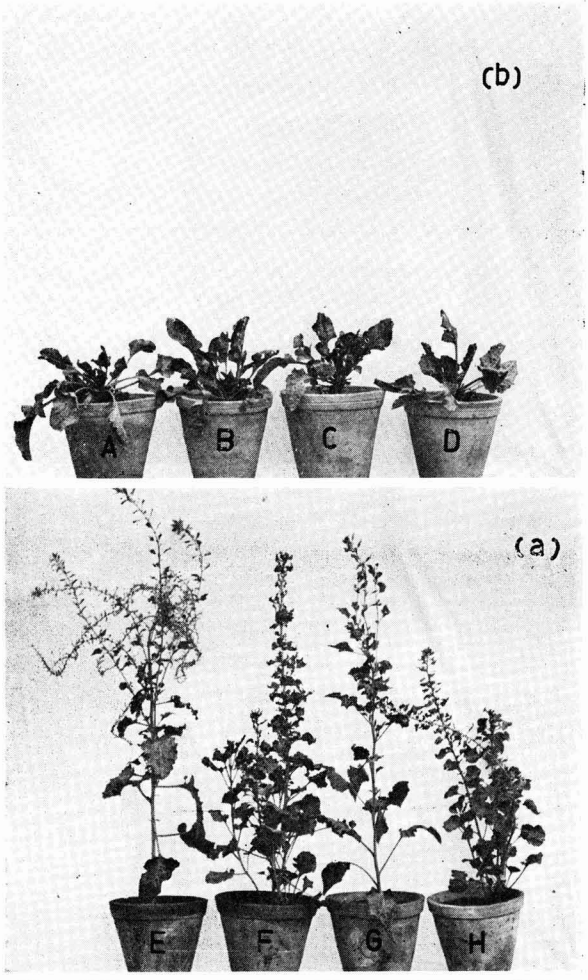

Fig. 1. Bolting and flowering of Poly AG sugar beet cultivar in Egypt

A: Untreated water-soaked seeds. *B:* Seeds vernalized. *C:* Seeds soaked in GA solution. *D:* Seeds soaked in GA solution and vernalized. *E:* Seedlings vernalized. *F:* Both seeds and seedlings vernalized. *G:* Seeds soaked in GA solution and seedlings vernalized. *H:* Seeds soaked in GA solution and both seeds and seedlings vernalized.

(plants attaining about 10–12 leaves), the plants of the four treatments were divided into two groups, one kept continuously under natural conditions, and the second group transferred to a controlled growth chamber for 45 days at 8°C. The photoperiod was 16 hours and light was supplied from fluorescent lamps providing 6000 lux at the plant level.

The circulation of air inside the chambers was sufficient to supply necessary ventilation. After the cold treatment, the plants were kept for 10 weeks at 16°C then transferred outdoors for two months (November and December). The average air temperature attained a maximum of 27° and 18°C, and a minimum of 16° and 9°C during November and December respectively.

Table I. Bolting and flowering time of sugar beet

Treatment	*Vernalization and GA treatment*	*Bolting* time*	*Flowering† time*
A	Water-soaked seeds	Vegetative rosette	
B	Seeds vernalized	,,	,,
C	Seeds soaked in GA solution	,,	,,
D	Seeds soaked in GA solution and vernalized	,,	,,
E	Seedlings vernalized	260	292
F	Both seeds and seedlings vernalized	232	—
G	Seeds soaked in GA solution and seedlings vernalized ...	304	—
H	Seeds soaked in GA solution and both seeds and seedlings vernalized	292	—

* Days from sowing to the emergence of the flower stalk.
† Days from sowing to the visible open flowers.

Bolting and flowering times (Table I) were calculated as the days from germination to the bolting or flowering dates based on 5 plants per treatment. Bolting of sugar beet was considered as the emergence of a flower-stalk capable of reaching an average length of 75 cm. Flowering was calculated when the visible open flowers appeared on the flower-stalk.

Data given in Table I reveal that bolting of sugar beet occurred only in the treatments where seedlings were vernalized (Fig. 1a). On the other hand, sugar beet plants resulting from all non-vernalized seedlings did not bolt and remained in the vegetative condition (Fig. 1b). The first bolting occurred in treatment F where both seeds and seedings were vernalized. Bolting in this treatment was about one month earlier as compared with treatment E where only the seedlings were subjected to vernalization. However, flowering did not occur in treatment F. Bolting times of plants produced from GA-treated seeds (treatments G and H) were later than treatment E by two months.

Flowering only occurred for plants of treatment E. It may be concluded that vernalization for 45 days of sugar beet seedlings of cultivar Poly AG (treatment E), was sufficient to produce flowers in Egypt (Fig. 2). Plants of sugar beet did not bolt and remained in a rosette vegetative stage when kept all the time in the natural environmental conditions of this location (Dokki, Cairo) even if the seeds were vernalized (treatment B), treated with GA before sowing (treatment C) or even by the combination of both treatments (treatment D).

DOXTATOR[8] reported that GA-treatment of monogerm sugar beet seeds had no effect on bolting. In addition, WHEATLEY & JOHNSON[9] found that biennial varieties of sugar beet treated with GA did not behave as annuals. MARGARA[3,4] emphasized that GA could promote flowering of beet but only when photothermal conditions were near the threshold of induction. MARTIN & LEONARD[10] stated that initiation of seed stalks and flowers of sugar beet was brought about mainly by the cumulative effect of exposure to low temperature followed or accompanied by the effects of long photoperiod. However, the present study leads to the conclusion that the exposure to low temperature (vernalization) at the seedling stage is the only decisive factor for flowering of sugar beet in Egypt, and that the photoperiod of Egypt (latitudes 24° and 31°N) is favourable and is not a limiting factor.

The results obtained encourage further research on this subject in Egypt by using other cultivars to be grown in natural agroclimatic locations which are as close as possible to the thermal requirements of sugar beet as determined in this investigation.

Finally, it is evident from this work that floral induction of sugar beet in Egypt was determined by vernalization (8°C) for 45 days during the 10 to 12 leaf-stage.

[8] *J. Amer. Soc. Sugar Beet Tech.*, 1958, **10**, 117–123.
[9] *ibid.*, 1959, **11**, 335–343.
[10] "Principles of Field Crop Production", 2nd Edn. (Macmillan, New York), 1970.

Fig. 2. Flowering of Poly AG sugar beet cultivar in Egypt
E: Seedlings vernalized. *A:* Untreated water-soaked seeds.

The defecation-remelt process of white sugar manufacture

By O. d'HOTMAN de VILLIERS* and MOHAMED AWAIS QURESHI †

EXCEPT for one small factory near Lahore which uses the double sulphitation process, it has been universal practice in West Pakistan to follow the double-carbonatation double-sulphitation process for the clarification of cane juice in the manufacture of plantation white sugar. The white sugar obtained is unfortunately of high ash content and, although of attractive appearance straight from the centrifugal, generally deteriorates quite rapidly in storage, an observation made also in India.

In 1971, the Fauji Sugar Mills, Khoski, a new 3000 t.c.d. factory supplied by A. & W. Smith & Co. Ltd., adopted the sulpho-defecation-remelt process, with carbonatation of the melt and using only light sulphitation of juice, and began producing good quality white sugar with excellent keeping characteristics.

As a result of a sufficiently long experimental run towards the end of this first crop, it was found that, by using as little as 1 ppm on cane of an efficient polyelectrolyte, the light juice sulphitation could be dispensed with altogether. Consequently, for the 1972/73 and 1973/74 crops, the process was followed without this feature and it was possible to operate using only two of the factory's three Oliver filters, even when crushing more than 3000 tons of cane per day.

Delay in adoption of the defecation-remelt process in Pakistan stemmed from legitimate opposition by technologists who, on the strength of repeated assertions in textbooks of sugar technology published over the years, feared that by losing the important clarification effect of the high dosage of lime used in the double-carbonatation double-sulphitation (DCDS) process—a gain of more than 2·5 units in gravity purity over mixed juice—there would be a loss in boiling house recovery which might reach two points or more.

On the basis of his experience in West Pakistan, D'HOTMAN had concluded[1] that it was doubtful if such a loss would exceed one point and later comparative studies, carried out in collaboration with Mr. AZIZ HUSSAIN, General Manager of Hyesons Sugar Mills, had led to the conclusion by 1968 that there was no fear of any loss in sugar bagged % cane.

The DCDS process in Pakistan, where the cane juice is of low purity, high ash and good reducing sugars content, is characterized by:

(*a*) Use of more than 3·5% limestone on cane, resulting in the destruction of a large proportion of the reducing sugars present and so giving a comparatively high final molasses purity. Further, the high lime dosage produces large quantities of filter cake (around 8% on cane) involving appreciable sugar loss which is difficult to assess accurately because of the problem of obtaining a representative sample of cake. Further, unaccounted losses arise through drippings and filter cloth washing at the huge press stations.

(*b*) Rather heavy sulphitation of the syrup, in general, which undoubtedly results in improved quality of the commercial sugar but at the cost of losses by inversion.

(*c*) Remelting of double-cured *C*-sugar and sometimes of part of the *B*-sugar, both melt liquors being mixed with syrup prior to sulphitation and thus increasing losses by inversion.

(*d*) Rather high (usually above 60°) *C*-massecuite purity; this raises the quality of the sugar but again at the cost of comparatively high losses in final molasses.

By contrast, the defecation-remelt process adopted by Khoski Sugar Mills during the 1972/73 and 1973/74 crops has the following characteristics:

(i) Simple defecation of the cane juice and melt carbonatation using a total of only 0·17% CaO on cane, as against about 1·9% for the DCDS process.

(ii) An integral double-einwurf system of massecuite boiling with single curing of all three massecuites for production of 100% *A*-raw sugar of high purity for remelting. The *C*-massecuite purity is kept as low as practical (around 53) for minimum purity of final molasses.

(iii) Carbonatation of the raw sugar, melted to about 67°Bx, using about 1% CaO on solids and washed flue gas. This produces a filtered, carbonatated melt of about pH 8·7 which, when lightly sulphited and refiltered, gives a fine liquor of about pH 7·0 and 99·5 purity.

(iv) Three straight boilings of white sugar, the last strike run-off being sent back to be mixed with the raw syrup.

It can be seen that the operations at Khoski are simpler and more straightforward. Whereas in the DCDS process the cane juice is subjected to very high alkalinities (of pH 10·5 and higher) at 52–58°C with large doses of lime and the mixture of syrup, *C*-melt and *B*-melt subjected, at the very opposite, to sulphitation at pH 5·4–5·8, at Khoski only the *A*-sugar melt—of high purity and insignificantly low reducing sugars content—is subjected to high alkalinities at about 80°C while the cane juice raw syrup and fine liquor are kept close to neutrality.

In Table I are given comparative figures from Khoski and four neighbouring factories in the Lower Sind province. (The values are arithmetical averages for the 1972/73 and 1973/74 crops.)

The gain of 0·7 in reduced boiling house recovery at Khoski is admittedly not convincing *per se* but, in view of the fact that the gain has been obtained while the whole reduced mill extraction is as much as 2·4 points higher than that for the average of the DCDS factories, there is ground for considering it to be significant. It should also be mentioned that a whole reduced extraction of 95·8% at Khoski is a record for Pakistan and is equal to the figures obtained in leading sugar countries such as Australia, Mauritius and South Africa.

A most significant observation is the somewhat higher loss of sugar in final molasses for the DCDS

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[1] *Paper presented to the Pakistan Society of Sugar Technologists*, 1964.

Table I

	Khoski	*Average of 4 DCDS factories*
Pol % cane	11·89	11·96
Fibre % cane	12·66	13·74
Whole reduced extraction (Mittal)	95·8	93·4
Mixed juice apparent purity	77·8	77·0
Final molasses apparent purity	32·9	39·6
Sucrose % commercial sugar (approx.)	99·9	99·6
Actual boiling-house recovery (sucrose/pol)	85·8	84·0
Reduced boiling-house recovery (sucrose/pol)	91·2	90·5
Sucrose bagged % cane	9·75	9·30
Whole reduced overall recovery (sucrose/pol)	87·4	84·6
Total losses % cane (sucrose/pol)	2·14	2·66
Final molasses at 85° Brix % cane	5·22	4·64
Pol lost in final molasses % pol in juice	12·87	14·05

factories in spite of the greater clarification effect on the cane juice. That this is due largely to the destruction of reducing sugars is demonstrated by the analyses of two comparable samples of final molasses taken on the same day, as given in Table II.

Table II

	Khoski	*DCDS*
Sucrose % solids	45·02	52·02
Reducing sugars % solids	18·27	10·91
Ash % solids	23·74	23·11

The uniformity of the soil-plant-climate complex and cultural practices throughout the area supplying cane to these factories in the Lower Sind is well known. Consequently the low final molasses purity attained at Khoski is almost wholly due to the different process of sugar manufacture adopted there. In 1964 D'HOTMAN had observed even lower reducing sugars and higher ash in the final molasses from DCDS factories and had predicted[1] an important drop in final molasses purity on adoption of the sulpho-defecation-remelt process.

The sugar produced at Khoski is also of greatly superior quality and keeps well on storage; it is of the standard required for pharmaceutical preparations, for fruit canning and for the production of beverages. Its characteristics are set out in Table III with comparative data for plantation white sugar produced by the DCDS process, the samples analysed having been taken the same day.

Table III

	Khoski	*DCDS*
Reducing sugars %	0·001	0·027
Ash %	0·019	0·260
Sucrose % (calculated)	99·946	99·373
SO_2 ppm	10	26
Colour, ICUMSA units	23	67
Moisture %	0·01	0·02

The very high ash content of the DCDS sugar is of the order of that found by D'HOTMAN in 1964[1], viz. 0·3% in the Lower Sind and generally higher than 0·2% in the Punjab.

By far the predominant advantage of the defecation-remelt process over the DCDS method lies in the important saving in manufacturing costs, especially for imported coke. In Tables IV and V are given materials consumption and labour cost for Khoski (average of the 1972/73 and 1973/74 crops) and the average of the 15 DCDS factories over the same period, for the crushing of 3000 t.c.d. over a 147-day crop. The figures are based on locally-produced lime, limestone, sulphur and filter cloth and imported polyelectrolyte and coke.

The tables demonstrate an impressive sum saved at Khoski, but there are several other items of economic importance which should be considered. First, as shown in Table I, Khoski produces additional final molasses amounting to more than 2500 tons which has a value, at current world prices, of more than one million rupees.

Second, the soils in Pakistan are generally calcareous and alkaline; since the filter cake from the DCDS process is also alkaline it is not advisable to use it as a fertilizer. By contrast, the cake from the defecation-remelt process, even with carbonatation of the melt, is acidic and contains only a small amount of calcium, so that it is suitable as a fertilizer for Pakistan soils. In addition, the DCDS filter cake is a soft, slimy material of which 35,000 tons per crop must be disposed of, whereas the defecation-remelt cake is friable and the 13,000 tons/crop may readily be disposed of because of its agronomic value.

Third, the quantity of sulphur used at Khoski is insignificant as compared with that necessary in DCDS factories where, in consequence, an appreciable sum must be spent on replacement of machinery corroded by sulphur dioxide.

Fourth, the defecation-remelt process offers advantage to those factories with distilleries attached for producing ethanol from their final molasses, owing to the preservation of the fermentable reducing sugars which are destroyed in the DCDS process.

On the debit side, the cost of a defecation-remelt plant is about 10% higher than a DCDS factory, and, calculating on reasonably high rates of interest and depreciation for the particular conditions of Pakistan, this extra cost involves a recurring sum of about half a million rupees annually.

Also, owing to the much greater clarification effect of the high lime dosage in the DCDS process, it is possible to run these plants non-stop for a month or longer whereas at Khoski, with the rational installation of a duplicate fourth vessel for the evaporator, a 12-hour shutdown for cleaning has been found necessary after runs of 10 days. On the other hand, the advantage of the DCDS factory is partly diminished by the rather low syrup Brix towards the end of a long run and, in addition, it is customary in Pakistan to shut down for 24 hours or longer for general cleaning after running a month or longer.

Table IV. Materials consumption and cost at Khoski

Material	*% on cane*	*Consumption per crop*	*Price, Rs.*	*Total cost, Rs.*
Lime	0·21	926·47 tons	272/ton	252,000
Sulphur	0·0017	7·5 tons	3495/ton	26,215
Filter cloth		1560 yards	11/yard	17,160
Polyelectrolyte	1 ppm	968 lb	30/lb	29,040
Labour cost				827,460
				1,151,875

Table V. Materials consumption and cost average for 15 DCDS factories

Material	*% on cane*	*Consumption per crop*	*Price, Rs.*	*Total cost, Rs.*
Limestone	3·83	16,882 tons	40/ton	675,280
Hard coke	0·35	1,543 tons	1500/ton	2,314,500
Sulphur	0·018	79·34 tons	3500/ton	277,690
Filter cloth		23,520 yards	11/yard	258,720
Labour cost*				1,098,930
				4,625,120

* Comparative data exclusively from another factory of the Fauji Foundation in Lower Sind.

On the whole, therefore, the difference is not so much to the disfavour of the defecation-remelt process, especially since significant benefits are derived in general maintenance and sanitation where, by law or tradition, factories shut down every week.

Summary and conclusions

The results of Khoski during these past two crops have eliminated the fear of a serious fall in boiling house recovery on changing from the traditional double-carbonatation-sulphitation process used in Pakistan to the defecation-remelt process with carbonatation of the melt (or its phosphatation or sulphitation, for that matter).

The excellent results have been achieved while using a tenth of the lime and sulphur and a fifteenth of the filter cloth of the DCDS process, avoiding the use of imported hard coke and only requiring a small amount of imported polyelectrolyte, at the same time producing a white sugar far superior to DCDS sugar, especially in its keeping quality, producing over 10% more final molasses capable of yielding more alcohol on fermentation, and producing only 13,000 tons per crop of friable acidic filter-cake suitable as fertilizer instead of 35,000 tons of agronomically objectionable, soft, slimy, alkaline and calcareous filter cake. The process offers significant savings in labour cost because of reduced manufacturing personnel requirements, and also gives reduced corrosion of machinery by sulphur dioxide.

As shown in Tables IV and V, the total of these savings plus the value of the extra molasses is about 5 million rupees a year at Khoski, as against less than 1 million to be subtracted for interest and depreciation on the slightly higher capital costs of the plant and the loss of crushing time because of the shorter intervals between shut-downs for cleaning.

For a developing country like Pakistan, the high proportion of foreign exchange in the savings achieved is of particular significance. This applies particularly to savings on the importation of hard coke at escalating prices and on the imported fuel and equipment needed for transporting only a tenth of the limestone used by a DCDS plant. Further, the export of the extra quantity of final molasses produced and of the filter cloth saved can also be a useful source of foreign exchange.

With the possible exception of those factories processing both cane and beet, adoption of the defecation-remelt or similar process in place of DCDS is a step forward in the development of the Pakistan sugar industry and it is to the authors' deep satisfaction that, not only have the Pakistan Authorities decided to continue in this direction regarding future new sugar factories, but also another DCDS plant in the Punjab is changing over to the defecation-remelt process. A useful adjunct to a general changeover would be the increase of the capacity of all the factories to permit the reduction of the harvesting season to 4–5 months per year in order to improve the overall quality of the cane being crushed.

Acknowledgement

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Boiling point elevation and superheat in impure cane sugar solutions

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Introduction

THE elevation of boiling point can be used as a measure of the concentration of sugar solutions, both pure and impure. As pointed out by NICOL[1] there are practical difficulties with the measurement in both industrial and laboratory crystallizers, and in particular the effects of superheating of the boiling liquid must be considered if a reasonable estimate is to be made of the concentration or supersaturation of the solution. This paper presents the results of measurements of the boiling point elevation of raw sugar solutions and superheat effects in laboratory crystallizers and an industrial scale pan.

Since the development of HOLVEN's automatic measuring device[2] and the later version of GENIE[3] there has been widespread use of boiling point elevation for the control of supersaturation in both laboratory and industrial pans, particularly in refinery

[1] *I.S.J.*, 1969, **71**, 325–238.
[2] *Ind. Eng. Chem.*, 1942, **34**, (10), 1234–1240.
[3] *I.S.J.*, 1957, **59**, 335–339; 1958, **60**, 10–15, 35–37.

applications, e.g. the modern control systems described by MORI & UMETANI[4] and RUY *et al.*[5] In the raw sugar industry the two measurements generally used for control of the supersaturation are the boiling point elevation and the conductivity of the massecuite. The relative merits of these measurements have been discussed elsewhere[6,7,8] and within the Australian sugar industry conductivity is generally used as a "stand alone" controller, as it is used to exercise some control over both crystal content and supersaturation[6]. Other raw sugar industries make use of the boiling point elevation which has the attraction that the equilibrium boiling point rise is a direct function of the ratio of solute to water in the solution, as is the supersaturation. However, there are certain disadvantages.

A major difficulty is the problem of measuring the equilibrium boiling temperature in a real boiling process. The boiling of a massecuite is a dynamic rate process and hence the temperature of the massecuite must exceed the equilibrium boiling temperature relevant to the absolute pressure applied to the pan vapour space. This excess, or superheat, is a complex function of boiling rate, circulation in the pan, and the transport properties (e.g. viscosity, crystal content, density and the thermal conductivity) of the massecuite. There has been some confusion in the past in the analysis of temperatures within boiling systems and in the selection of average temperatures within equipment, but the work of NICOL[1] shows clearly the temperatures which are relevant to any discussion of superheat, boiling point elevation and concentration. Results are presented in this paper of superheat measurements and their variation with boiling rate, massecuite properties and pan conditions for small- and large-scale crystallizers.

A further difficulty in the use of the boiling point elevation for raw sugar solutions is the manner in which the non-sucrose impurities modify the equilibrium boiling point elevation. The strength of the effect (on a dissolved solids/water basis) can be greater than that of sucrose itself but, provided reliable information on the magnitude of the impurity effect is available, modern control schemes using boiling point elevation[9] can cope with any deviations caused by purity changes. Unfortunately, the data available for cane syrups are limited to those of THIEME[10] who reported boiling point elevations at atmospheric pressure and the values were found to be inappropriate at reduced pressures in tests carried out in a laboratory pan under carefully regulated conditions[11]. To remedy this situation a new set of data was generated using the vapour pressure technique of DUNNING *et al.*[12] which has the advantage that during measurement no bubbling occurs, and hence there is no superheat to confuse the issue and accurate results can be obtained rapidly.

MEASUREMENT OF BOILING POINT ELEVATION

Experimental

The vapour pressure measurements were made in the closed system shown in Fig. 1 comprising a flask A fitted with a magnetic stirrer and connected to a manometer system B and mercury reservoir C. The whole apparatus is immersed in a temperature-controlled water-bath D.

After a molasses sample has been placed in flask A and the flask connected to the apparatus the stirrer is started and the whole apparatus immersed in the water bath. With the mercury in the reservoir the system is evaculated, the mercury admitted to the manometer B by introducing a small amount of air into C and finally tap E is opened for a brief time to distill off some water from the sample and also to purge any air from the system. After equilibration (approximately 60 minutes) the vapour pressure indicated by the manometer B is measured by means of a kathetometer mounted beside the water bath.

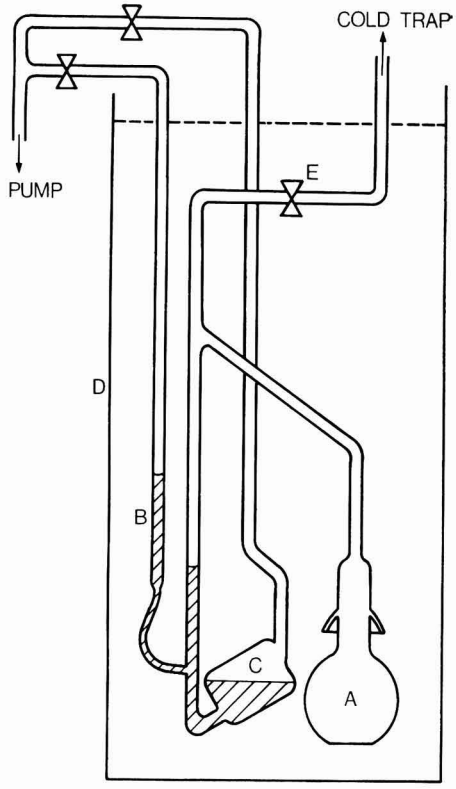

Fig. 1. Apparatus for measurement of vapour pressure

Measurements taken with pure water were consistent with values given in steam tables within 0·05°C. Raw cane sugar solutions of 0·405 and 0·704 true purity (parts sucrose/parts dissolved solids) were used as well as pure sugar solutions. The physical dimensions of the apparatus limited the pressures

[4] *Proc. 13th Congr. ISSCT*, 1968, 1641–1653.
[5] *ibid.*, 1661–1674.
[6] FOSTER & WRIGHT: *Proc. 11th Congr. ISSCT*, 1962, 940–950.
[7] WRIGHT: *Proc. 28th Conf. Queensland Soc. Sugar Cane Tech.*, 1961, 203–210.
[8] BATTERHAM *et al.*: *Proc 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 187–192.
[9] *idem*: *Proc. 15th Congr. ISSCT*, 1974, 1326–1338.
[10] "Studies in Sugar Boiling". (Facts About Sugar, New York), 1928.
[11] BATTERHAM *et al.*: *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 363–368.
[12] *J. Chem. Soc.*, 1951, 2363–2372.

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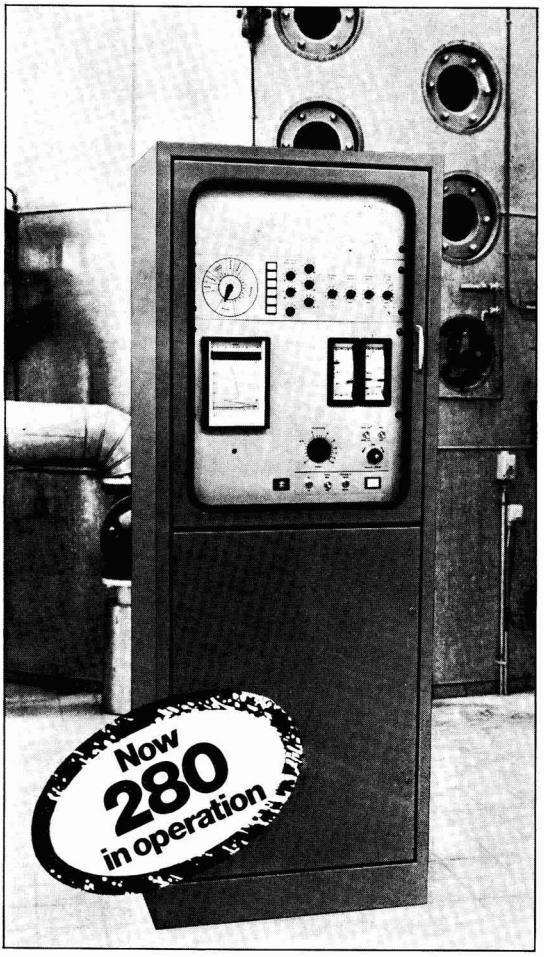

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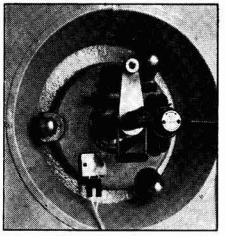
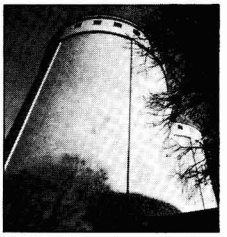


The direct view DDS Pan Microscope.



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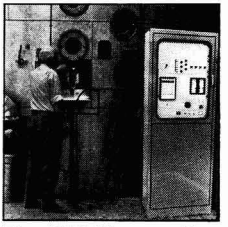

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attainable and hence the range of dissolved solids for each solution to approximately 50–80 parts dissolved solids/100 parts solution. No crystallization or nucleation was permitted.

Results

Pure sugar

The vapour pressure of pure sucrose solutions has been well established by Nicol[13] who showed that at constant concentration there is a linear relationship (the Dühring rule) between the solution temperature (T_s, °C) and the temperature of water vapour (T_w, °C) in equilibrium with the solution at a given pressure. Thus

$$T_w = a\,T_s - b \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where a and b are functions of sucrose concentration. The boiling point elevation $\Delta T = T_s - T_w$ and equation (1) leads to

$$\Delta T = A\,T_w + B \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where A and B are functions of the sucrose concentration and have been established by Nicol for the range of concentrations 60 to 80 g sucrose/100 g solution. The concentrations used in the work exceeded this range so that it was necessary to derive further A and B values from Dunning's original work and re-derive the polynomial expressions for A and B. The results of the curve fitting were

$$A = 0{\cdot}3604 - 2{\cdot}5681Z \times 10^{-2} + 6{\cdot}8488Z^2 \times 10^{-4} - 8{\cdot}0158Z^3 \times 10^{-6} + 3{\cdot}5601Z^4 \times 10^{-8} \quad \ldots (3)$$

(where Z is the concentration in g dissolved solids/100 g solution) with a correlation coefficient of 0·99990 and

$$B = 50{\cdot}84 - 3{\cdot}516Z + 9{\cdot}122Z^2 \times 10^{-2} - 1{\cdot}0492Z^3 \times 10^{-3} + 4{\cdot}611Z^4 \times 10^{-6} \quad \ldots (4)$$

with a correlation coefficient of 0·99994. As shown in Fig. 2 these equations adequately cover the range of Z from 45 to 80. Using equations (3) and (4) Fig. 3 has been constructed which shows the measurements made with the apparatus at various pure sucrose concentrations. The measurements agree with equations (3) and (4) (i.e. the vapour pressure determinations reported by Nicol and Dunning) with a standard error of 0·207°C, thus validating the present apparatus and method.

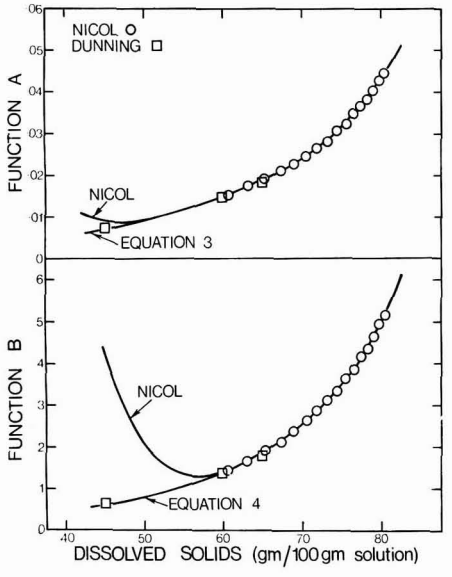

Fig. 2. Experimental values of constants A and B in the Dühring equation and the polynomial expressions of Nicol and Eqns. (3) and (4).

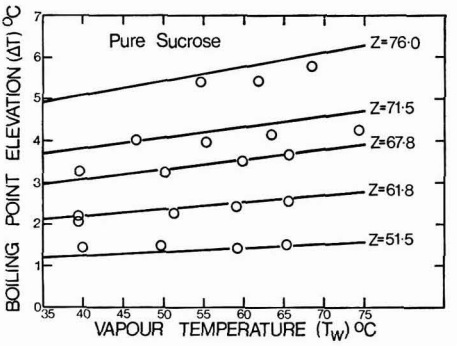

Fig. 3. Boiling point elevation for pure sucrose

Impure sugar

Vapour pressure measurements, converted to boiling point elevations, are presented in Figs. 4 and 5 for molasses purities of 0·405 and 0·704. The results have been correlated by the equation

$$\Delta T = AT_w + B + C \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where A and B are functions of concentration (i.e. total dissolved solids) and are given by equations (3) and (4), and C is a function of purity and concentration, viz.

$$C = -0{\cdot}272 - 2{\cdot}270P + 2{\cdot}542P^2 + 0{\cdot}05311Z(1-P) \quad \ldots\ldots\ldots\ldots\ldots (6)$$

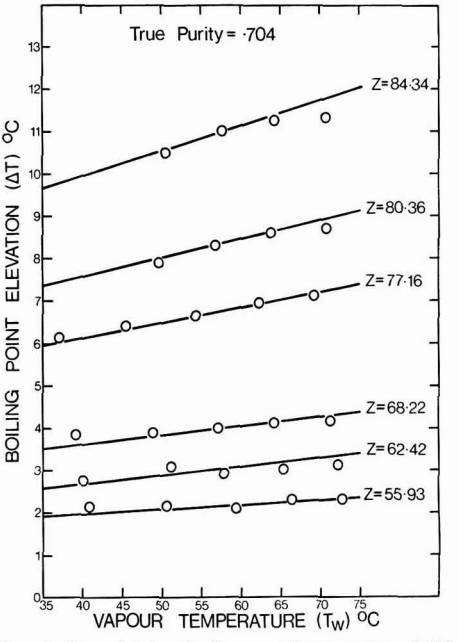

Fig. 4. Boiling point elevation for cane molasses, purity = 0·704

where P is the concentration in g sucrose/g dissolved solids. The constants are such that C reduces to zero when $P = 1$ (i.e. pure sucrose) so that equation (5) may be applied for any purity between 0·4 and 1·0. The measurements agree with the equation with a standard error of 0·251°C, the most significant discrepancies being the low purity results for $Z = 80$ and higher—a factor attributable to the poor stirring of these highly viscous solutions.

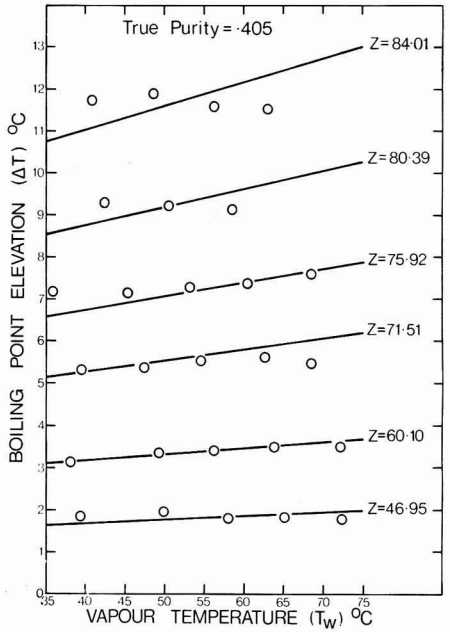

Fig. 5. Boiling point elevation for cane molasses, purity = 0·405

It can be argued that the function A is dependent on purity as well as the dissolved solids. In the present work, the experimental range was chosen so that the results could be used in the control of industrial pans operating under normal conditions. Consequently, the range of T_w was 40°C to 75°C which was insufficient to determine any dependence of the A term (i.e. the slope of the BPE *versus* T_w) on purity.

Comparison with the data of THIEME is difficult, as the values reported are for atmospheric pressure, i.e. $T_w = 100$°C. Assuming that the function C (which is the purity effect on the boiling point elevation) is independent of pressure, as found for the limited range of pressures investigated in this work, then equation (5) can be applied to THIEME's data. This involves calculating values of C in equation (5) from the data for $T_w = 100$°C, then with A, B and C constant, recalculating ΔT for the lower T_w value. The values so obtained for the boiling point elevation are substantially higher than those found in this work, as can be seen in Table I. This discrepancy may be due to the assumption above, differences in molasses type or to the presence of superheat effects in THIEME's data. Such effects are considered in the next section.

Table II represents the smoothed data for the boiling point elevation as a function of dissolved solids, true purity and vapour temperature.

Table I. Comparison of Thieme's data for boiling point rise with the present work

Dissolved solids g/100g solution	*True purity g sucrose/ g dissolved solids*	*Boiling point rise, °C — Thieme 1 atm pressure*	*Thieme extrapolated to Tw = 60°C*	*This work equations (4), (5) and (6) for Tw = 60°C*
80	1·00	9·0	7·3	7·63
70	1·00	5·0	4·1	3·97
60	1·00	3·0	2·4	2·31
50	1·00	2·0	1·6	1·30
80	0·70	11·0	9·3	8·29
70	0·70	6·5	5·5	4·47
60	0·70	4·0	3·4	2·65
50	0·70	2·5	2·1	1·49
80	0·45	13·5	11·8	9·19
70	0·45	8·0	7·0	5·24
60	0·45	5·0	4·4	3·28
50	0·45	3·0	2·6	1·98

Table II. Calculated boiling point elevations of cane sugar solutions

Vapour temp., °C	*Dissolved solids (g/100g solution)*	*True purity (g sucrose/g dissolved solids) — Boiling point elevation, °C* 1·0	0·9	0·8	0·7	0·6	0·5	0·4
40	45	0·93	0·93	0·95	1·03	1·17	1·35	1·59
40	50	1·12	1·13	1·19	1·30	1·46	1·68	1·94
40	60	2·00	2·07	2·18	2·35	2·56	2·83	3·14
40	70	3·49	3·60	3·77	3·99	4·26	4·57	4·94
40	80	6·77	6·93	7·15	7·42	7·75	8·12	8·54
50	45	1·00	1·00	1·02	1·10	1·24	1·42	1·66
50	50	1·21	1·22	1·28	1·39	1·56	1·77	2·03
50	60	2·16	2·22	2·33	2·50	2·71	2·98	3·29
50	70	3·73	3·84	4·01	4·23	4·50	4·82	5·19
50	80	7·20	7·37	7·59	7·86	8·18	8·55	8·97
60	45	1·07	1·07	1·09	1·17	1·31	1·50	1·73
60	50	1·30	1·31	1·37	1·49	1·65	1·86	2·12
60	60	2·31	2·37	2·48	2·65	2·86	3·13	3·44
60	70	3·97	4·08	4·25	4·47	4·74	5·06	5·43
60	80	7·63	7·80	8·02	8·29	8·61	8·98	9·41
70	45	1·14	1·14	1·16	1·25	1·38	1·57	1·81
70	50	1·39	1·40	1·46	1·58	1·74	1·95	2·21
70	60	2·46	2·52	2·63	2·80	3·01	3·28	3·60
70	70	4·21	4·32	4·49	4·71	4·98	5·30	5·67
70	80	8·06	8·23	8·45	8·72	9·05	9·42	9·84
80	45	1·21	1·21	1·23	1·32	1·45	1·64	1·88
80	50	1·49	1·50	1·56	1·67	1·83	2·04	2·31
80	60	2·61	2·67	2·78	2·95	3·16	3·43	3·75
80	70	4·45	4·56	4·73	4·95	5·22	5·54	5·91
80	80	8·50	8·67	8·89	9·16	9·48	9·85	10·27

SUPERHEAT IN PANS

Laboratory crystallizer

Measurements of the liquid superheat necessary to maintain boiling were made in a 17-litre stirred pan shown in Fig. 6. The pan was heated by a calandria (heating surface:volume ratio = 1·2 m^{-1}) through which hot water from tank A was circulated under computer control.

The control algorithm was such that the heat input could be accurately regulated by manipulation of the hot water flow and the water bath temperature. Temperatures within the pan were measured with traversing resistance thermometers or by movable 0·1 cm-diameter mineral-insulated metal-sheathed thermocouples (Fig. 6). The net evaporation was computer-controlled by manipulations of the condensate withdrawal rate, any excess being returned to the pan. The feed rate from tank B was also under computer control with a temperature adjustment C to ensure that feed entered the pan at the correct temperature. The absolute pressure in the pan was controlled within 0·15 mm Hg.

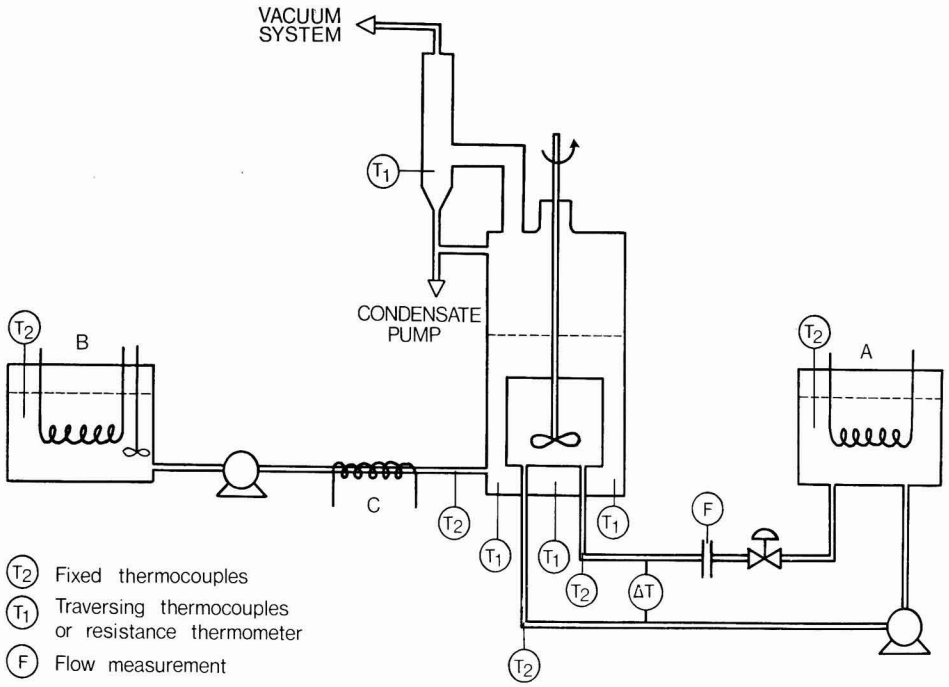

Fig. 6. Laboratory pan

The large temperature gradients observed by NICOL and those responsible for the apparent solubility changes observed by BENNETT & FENTIMAN[14] were not apparent with this apparatus. Under normal operation the maximum difference in temperature between the calandria wall and the fluid at the surface was 8°C (*cf.* the 14·5°C between the bulk and a point 0·5 mm from the heated wall in NICOL's apparatus).

The bulk temperature measured in the apparatus and used in the calculation of superheat was the solubility average temperature for the pan so that saturation values determined in the apparatus for pure sucrose were in complete agreement with the data of CHARLES[15]. (The solubility average temperature has been defined by NICOL[1] as the average temperature at steady state in a crystallizing system as deduced from equilibrium solubility tables.) Superheat is thus the difference between the bulk temperature (the solubility average temperature) and the temperature predicted from the boiling point elevation correlation given earlier.

Superheat was found to vary with the heat input rate, calandria wall temperature, stirrer speed, level and massecuite crystal content and purity. The results are shown in Table III and Fig. 7 and indicate that increasing any factor likely to increase the temperature gradients within the pan (e.g. heating rate, temperature of the heating surface or the level) raises the average superheat in the pan. The increase occurring with an increase in the level is less than

Table III. Variation of superheat in the laboratory pan, effect of single variables

Variable	*Change*	*Effect on superheat*
Heat input rate	3 kW to 1 kW	Reduced by 0·5°C
Stirrer speed	Not investigated	—
Position in pan	2 cm from calandria to surface	Reduced by 0·1°C
Calandria wall temperature—pan temperature	8°C to 4°C	Reduced by 0·5°C

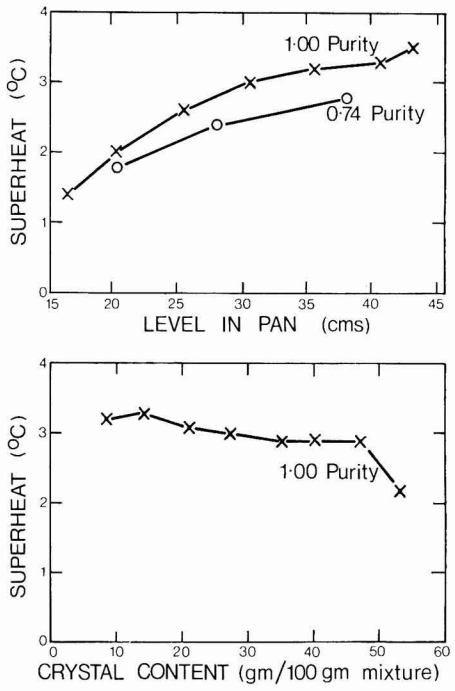

Fig. 7. Variation of superheat in the laboratory pan

that predicted from the rise in hydrostatic head, showing that at the higher levels boiling no longer occurs in the lower portions of the pan.

The effect of crystal content and purity are more difficult to explain; it would appear that increasing the massecuite viscosity reduces the superheat, possibly implying a significant change in the flow pattern or the type of boiling action.

Industrial scale

During the course of some investigations into computer control of an 81-m³ pan[16] (a conventional design of floating calandria pan with a heating surface:volume ratio of 0·54 m^{-1}) extensive measurements were made of the superheat within the liquid. The results of several temperature traverses and many hundreds of static measurements were compatible with the circulation patterns of WRIGHT[17]. Briefly, the temperature rise through the tubes was generally less than 0·6°C, with the rising liquid maintaining its temperature to within 30 cm of the surface where a drop of 1·5°C was noted. The bulk (i.e. solubility average) temperature was usually raised by superheating by about 3·3°C. The water vapour temperatures were computed from absolute pressure measurements to avoid introducing any additional superheat terms. Results could be correlated by

$$SH = 9{\cdot}905 + 0{\cdot}0290L + 3{\cdot}99H/(T_H - T_L) - 1{\cdot}728CC + 0{\cdot}120TP$$

where SH is the superheat (°C), L is the mass in the pan (metric tons of massecuite), H is the steam flow (metric tons/hr^{-1}), T_H is the temperature in the calandria (°C), T_L is the bulk liquid temperature (°C), CC is the crystal content (g crystal/g massecuite), TP is the true purity (g sucrose/100 g dissolved solids).

The standard error of the estimate was 0·20°C. As with the laboratory pan, the major variables were level, heating rate and crystal content, each of which gave similar results to the laboratory investigations.

CONCLUSIONS

Accurate results for the boiling point elevation of cane sugar solutions have been presented. The results have been correlated using a Dühring rule-type of equation with the addition of a suitable term to cover the effect of the impurities.

The correlation has been used to determine the factors affecting liquid superheat under boiling conditions in a laboratory pan and in an industrial-scale pan. The dependence of superheat on liquid level, heating rate, heating surface temperature and crystal content of the massecuite was shown to be similar in the two cases.

Acknowledgements

The vapour pressure experiments were designed by Mr. F. A. SWEET of C.S.I.R.O.

The measurements taken on the 81-m³ pan were made jointly with the Sugar Research Institute, Mackay, whose officers Drs. E. T. WHAYMAN and P. G. WRIGHT contributed valuable material on the variation of the boiling point elevation with pressure.

[13] *I.S.J.*, 1968, **70**, 199–202.
[14] *ibid.*, 9–13, 36–39.
[15] *ibid.*, 1960, **62**, 126–131.
[16] BATTERHAM *et al.*: *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 71–80.
[17] *Proc. 33rd Conf. Queensland Soc. Sugar Cane Tech.*, 1966, 179–184.

Electronic data processing at the Sugar Research Institute

THE installation in 1975 of a new $A250,000 computer at the Sugar Research Institute at Mackay, Queensland, has been announced, which doubles the capacity of the existing electronic data processing facilities. The new computer, an IBM System/370 Model 115, is intended to process data associated with development of a computer model of a complete sugar factory; feasibility studies for this project were carried out jointly with CSR Ltd., the Bureau of Sugar Experiment Stations and the IBM Systems Development Institute in Canberra. The system will also make more computing time available to the Institute's 26 member factories for cane transport scheduling, farm plotting and specific engineering and chemical plant studies required for the most economical approach to factory expansion. The Institute's existing IBM 1130 computer and two new IMB 2741 interactive keyboard computer terminals will be connected to the Model 115 and thus permit up to four factories to use the combined system simultaneously, so that important savings in time can be made at peak demand.

Dr. C. R. MURRY, Head of Systems Research at the SRI, is of the opinion that there will be accelerated demand for computing from sugar research staff and member factories; the problem is to apportion the computer facilities fairly to all member factories whether they are within the Mackay district or situated some distance from the Institute. He regards the Model 115 as a multi-user system with the capacity to investigate "remote" process control applications in sugar factories. Planned applications include investigation of large-scale management aids for the industry, faster execution of optimization and mathematical programming studies and investigation of inter-processor interfaces. Dr. MURRY points to sugar factory modelling as the catalyst which launched the 115 project, and indicates that success so far achieved in cane mill simulation has already given Australian factories a five-year lead in cane milling efficiency, although much remains to be done to develop an "average"-performance throughput model of a cane sugar factory based on physical specifications of the individual process units.

There are two distinct parts of the sugar factory modelling project in which the development of a general-purpose programme for the solution of simultaneous, non-linear equations has been undertaken as one section, while detailed models of individual process blocks have been constructed in the second part of the project. Success has been achieved in simulation of the evaporator station, including vapour bleeding and juice heating. Work is in progress on boiler plant simulation in which the boiler is modelled as a combustion chamber and a series of heat exchangers representing the evaporator, economiser, superheater and air preheater. Some work has been undertaken on development of an "average" model of the boiling process by using a vacuum pan model to estimate process parameters and a pseudo-steady-state model of the station to estimate throughput and performance.

Sugar cane agriculture

Response of sugar cane to foliar fertilization with nitrogen, phosphorus and potash. R. G. SINGH. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), A91–A101.—N-P-K fertilization experiments during 1953–74 and 1967–70 at two cane research stations in India are discussed; foliar and soil application were practised, and results are tabulated.

* * *

Helminthosporoside, a host-specific toxin from *Helminthosporium sacchari*. G. W. STEINER and G. A. STROBEL. *J. Biol. Chem.*, 1971, **246**, 4350–4357. Details are given of a procedure for isolation and purification of a host-specific toxin, helminthosporoside, from the pathogen *H. sacchari*, causal agent of eye spot. Cane leaves inoculated with the pure toxin exhibited symptoms which were identical with those produced by the fungus, viz. the occurrence of a light green area which eventually developed into a reddish-brown stripe. The toxin showed no loss of biological activity during 57 days (after which the test was terminated) when stored at —15°C or room temperature under vacuum or covered with a film of paraffin. Properties and structure of the toxin were determined by paper, gas and thin-layer chromatography, spectrophotometry and nuclear magnetic resonance; these indicated that the toxin is a glycoside containing a cyclopropane ring having a hydroxyl function. An empirical formula $C_9H_{15}O_7$ is suggested, and 2-hydroxycyclopropyl-α-D-galactopyranoside proposed as the structure. The presence of cyclopropane rings in other naturally-occurring compounds which are also toxins is mentioned.

* * *

The helminthosporoside-binding protein of sugar cane. Its properties and relationship to susceptibility to the eye spot disease. R. A. STROBEL. *J. Biol. Chem.*, 1973, **248**, 1321–1328.—Investigations of the mechanism of cane susceptibility and resistance to eye spot showed that susceptible clones passess a membrane protein that binds helminthosporoside, the host-specific toxin produced by the pathogen (see preceding abstract), while membrane preparations from resistant cane do not have the binding activity, which is of intermediate strength in slightly susceptible cane. The protein has a molecular weight of about 49,000 (as determined by gel electrophoresis) or 45,000 (as found by gel filtration) and consists of four sub-units with at least two binding sites for helminthosporoside. The amino-acid composition and iso-electric point have been established.

* * *

Biochemical basis of the resistance of sugar cane to eye spot disease. G. A. STROBEL. *Proc. Nat. Acad. Sci.*, 1973, **70**, 1693–1696.—The toxin-binding protein (see preceding abstract) from eye spot-susceptible cane was compared with that from a resistant cane. The protein from the resistant cane did not bind the toxin unless first treated with mild detergent. The two proteins were found to be antigenically identical, have the same molecular weight and each contains four sub-units, but differ slightly in electrophoretic mobility and in the number of residues of lysine, serine, glutamic acid and glycine (a unit difference in each case).

* * *

Micronutrient composition of sugar cane sheaths as affected by age. J. E. BOWEN. *Trop. Agric.* (Tinidad), 1975, **52**, 131–137.—In studies of the effect of plant age on accumulation of micronutrients in leaf sheaths of six cane varieties, calcium, magnesium and manganese were found to be negatively correlated with age (the decrease in Mn levels with age not being clearly delineated), while copper and boron accumulation was unaffected by age, and zinc accumulation was independent of age in all but one variety. However, the results should not be regarded as conclusive, since other factors such as tissue moisture content and levels of other nutrients in the plant may also affect micronutrient accumulation.

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The taxonomic significance of leaf flavonoids in *Saccharum* and related genera. C. A. WILLIAMS and J. B. HARBORNE. *Phytochem.*, 1974, **12**, 1141–1149. A survey of 120 plants of *Saccharum* (including F_1 hybrids and commercial cane varieties) and related genera showed that certain leaf flavonoids were useful systematic markers, some being present in some of the genera and *Saccharum* species studied but not in others, while other flavonoids were found in all genera and *Saccharum* species. Some *Saccharum* F_1 hybrids inherited parental leaf flavonoids. It is suggested that some chromosomal disturbance occurs in hybrids and affects the enzymes controlling flavone hydroxylation. The evidence supports the view that cultivated sugar canes originated from *S. robustum*.

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The possible resuscitation of older (cane) varieties, and some notes on newer varieties. P. G. C. BRETT. *S. African Sugar J.*, 1975, **59**, 51–53.—It is pointed out that there are at present 22 cane varieties which may be grown legally on a commercial basis in South Africa, but that some of these have virtually disappeared from cultivation. The varieties are listed, as are five varieties which were excluded from the list of released varieties when legislation was revised in 1964. Properties of the older varieties are given, and the performances of varieties in regions for which they were not selected are indicated. Reasons for the decline of a variety and the possible benefits of re-introducing certain older varieties examined. Brief notes are also given on varieties N 52/219, J 59/3 (bred in Cuba) and N 64/38 which may qualify for release.

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Army worm outbreaks in the cane belt. A. J. M. CARNEGIE. *S. African Sugar J.*, 1975, **59**, 54–55. Reports have been received from many parts of

northern Natal of severe but localized attacks by the army worm *Spodoptera exempta*. It is pointed out that this pest usually attacks cane only when an alternative food source (such as maize, rice and grass) is not available, and the caterpillars therefore show preference for young plant cane, so that crop losses are unlikely to be very severe—once the foliage is eaten the caterpillars move on, and under good growing conditions the only ill effect is perhaps a set-back of one or two weeks' growth. The life cycle of the pest and possible control measures are described. Most available insecticides are effective against the army worm.

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Studies on intercropping of rabi crops in autumn-planted sugar cane. K. S. RATHI, H. N. TRIPATHI and D. SINGH. *Indian Sugar*, 1974, **24**, 701–705.—Cane intercropping trials in Uttar Pradesh are reported in which the effects of various crops on cane yield were determined as well as the yields of the crops themselves and the income derived.

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A new pathogenic strain of *Glomerella tucumanensis* (Speg.) in Uttar Pradesh. L. N. PANDEY and R. SAKAL. *Indian Sugar*, 1974, **24**, 707–709.—The morphology of a new strain of the red rot pathogen, R-185, is compared with that of other strains and its comparative virulence relative to a number of cane varieties indicated.

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Studies on crop estimation and forecasting yield and quality of sugar cane. II. Optimum time of nitrogen estimation for use in forecasting. U. S. SINGH and L. SINGH. *Sugar News* (India), 1974, **6**, (8), 5–9.—Tests in a randomized block design with eight different dates of N application showed that the average N content of the leaf blade in September had a high positive correlation with cane yield and a high negative correlation with cane sugar content and juice purity, so that it could be used to predict the above-mentioned factors in place of the average leaf N content for the period May-December as suggested earlier.

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Pre-harvest spray with 2,4-D for control of ripening in sugar cane. R. S. SACHAN. *Sugar News* (*India*), 1974, **6**, (8), 11–12.—Preliminary tests with two cane varieties sprayed with a 0·25% solution of 2,4-D as sodium salt showed that the treatment increased the pol content and juice purity (as determined 1 and 2 weeks after application) but that the effects were more pronounced in one variety than in the other.

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Fertility status of soils of Shahjahanpur, Pilbhit and Lakhimpur districts in U.P. B. SINGH and A. C. SHUKLA. *Sugar News* (India), 1974, **6**, (8), 13–17. The N, P and K contents in soils of the districts mentioned in the title were determined and the results are discussed.

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Influence of climatic conditions on the incidence of smut on sugar cane. M. B. BACHCHHAV, A. O. PATIL, S. J. RANADIVE and S. S. LAMBHATE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A7–A9.—Investigations of smut incidence on 10 cane varieties showed that outbreaks were most severe at high temperatures accompanied by low relative humidity and absence of rain.

A note on unusual sugar cane smut symptoms. M. B. BACHCHHAV, A. O. PATIL and S. J. RANADIVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A10.—Unusual symptoms of smut observed on Co 740 and Co 419 are described as (*i*) multiple buds, (*ii*) adventitious leaves, (*iii*) stalk distortion, (*iv*) galls and outgrowth, and (*v*) formation of whips beneath leaf sheaths.

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Studies on promising sugar cane varieties with respect to yield and quality. M. LALL and P. N. CHOUDHARY. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A11–A15.—Cane varietal trials conducted at Coimbatore are reported. Co 6304 has proved an impressive variety from both the agronomic and processing standpoints.

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The conservation of nitrogen with the use of slow-release fertilizer, urea acetaldehyde, for sugar cane. R. R. PANJE, A. S. HADIMANI and R. S. SACHAN. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A16–A22.—Leaching tests showed that only slightly over half as much ammonia- and nitrate-N was lost from soil treated with urea acetaldehyde as from soil to which urea had been applied. The greater loss from urea-treated soil was still apparent after a number of irrigations, while tillering and cane dry weight was noticeably greater with urea acetaldehyde.

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Sugar cane smut—a problem of Maharashtra State. A. O. PATIL, M. B. BACHCHHAV and S. J. RANADIVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A23–A25.—The causal agent of cane smut, how the disease occurs, the pattern of outbreak in Maharashtra, extent of losses and possible control measures are discussed.

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Varietal resistance to sugar cane rust in Maharashtra. A. O. PATIL, M. B. BACHCHHAV and S. J. RANADIVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A26–A28.—Details are given of screening tests, in which 25 out of 32 cane varieties tested proved resistant to the disease.

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Investigation into the virus concentration of grassy shoot disease in different buds of affected and apparently healthy canes. A. O. PATIL, M. B. BACHCHHAV and S. J. RANADIVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A29–A31.—Single-bud setts from both infected and apparently healthy seed cane were planted and the percentage incidence of the disease in the buds on the growing cane observed at monthly intervals. Data indicated that cane from both infected and apparently healthy sources became infected and that the greatest infection occurred in the bottom buds and tended to decrease towards the top (out of 20 buds).

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A note on the effect of different levels of potash application on sugar cane yield and sugar recovery. R. M. RAUT, V. G. SATRALKAR and R. A. GHULE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), A32–A33.—While 60 kg K_2O per ha increased the cane pol content compared with untreated cane, addition of 120 and 180 kg K_2O per ha had no greater significant advantage.

Varietal tolerance of sugar cane to "Lasso". M. LALL and P. N. CHOUDHARY. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A34–A40.—Trials with a number of cane varieties showed that application of 50% "Lasso" herbicide at 10 and 2·5 kg a.i. per ha had no detrimental effect, except in the cane of one variety (Co 62174), while in some cases the number of shoots when the higher dose was applied was significantly greater 160 days after planting than in untreated cane growing in a weeded field. The herbicide also increased plant height with some varieties, and generally the cane with "Lasso" treatment was more vigorous (particularly at the higher dosage) than the controls.

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White grub (*Holotrichia serrata* F.), a pest of sugar cane in Maharashtra State. P. R. MOHOLKAR, S. J. RANADIVE and A. G. WANI. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A53–A59. The life cycle of this pest and the nature of the damage it causes to cane are described, and trials with insecticides reported. Effective control of the grub was obtained with two separate applications of "Heptachlor" or BHC (one dose at planting and the second 2 months later), while control of the adults, which at night feed on leaves of the neem tree, was obtained with BHC, "Carbaryl" or ethyl "Parathion".

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Comparative efficacy of some of the insecticides against early shoot borer (*Chilo zonellus* Swin.) in sugar cane. P. R. MOHOLKAR, S. J. RANADIVE and A. G. WANI. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A60–A65.—While in one experiment foliar application of "Endrin", "Phosphamidon", BHC or "Endosulfan" gave effective control of this cane pest, soil application of gamma-BHC at the time of planting was found in another set of experiments to be most effective in reducing the percentage of dead hearts and gave a maximum cane yield with maximum millable stalk population. However, results of the second experiment need confirmation by further tests.

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A note on chemical weed control. Preliminary report. L. N. KOLHE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A66–A70.—In comparative trials, 2,4-D at 2 kg a.i. per ha applied 5 and 25 days after cane planting gave greatest reduction in weeds (expressed as fresh green weight), followed by "Atrazine" applied at 2·5 kg a.i. per ha as a pre-emergence herbicide 4 days after planting, "Ansar 529" + 2,4-D applied at the rate of 5 litres and 1 kg a.i. per ha, respectively, 20 and 28 days after planting as a post-emergence combination, and finally hand weeding, all treatments giving a greater number of canes 10½ months after planting than did absence of treatment. However, in terms of the number of canes, the best results were obtained with "Ansar 529" + 2,4-D, but this was not effective against a wide spectrum of weeds.

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Companion cropping of sugar beet and vegetables in sugar cane and its economics. B. V. MOHITE, S. N. SHINDE and S. J. RANADIVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A71–A81. While cane yield and sugar content were adversely affected by intercropping with onion, knolkhol, cabbage or sugar beet, the net profit obtainable from the cane plus intercrop was greater than from cane alone, except where the sugar beet was grown on both sides of the ridge. The highest return was from cane plus cabbage.

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Work done with *Azotobacter* on sugar cane at Sugarcane Research Station, Padegaon. J. S. JADHAV, S. S. ANDHALE and S. J. RANADIVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A82–A84. Of various methods used to apply *Azotobacter* culture to cane, the most suitable as regards increase in cane yield over the untreated control was smearing of the culture on the root band. This gave a cane yield of 103·15 metric tons per ha (the average of 3 seasons) compared with 71·48 tons per ha for the control.

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Is chemical weed control paying in Maharashtra State? B. V. MOHITE, L. B. SABNIS and S. J. RANADIVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A85–A92.—Comparative trials with pre- and post-emergence herbicides are reported. As regards net profit from the various treatments, none were as good as hand weeding. However, better results than non-treatment were achieved with 3·75 kg 2,4-D per ha after emergence or trash mulching, while 2,4-D plus "Karmex" ("Diuron") or "Simazine" were effective in controlling weeds and giving reasonable monetary returns when labour is short.

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Concluding studies on weed control in sugar cane. M. V. SANT and A. P. JADHAV. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A93–A101.—Trials with ammonium sulphamate and "Asulox 40" on its own or combined with "Actril D" in pre- or post-emergence application showed that none of these treatments was better than 2·5 kg a.i. "Atrazine" per ha applied as pre-emergence herbicide. Delayed spraying with "Atrazine" was effective in controlling dicotyledons, which require more time to germinate than do monocotyledons.

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Feeler trial with cane ripeners for inducing early maturity. M. V. SANT. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A102–A108. "Polaris" induced early maturity in cane of variety Co 740 and increased juice Brix and sucrose content significantly 2 months after application compared with the untreated control and was more effective than "Cycocel".

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Twelve years of agronomic research in Réunion. R. DADANT. *Agron. Trop.*, 1974, **29**, 1159–1192.—The work of IRAT (Institut de Recherches Agronomiques Tropicales) in Réunion over the last 12 years is summarized. It includes information on sugar cane fertilization studies over a 10-year period, from which N, P and K recommendations have now been established for both plant and ratoon cane according to location and altitude. Tests on hot water treatment of setts to combat chlorotic streak are discussed; in one location the treatment of diseased setts was effective in increasing the subsequent sugar yield, while in another the yield of treated healthy setts was reduced whereas that of treated diseased setts was increased; the treatment is however regarded as uneconomical. While R 526 has proved a high-yielding variety, its fertilizer and water requirements are also high. Whereas

rainfall averages about 1000 mm per year, the cane uses 1500 mm a year, and the effective rainfall is 500–600, so that 900-1000 mm needs to be made up by irrigation. However, the costs of irrigation are covered by 15–20 metric tons of cane per ha, and the irrigation can raise the yield by 30–101 tons per ha. Among the pests for which biological control is being studied are various cane borers, and results of investigations are summarized. (See also *I.S.J.*, 1975, **77**, 147.

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Isolation of protoplasts from young sugar cane leaves. W. H. CHEN and M. C. LIU. *Rpt. Taiwan Sugar Research Inst.*, 1974, (64), 1–10.—A combination of two commercial enzymes were used to release protoplasts from the young leaves of *Saccharum* species and F 160 cane. Significant differences were found in the numbers of protoplasts released, *S. robustum* tending to give the highest yield. Two kinds of protoplast were found to be morphologically distinct, one having a dense cytoplasm and the other having a larger vacuole. The individual enzymes on their own failed to release protoplasts, and increase in enzyme concentration was of little benefit compared with the results obtained with 1·0% "Onozuka R-10" + 0·5% "Macerozyme R-10". Maximum yield was obtained after 2 hours; a longer period than this was accompanied by a fall in yield. Protoplast release was closely related to the meristematic conditions of the leaves, while mature leaves yielded no protoplasts at all. Spontaneous fusion of protoplasts was occasionally observed during isolation.

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Compaction studies on mechanized cane field soils. I. Influence of soil texture and moisture content on soil compaction. S. J. YANG. *Rpt. Taiwan Sugar Research Inst.*, 1974, (64), 11–22.—Laboratory studies of the influence of soil texture and moisture content on soil compaction are reported, in which seven soils of different texture were treated to vary their moisture contents and then compressed with a hydraulic press under various loads. Generally, soil compaction (expressed as dry bulk density) increased with moisture content and applied pressure, the pressure required to produce a given bulk density decreasing exponentially with moisture content, although this trend was more pronounced with medium to fine textured soils. It is concluded that soil compaction caused by machinery is not serious in coarse-textured soils but has a very detrimental effect on the other soils under wet conditions.

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Incidence, colour appearance and index of ratoon stunting disease in Taiwan sugar cane varieties and clones. W. S. TENG and L. S. LEU. *Rpt. Taiwan Sugar Research Inst.*, 1974, (64), 23–36.—Investigations on RSD incidence in commercial Taiwan cane varieties and N:Co 310 are reported. N:Co 310 and one Taiwan variety showed highest incidence. Generally, incidence of the disease increased with the time since the variety was first raised. The colour of vascular bundles in the nodal region, which varied between varieties but was constant for any one variety, was unrelated to RSD incidence and could affect diagnosis accuracy. Values of the disease index, referring to the number of discoloured commas appearing in the vascular bundles, are given. Regardless of variety and time of planting, the index was higher in the 1st–10th nodes and most conspicuous in the 3rd–8th nodes above ground level.

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Control of the sugar cane white grub, *Alissonotum impressicolle*, **and wireworm,** *Melanotus tamsuyensis* **with non-persistent insecticides.** S. A. HSIEH. *Rpt. Taiwan Sugar Research Inst.*, 1974, (64), 37–47.—In trials, "Terracur P" applied in the furrow before planting of autumn cane at the rate of 3·0 kg.ha^{-1} gave best control of both pests mentioned, and increased cane yield by 11·9–14·5% and 12·8–24% compared with untreated controls and cane treated with 2·5% "Heptachlor" dust. In ratoon cane, application of 1·5 kg.ha^{-1} "Furadan" to a depth of 15 cm on both sides of the stools after harvesting of the plant cane effectively controlled wireworm infestation and increased cane yield by 23·4% and 10·6% compared with the untreated and "Heptachlor"-treated cane. "Terracur P" and "PP 211", both at 2 kg.ha^{-1}, were also effective against wireworm, increasing cane yield by 18·1–18·5% compared with the untreated plots and by 4·3–5·7% compared with "Heptachlor"-treated plots. However no obvious yield increases were obtained by applying the insecticides in ratoon cane to control white grub.

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Ecological study on the sugar cane cicada, *Mogannia hebes* **Walker. I. The relationship between the nymphal density and soil characteristics.** B. H. JIANG and R. S. HWANG. *Rpt. Taiwan Sugar Research Inst.*, 1974, (64), 49–57.—In investigations, the greatest number of nymphs of *M. hebes* was found in soil having a pH of 6·5–7·6, and positive correlation was established between the numbers per stool of ratoon cane and soil organic matter and clay contents. However, this relationship was not observed at an organic matter content greater than 1·1%. A negative correlation was found between the numbers and soil sand content, while silt content appeared to have no significant effect on the numbers. Germination of the cane was found to be severely retarded when more than 10 nymphs were found on the root part of the stool.

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Effective rainfall on sugar cane fields. Y. CHU. *Taiwan Sugar*, 1974, **21**, 213–216.—Investigations of the relationship between rainfall and effective rainfall, i.e. that proportion which is consumed by the cane and stored in the root zone for future use, made use of a rain simulation system. The results showed that on sandy soil, up to 105 mm of rain can fall per hour without any run-off; however, since in Taiwan cane-growing areas the normal rainfall does not exceed 15 mm per hour, it is concluded that rainfall intensity does not normally have any appreciable influence on the effective rainfall. Nevertheless, the studies did yield a relationship between rainfall and effective rainfall which is valid for different root zone depths.

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Eldana **borer on the increase.** ANON. *S. African Sugar J.*, 1975, **59**, 105.—*Eldana saccharina* Walker is not a significant pest of sugar cane in Zululand, it is stated, but all commercial cane varieties, particularly the relatively soft N 55/805, appear to be susceptible, and a really severe infestation can mean the complete loss of a crop. A number of measures can be adopted to control the pest, but it is admitted that even where the recommendations have been followed, infestation

of ratoons has occurred and heavy attacks have been reported in plant cane, even on virgin land. While the use of persistent chemicals is discouraged, trials are to be conducted at the Experiment Station with various insecticides to determine at which stage of its life cycle the pest may best be attacked and whether a crop would enjoy any short- or long-term benefits from such treatment. Studies to find promising parasites will also be conducted, although it is pointed out that *E. saccharina* is less readily parasitized than other similar borer species, probably because it is tougher and because it can produce a repellent alkaline fluid when attacked, although attacks by certain parasites in other parts of Africa have been reported. The chances of controlling the borer are increased if its presence is discovered at an early stage. Details are given of the borer's life cycle.

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A method of cutting untrashed cane plants. H. L. BOYLE. *Cane Growers' Quarterly Bull.*, 1975, **38,** 78–79.—Details are given of an arrangement devised by a Queensland cane farmer whereby his whole-stalk harvester can deliver cane stalks directly onto a planter trailer. Before the cane is cut, trash is partially stripped from it to facilitate feeding of the planter. A team of six men is required with the new system compared with ten men operating a conventional planting unit.

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Vine weeds—species and control measures. L. K. IZATT. *Cane Growers' Quarterly Bull.*, 1975, **38,** 80–82.—The 10 major species of vine found in Queensland are listed, the areas in which they occur being given as well as their behaviour and sometimes a brief description of the weed. Spread of vines is attributed to their prolific seeding capacity, the standing-over of cane, and the spread of seeds by agricultural machinery. The most effective method of control is good cultivation during the fallow (not recommended along river banks or on regularly flooded alluvial plains) and during seed bed preparation, chemicals then being applied to maintain control. 2,4-D at 1100 g a.i. per ha and 2,4,5-T at 600 $g.ha^{-1}$ are the most effective herbicides, and together will kill all except *Passiflora foetida*, of which only the top growth is killed. Since some cane varieties are very susceptible to hormone damage, spraying is not recommended during fast-growing periods and, where possible, the rate of application of 2,4-D should be reduced to 600 $g.ha^{-1}$.

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Poor quality irrigation water—its effects and management. W. A. C. WEBB. *Cane Growers' Quarterly Bull.*, 1975, **38,** 83–86.—The detrimental effect of irrigation water salinity on cane and soil is discussed. The value of water testing is emphasized, and possible remedial measures which can be adopted where salt accumulation in the soil reaches problem levels are described. By far the most effective method, as stated by the author, is to find an alternative source of higher quality water.

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Weedkiller application requires caution. G. R. CULLEN. *Cane Growers' Quarterly Bull.*, 1975, **38,** 87–88.—The damage to other crops that can be caused by spray and vapour drift when cane fields are being treated (particularly with 2,4-D and 2,4,5-T) is discussed, and steps that can be taken to ensure that drift does not occur are described.

To protect your cane—keep out the pigs. R. E. KERKWYK. *Cane Growers' Quarterly Bull.*, 1975, **38,** 93–94. The incidence of pig damage to cane crops in Queensland is on the increase, it is pointed out; so far, efforts to control wild pigs have failed, but the author suggests one method which does not seem to have been widely tested, viz. the electrified fence. He gives advice on the erection and maintenance of the electric fence and its power source. Three growers in one area who have installed such fences have not reported any pig damage during efficient operation of the fence, despite the fact that the farms are in an area of severe pig damage bordered by dense forest or open scrub on gully-eroded ground.

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Q 90—a progress report. T. G. WILLCOX. *Cane Growers' Quarterly Bull.*, 1975, **38,** 95–96.—A description is given of Q 90 cane variety. First approved for mill areas in the very north of Queensland in 1970, by 1974 it exceeded the combined total of cane of all other varieties and is expected to gain in popularity during the next few years.

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Leaf scald disease—Proclamation No. 40. What is the connexion? A. W. FORD. *Cane Growers' Quarterly Bull.*, 1975, **38,** 97–98.—Proclamation No. 40 issued under the Sugar Experiment Stations Act makes all eight mill areas in the Mackay and Prosperpine districts of Queensland into a single quarantine district and sets limitations on the planting and growing of cane under certain disease situations which may exist within varieties or on farms. Paragraphs 1–6 of the Proclamation, which deal with leaf scald disease, are reproduced and explained.

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Disease resistance testing. P. E. LEDGER. *Cane Growers' Quarterly Bull.*, 1975, **38,** 99–103.—The procedures used by the Pathology Division of the Bureau of Sugar Experiment Stations in Queensland to test cane seedlings for resistance to leaf scald, Fiji disease, red rot, mosaic, yellow spot and striate mosaic are described.

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Fauna Conservation Act 1974—how it affects cane farmers. ANON. *Cane Growers' Quarterly Bull.*, 1975, **38,** 103.—Under this act, it is illegal to kill Australian native fauna except where they are causing serious damage to cane crops, when permits can be obtained for so doing. Among native fauna that are cane pests are coots, white cockatoos, wallabies and rats.

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Parallel contour farming—the compromise. P. J. NIELSEN. *Cane Growers' Quarterly Bull.*, 1975, **38,** 104–107.—The parallel contour bank system, which is a compromise between the old system of short rows with tight curves (unsuitable for modern mechanized cane agriculture) and long, uninterrupted straight rows, is described and the advantages of the gently curving banks coupled with grassed surface waterways are discussed.

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Leafhopper control experiments. ANON. *Australian Sugar J.*, 1974, **66,** 437.—Reference is made to experiments at the Bureau of Sugar Experiment Stations on biological control of the leafhopper with *Tytthus*

mundulus (which feeds exclusively on the eggs of the leafhopper) and a minute, wingless wasp (Dryinidae) which lays an egg on the leafhopper nymph; the larva from the egg embeds itself in the leafhopper's body wall. Both egg predator and parasite were observed to be well established after release and breeding throughout two cane fields in the Fairymead area. This method, plus the growing of suitable cane varieties, is expected to make a significant contribution to the control of Fiji disease.

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Locusts threat to cane. ANON. *Australian Sugar J.*, 1974, **66**, 437.—Certain coastal areas of central Queensland have become heavily infested with spur-throated locusts which pose a threat to the cane crops. While nothing can be done to control the adult locusts which are flying, growers are recommended to keep a close watch on obvious egg beds and spray with chemicals as soon as the wingless locusts emerge. Otherwise, once they have depleted the supply of grass around them they will move into the cane fields and possibly inflict considerable damage. Satisfactory control is given by "Dieldrin 30" at 13 fluid ounces per acre or by "Diazinon 80" at 10 fluid ounces per acre. However, limitations are imposed because of the danger to livestock.

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Cane harvesting and transport in Australia. L. G. VALLANCE. *Australian Sugar J.*, 1974, **66**, 441–447. Various aspects of cane harvesting and transport are discussed with the aid of illustrations showing the different types of equipment in use. The cane tonnages handled by particular harvesters are given. Information is given on a quick-change system under which half-tracks can be fitted to Massey-Ferguson MF 102 and 201 harvesters. The advantages of half-tracks over rubber tyres include greater manoeuvrability and stability of the harvester, greater stability of the base cutter, good control of ground cutting, and improvement in both flotation and traction. Tests are also under way on a bin trailer fitted with half-tracks. The successful performance of the Toft "Robot" Mark II in New South Wales is discussed, including some teething troubles which were quickly dealt with. Serious cane losses (of the order of 10%) have been caused by the blades of extraneous matter extractors on both Massey-Ferguson and Toft harvesters, and a more thorough examination of the question of trash reduction under these circumstances is suggested.

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A bulk "aqua ammonia" tank saves work. ANON. *Producers' Rev.*, 1975, **65**, (1), 24.—Details are given of a 20-metric ton capacity "aqua ammonia" tank installed on a farm for central storage of the fertilizer. The system for receiving the liquid fertilizer and discharging it to a gravity-feed applicator is described.

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Mossman pigs fall for trap. ANON. *Producers' Rev.*, 1975, **65**, (1), 45.—Information is given on a pig trap built adjacent to a cane field in Queensland which has been responsible for catching 45 wild pigs.

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Ingham trimmer mulcher saves work. ANON. *Producers' Rev.*, 1975, **65**, (1), 46.—Ratooning operations have been streamlined and considerable savings in time and labour achieved on a cane farm with a tractor-towed stool trimmer mulcher attachment which is described.

Spinner provides good soil cover. ANON. *Producers' Rev.*, 1975, **65**, (1), 49.—A brief description is given of a spinner added to a converted drag planter which provides better regulation of earth cover in planting regardless of soil type.

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Joint ownership of mechanical cane harvesters has benefits. A. J. UTTING and G. T. CRAWFORD. *Producers' Rev.*, 1975, **65**, (1), 50–51.—The more important reasons for cooperative or joint ownership of farm equipment, particularly cane harvesters and haulage equipment, are explained and factors which should be considered in drawing-up an agreement are listed. Operation of such a scheme is also examined.

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Energy use in agricultural systems. C. R. W. SPEDDING and J. M. WALSINGHAM. *Span*, 1975, **18**, (1), 7–9. Agriculture in developing countries relies more and more on considerable quantities of support energy other than solar energy, it is stated. The energy is consumed in various forms, e.g. as fuel for agricultural machinery, for manufacture of this machinery and fertilizers, and for processing and distribution of the agricultural products. While agriculture is an indispensable industry, there is need for a reduction in its energy consumption and for more efficient use of such energy. The differences in energy efficiencies (gross energy in product/support energy input) are indicated by tabulated data, showing that beet and cane are less efficient than many crops.

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Sugar cane: its energy relationships with fossil fuel. J. C. HUDSON. *Span*, 1975, **18**, (1), 12–14.—The advantage cane has over other crops, including sugar beet, in not requiring fossil fuel because of the use of bagasse as fuel is discussed, although it is pointed out that the value of fossil fuel represented by the heavy machinery used in the cane sugar factory is such as to deter expansion of the industry. Details are given of the cane fibre and pith separation process developed in Barbados[1] and reference made to the burning of trash and to production of alcohol as fuel for agricultural machinery and potentially for cars.

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Energy balance in the use of fertilizers. A. C. SCHUFFELEN. *Span*, 1975, **18**, (1), 18–20.—The subject is discussed in relation to a number of crops. As regards sugar production, it is shown that the yield increment per kg of nitrogen applied and the energy value of this increment are much lower than for other crops considered.

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Studies on crop estimation and forecasting yield and quality of sugar cane. III. Intrinsic relationship between daily growth, corresponding yield, sucrose and purity of juice. U. S. SINGH and L. SINGH. *Sugar News* (India), 1975, **6**, (10), 4–8.—Investigations showed a significant positive correlation between the average cane growth rate throughout the period July-December and the ultimate cane yield, although a greater correlation was found between the growth rate in August and final yield. On the other hand, no relationship was established between growth rate and sucrose content or juice purity.

[1] *I.S.J.*, 1974, **76**, 318.

Sugar beet agriculture

Planters for sugar beet seedlings. I. ELEKI and E. SZEMES. *Cukoripar*, 1975, **28,** 1–4.—Details and methods of operation of the French "Super Prefer T" and of the "Accord" planter are given, and the advantages of mechanical over manual planting discussed. Preference is shown for the French equipment.

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Trials on combating *Cercospora* at Mezohegyesen with various quantities of "Brestan 60" in 1972 and 1973. L. LUKÁCS, F. PÓSCY and J. ZANA. *Cukoripar*, 1975, **28,** 5–12.—Results of trials are reported in which "Brestan 60" at 1·04 kg.ha^{-1} was effective in reducing *C. beticola* infection of different varieties of beet, whereby beet and sugar yield were increased compared with untreated controls. Greater amounts of the fungicide (1·39 and 2·08 kg.ha^{-1}) did not improve significantly on the results achieved with the minimum quantity, and in fact in some instances reduced the sugar content. "Brestan 60" was also highly effective against cutworms.

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Expand sugar beet area? What problems must be overcome? W. C. VON KESSEL. *Die Zuckerrübe*, 1975, **24,** (1), 8–11.—The question of beet area expansion and the problems involved are discussed. Since any expansion will entail replacement of other crops by beet, the question of changes in crop rotation arises. The author discusses the factors to be considered in conversion from a 4- to a 3-year rotation and examines those crops which best precede or follow beet. Pests are another important factor considered, and attention is focused on beet nematodes and their spread by *Chenopodium album*. Measures to adopt in more restricted rotation are recommended. Labour organization is discussed and the economics of beet expansion examined. The question of fodder is also considered: while more beet will mean more fodder available in the form of pulp and leaves, expansion of the beet area will also be accompanied by a reduction in the amount of fodder beet grown.

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Seed quantities, drilling costs and populations. ANON. *Die Zuckerrübe*, 1975, **24,** (1), 12.—Tables are given showing the plant populations, quantities of seed and drilling costs at 50% and 60% emergence for graded and pelleted seed and row spacings of 45 and 50 cm with intervals between plants of 4, 6 and 8 cm. The data, applicable to West German conditions, cover diploid, polyploid and monogerm seed. Advice is given where applicable.

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Beet pests. ANON. *Die Zuckerrübe*, 1975, **24,** (1), 12–13.—Pests and the damage they cause to the beet are discussed briefly, including the beet fly, field-mouse, the gamma moth and its larva, *Myzus persicae* (peach potato aphid) which is a beet yellows vector, *Atomaria linearis* (pygmy mangold beetle) and *Chaetocnema* spp. Possible means of control are indicated.

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Prompt and correct soil treatment creates friability and controls weeds. ANON. *Die Zuckerrübe*, 1975, **24,** (1), 13.—Advice is given on seedbed preparation for beet, differences in soil texture being considered.

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Quality starts with the seed. U. DIECKMANN. *Die Zuckerrübe*, 1975, **24,** (1), 14–15.—The advantages and disadvantages of the different types of beet seed are discussed and advice given on seed selection as one of the more important factors in determining sugar yield.

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Weed control in sugar beet 1974. K. GÖRTZ and G. EBERS. *Die Zuckerrübe*, 1975, **24,** (1), 17–19.—Results of small- and large-field weed control tests with herbicides are tabulated and discussed.

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Are there compromise solutions between sugar beet agriculture with thinning and non-thinning agriculture? –. KESTEN. *Die Zuckerrübe*, 1975, **24,** (1), 20–22. While planting to stand has advantages where labour is short and expensive, it also has disadvantages. However, one compromise solution is the drilling of monogerm seed at 12–13 cm distances and a row spacing of 50 cm. This method has been evaluated in tests conducted during 1973, and the results are discussed. The scheme involves manual thinning, but at 60% or more emergence, thinning can be omitted if the row spacing is reduced to 45 cm, row widths of 18–22 cm used and the grower is prepared to risk a reduction in the final beet population.

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Fertilization and plant protection—two essential factors for yields and costs in beet agriculture. W. C. VON KESSEL. *Die Zuckerrübe*, 1975, **24,** (2), 8–10.—Advice is given on optimum application of P, K, Mg and N as well as trace elements, and recommended herbicides and pesticides and their rates of application are discussed. The article has been prompted by the steep rise in costs of fertilizers and plant protection chemicals which makes careful planning essential.

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"Tramat"—a new beet herbicide. D. KIRSTEN. *Die Zuckerrübe*, 1975, **24,** (2), 12.—Information is given on "Tramat" ("Ethofumesate") and on its optimum application before or after planting or after emergence in combination with "Venzar" or "Betanal".

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Effect of beet herbicides on weeds. ANON. *Die Zuckerrübe*, 1975, **24,** (2), 14.—Data are given showing the effectiveness of seven herbicides against named weeds.

Nightshade in beet leaves causes cattle poisoning. ANON. *Die Zuckerrübe*, 1975, **24**, (2), 14.—Reference is made to the highly toxic properties of nightshade when occurring in beet leaves used as animal fodder. Although difficult to eliminate, the weed is susceptible to the action of certain herbicides which are specified.

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Care in the filling of plant protection equipment. ANON. *Die Zuckerrübe*, 1975, **24**, (2), 15.—The article calls for caution in the filling of tanks with plant protection chemicals and describes various types of fillers intended to prevent accidents.

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Reliability in weed control. C. CHILLA. *Die Zuckerrübe*, 1975, **24**, (2), 16–18.—Advice is given on herbicide application within the context of rising costs and price differences between the various chemicals available. The article deals especially with the use of "Pyramin" and "Pyramin" + "Avadex".

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Optimum sugar beet fertilization. D. MERKEL. *Die Zuckerrübe*, 1975, **24**, (2), 20–23.—Optimum N-P-K rates are discussed, soil analysis methods briefly examined and the situation as regards Na fertilization considered. Mention is made of practices in the UK which are equally applicable in West Germany, and in this regard references are made to "Sugar beet nutrition" by DRAYCOTT[1].

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Phosphate fertilization of sugar beet. E. WAGNER. *Die Zuckerrübe*, 1975, **24**, (2), 24.—The importance of phosphorus for beet growth and sugar content is discussed and figures presented showing the increase in beet and leaf yield and sugar content with increase in the phosphate rate at constant N and K application. Optimum rates under West German conditions are discussed.

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Sugar beet harvesting techniques. H. TRAULSEN. *Die Zuckerrübe*, 1975, **24**, (2), 25–27.—A survey is presented of beet harvesters available in West Germany, with mention of the benefits of saving beet leaves for use as fodder and the harvesting techniques best suited to this. Automatic steering, the significance of beet row width and beet cleaning equipment are also briefly discussed.

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"Tramat"—a new means of weed control in beet. R. MAKAS. *Zucker*, 1975, **28**, 133–137.—Details are given of trials during 1972 and 1973 with "Nortron" ("Tramat"), a herbicide developed by Fisons Ltd. and containing "Ethofumesate" as active ingredient. The mono- and dicotyledons against which the herbicide is effective are listed and the kill rates obtained with "Nortron" in mixtures with "Lenacil" and "Betanal" as pre-drilling and pre- and post-emergence treatments are given.

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Depth of drilling. Results of field trials 1964-1972. D. O. G. THOMSON. *British Sugar Beet Rev.*, 1975, **43**, 55, 78.—Results of 39 trials over a 9-year period showed that pelleted seed generally produced better seedling emergence than did unpelleted seed when drilled to a greater depth (1–1¼ inch) in a "normal" spring of adequate rainfall and soil moisture, whereas in a dry spring unpelleted seed gave better emergence than did pelleted seed with shallow drilling (½–¾ inch). In a "normal" year, however, coulter depth has less effect than the pelleting of the seed; for consistently high emergence, drilling at 1 inch (1¼ inch under dry conditions) is recommended.

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Aphid and yellows control. A. DUNNING. *British Sugar Beet Rev.*, 1975, **73**, 56, 78.—Recommendations are given on pesticide application to control aphids, including foliage and seed treatment as well as furrow application. Both liquid and granular forms of pesticide can be used for foliar treatment.

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Lincolnshire grower eliminates side hoeing, cuts costs and streamlines beet enterprise. D. CHARLESWORTH. *British Sugar Beet Rev.*, 1975, **43**, 59–60.—The practices used by a farmer in Lincolnshire on 154 acres of beet fields are described; the use of drilling to a stand (first adopted in 1968) has increased yields, and a major advantage is the reduced time taken to sow (7–10 days, according to weather) compared with 1 month when hand singling is used.

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Beet through the eyes of a grower. J. H. PALMER. *British Sugar Beet Rev.*, 1975, **43**, 64–65, 77.—The practices used and results obtained by a beet grower in Lincolnshire are described.

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Safety with chemicals. T. J. MAYNARD. *British Sugar Beet Rev.*, 1975, **43**, 66, 69.—A representative of a major manufacturer of agricultural chemicals gives advice on handling granules of "Temik 10 G" used to control nematodes, aphids, the pygmy beetle, leaf miner and millepedes.

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Hints on fitting a micro-band applicator to a seed drill. A. PECK. *British Sugar Beet Rev.*, 1975, **43**, 67. Guidance is given on fitting of a micro-band applicator to a multi-row beet seed drill.

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Underleaf spraying of herbicides. N. V. TURNER. *British Sugar Beet Rev.*, 1975, **43**, 68.—See *I.S.J.*, 1975, **77**, 311.

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Beet grown on non-ploughed land. D. CHARLESWORTH. *British Sugar Beet Rev.*, 1975, **43**, 70.—The problem of large numbers of stones and how it is tackled by a farmer on two farms totalling 1800 acres (of which 450 acres are devoted to beet) are described. Basically, the land is left unploughed so as to allow frosts to break the stones. Over the 3-year period 1971–73 yields of beet were considered as good as on ploughed land.

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Irrigation to promote seedling emergence. D. TOLLER. *British Sugar Beet Rev.*, 1975, **43**, 73.—The results achieved by overhead irrigation after drilling to induce beet germination and emergence on 120 acres of beet field are described.

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How waste lime benefits a farm with a wide range of soils. D. CHARLESWORTH. *British Sugar Beet Rev.*, 1975, **43**, 76–77.—Information is given on the practices used on a 1600-acre farm which has a wide variety of soils and where sugar factory waste lime is applied to correct soil lime deficiency and improve soil structure.

[1] *See I.S.J.*, 1974, **76**, 38.

Preliminary studies on induced male sterility in sugar beet (*Beta vulgaris* L.). P. S. BHATNAGAR. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), A49–A52.—Trials were conducted with "FW 450" (2,3-dichloro*iso*butyrate) and estrone applied at three stages of ontogenic development of two genotypes of beet. Results indicated that "FW 450" was more effective in inducing male sterility but its phytotoxicity precludes its use for practical purposes. Further studies on the subject are suggested.

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Sugar production and profit per hectare from sugar cane and sugar beet. R. K. SHARMA and D. V. S. CHAUHAN. *Sugar News* (India), 1974, **6**, (8), 19–20. From estimations of the sugar yields per ha for five varieties of cane and five varieties of beet and of the costs of cultivation, the author shows that beet brings a higher net profit per ha than does cane and over a much shorter period.

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Genetic and ecological effects on beet nitrogen content. II. Noxious amido-nitrogen during beet growth. V. STEHLÍK. *Listy Cukr.*, 1975, **91**, 25–31.—Factors affecting the level of noxious N in beet are examined on the basis of tests and data from the literature. While ecological factors such as climate and soil will affect the N levels, agricultural practices will have a predominant influence.

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Advice on beet drilling. R. VANSTALLEN and A. VIGOUREUX. *Le Betteravier*, 1975, **9**, (85), 11, 14. Guidance is given on how to achieve optimum drilling, covering seed quality, drilling date, soil conditions, drilling speed and seed spacing. Careful application of herbicide and insecticide sprays is recommended. Tests have shown that a final population of 80,000 plants per ha is optimum under Belgian conditions.

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Micro-granulators. R. VANSTALLEN and A. VIGOUREUX. *Le Betteravier*, 1975, **9**, (85), 12–13.—Descriptions are given of four micro-granulators, as used for application of "Temik 10G", and details are given of bench tests on them. Advice is given on distribution rates and how to maintain uniformity of application.

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Do not mistake millepedes for small worms. ANON. *Le Betteravier*, 1975, **9**, (85), 13.—Brief descriptions are given of millepedes and small earthworms to facilitate distinguishing between them, although it is pointed out that it is very difficult to do this on the spot without a magnifying glass.

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Need for a revised fertilizer recommendation for sugar beet in Nira Valley. A. D. KARVE, O. P. SINGH, A. C. BHALERAO and A. R. GHANEKAR. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A1–A6.—Good response of beet to 120 kg N and 40 kg P per ha (in terms of beet and sugar yield) was obtained in trials at three locations in this region of Maharashtra during 1971–74, while K had no effect.

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Effect of plant population and nitrogen fertilization on yield and quality of sugar beet. O. P. SINGH, A. C. BHALERAO, A. R. GHANEKAR and A. D. KARVE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), A41–A52.—While significant differences in beet and sugar yield and juice pol content were found at different locations and in different years as a result of differences in inter-row and inter-plant spacings and differences in N dosage (120 *vs.* 240 kg.ha^{-1}), the overall averages failed to reflect the results, and it is recommended that the grower select any plant population up to 100,000 plants and apply 120 kg N per ha.

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Evaluation of wax coatings for improving sugar beet storage. R. E. WYSE and D. R. DILLEY. *Crop Sci.*, 1973, **13**, 567–570; through *S.I.A.*, 1975, **36**, Abs. 75-302.—Beets were coated with paraffin or a commercial wax product by immersion, and stored at 5° or 23°C for up to 30 days or at 10° or 20°C for 7 days. Respiration rates, weight losses and sugar losses were measured; results are shown in graphs. The coatings reduced respiration rates most under conditions where the rates were high and were thus governed mainly by gaseous diffusion. The effects of the coatings were greater with small beets than with large ones.

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Storage of sugar beet roots in controlled atmospheres to conserve sucrose. R. E. WYSE. *Crop Sci.*, 1973, **13**, 701–703; through *S.I.A.*, 1975, **37**, Abs. 75-303. Beets were stored for up to 60 days at 5°C in atmospheres containing 0, 5 or 10% CO_2 and 5, 10 or 21% O_2. Increasing the CO_2 concentration had no significant effect on sucrose losses. With 5% O_2 and 5% CO_2, sucrose losses were lower than in air, but the purity of clarified juice was also lower. It is considered that low-O_2 atmospheres would be beneficial in short-term storage. The different atmospheres had no significant effects on reducing sugars contents, and the effects on raffinose and amino-acid contents showed no consistent trends.

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New planters for experimental sugar beet plots. G. E. COE. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 220–229.—Details are given of a vegetable planter modified for precision planting of beet seed in experimental nursery plots. Drilling trials with monogerm seed placed 4·1 inches (sometimes 6·2 inches) apart, followed by hand thinning, showed less than 5% of the "hills" contained more than one seedling, and weed control was good to excellent. The effect of close plant spacing on yield was not determined.

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A precision planter for sugar beet plots. W. M. BUGBEE and K. J. PAZDERNIK. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 225–229.—Further details and illustrations are given of the modified vegetable planter mentioned in the preceding abstract.

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Development of a methodology for the production of *Aphanomyces cochlioides* oospores *in vitro*. C. L. SCHNEIDER and D. L. YODER. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 230–239.—Studies are reported on the possibility of producing oospores of *A. cochlioides*, a causal agent of black root, for use as inoculum in beet seedling screening trials. The most suitable medium for oospore production *in vitro* was found to be oatmeal homogenate broth, since it was more easily prepared and a 0·5% broth adjusted to pH 6·5 consistently yielded $2{\cdot}0 \times 10^4$ oospores per cm^3 when the cultures were incubated in the dark. Other media were found to give higher yields, but it is considered that there is no advantage in using a replacement

medium unless acceleration of sporulation is desired. The oospores produced were able to germinate and initiate infection of beet seedlings in the greenhouse.

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The effects of *Heterodera schachtii* and *Aphanomyces cochlioides* on root rot of sugar beet. E. D. WHITNEY and D. L. DONEY. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 240–245.—*H. schachtii* (a nematode) and *A. cochlioides* (a fungus) at high inoculum levels showed a synergistic effect in the killing of sugar beet; the sum of the effects of the two organisms alone on yield was, however, greater than the effects of the combination. An increase in the level of inoculum was accompanied by a fall in beet sugar content, while yield fell with increase in the numbers of the nematode, a high nematode population tending to predispose plants to infection by the fungus while the nematode alone killed few plants. The results suggest that wilting of plants is related to root damage; water consumption was negatively correlated with wilting.

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Effect of six four-year rotations on yield, quality and monetary return of sugar beets. O. C. SOINE. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 246–253.—The effect of six different 4-year rotations on beet yield, sugar content, quality and profitability was studied with the aim of providing information for beet growers in the Red River Valley of Minnesota and North Dakota who wish to change over from a system of fallowing the year before planting beet. Recoverable sugar yields from beet in all six systems were similar, despite increased beet yields in the three rotations incorporating fallowing. Beets following three non-fallow rotations contained more sugar than did beets following the fallow rotations, the latter beet also containing more sodium, amino-N and impurities than those grown on land cropped each year. Hence, fallowing the land did not increase the net income from beet nor the total 4-year income.

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Survey of sugar beet production practices in Ohio and their effect on sugar beet quality and yield. M. E. KROETZ, W. H. SCHMIDT, F. B. RUSSELL and P. BRIMHALL. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 254–259.—The survey covers the years 1968 and 1969 and indicates that highest yields were associated with early planting, frequent cultivation, a ridge height averaging 4·3 inches, narrow rows (averaging 31 inches) and late harvest. The yield also increased with increase in soil pH, plant population, amount of N applied before planting and with earliness of N applied as a side dressing.

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Sugar beet production in the Red River Valley as affected by population and nitrogen fertilizer. J. T. MORAGHAN, P. TIEDEMAN and R. TORKELSON. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 260–269.—The effect of beet plant population, N fertilizer application and date of harvest on beet and sugar yield and juice purity was studied. Results obtained for the area, which is semi-arid, apply to 1969 and 1970.

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Sugar beet growth and development under controlled climatic conditions with reference to night temperature. K. OHKI and A. ULRICH. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 270–279.—Investigations are reported in which beets were grown in vermiculite, watered daily with a Hoagland solution modified to include some NaCl and harvested after 5, 9, 13 and 17 weeks of growth. It was found that the sugar concentration increased with decreasing night temperature in the range 2–26°C, while root weight fell when the night temperature was 2°C at 5 weeks and 26°C at 17 weeks of growth. Maximum fresh weight of tops was obtained at a night temperature of 14°C, while it was greatly reduced at 2°C. The effects of night temperature established are similar to previous results obtained in sunlight, indicating that artificial light can be substituted for sunlight growth studies. (Day temperature in the tests was 20°C, with fluorescent-incandescent illumination for photo-periods of 16 hours).

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Boron tolerance of sugar in relation to the growth and boron content of tissues. J. VLAMIS and A. ULRICH. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 280–288. Beet plants were grown for 6 weeks in 20-litre pots containing nutrient solutions in which the proportion of boron ranged from adequate to highly toxic (0·5–128 ppm). Up to 8 ppm, boron had no detrimental effect on rate of growth of tops or fibrous roots, the first fall in yield occurring at 16 ppm B after which there was a constant fall, a 50% reduction in growth of tops and fibrous roots taking place at 28 ppm and in growth of beet roots at 16 ppm B. Symptoms of B toxicity in the leaves are described; the roots appeared healthy at all B levels and the fall in yield was the only evidence of toxicity. The B content of the leaves increased with their physiological age, the B content of the blades being considerably greater than of the corresponding petioles, and it is suggested that old blades could be used as diagnostic material in determining the B status of nutrient medium in the toxic range. The B content of the roots was of the order of magnitude of that in the petioles. It is concluded that the beet is more tolerant to high B concentrations than are certain other crops and should be grown in preference to these where the soil or irrigation water boron content is high, as in western parts of the USA.

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Beet hollowness—one of the causes of a drop in root quality factors. S. G. ENIKEEV and L. Z. MESHKOVA. *Izv. Vuzov, Pishch. Tekh.*, 1975, (1), 18–20.—Studies were conducted on beet having cavities in the crown. Results indicated that the sucrose content fell and the reducing matter and moisture contents rose as the tissue in the cross-section from the central parenchyma of the beet to the periphery deteriorated from whole tissue through perforated, creviced and finally open-cavity tissue. Full details are tabulated for the alternate rings of vascular bundle and parenchyma.

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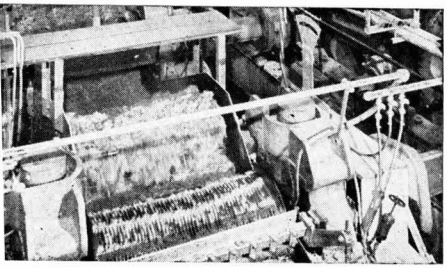
Results of cutting bolted and weed beets. A. VIGOUREUX and R. VANSTALLEN. *Publ. Trimest. Inst. Belge Amél. Betterav.*, 1974, **42**, 195–203.—While use of a rotary cutter did not provide a curative solution to the wild beet problem, it was found to reduce seeding and would reduce infestation by normal bolters. Moreover, by eliminating the seed stalks of wild beet and bolters, the method does increase exposure of the normal beet to light. Two applications considerably reduced the production of viable seed and numbers of emergent seedlings, one during flowering and the second 1 month later; however, if only one cut is made, this should be done 15 days after flowering.



Cane sugar manufacture

R5,500,000 expansion project at TSB Malelane. G. H. JONES. *S. African Sugar J.*, 1975, **59**, 56–57.—Details are given of the expansion plans for Malelane sugar factory intended to increase the average crushing rate from 220 to 275 t.c.h., with allowance for yet further expansion in the future. Among the new equipment is a BMA cane diffuser which will run in parallel with an existing bagasse diffuser. The refinery section is being extended to produce about 160,000 tons of sugar per year.

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The fallacy of heat transfer surface in cane sugar factories. U. C. UPADHIAYA. *Indian Sugar*, 1974, **24**, 607–617, 683–698.—The author considers that capacity rating of heat equipment on the basis of heat transfer surface alone is not a valid criterion since the performance of each specific type of equipment is governed by a variety of factors. He demonstrates this by examining the heat transfer processes in boilers, juice heaters, evaporators and vacuum pans and presenting formulae for calculation of the available heating surface as well as looking at those factors needing consideration in evaluation of the equipment.

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Increase in crushing capacity at Harinagar Sugar Mills Ltd. K. S. SHAR, C. A. MEHTA and K. S. MOKHA. *Sugar News* (India), 1974, **6**, (8), 21–23. The crushing capacity of a 17-roller milling tandem was increased from 1700 to 1950 t.c.d. without a fall in juice extraction by a number of steps, including modifications to the cane feed system, installation of a chopper, raising the horsepower of the cane leveller in the preparation plant, increasing mill roller speed and replacement of the 1st mill drive shaft and bearings and of the bedplates of all mills.

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Automation of self-discharging centrifugals. N. A. KORE and S. A. KHOT. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M1–M4.—Advantages of conversion of batch-type, self-discharging centrifugals to fully-automatic operation for *A*-massecuite double curing are discussed on the basis of trials before and after conversion and of two seasons' operation.

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A note on observations of the mechanical circulator working with reduced speed. V. B. BAGAL and M. ANAND. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M5–M10.—See *I.S.J.*, 1975, **77**, 341.

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Investigations into the causes of high purity of final molasses at Warananagar during some seasons. R. G. DURVE and M. R. KULKARNI. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M11–M26.—Despite a number of improvements in *C*-massecuite boiling and curing and installation of pan stirrers, crystallizer cooling coils and high-speed centrifugals at the authors' factory, molasses purity in 1973–74 was higher than in the previous season and almost as high as during 1971–73 before the changes were made. Investigations are reported, which revealed that the molasses purity fluctuations were due primarily to cane juice reducing sugars content and the above-mentioned measures had had no beneficial effect.

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Evaluation of SP-2 as settling aid in cane juice clarification. A. C. CHATTERJEE and H. R. APTE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M27–M35.—Trials with an Indian settling aid, SP-2, showed that it improved clarification, with results which were almost comparable to those obtained using "Sedipur TF-2"; since the latter is an imported product, SP-2 is recommended.

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Reduced boiling house recovery—a new concept. R. T. PATIL and J. B. CHAVAN. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M36–M40.—The GUNDU RAO formula for calculation of reducing boiling house recovery has been modified by replacing k (non-sugars in clarified juice % non-sugars in mixed juice) with a factor F (losses in final molasses per unit sugar in mixed juice) and eliminating m (final molasses purity). Calculated results obtained with the new formula are compared with values given by the formulae of DEERR and GUNDU RAO as well as the *s-j-m* formula.

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An assessment of the performance of the milling-cum-D.D.S. diffusion system. T. T. OOMMEN. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M41–M44.—See *I.S.J.*, 1975, **77**, 341.

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Technical control at the evaporators. M. SINGH and V. V. SUBBARAO. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M45–M50.—The operation of a quintuple-effect evaporator to control heat flow as a function of temperature difference across the evaporator is discussed and the effects of non-optimum operation examined.

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Clarification of sweet sorghum juice for jaggery making. A. D. KARVE and A. R. GHANEKAR. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc.* (*India*), 1974, (1), M51–M53.—Results of trials on clarification of sorghum juice, which contains 0·8–1·34% starch, for manufacture of jaggery are briefly reported. Enzyme treatment to convert the starch to glucose did not remove other colloids; flotation proved successful and gave good quality jaggery without the need for any special equipment, but the process is time-consuming; treatment with flocculation aids is very rapid and

gave very high quality jaggery, but extra equipment is necessary.

* * *

Unexpected financial loss to sugar factory due to froth fermentation of final molasses. P. F. JAIN. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M54–M60.—Spontaneous destruction of final molasses stored in a pit at the author's sugar factory is reported, and reasons for the phenomenon are suggested. The views of other authors on the subject are also considered.

* * *

Utopia and reality of the ion exchange process for demineralization of sugar cane juice. R. L. SRIVASTAVA and P. GUPTA. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M61–M65.—Reference is made to pilot plant studies of ion exchange demineralization of clarified juice and to the economics of the process, from which it is concluded that it is a promising means of increasing sugar recovery in India but that its technical advantages have yet to be convincingly demonstrated on a commercial scale.

* * *

Non-condensable gases—the importance of their removal in an evaporator unit. S. SRINIVASAN. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M66–M72.—Noticeable fluctuation in juice Brix in a quadruple-effect evaporator was found to be a result of inadequate incondensable gas removal. After establishing the cause of the trouble and rectifying it, considerable improvement in evaporator operation was effected and juice Brix maintained reasonably constant at 60°C.

* * *

A mechanical sugar distributor. V. S. BAGI. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M73–M75.—A short description is given of a vibratory distributor for supplying sugar from the elevator to the graders.

* * *

New molasses conditioning apparatus at Sakharwadi. D. P. KULKARNI and A. V. DESHPANDE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M76–M81.—Details are given of a rectangular-sectioned trough for dilution and heating of molasses with hot water and steam before it is fed to the pan supply tanks. Brix and temperature values are given from 7 days' measurements, demonstrating maintenance of both factors within reasonable limits.

* * *

Clarification at Warananagar with special reference to the use of magnesia preprata. H. G. KULKARNI and A. N. GODBOLE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M82–M86.—Use of magnesium oxide together with lime at a 10:3 CaO:MgO ratio has helped reduce evaporator scaling at the authors' factory without adversely affecting clarifier performance, by comparison with use of lime alone, and without increasing molasses ash content and purity. Further reduction in scale can be obtained by increasing the MgO proportion, but mud volume increases and the final sugar quality is reduced.

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Last body of quadruple (-effect evaporator). H. G. KULKARNI, S. K. BHAGWAT and M. R. MOOG. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M87–M95.—Reference is made to the article by MISHRA[1], particularly to the beneficial effects of increasing the heating surface of the last evaporator effect. The authors, on the staff of the same factory as MISHRA, describe the problems concerning evaporation but indicate that the remedies lay in a different direction than those instituted by MISHRA, who converted the evaporator to a forced-flow system, regarded by KULKARNI *et al.* as unsuitable when the heating surface of the first effect is too great for the rated crushing capacity of the factory. Moreover, the last effect does not have to be of greater heating surface, although it should not be too small.

* * *

Complete automation of centrifugal machines at Bhogawati. V. R. R. BHONSALE. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M96–M107.—Conversion of batch-type Buckau-Wolf centrifugals to fully-automatic machines and the benefits this has brought in terms of sugar quality are reported.

* * *

Different methods of graining for low-grade boiling. B. N. KANKAREJ. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M108–M112.—Brief descriptions are given of the various graining methods used for *C*-massecuite boiling, and results are given of tests on the Apre slurry method which has shown a number of advantages, including greater uniformity of grain and absence of false grain.

* * *

A simple method for automatic addition of triple superphosphate slurry. S. V. BAPAT. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), M113–M116.—A simple automatic system for addition of triple superphosphate slurry to mixed juice (suitable for any clarification additive solution) is described.

* * *

Power generation for public utility by sugar factories. R. K. SIRDESHMUKH. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), E1–E7.—Assuming certain data (including cane fibre content and bagasse yield) for a factory having a 15-roller milling tandem of 100 t.c.h. crushing rate, the author calculates the costs of producing enough electricity for the factory's requirements and supplying surplus to the national grid.

* * *

Bagasse for energy crisis. K. R. PUNDIR. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), E8–E20.—Calculations are presented to demonstrate the value of bagasse as a fuel in production of electricity in sufficient quantity to satisfy the needs of the factory and supply some to the national grid. Heat losses and causes of low steam pressure are discussed, and the economics of power generation examined.

* * *

On economizing in use of raw water in sugar plants—a case study. M. SINGH and R. K. VARMA. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), W2–W12.—Calculations of water requirements at a specific sugar factory are used to show, with the aid of a diagram, how recycling of treated effluent can help reduce raw water consumption.

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[1] *I.S.J.*, 1974, **76**, 277.

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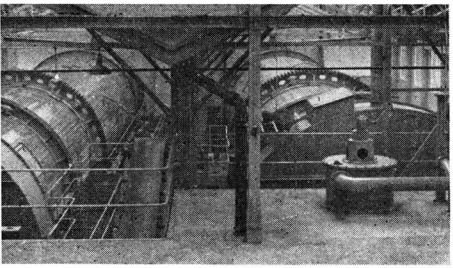

Beet sugar manufacture

Osmotic phenomena during beet fluming. J. HAŠEK and A. ŘÁDKOVÁ. *Listy Cukr.*, 1975, **91**, 31–35.—The effect of water on weight of beet during conditions analogous to fluming was investigated. It was found that the weight rose by between 0·65% after 10 minutes' contact with water and by 1·8% after 60 minutes. The absorption was attributed to the semi-permeability of cell cytoplasm.

* * *

Beet soil and leaves separator. F. HRUŠKA. *Listy Cukr.*, 1975, **91**, 42–45.—Two types of separators are described with diagrams: a roller type and a vibratory type.

* * *

Microbiological problems in the sugar factory. H. KLAUSHOFER. *Cukoripar*, 1974, **27**, 210–214; 1975, **28**, 3–18.—The problems caused by micro-organisms in beet sugar factory products and particularly in diffusion are surveyed (with 37 references to the literature) and means of determining bacterial counts and losses in a tower diffuser are examined. Suitable dosing with disinfectants is discussed.

* * *

The active alkalinity of sugar factory juices. K. VUKOV. *Cukoripar*, 1975, **28**, 18–25.—See *I.S.J.*, 1975, **77**, 247.

* * *

The Stord horizontal twin-screw pulp press. P. MATHISOMOEN. *Cukoripar*, 1975, **28**, 26–29.—Information is given on Stord high-capacity twin-screw beet pulp presses installed in sugar factories of the British Sugar Corporation, Great Western Sugar Co., Süddeutsche Zucker-AG. and the Irish Sugar Co.

* * *

The biological treatment of sugar beet factory wastes. J. H. FISCHER. *Sugar y Azúcar*, 1975, **70**, (2), 20–22. Information is given on the scheme at the Longmont factory of The Great Western Sugar Co. for treatment of beet flume and wash water which is collected in a sump and pumped to elevated Dorr-Oliver DSM screens. Treated water proceeds to a Parshall flume, where milk-of-lime is added, and flows to a mixing box from which it is fed to one of two settling ponds. The underflow from the screens is returned to the flumes. From the two settling ponds the water passes by gravity to an anaerobic pond and from there it is recycled to the flumes. The scheme, for which experimental results from 1967/68 and 1969/68 are discussed, is recommended for areas where the temperature of system water does not exceed 20°C.

* * *

Sugar house schemes—an example of improvement in information with the aid of electronic data processing. P. W. VAN DER POEL, J. BLOK, N. H. M. DE VISSER and W. A. FENSTRA. *Zucker*, 1975, **28**, 122–131.—The data processing system used by Centrale Suiker Mij. for a number of purposes is described and its application to calculation of 3- and 4-stage and refined sugar boiling parameters demonstrated. Provision is made in the programmes for comparison between actual and target values. The value of the scheme in providing greater information on the boiling process is indicated.

* * *

Survey of first carbonatation juice filtration in sugar factories. H. FORTH. *Zucker*, 1975, **28**, 131–132. The article by GAUDFRIN & SABATIER[1] is criticized on a number of points, particularly concerning the basis on which the filtration coefficient F_k is calculated.

* * *

The recovery of sugar from beet molasses by ion exclusion. J. F. ZIEVERS and C. J. NOVOTNY. *Proc. 33rd Meeting Sugar Ind. Tech.*, 1974, 83–90.—While beet molasses sugar recovery by ion exclusion has appeared from investigations over the last 20 years to be unpractical on a large scale for various reasons which are stated, the authors consider that the process enjoys one major advantage which could make it an attractive proposition, viz. it uses fuel directly, i.e. almost entirely for evaporative heat, in contrast to other processes which use less direct fuel as heat but more indirect fuel for chemical manufacture. Based on a molasses feed of 60°Bx, it is shown that 50% sugar recovery is possible with the type of processes and plant developed by the authors' company in association with Pfeifer & Langen.

* * *

Kinetics of moisture movement during air drying of sugar beet root. L. M. VACCAREZZA, J. L. LOMBARDI and J. CHIRIFE. *J. Food Technol.*, 1974, **9**, 317–327; through *S.I.A.*, 1975, **37**, Abs. 75-381.—The effect of several variables on the drying rate of sugar beet slices was investigated. Measurements were made on blanched or unblanched slices 6 cm square and 0·04–1·0 cm thick, and drying curves are shown for air flow rates of 2–6·5 m.sec^{-1} at 47°, 60° and 81°C. The standard solution of the non-stationary state diffusion equation was used to analyse the experimental results during the initial phase of the falling rate period of drying. Fick's law can be used to predict the average drying time, internal moisture distribution and sample temperature during dehydration.

* * *

Studies on the continuous inversion of sucrose. I. Research data. O. V. BONNEY and J. P. THOMAS. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 187–194. **II. Application of research data.** D. R. HASKELL. *ibid.*, 195–199. **III. Physical installation.** J. RAMANAUSKAS. *ibid.*, 200–211.

I. Laboratory experiments on syrup inversion by HCl showed that a 50% invert syrup could be obtained from a syrup of 80% refractometric dry solids at a

[1] *I.S.J.*, 1974, **76**, 279.

temperature of 85–100°C (for which a reaction time of 11–2½ minutes was required) with addition of 0·81–1·29 × 10^{-4} g HCl per g of sucrose, 1·06 × 10^{-4} g/g sucrose corresponding to formulations normally used in a factory batch procedure for partial inversion of high-density syrup. Colour formation during inversion at the temperatures studied was negligible, but colour did form during preparation of the initial syrup and in the neutralized invert syrup when stored at 35°C for up to 10 days at low pH (3·5–5·0). Since most of the ash in 50% invert syrup emanates from the reagents used, a reduction in the quantity of acid used may significantly affect the ash content. However, sugar ash content and water quality also affect the invert syrup, and both sugar and water should be of suitably high quality.

II. The reaction kinetics of invert syrup production were studied on a laboratory scale, and from computerized data obtained on the basis of mathematical expressions it was possible to specify a minimum size of reactor to meet the requirements of design throughput and to specify feed rate (time), acid metering rate and reactor input temperature.

III. Details are given of the continuous 50% invert syrup plant installed at the Manteca factory of the Spreckels Sugar Division of Amstar Corporation in California which was based on the above-mentioned studies and was designed to produce 100 gal.min^{-1} with a 20% built-in reserve. The unit has given a product with minimum colour increase and with practically no losses.

* * *

Optimum carbonatation system design. V. M. JESIC. *J. Amer. Soc. Sugar Beet Tech.*, 1973, **17**, 212–219. Three basic carbonatation systems are compared and shown to have identical efficiencies. A new system is described, the design of which is intended to meet three major requirements: (1) improvement of the juice chemical properties while the physical properties are improved by means of flocculants, (2) simplification of juice processing without sensitive spots, and (3) minimization of capital investment for equipment. The scheme, a flow diagram of which is presented, includes coagulation carbonatation to pH 10·8 with addition of 1·2% CaO on beet followed by clarification with the addition of flocculants. The clarifier mud of 45°Bx is washed with limed water of pH 11·0 in order to avoid non-sugar desorption, and the clarifier overflow and filtrate from the mud vacuum filter are sent to a main liming tank, where the contents are limed with 1% CaO (on beet) and retained for 6 minutes at 88°C. The juice is then subjected to adsorbing carbonatation to pH 11·4 and recycled to the clarifier, underflow from which (of 55°Bx) is recycled to the coagulation carbonatation. Carbonatated juice from both coagulation and adsorbing carbonatation pass through individual mixer tanks where the flocculant is added before the clarifier. The coagulation carbonatation juice receives 1 ppm flocculant, while the other juice receives 0·5 ppm flocculant.

* * *

The heat pump in the sugar industry. G. VERNOIS. *Zeitsch. Zuckerind.*, 1975, **100**, 134–135.—The possibility of using heat pumps to condense sugar factory vapour is examined. It is shown that they can be economically applied provided there is ample electric power available. Vapour condensation contributes to steam economy and to an increase in beet processing capacity through increased evaporator efficiency.

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The application of ultrafiltration to raw juice purification. I. M. FEDOTKIN, A. S. DYCHENKO, V. V. ZELINSKII, V. P. DUBYAGA and E. E. KATALEVSKII. *Izv. Vuzov, Pishch. Tekh.*, 1975, (1), 150–151.—The use of semi-permeable membranes to treat raw juice was tested. Results indicated a rise in purity and a fall in colour as a result of the process, while high-molecular substances were considerably reduced.

* * *

Effect of the sugar melting method on the size of evaporator heating surface. A. KUBASIEWICZ and W. LEKAWSKI. *Gaz. Cukr.*, 1975, **83**, 34–36.—Two idealized evaporation schemes are compared: (i) where 5·1% thin juice (on beet) is used to melt 2nd sugar to produce a melt of 65°Bx and the remainder of the thin juice (127·8% on beet) is evaporated to a thick juice of 65°Bx, and (ii) where all the thin juice (132·9% on beet) is evaporated to a thick juice of 56·5°Bx and all of this used to melt 2nd sugar to give a standard liquor of 65°Bx. Assuming the same temperature gradient across the evaporator, it is shown that scheme (ii) will reduce the evaporator heating surface requirements by about 12% compared with scheme (i). Tabulated data are given for both schemes, which are applicable to a factory slicing 3000 metric tons of beet per day.

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Means of saving fuel in sugar factories. P. CHRISTODOULOU. *Hellenic Sugar Ind. Quarterly Bull.*, 1975, (20), 239–259.—Various means of economizing with fuel in beet sugar factories are examined, including: maintenance of nominal diffusion rate (without overloading) to ensure low sugar losses and low juice draft and hence low steam consumption in evaporation; using thermo-compression to raise the juice Brix (e.g. to 70°) and save steam; operation of vacuum pans on 3rd or 4th evaporator effect vapours; operation of the boilers at 45–60 atm; and avoidance of waste of electric power. By these measures it is calculated that a 30% saving in fuel could be obtained.

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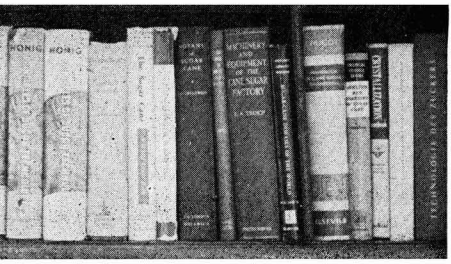
Simplified calculation of beet sugar products. N. S. SKUGOREV, B. M. DANIYAROV, D. D. KLOCHKO, N. N. BOGATIKOV and L. G. BELOSTOTSKII. *Sakhar. Prom.*, 1975, (3), 39–42.—Calculations of boiling parameters at Merkenskii sugar factory are presented to show how an improvement in sugar production can be achieved by converting a 2-massecuite to a 3-massecuite boiling scheme, using some of the 2nd massecuite as footing for 3rd massecuite, which would yield large crystals and thus reduce curing time in the centrifugals and raise the quality of the remelt liquor used for 1st massecuite boiling. The factory processes beet of low sugar content but of high reducing matter, ash and organic acid contents.

* * *

Mixer heaters in the heating scheme of a sugar factory. V. I. DOVGOPOL and I. I. SAGAN'. *Sakhar. Prom.*, 1975, (3), 42–46.—Details are given of a multi-spray heater for steam treatment of condenser, press and fresh water which has successfully operated in more than 20 Soviet sugar factories.



New books

The Australian Sugar Year Book, Volume 34, 1975. Ed. W. KERR. 388 pp; 18×24 cm. (Strand Publishing Pty. Ltd., Brisbane, Queensland, Australia.) 1975. Price: A$8.00.

The layout and format of the latest edition of the Australian Sugar Year Book are as for previous editions (which means that both are satisfactory). The book is split roughly into two halves: the first is a collection of reports of the various cane and sugar organizations' meetings held during 1974, interspersed with original articles, papers presented at the conference of the Queensland Society of Sugar Cane Technologists, feature articles, a directory of sugar industry organizations and their officials, and Queensland sugar statistics for 1974; the latter half of the book is concerned with Queensland and New South Wales sugar factories and districts and offers a very detailed account of factory operations and of the townships which have developed in the cane areas. For all those interested in the Australian sugar industry there is no better source of information than this volume.

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Sugar y Azúcar Yearbook 1974. Ed. D. SMITH. 140 pp; 22×30 cm. (Sugar y Azúcar Yearbook, 25 West 45th St., New York, N.Y., 10036 USA.) 1974.

The 1974 edition of the Yearbook contains surveys of the sugar industries of a number of Asian countries, viz. Bangladesh, Burma, China, India, Iran, Pakistan, Thailand as well as lesser details of the sugar industries of Cambodia, Iraq, Nepal, Malaysia and South Vietnam. The material is supported by personal observations made by the editor, DUDLEY SMITH, who has travelled extensively in the areas mentioned, apart from China. The information given concerns both agricultural and factory aspects, with general examinations of history, development and future prospects of the industry in each country and the human aspects. It must be emphasized that the surveys are of a general nature, so that where a country as large as India comes into question there is perhaps danger of oversimplification of the situation. The list of major sugar-producing states is not sufficiently accurate, since figures published in India indicate that in 1973/74 the major sugar states included two not mentioned in the yearbook, viz. Tamil Nadu (third major sugar producer in India) and Gujarat (seventh in the list of sugar producers). Admittedly, the Indian sugar industry is rather a complex one, and the only other country which could offer difficulties of accuracy is China, which is dealt with only in outline. The yearbook also carries a survey of world production and use of sweeteners (in English and Spanish). The material is well laid out and easy to read.

Official methods of analysis of the Association of Official Analytical Chemists, 12th Edition. Ed. W. HORWITZ, A. SENZEL, H. REYNOLDS and D. L. PARK. 1094 pp; 18·5 × 27·0 cm. (Association of Official Analytical Chemists, PO Box 540, Benjamin Franklin Station, Washington, D.C., 20044 USA.) 1975. Price: $41.00

The AOAC is an organization which develops and evaluates analytical methods for drugs, foods, agricultural materials, cosmetics, colours, beverages and other substances affecting public health. Approved methods are given official sanction at the Association's annual meeting, are first published in the Journal of the AOAC and are finally collected together in the "Official methods" of which this is the 12th Edition.

Obviously, the bulk of the work is of little interest to our readers; but the section on "Sugars and sugar products" has a more specific appeal. Included are details of methods and procedures for determination of colour, moisture, reducing sugars, sucrose and raffinose in beet and cane juice and molasses. Reference tables at the back of the book include a number concerned with sucrose and other sugars.

While the work cannot be regarded as an alternative to books of a similar nature specifically concerned with sugar, it will undoubtedly have an interest for those readers more concerned with the US sugar industry or those who wish to know details of a specific method mentioned only briefly in an article. The printing is very legible and neat and the general layout is an example of how such a work should be arranged.

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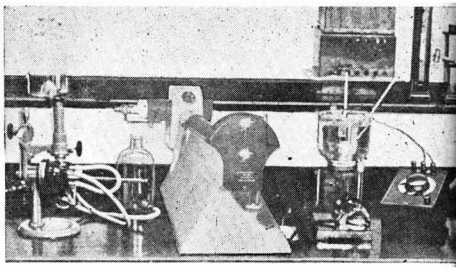
The sugar economy of the Comecon countries. 79 pp. 21 × 29·5 cm. (F. O. Licht K.-G., Ratzeburg, P.O.B. 1220, Germany.) 1975. Price: DM 25.–

This special edition of F. O. Licht's International Sugar Report gives information on the sugar economies of Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania and the USSR, including an outline of the climatic conditions and general agriculture, beet agriculture, sugar production, consumption, imports and exports, campaign results, factory names and locations, and major departments and organizations concerned with the sugar industry or associated fields. Accompanying the details are maps, reproduced from F. O. Licht's "Atlas of the world beet sugar industry" (1973 Edition) showing the locations of the factories listed. For those interested in the East European sugar industries, this is a unique, interesting and valuable source of information.

Laboratory methods & Chemical reports



Possibilities of using enzymatic analysis in sugar factory laboratories. W. AMBROZIAK. *Gaz. Cukr.*, 1975, **83**, 30–33.—The value of enzymatic analysis in the beet sugar factory laboratory is discussed, and determination of glucose and fructose used as an example. The reactions which take place in the determination of various substances are briefly described and a standard procedure given for determining lactic acid, raffinose, sucrose, glucose and fructose, and citric acid in factory products. Some values and correction factors are tabulated.

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Plant pigments as colorants in cane sugar. L. FARBER and F. G. CARPENTER. *Proc.* 1972 *Tech. Session Cane Sugar Refining Research*, 23–31.—The subject is reviewed (with 27 references to the literature) and the work of the Southern Regional Research Centre of the Agricultural Research Service of the US Dept. of Agriculture summarized. (See also CARPENTER *et al.: I.S.J.*, 1975, **77**, 9–12.)

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Characteristics of raw sugar from sweet sorghum. B. A. SMITH, R. C. SMITH, R. V. ROMO, R. A. DE LA CRUZ and B. J. LIME. *Proc.* 1972 *Tech. Session Cane Sugar Refining Research*, 32–39.—See *I.S.J.*, 1974, **76**, 116.

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Fluorescence in commercial sugars. F. G. CARPENTER and J. H. WALL. *Proc.* 1972 *Tech. Session Cane Sugar Refining Research*, 47–61.—Fluorescence studies of raw and refined sugars and molasses are described and details given of the procedure used to obtain corrections for transmission within the active fluorescing element and response and source factors (values of these and the transmission corrections are tabulated). Errors due to scattering were not considered. For each raw sugar sample the fluorescence diagram had four peaks, three of which (peaks 2, 3 and 4) were removed by clarification, bone char treatment and granular carbon treatment, respectively, while peak 1 was the central peak in all sugars. Measurements of fluorescence show promise as a valuable control in refining and could be more informative than colour measurement, it is stated.

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Physical chemistry of phosphatation and carbonatation. M. C. BENNETT. *Proc.* 1972 *Tech. Session Cane Sugar Refining Research*, 62–75.—See *I.S.J.*, 1974, **76**, 40–44, 68–73.

* * *

Calcium activity in phosphate precipitation. M. A. CLARKE and F. G. CARPENTER. *Proc.* 1972 *Tech. Session Cane Sugar Refining Research*, 76–81.—Studies on calcium phosphate clarification aimed at determining calcium ion activity involved use of a calcium ion-selective electrode. Values of pH, pCa (measure of Ca ion activity and defined as the negative log of the calcium ion activity in moles per litre), total calcium, total phosphate, temperature and Brix were fed into a computer to obtain a plot of critical ion activities and hence the nature of the precipitate. The results are discussed, and plans for future study of the process are outlined. It was found that addition of sucrose considerably affects values of pCa; the activity of water in the sucrose-water mixture acting as solvent for the calcium phosphate is a controlling factor in the precipitation. Problems with Ca ion-selective electrodes are also briefly discussed.

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Gas-liquid chromatography of minor constituents in sugars. M. A. GODSHALL. *Proc.* 1972 *Tech. Session Cane Sugar Refining Research*, 93–100.—Gas-liquid chromatography was used to determine malic acid, *p*-hydroxybenzoic acid, palmitic acid and oleic acid in raw and refined sugar. Details are given of the method used involving ethyl acetate as solvent, and levels of the constituents are tabulated, showing the reduction in each brought about by carbonatation, phosphatation, char and resin treatment. Brix was found to affect the amount extracted by the solvent, although the extent was governed, for each component, by the quality of the raw sugar and was not great in higher-quality sugar.

* * *

Statistical methods for the evaluation of polarization settlements. J. LOPEZ O. *Proc.* 33*rd Meeting Sugar Ind. Tech.*, 1974, 22-31.—The use of the difference control chart (to detect causes of variation) and the theory of runs (to test for non-randomness of values in the difference control chart) to evaluate the performance of laboratories used as referees in raw sugar pol determination is explained.

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Heavy metals in cane sugar products. II. M. A. CLARKE, N. M. MORRIS, V. W. TRIPP and F. G. CARPENTER. *Proc.* 33*rd Meeting Sugar Ind., Tech.*, 1974, 91–100.—Sugar samples and refinery process liquors were analysed by atomic absorption spectroscopy to determine Pb, Ni, Co, Cd and Zn. Results indicate that Cd and Pb levels were well below legal limits, while nutrient metals Co and Zn were also too low to be of significant value; Ni, an essential trace element for rats and chicks and possibly man, was also present at very low levels, but there are no legal limits for this element. Comparison is made between the levels of the elements of nutritional value in refined sugar and flour, and requirement levels are suggested.

* * *

Extraneous matter in cane in relation to harvesting. D. P. KULKARNI and P. B. WAGH. *Proc.* 40*th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), A13–A20. Cane samples were separated into top, middle and bottom portions and subjected to laboratory analysis. The top portions were found to contain more fibre and higher impurities contents than the other portions,

particularly in the case of immature cane. The juice from the top portions had a very much higher colour content after defecation than did the other juice. On the basis of the results, it is suggested that norms should be adopted for trashy and clean cane.

* * *

Factors influencing the Java ratio. S. C. SHARMA. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), M31–M49.—Factors affecting the Java ratio examined include errors arising in chemical control balances, e.g. weight of cane and mixed juice, quantity of maceration water, and pol of 1st expressed juice, mixed juice and bagasse, as well as cane condition. The extent to which the ratio can fluctuate from factory to factory and from region to region is discussed.

* * *

Spectrophotometric study of iron content in sugar manufacturing process. S. T. ANJAL, A. B. MAISALE and S. A. MISAL. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), M85–M94 + 1 fig.—The iron content in cane sugar factory products from primary juice to final molasses was determined spectrophotometrically. The results are tabulated and a number of conclusions drawn.

* * *

Evaluation of and remedy for sugar factory losses. P. F. JAIN. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), G29–G36.—Losses occurring in a cane sugar factory are examined and the drawing up of various balances is recommended as a means of establishing Brix and pol losses. Typical balances are presented as examples.

* * *

Sucrose nucleation. I. R. BRETSCHNEIDER and M. SVOBODOVÁ. *Listy Cukr.*, 1975, **91**, 36–41.—Mathematical expressions are presented from which is derived a generalized equation which describes nucleation kinetics in terms of the relationship between the weight of the nuclei formed and the supersaturation coefficient of the solution. Practical investigations, in which the temperature of a saturated sugar solution was reduced in order to effect spontaneous nucleation, were aimed at establishing the limits of the metastable zone. Curves of conductivity *vs.* temperature were plotted and the temperature at which spontaneous nucleation took place noted, from which the factors (temperature and saturation rate) affecting the width of the metastable zone were determined. Values are tabulated for a refined sugar solution.

* * *

Studies on the preparation of cane. V. V. SUBBARAO and V. M. MURUGKAR. *Proc. 26th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1974, (1), E21–E24. Details are given of an apparatus for determining cane bulk density, and a procedure outlined for approximate determination of the percentage of ruptured cells.

* * *

The mechanical strength of sucrose crystals. S. SINGH and H. J. DELAVIER. *Zeitsch. Zuckerind.*, 1975, **100**, 124–133.—The subject of crystal hardness and physical strength is discussed with 139 references to the literature. It is pointed out that, while hardness tests can be conducted on individual crystals, determination of the effect of attrition on bulk sugar is less precise. However, tests were conducted on 100-g samples in a drum rotating at 50 rpm; sieve analyses were made every hour during a total period of 10 hours. The results, expressed as degree of destruction and dust content, showed obvious differences for different sugars of the same grain size. The degree of destruction increased with grain size as a result, it is concluded, of increase in the conglomerate proportion of the sugar with grain size. While no correlation was established between dust proportion and initial grain size, the dust increased, as did degree of destruction, with time of exposure to stress. No correlation was found between either of the "damage" factors and non-sucrose components. Since hardness and rupture strength have been found to be the same for different sugars, the validity of the concept of harder or softer sugar cannot be confirmed within the context of factory processing.

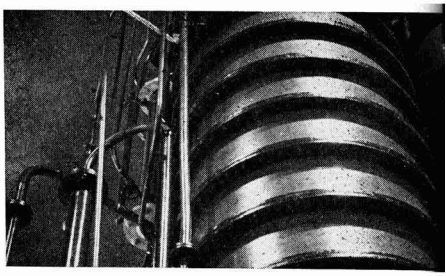
* * *

Analytical investigations on sugar factory waste waters, particularly on the COD value of storage pond waters. E. REINEFELD, H. P. HOFFMANN-WALBECK and J. WITTECK. *Zucker*, 1975, **28**, 165–173.—In view of future legislation in West Germany which will take the COD value of waste water as criterion of its purity instead of BOD_5, investigations were carried out on model waste waters and storage pond waters of varying degrees of degradation to seek a correlation between the two parameters. While COD was found to be equivalent to 1·5 BOD_5 at BOD_5 values above 700 mg.litre^{-1}, below this value there was no constant relationship, the tendency being for the COD value to increase with drop in the BOD_5 value. Further studies are considered necessary in order to identify the residual organic substances which are not directly degraded biochemically and so give high COD values; it is suggested that polysaccharides may contribute to this. In further investigations, the behaviour of specific acids (formic, acetic, propionic, butyric, valeric and lactic acids), determined quantitatively and qualitatively by thin-layer chromatography, was examined. As found earlier, in the anaerobic stage of degradation the ratio of BOD_5 to total volatile acid content (meq.litre^{-1}) is 85:1.

* * *

Isolation and characterization of some colouring matters from syrup. T. S. LAI, T. C. CHEN and Y. T. LIN. *J. Chin. Agr. Chem. Soc.*, 1971, (Dec.), 40–50; through *S.I.A.*, 1975, **37**, Abs. 75-710.—The colorants of syrup from a cane sugar factory using double carbonatation were separated from sugars by adsorption on activated carbon and extensive washing with water, followed by extraction with an azeotropic solution of pyridine and water. After concentration and chromatographic separation, 135 mg of the brown, 63 mg of the yellow and approx. 10 mg of the greenish-yellow colorant were obtained from 4 litres of syrup, the estimated recoveries being 94, 37 and 43%, respectively. The brown colorant (empirical formula $C_{17}H_{28}O_{13}N$) liberated glycine and aspartic acid on hydrolysis and contained the C=C group, probably in conjugation. The yellow colorant (empirical formula $C_{12}H_{22}O_{11}$) showed strongly the presence of a carbonyl group. It is suggested that the brown colorant was probably related to melanoidins while the yellow colorant was probably derived mainly, if not entirely, from sugars.

By-products



Influence of cane varieties in the production of high-yield pulp. R. BAMBANASTE M. and C. M. LORENZO. *Revista Icidca*, 1974, **8**, (3), 16–25.—Fibre and pith content, particle size distribution, chemical analysis and fibre dimensions of bagasse, and physico-mechanical and optical properties of the resulting pulps were determined at intervals during the 1972/73 season at Pablo Noriega sugar factory and related to the variety of cane being crushed; it was found that, of these characteristics, variety only affected particle size distribution, so that high-yield pulp of good quality may be produced from all the varieties.

* * *

Hydrolysis of bagasse. III. R. BLANCO A., J. LASTRA R. and L. LAMI I. *Revista Icidca*, 1974, **8**, (3), 26–35. The kinetics of bagasse hydrolysis with dilute H_2SO_4 in the temperature range 150–180°C have been studied under static conditions. The amount of residual polysaccharides which are hydrolysable only with difficulty has been expressed as a function of temperature, acid concentration and reaction time.

* * *

Determination of true protein in forage yeast. N. GONZÁLEZ, J. KOPECKY and I. VOTRUBA. *Revista Icidca*, 1974, **8**, (3), 36–39.—Non-protein nitrogen is removed from a yeast sample with trichloroacetic acid solution and the protein solubilized in 1N NaOH and the Lowry method used for analysis of protein in solution. For comparison, protein was measured by the method of Barnstein and also by multiplying the Kjeldahl N content by a factor of 6·25. The first two methods gave results comparable to each other and to the last method as applied to the TCA-extracted yeast.

* * *

Technological study on the neutral sulphite pulping process for sugar cane bagasse. C. AGÜERO T., R. BAMBANASTE M. and V. GALISHEV. *Revista Icidca*, 1974, **8**, (3), 40–59.—The process has been studied and found to be very rapid, with reagent concentration as the dominant factor. Cooking parameters are related to chemical and physico-mechanical characteristics of the pulp, and a relationship found between the KAPPA number and the lignin content of the pulp which is linear up to 15% lignin.

* * *

Increase in the digestibility of bagasse for forage. A. CABELLO, O. ALMAZÁN and P. C. MARTIN. *ATAC*, 1974, **33**, (4/5/6), 28–37.—Treatment of bagasse with alkali under pressure, to effect a swelling of the fibre and improve its digestibility, was studied by examining the effects of varying the NaOH concentration, pressure, bagasse:water ratio in a total of 27 combinations. The low concentrations of NaOH were significantly effective, especially at the 5:1 ratio of water:bagasse compared with 10:1, and a subsequent test showed similar results with a 1:1 ratio. The optimum conditions were 2 atmospheres pressure and 6% NaOH on bagasse dry weight.

Sucrose esters in food products. A. G. PEROTTI. *Ind. Alimentari*, 1975, **14**, (1), 77–81.—The chemistry of sucrose ester formation and the properties of sucrose monopalmitate, mono- and distearate are briefly described and advantages of their use (particularly of monopalmitate) in specified food products are explained.

* * *

Traditional molasses and cane juice fermentation processes in the French West Indies. A. PARFAIT and G. SABIN. *Ind. Alim. Agric.*, 1975, **92**, 27–34.—Studies on rum production in the French West Indies are reviewed and the effects of pH, strain of yeast, sugar concentration, nitrogenous matter and acetic acid indicated. Some production figures are given as well as process data and a diagram of the fermentation process and distillation.

* * *

Effect of furfural and 5-hydroxymethyl furfural on the growth and alcohol production by yeast. N. BANERJEE and L. VISHWANATHAN. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), G1–G4 + 2 figs.—Investigations were conducted on alcohol production from cane molasses cultured with *Saccharomyces cerevisiae* in the presence of furfural and 5-hydroxymethyl furfural. At 0·46 $mg.cm^{-3}$, furfural reduced alcohol production by 78·4%, whereas 5-hydroxymethyl furfural reduced production appreciable (by 24·1%) only at 2 $mg.cm^{-3}$. The aim of the study was to establish the possible effect of two major products of molasses browning on fermentation, although it is admitted that the quantities of the two components used in the tests were greater than are likely to occur normally in molasses.

* * *

A techno-economic study on the production of feed yeast from molasses. R. L. SRIVASTAVA and P. GUPTA. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), G15–G21.—Optimum fermentation conditions and fodder yeast yields obtainable from cane molasses are discussed and the economics of the process examined.

* * *

Studies on the use of cane waste molasses in the production of dextran. R. BHATNAGAR and K. A. PRABHU. *Proc. 40th Ann. Conv. Sugar Tech. Assoc. India*, 1974, (1), G23–G27 + 1 fig.—Clinical dextran production by fermentation of juice and molasses clarified by various means, which are specified, showed that the juice yielded more than did the molasses, but that highest yields were obtained from unclarified juice. Comparison of seven cultures tested on a juice-peptone medium showed that Stacey's medium and that of HASSID & BARKER gave highest dextran yields.

Peru sugar statistics[1]

	1974	1973	1972
	(*metric tons, raw value*)		
Initial stocks	67,178	60,639	101,408*
Production	992,464	897,634	899,415
	1,059,642	958,273	1,000,823
Consumption	523,986	484,084	459,252
Exports—Chile	0	0	19,896
USA	427,171	377,011	393,886
USSR	35,000	30,000	67,150
(*Total*)	(*462,171*)	(*407,011*)	(*480,932*)
Final stocks	73,485	67,187	60,639

* Calculated.

The late G. P. Meade.—We regret to report the death on the 23rd October of Dr. GEORGE P. MEADE, at the age of 91. He was born in Cumberland, Md., USA and graduated from New York University in 1905. Almost immediately he was appointed assistant chemist at Central Fajardo in Puerto Rico before undertaking graduate studies at the University of Michigan. From 1906 to 1909 he worked as assistant chemist for the National Sugar Refining Co. at Yonkers, N.Y., then becoming assistant superintendent and chief chemist of the Colonial Sugar Company refinery at Gramercy, La. In 1913 he was appointed superintendent of the Cardenas refinery of Cuban-American Sugar Co., becoming general manager in 1920. In 1923 he left Cuba to become general manager of the Gramercy refinery, becoming a member of the Board of Directors in 1950. He retired in 1956 and subsequently contributed a column entitled "The Proof Stick" in *The Sugar Journal*. He was a prolific contributor to the sugar literature but his name will be most widely known as the author of the later revised editions of the "Cane Sugar Handbook", originally written by G. L. SPENCER. He was a former Vice-President and strong supporter of ICUMSA, as well as a long-time member of Sugar Industry Technologists Inc. His interests included mathematical aspects of track athletics records and the natural history of Louisiana, particularly its snakes. He will be missed by his many friends in the industry.

* * *

Commodity price stabilization conference.—A number of conferences have been held recently under the auspices of the United Nations and political groupings which have been concerned with the stabilization of commodity prices through international agreements, buffer stocks, etc. The first such conference to be held by business interests is to take place in Kuala Lumpur, Malaysia, on the 8th and 9th December. It is to be opened by the Malaysian Minister of Primary Industries and is being organized by the Financial Times Ltd. of London. Speakers will include the EEC's Director for External Relations, the Director of the Commodities Research Unit, the Philippines Secretary of Labour, the Chief Economist of the Asian Development Bank and the President of the Japanese Overseas Economic Cooperation Fund. Further information is available from the Financial Times Ltd. Conference Organization, 388 Strand, London WC2R 0LT.

* * *

Rumanian sugar expansion[2].—Favourable weather conditions, early sowings and adequate rainfall up to the end of April encourage hopes that the production target of 8·5 million tons of sugar beets will be attained in Rumania this year. A substantial enlargement of the beet area is planned for the next five years and, according to press reports, sugar production is to be raised to 1 million tons by 1980.

* * *

The late P. O. Wiehe, C.B.E.—We regret to report the death in August of Dr. PAUL O. WIEHE, former Director of the Mauritius Sugar Industry Research Institute. He graduated from the College of Agriculture in 1930 and obtained his D.Sc. from the University of London. He started his career in the Colonial Education Service in 1936 and between 1938 and 1953 was an officer of the Colonial Agricultural Service in Mauritius, Nyasaland and British Guiana. In 1945 he was responsible for research work in Trinidad and in 1948 was Joint Secretary of the Mauritius Economic Commission. In 1953 he was appointed the first Director of the MSIRI, remaining in this post until 1968 when he became Vice-Chancellor of the newly-created University of Mauritius, from which he retired in 1973. He remained active in sugar affairs and was a consultant on sugar projects for the World Bank. He was an active member of the International Society of Sugar Cane Technologists and served as Chairman of the 11th Congress held in Mauritius.

Brevities

The late E. L. Symes.—We regret to report the death in October of EARL L. SYMES at the age of 83. Born in Marionette, Wis., USA, he graduated from the University of Chicago and Tulane University and moved to Cuba where his father was manager of Colonia La Vega. He worked in the Cuban sugar industry becoming chief chemist of Central Soledad and also of Central Punta Alegre. He then represented the Petree-Dorr Company in Brazil and later throughout most of South America. After retirement he acted as a consultant, with his activities based on his home in New Orleans.

* * *

Bolivian alcohol distillery[3].—The Banco do Brasil is to finance a US $5,000,000 contract awarded by the Corporación Boliviana de Fomento to the Brazilian concern Conger for the construction of an alcohol distillery at the Guabirá sugar factory near Santa Cruz.

* * *

Cuban drought[4].—According to press reports the 1974/75 sugar season in Cuba ended at an unusually early date, as a consequence of drought. The yields in most of the important sugar-producing provinces have been reduced, owing to the drought. Production figures have not been announced, although Prime Minister CASTRO has stated that the drought would result in a loss of some 800,000 tons of sugar, and it is anticipated that the Cuban crop may have been considerably below that of last year.

* * *

Sweden sugar imports 1974[5].—Imports of sugar by Sweden in 1974 were only 66,563 metric tons, raw value, as against 114,681 tons the previous year. The largest amount came from Cuba (36,019 tons compared with 54,172 tons in 1973), while the Dominican Republic supplied 22,912 tons (0 in 1973); 4318 tons came from Finland (42,920) and 3112 tons from the UK (29). The balance of 202 tons came from other countries including Poland which in 1973 had supplied 16,798 tons.

* * *

Sugar beet trials for South Africa[6].—Following a visit by O. ROSE, former Agricultural Director of the British Sugar Corporation Ltd., at the invitation of the South African Sugar Association, his recommendations were approved by the Association. These included the conducting of trials by the Experiment Station and under its aegis by farmers to assess yield and quality potential in the main ecological areas of the Natal midlands and to determine the effects of soils and planting times on the performance of a number of varieties.

* * *

Brazil sugar expansion[7].—Brazil is studying various monumental agricultural projects, the largest approved being the Ometto sugar project which has 35,000 hectares of irrigated land for its production. The factory will be the biggest ever and will eventually produce 540,000 tons a year. Trials with the most promising varieties have yielded between 150 and 200 tons per hectare, one of the highest yields in the world and comparing with 60 tons per hectare in São Paulo.

* * *

Florida cane sugar expansion[8].—Although there are no present plans for the erection of new mills, a programme of expansion is under way. At the Sugar Cane Growers' Cooperative in Belle Glade a second tandem was due to come into operation for the 1975/76 season which will permit the crushing of 18,000 tons of cane per day as against 10,781 tons averaged in 1974/75. A new milling tandem at the Okeelanta Sugar Division of Gulf and Western Food Products Co. will increase capacity from 9000 to 12,000 t.c.d. while capacity at the Glades County Sugar Growers' Cooperative in Moore Haven is to be raised by 2000 t.c.d.

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[1] *I.S.O. Stat. Bull.*, 1975, **34**, (6), 83.
[2] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (16), 9.
[3] *Bank of London & S. America Review*, 1975, **9**, 263.
[4] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (16), 12.
[5] *I.S.O. Stat. Bull.*, 1975, **34**, (4), 99.
[6] *S. African Sugar J.*, 1975, **59**, 413.
[7] *Amerop Noticias*, 1975, (23), 11.
[8] *Sugar y Azúcar*, 1975, **70**, (8), 10.

Brevities

Walkers sugar machinery order from Indonesia.—Walkers Ltd. of Maryborough, Queensland, have won an export contract worth $A 6,000,000 for the supply of cane handling, preparation and milling equipment to East Java.

* * *

Hurricane damage in Cuba[1].—The Cuban Ministry of Sugar has reported that hurricane Eloise seriously damaged sugar cane plantations in parts of Oriente province although the loss has not yet been evaluated. Transportation used to take cane to the mills has been seriously affected, as roads and railways have been damaged and will have to be overhauled before the beginning of the harvest in early December.

* * *

Somalia sugar project.—Booker McConnell Ltd. has been invited by the Government of Somalia to develop, on a turnkey basis, a major agro-industrial sugar project in the Middle Juba region of the country. The total cost of this development will be of the order of £28 million. The project calls for a fully-irrigated sugar cane estate with an ultimate size of 12,000 hectares, a 50/60,000-ton sugar factory capable of expansion to 100,000 tons of sugar a year and a distillery to process the molasses produced by the factory. Estate roads, housing for 12,000 families, necessary amenities and ancillary services will be included in the development. The agricultural development of this project will be the responsibility of Bookers Agricultural and Technical Services Ltd. and the factory will be supplied by Fletcher and Stewart Ltd. of Derby, both members of the Booker Group.

* * *

Pakistan cane crop reduction[2].—According to a US Department of Agriculture report, unfavourable weather conditions, particularly drought, have reduced the crop prospects for sugar cane in Pakistan. In order to avoid expensive imports, the domestic sugar ration has been reduced and the consumer price has been raised.

* * *

Cane smut research in Hawaii[3].—Under a cooperative agreement with the US Department of Agriculture, the Experiment Station of the Hawaiian Sugar Planters' Association is to carry out research on breeding of smut-resistant but high-yielding cane varieties. During the 3-year work, the Station will propagate about 2·7 million seedlings each year and screen about 125,000 of these for reaction to smut disease. Another study is to be made on inter- and intra-island wind dispersal of the disease and its dispersal by migratory birds.

* * *

Bagasse paper study project[4].—Mexico and Guyana are to undertake studies for joint-venture programmes including the development of paper manufacture from bagasse.

* * *

Bagasse utilization studies in Florida[5].—Scientists at the Florida Agricultural Experiment Station, Gainesville, are to assess the technological and economic feasibility of methods for direct fermentation of bagasse to ethanol, production of methane for converting to methanol, and conversion to oil.

* * *

New sugar factories in Kenya[6].—The Kenya Government plans to build a K£22 million white sugar factory at Awendo in the South Nyanza District. Available reports indicate that all the preliminary work has been completed and that construction is expected to begin in early 1976. The project is expected to employ about 3000 workers and will require some 40,000 acres of land. The contract signed with Fives-Cail Babcock[7] is for construction of a K£12·3 million sugar factory in the Bungoma District of Western Province of which 80% will be financed by French bank credits. When completed, the factory will have an output capacity of 90,000 tons of white sugar annually, although initially production will reach 60,000 tons. The Nzoia Sugar Co. Ltd. will manage the project.

* * *

Bagasse pulp manufacture in Peru[8].—A bleached pulp plant, with a capacity of 350 tons a day, using bagasse, is to be set up near Chiclayo at a cost equivalent to US$105 million and will begin production in 1978.

Taiwan sugar exports[9]

	1974	1973	1972
	(metric tons)		
White sugar:			
Hong Kong	1,103	411	320
Indonesia	0	21,975	0
Japan	0	0	160
Jordan	4,000	1,088	0
Khmer Republic	0	0	1,200
Laos	0	359	0
Malaysia	0	1,839	0
Qatar	2,000	0	0
Saudi Arabia	13,000	6,576	0
Singapore	0	1,196	2,100
Sudan	0	0	20,000
Yemen	0	5,381	0
Other countries	5,083	999	2,193
Total	25,186	39,806	25,973
Raw sugar:			
Hong Kong	501	0	0
Japan	169,882	143,563	135,250
Khmer Republic	0	0	10,293
Korea, South	239,342	226,428	203,182
Lebanon	10,999	0	0
Malaysia	30,671	0	5,661
USA	66,152	78,227	78,304
Vietnam, South	0	19,660	59,083
Other countries	8,555	0	0
Total	526,102	467,878	491,773
Grand Total (raw value)	553,478	507,684	520,003

Zaire sugar projects[10].—Two new projects have been formulated to develop the sugar industry of Zaire. A sum equivalent to $15·5 million has been allocated for the cultivation of 10,000 hectares of sugar cane in the Bandundu Region[11]. Another development project is being undertaken by the Office National du Sucre in the Shaba Region, in cooperation with a French company, Technisucre.

* * *

Thailand sugar production 1974/75[12].—According to latest reports from Thailand, 1974/75 sugar production amounted to 1,112,109 metric tons, raw value, compared with 964,261 tons produced in 1973/74, an increase of 148,000 tons or 15%. The amount of cane harvested in 1974/75 totalled 13,400,000 tons against the 14,500,000 tons estimated at the beginning of the season. During the crop year seven new mills started working, including Wanachai Sugar Industry and Thaiekkarak Sugar Industry in the Northern area, Thai Pumpoon Sugar Industry, Rachburi Sugar Industry, Prachup Sugar Industry, Mahakun Sugar Industry and Bam Pong Sugar Industry in the Central area. All these mills worked at only part capacity and it is expected that they will increase throughput during the 1975/76 crop, which is currently estimated at 16·5 million tons of cane.

* * *

Bulgaria sugar expansion plans[13].—Bulgarian sugar production, at present 370,000–380,000 metric tons a year, is to be trebled by 1980 to allow the country to become self-sufficient in sugar.

* * *

St. Kitts sugar production[14].—Sugar production reached 24,582 long tons in the crop just ended, some 6% below the previous outturn. The decline was due to a reduction in the cane harvested from 217,220 tons in 1974 to 215,985 this year, resulting from a reduced acreage.

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[1] *Public Ledger*, 1st November 1975.
[2] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (16), 13.
[3] *USDA News*, 9th August 1975.
[4] *Bank of London & S. America Review*, 1975, **9**, 535.
[5] *USDA News*, 13th August 1975.
[6] *Standard and Chartered Review*, September 1975, 10.
[7] *I.S.J.*, 1975, **77**, 319.
[8] *Bank of London & S. America Review*, 1975, **9**, 540.
[9] *I.S.O. Stat. Bull.*, 1975, **34**, (7), 29.
[10] *Standard and Chartered Review*, September 1975, 7.
[11] See *I.S.J.*, 1975, **77**, 31.
[12] F. O. Licht, *International Sugar Rpt.*, 1975, **107**, (22), 17.
[13] *Die Lebensmittelind.*, 1975, **22**, 332.
[14] *Reuter's Sugar Rpt.*, 22nd July 1975.

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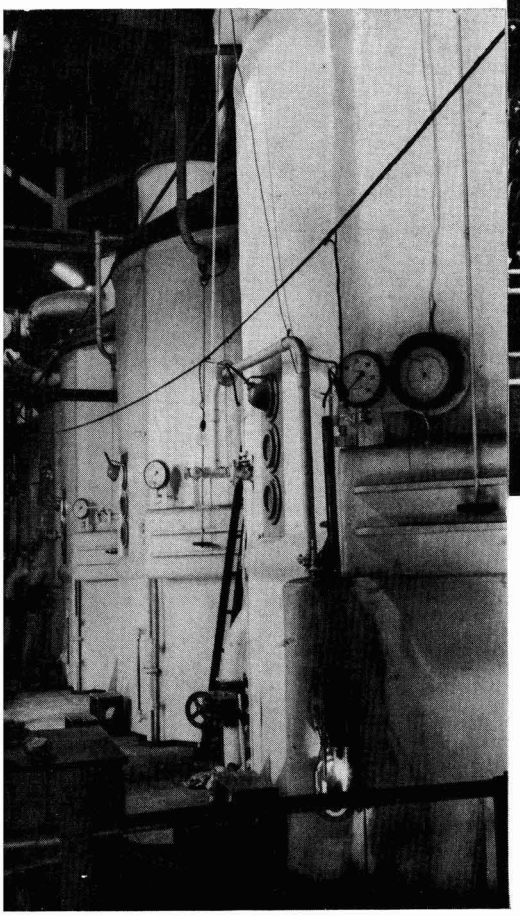

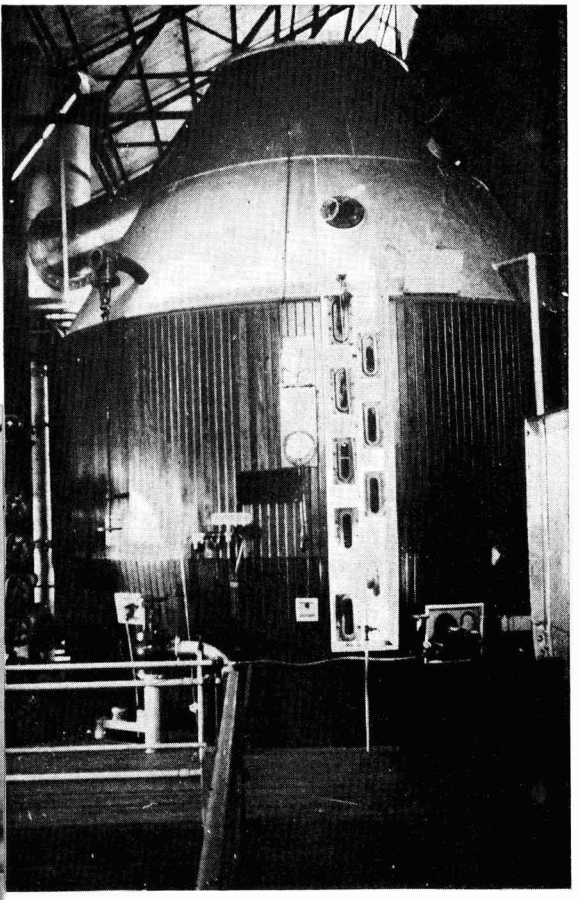

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ERRATA AND CORRIGENDA

Page 15.	Line 9 of column 1.	Read "B. J. COCHRAN" for "W. J. COCHRAN".
Page 17.	Line 34 of column 1.	Read "Problems of weed control. J. H. ARMSTRONG" for "A note on liquid fertilizers. R. C. CRAWFORD".
Page 57.	Line 52 of column 2.	Read "LYSYANSKII" for "LYSYANSKI".
Page 60.	Line 44 of column 1.	Read "of" for "for".
Page 113.	Line 33 of column 1.	Read "19" for "209".
Page 177.	Line 59 of column 2.	Read "compared with 53 tons per ha without treatment" for "without treatment".
Page 213.	Line 56 of column 2.	Read "TSYUKALO" for "TYSUKALO".
Page 239.	Line 36 of column 2.	Read "AGAFONOV" for "AGAFANOV".
Page 239.	Line 57 of column 2.	Read "AGAFONOV" for "AGAFANOV".
Page 272.	Line 7 of column 2.	Read "to" for "ot".
Page 311.	Line 45 of column 1.	Read "NEURURER" for "NEUPURER".
Page 347.	Line 1 of column 2.	Read "BOGDAN-" for "BODAN-"

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SOME REMARKS ON ITS USE

In using this Index it should be noted that the principal entries cover the several stages of production : CULTIVATION (*see* Beet; Cane; Diseases; Fertilizers; Irrigation; Mechanization; Pests; Soils; Transport; Varieties; Weeds, etc.); SUGAR PROCESSING (*see* Bagasse; Boilers; Boiling; Carbonatation; Centrifugals; Clarification; Crystallization; Diffusion; Evaporators; Filters; Massecuite; Milling; Mills; Molasses; Pans, Vacuum; Scale; Sucrose; Sugar; Sulphitation; Water, etc.); REFINING (*see* Bone Char; Carbon; Refining; etc.); and BY-PRODUCTS (*see* Alcohol; Animal Fodder; By-Products; Fermentation; Paper; Pulp; Yeast, etc.).

Subjects covered separately include Ash; Bulk handling and storage; Colour; Control, Automatic and Chemical; Countries; Ion exchange; Juice; Micro-organisms; pH; Polarization; Transport; Weighing, etc. Glucose and Fructose are to be found under Dextrose and Levulose. Obituaries, Statistics and Trade Notices are collected together under those headings. "Sucrose" implies the pure chemical; "Sugar" the commercial product; and "Sugars" the chemical family, rather than grades of sugar. When looking under the author's name, it should be remembered that the surname may be the penultimate in Spanish.

(Abs.) indicates *Abstract*; (Brev.), *Brevity*; (N.B.), *New Books*; (N.C.), *Note and Comment*; (Pat.), *Patent*; (Stat.), *Statistics*; (T.N.), *Trade Notice*.

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