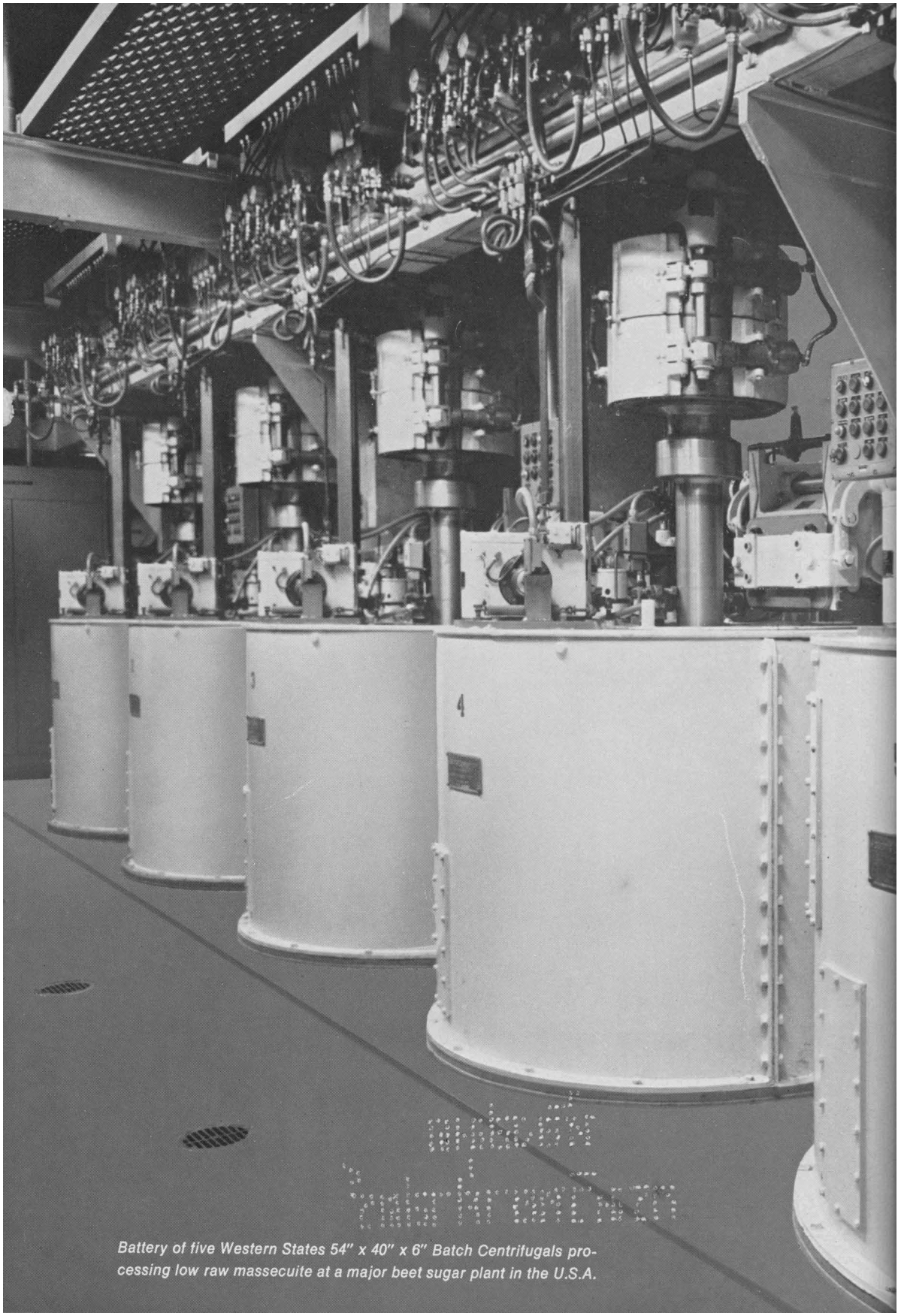
THE International Sugar Journal

MARCH 1970



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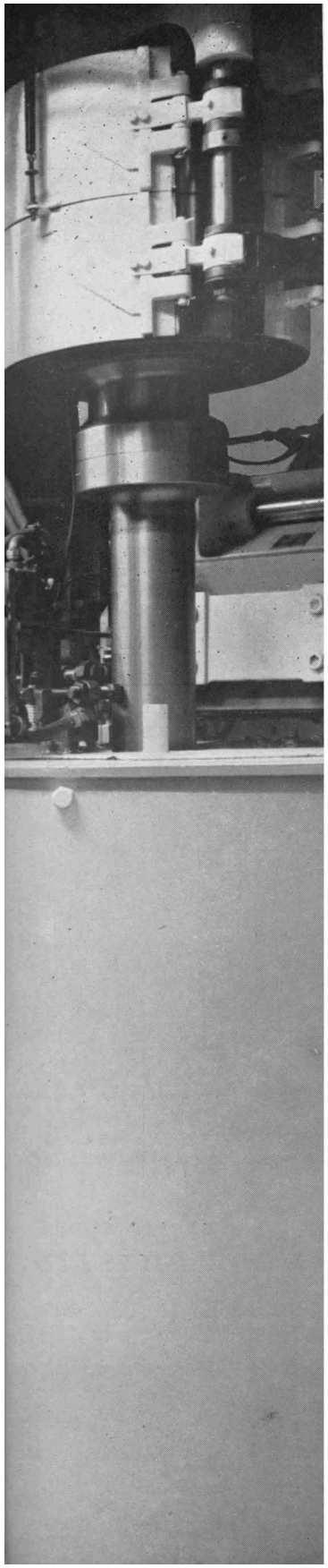

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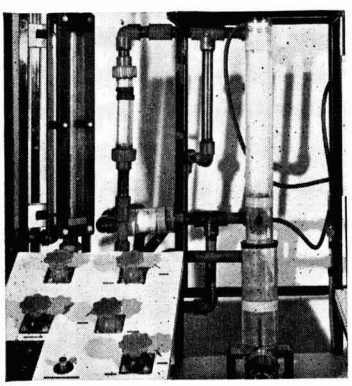

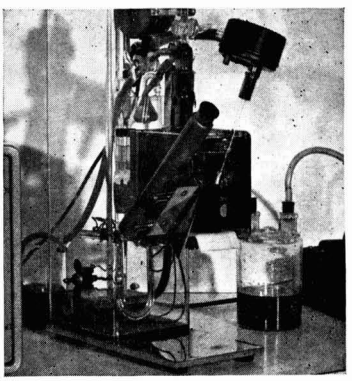

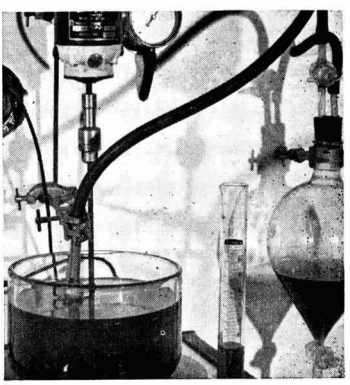

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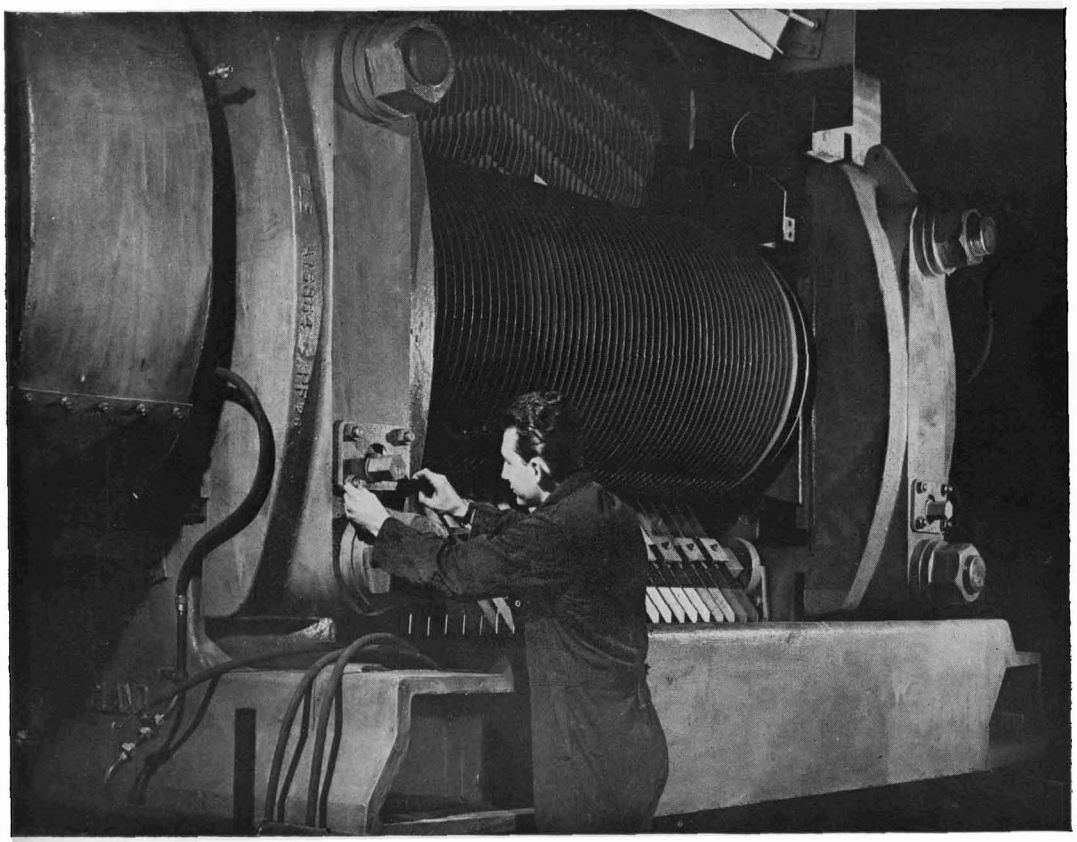

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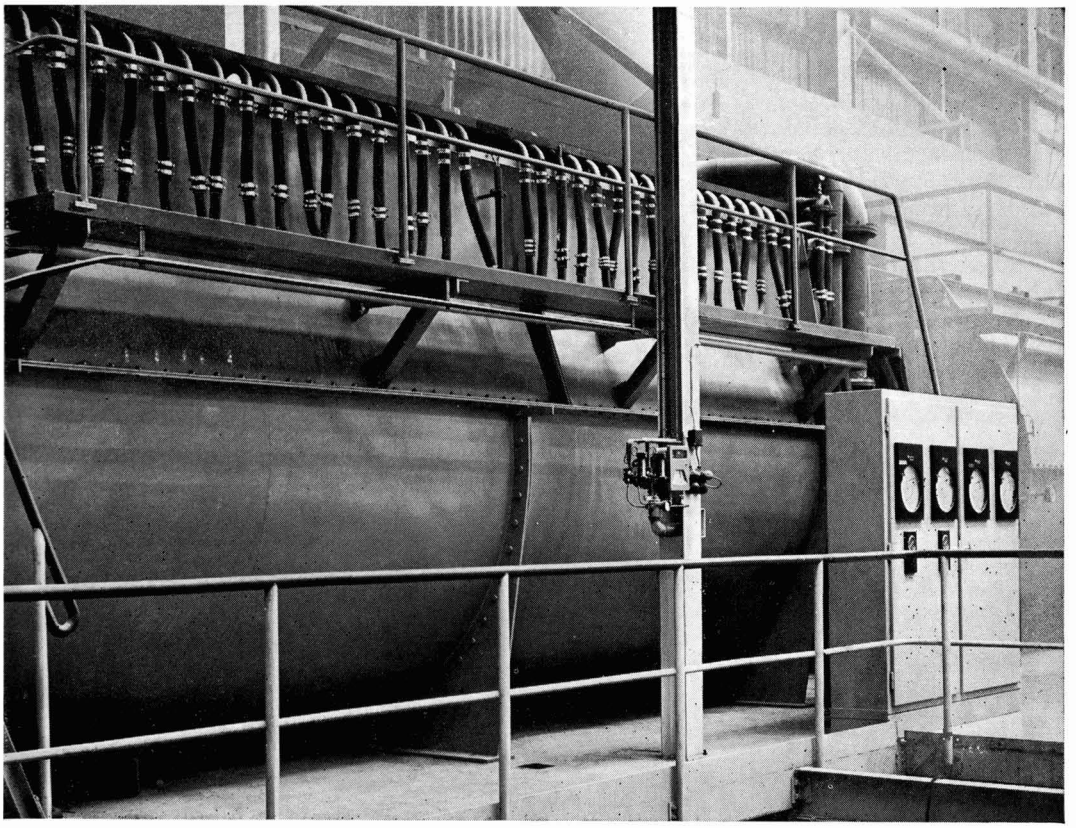

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Editor and Manager:
D. LEIGHTON, B.Sc., F.R.I.C.

Assistant Editor:
M. G. COPE, M.I.L.

Agricultural Editor:
F. N. HOWES, D.Sc., I.S.O.

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

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Annual Subscription: 50s 0d or $8.00 post free

Single Copies: 6s 0d or $1 post free

March 1970

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Quelques observations sur la diffusion de canne par des techniques de percolation et d'immersion. E. J. BUCHANAN et L. M. S. A. JULLIENNE. *p.* 67–70

La première partie de cet article sur la diffusion de canne décrit l'équipement "courant" et les techniques utilisées au cours d'expériences de diffusion par percolation et par immersion menées sur une petite échelle à l'aide de bagasse sortant du premier moulin. Bien que les vitesses d'extraction étaient initialement plus élevées en diffusion par percolation qu'en diffusion par immersion, l'introduction d'air et la formation de canaux ont réduit la vitesse de percolation à un point tel que le niveau final d'extraction se situait légèrement en dessous de celui atteint en diffusion par immersion. Les vitesses de percolation diminuèrent en fin de diffusion par suite du tassement du lit de bagasse.

* * *

Méthodes de classification, pour le sucre de canne, de grandes populations de clones. I. Emploi d'une presse hydraulique pour l'estimation de la concentration en fibres % poids de matériau frais. N. D. STEVENSON, J. DANIELS, D. R. HORSLEY et A. S. MASILACA. *p.* 70–75

Les résultats de tests ont montré que l'on peut estimer rapidement la teneur en fibres dans un clone de canne à partir du volume de jus exprimé, à l'aide d'une presse hydraulique, d'une quantitité pesée de canne préalablement réduite en fibres. L'équipement utilisé est décrit et les effets de poids de l'échantillon, de la pression exercée et du moment de la prise d'échantillon sont discutés.

* * *

Raffinage du sucre—Notes sur les procédés unitaires. VIe Partie. Considérations sur la cuisson du sucre. F. M. CHAPMAN. *p.* 76–78

Parmi les caractéristiques de la cuisson discutées dans la première partie de cet article, figurent la formation de conglomérats et l'emploi d'agitateurs afin d'éviter leur formation, la vitesse de croissance des cristaux et les effets des conglomérats et de la poussière sur la signification du coefficient de variation (ou déviation standard) de la dimension des cristaux.

Einige Beobachtungen über die im Perkolationsverfahren und die submers durchgeführte Zuckerrohr-Diffusion. E. J. BUCHANAN und L. M. S. A. JULLIENNE. *S.* 67–70

Im ersten Teil dieser Arbeit über die Zuckerrohr-Diffusion werden apparative Ausgestaltung und Methode der in Kleinversuchen nach dem Gegenstromprinzip im Perkolationsverfahren und submers durchgeführten Diffusion von Bagasse aus der ersten Rohrmühle beschrieben. Obwohl bei der Perkolationstechnik die Extraktionsgeschwindigkeit anfangs grösser war als bei der submers durchgeführten Diffusion, nahm die Perkolationsgeschwindigkeit durch Luftzutritt und Kanalbildung so ab, dass die schliesslich erreichte Extraktion etwas geringer war als bei der submers durchgeführten Diffusion. Die gegen Ende der Diffusion beobachtete Abnahme der Perkolationsgeschwindigkeit war eine Folge der Verdichtung der Bagasseschicht.

* * *

Selektionsmethoden für Zuckerrohr-Zuchtstämme, die aus Klonen erhalten wurden. I. Die Verwendung einer hydraulischen Presse zur Bestimmung des Rohfasergehaltes in Prozent des Frischgewichtes. N. D. STEVENSON, J. DANIELS, D. R. HORSLEY und A. S. MASILACA. *S.* 70–75

Versuchsergebnisse lassen erkennen, dass der Rohfasergehalt in einem Zuckerrohr-Klon schnell aus dem Volumen des Saftes bestimmt werden kann, der mit Hilfe einer hydraulischen Presse aus einer abgewogenen Menge zerfaserten Rohres ausgepresst wurde. Es werden die benötigte Ausrüstung sowie der Einfluss des Gewichtes der Probe, des Pressdruckes und des Zeitpunktes der Probenahme diskutiert.

* * *

Zuckerraffination—Bemerkungen über Grundoperationen. Teil VI. Gedanken über den Kochprozess. F. M. CHAPMAN. *S.* 76–78

Im ersten Abschnitt dieses Artikels werden die Bildung von Konglomeraten und die Verwendung von Rührwerken zu ihrer Vermeidung, die Wachstumsgeschwindigkeit der Kristalle sowie der Einfluss von Konglomeraten und Staub auf die Bedeutung des Variationskoeffizienten bzw. der Standardabweichung (CV) der Kristallgrösse als charakterische Merkmale des Kochprozesses behandelt.

Algunas observaciones sobre difusión de caña por técnicas de percolación y sumersión. E. J. BUCHANAN y L. M. S. A. JULLIENNE. *Pág.* 67–70

En el primer parte de este artículo se describen los equipos y las técnicas usado por ensayos a pequeña escala de difusión a co-corriente de bagazo del primer molino en la forma de percolación y de sumersión. Mientras que en difusión por percolación las velocidades de extracción estaban inicialmente superior a ellas en difusión, aeración y formación de canales reducieron la velocidad de percolación de modo que la extracción final estuvo algo menos que con difusión por sumersión. Las velocidades de percolación se disminuieron hasta el fin de difusión a causa de compactación de la cama de bagazo.

* * *

Métodos de clasificación para grandes poblaciones clonales de caña de azúcar. Parte I. El uso de una prensa hidráulica para estimar la concentración de fibra por ciento de peso fresco. N. D. STEVENSON, J. DANIELS, D. R. HORSLEY y A. S. MASILACA. *Pág.* 70–75

Resultas de ensayos han demostrado que el contenido de fibra en una clona de caña puede estimarse rápidamente del volumen de jugo expresado por una prensa hidráulica de una cantidad pesada de caña desfibrada. Se presenta una descripción del equipo adaptado por la técnica y se discuten los efectos del peso de la muestra, de la presión y de la etapa de desarrollo de la caña cuando la muestra se toma.

* * *

Refinación de azúcar—Notas sobre procesos unitarios. Parte VI. Pensamientos sobre cocción de azúcar. F. M. CHAPMAN. *Pág.* 76–78

Entre los aspectos de cocción en tachos que se discuten en la primera sección de este artículo se incluyen la formación de conglomerados y el uso de agitadores para la evitar, la velocidad de crecimiento de cristales y los efectos de conglomerados y polvo sobre la significación del coeficiente de variación (o deviación normal) de tamaño de los cristales.

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXXII MARCH 1970 No. 855

Notes & Comments

Queensland 1969 sugar crop[1].

The 27 weeks of the 1969 Queensland crushing season from 17th June to 23rd December was one of the most difficult and disappointing for many years. Following on the generally excellent harvest of the previous year, the field conditions during 1969 put both men and equipment fully to the test and the performance achieved under such adverse conditions was a tribute to growers and mill owners and their employees. Queensland as a whole was in the grip of drought when 1969 commenced and all cane-growing districts suffered when the normal monsoonal rains did not appear until very late.

To compound the difficulties, winter rains interrupted the harvest and, at the Moreton and Rocky Point mills, crushing was actually shut down for some weeks because of water-logged fields. Elsewhere, except at Bundaberg, Childers and Maryborough which were still drought-stricken, growers were experiencing great difficulty with their harvesting equipment under wet field conditions. The result was more costly harvesting and almost insuperable problems of extraneous matter because of immature cane and poor conditions for pre-harvest burning. Nevertheless, with about 83% of the crop mechanically harvested, 1969 will go down in history as the year which proved that reliable machines are capable of delivering good quality cane even under the most unfavourable of field conditions.

The 505,711 acres harvested was 40,595 acres or 7·43% less than the record 546,306 acres of the 1968 season and yielded 14,699,282 tons of cane which is the lowest figure since 1966 and was 15·59% less than the record 17,414,966 tons of 1968. Sugar manufactured totalled 2,080,353 tons of 94 N.T. sugar, 523,965 tons or 20·12% less than the 2,604,318 tons of 1968. Sugar production in New South Wales, totalling 98,000 tons, brings the 1969 Australian production to 2,178,353 long tons 94 N.T.

Yields of 29·07 tons of cane and 4·11 tons 94 N.T. sugar per acre give a cane:sugar ratio of 7·066 for 1969 which compares unfavourably with the 6·69 ratio of 1968 and is slightly poorer than the 1959/68 average ratio of 6·99.

World sugar balance, 1969/70.

First estimates of the world sugar balance in the crop year September 1969/August 1970 have been published by F. O. Licht K.G.[2] and are reproduced below, together with revised figures for the two previous crop years.

	1969/70	1968/69	1967/68
	(*metric tons, raw value*)		
Initial stocks	18,425,657	19,637,969	19,333,587
Production	73,079,375	68,298,413	67,806,979
Imports	23,533,925	21,326,637	22,178,635
	115,038,957	109,263,019	109,319,201
Exports	23,510,550	21,386,553	22,042,786
Consumption	71,831,321	69,450,809	67,638,446
Final stocks	19,697,086	18,425,657	19,637,969
Production increase..	4,780,962 (7·00%)	491,434 (0·72%)	2,190,470 (3·34%)
Consumption increase	2,380,512 (3·43%)	1,812,363 (2·68%)	2,320,564 (3·55%)
Final stocks % consumption ..	27·42%	26·53%	29·03%

Although these figures indicate a substantial increase in the stock position during the year there was little reaction from the world sugar market since it was generally realized that irrespective of world supply and demand figures, availability of sugar is largely controlled by the operation of the International Sugar Agreement. Further, Licht drew attention to the fact that the 1969/70 production figure included an estimate of 8 million tons for the current Cuban crop which is higher than most observers have been anticipating, and the stock figure includes a figure of 2,381,000 tons for India which is not likely to reach the world market because of its high production cost and the reluctance of the Indian Government to subsidize its disposal.

Licht also has indicated[3] that his production estimate includes a figure of 9·5 million tons for the USSR and that latest advice from the Soviet Union indicates that not all the beets harvested have been processed so that the estimate may have to be reduced. Finally, Licht also acknowledges that the unknown

[1] *Producers' Review*, 1970, **60**, (1), 3.
[2] *International Sugar Rpt.*, 1969, **102**, (3), 1.
[3] *ibid.*, (4), 5.

effects of the banning of cyclamates in many countries produce a degree of uncertainty in the sugar consumption figures for 1969/70 and that the figure set in the estimated balance will be higher on later revision, rather than lower.

* * *

International Sugar Organization.

The Executive committee of the International Sugar Organization met in London on the 2nd February to discuss and make recommendations concerning Article 30 (which deals with supplies to importing members when the price rises above 4·75 cents/lb) to the Council for its meeting in March.

* * *

UK sugar surcharge.

In view of the rise in the world price of raw sugar, the UK Minister of Agriculture, Fisheries and Food made Orders under the Sugar Act 1956 reducing the surcharge on three occasions recently whereby the surcharge of 2½d per lb (23s 4d per cwt) was reduced to 2¼d per lb (21s 0d per cwt) from 20th January 1970, to 2d per lb (18s 8d per cwt) from 22nd January and to 1¾d per lb (16s 4d per cwt) from the 3rd February.

* * *

India's expanding production[1].

Sugar production in India has undergone remarkable fluctuations in recent years. Although this in general reflects climatic conditions, it must be remembered that there is a substantial non-centrifugal sugar industry in the country, and the fiscal measures of the Indian Government have also been responsible for important variations from year to year in the quantities of cane made available for processing by the sugar mills.

The industry in India is old-established and, recognising the need for reorganization, the Government set up a Sugar Enquiry Commission, which submitted its report in October 1965. This called for an expansion in the industry and some resiting of installations. It was forecast that by 1970/71 production in the country would rise to around 4·5 million tons, of which 3,760,000 tons would be needed for domestic requirements. It was also recommended that the level of initial stocks held at the commencement of a new campaign should be maintained at around 800,000 tons but, in any case, at a figure not less than 20% of the previous season's output.

In 1965/66, the first season after the publication of the report, production expanded to a figure in excess of 3·5 million metric tons, tel quel, but acute drought severely limited output during the following two campaigns and production was only in the region of 2·2 million tons. Measures taken by the Indian Government to encourage cane suppliers to deliver to the sugar factories rather than the gur producers, together with an improvement in the weather conditions, led to an expansion in production and in 1968/69 output once more exceeded 3·5 million tons.

For the 1969/70 season the minimum price for cane is being maintained at around £4 per metric ton, which should ensure adequate deliveries to the sugar factories, while the sugar producers will again be permitted to sell 30% of their output at free market prices, leaving the balance to be distributed at the level controlled by the Government. Output is currently forecast at around four million tons and, if this is realized, it will pose something of a problem for the Indian Government. Carry-over stocks this year amounted to 1·25 million tons, which indicates that total sugar availability in 1969/70 will be in the region of 5,250,000 tons. In 1968/69 consumption requirements were below 2,700,000 tons and even if this figure were to increase by as much as 20% in 1969/70 the outlet would be only 3,250,000 tons, which would leave two million tons for stocks and exports. Small guaranteed export markets are available in both the United Kingdom and the United States and measures have already been taken to allow sugar to be shipped to these destinations during 1970. These will require a measure of subsidization but far greater financial assistance would be necessary if India were to take advantage of her ISA quota and ship her entitlement to the world market. In 1969 the Indian Government decided against providing means whereby sugar for export could be subsidized for delivery to the world market and although adequate supplies were available the entire ISA quota was relinquished. To date no decision has been made in respect of free market exports in 1970.

A new element now appears likely to enter the Indian sugar scene. Sugar beet is to be grown on an experimental basis in several provinces in 1970/71 and it is anticipated that harvesting will commence in April/May 1971. Even if the new crop should prove to be a successful venture it is unlikely that more than a few thousand tons of sugar will be produced during the initial years, but thereafter this new source could make a noticeable addition to the availability of sugar in India.

* * *

UK refined sugar prices.

The UK Ministry of Agriculture, Fisheries and Food announced in January that the ex-refinery price for granulated sugar in 1-cwt paper bags was expected to be maintained within the range 70s 0d to 76s 0d per cwt during 1970. The target range for 1969 was 73s 0d to 78s 0d while actual prices varied between 68s 6d and 78s 6d, averaging 74s 11½d per cwt. C. Czarnikow Ltd[2]. mentions that this was the highest level since 1964 but points out that, by comparison, the price parity in the US in 1969 averaged 106s 10d per cwt while that in Japan reached 125s 10d per cwt. The basic intervention price in the northern region of the EEC in 1969 worked out at 89s 10½d per cwt.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1969, (944), 197; 1970, (954), 13.

[2] *Sugar Review*, 1970, (955), 18.

Some observations on diffusion of cane by percolation and submerged techniques

By E. J. BUCHANAN and L. M. S. A. JULLIENNE*
(Sugar Milling Research Institute, Durban, Natal, South Africa)

INTRODUCTION

FROM Pioneer factory in Hawaii, diffuser extractions of 98% and boiling house recoveries of over 88% have been reported. In the first ten weeks of operation in 1969 the percolation type cane diffuser at Dalton, in South Africa, averaged 98·4% extraction with a boiling house recovery of 87·6%. During the whole of last season the averages were respectively 97·08% and 86·27%. The improvement in extraction is attributed to the marked increase in fineness of cane preparation achieved by reversing the rotation of both sets of knives. The sucrose:fibre ratio in cane remained constant so that the two extraction figures are comparable. The improvement in boiling house recovery was in sympathy with a small increase in juice purity but the result is excellent by local standards for a notoriously poor cane area.

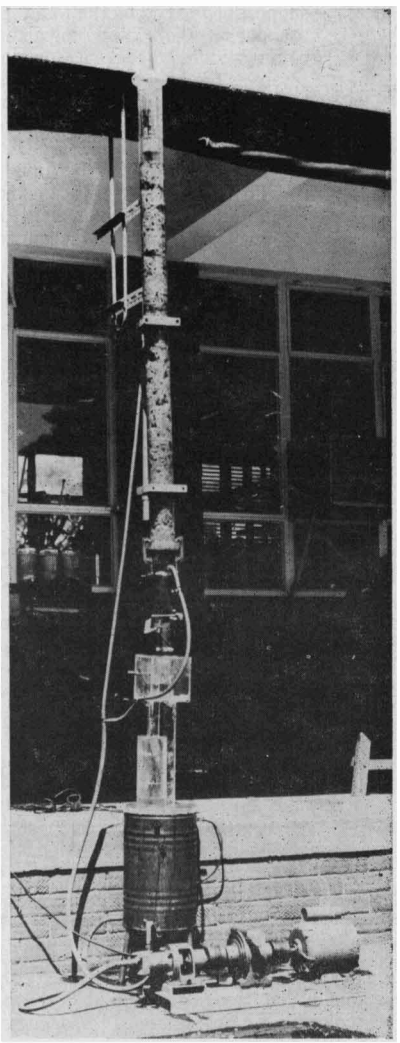

Fig. 1. Batch column diffuser fitted with flowmeter and thermostatic recirculation system used for percolation diffusion experiments

In spite of these encouraging results the true value of increased extraction by diffusion in terms of bagged sugar is often disputed[1] and several investigations have been reported on attempts to demonstrate the adverse effects on impurity extraction of certain process conditions such as pH, retention time, temperature and preparation[2,3]. Furthermore, the mechanism by which extraction occurs in a diffuser has been a subject of controversy. While some authors suggest that molecular diffusion is the controlling mechanism[4,5] others consider "diffusion" to be a misnomer and prefer "displacement washing" or lixiviation[6,7]. Apart from these more fundamental concepts the practical aspects of diffuser operation and selection have not been resolved. In particular, the relative merits of submerged and percolation diffusion warrant closer investigation.

This paper deals with an investigation into the mechanism of extraction during cane diffusion, the limitations of percolation and submerged diffusion and the effect of process variables on the extraction of impurities from cane. The tests were conducted using small-scale batch diffusers owing to the limitation of cane supply. Since only the principles of diffuser operation were being investigated, the quantitative aspects of the results were regarded as being of secondary importance and for this reason small-scale batch co-current operation was selected as being most practical for a laboratory investigation. Owing to the wide scope of the investigation and the vast amount of data accumulated this paper contains only a summary of the main aspects of the investigation.

---

* Mr. Buchanan is now Technical Adviser to the S.A. Cane Growers' Association and Mr. Jullienne has joined the Tongaat Sugar Co. Ltd.

[1] SEAFORD: *I.S.J.*, 1968, **70**, 70.

[2] BJERAGER and BRÜNICHE-OLSEN: *Proc. 13th Congr. I.S.S.C.T.*, 1968, 151–164.

[3] LOFT: *Sugar J.*, 1969, **31**, (9), 31.

[4] BUCHANAN: *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 65.

[5] GRAHAM *et al.*: *Proc. 13th Congr. I.S.S.C.T.*, 1968, 122–132.

[6] PAYNE: *Proc. 11th Congr. I.S.S.C.T.*, 1962, 971.

[7] TANTAWI: *Proc. 12th Congr. I.S.S.C.T.*, 1965, 1497.

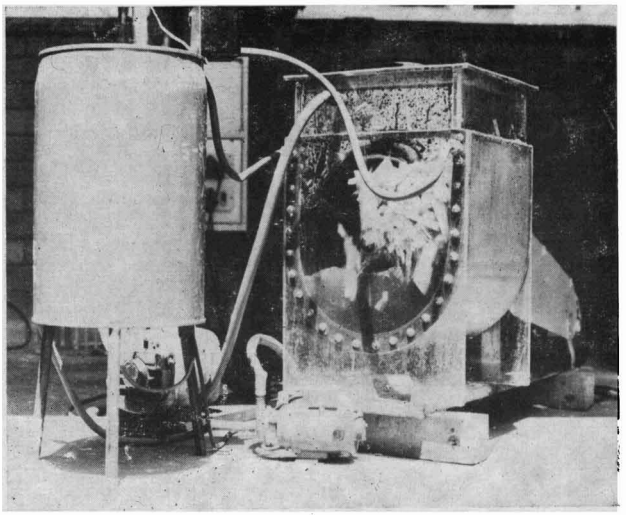

Fig. 2. Mixing tro . n fitted with thermostat'c recirculation systeni for submerged diffusion

EQUIPMENT AND METHODS

The diffusion tests wei e carried out in two batch diffusers, one operating on the percolation principle (Fig. 1) and the other submerged (Fig. 2). Owing to the difficulty of operating test equipment in counter-current fashion and in view of the fact that only qualitative conclusio is were envisaged, co-current operation was used throughout the tests. The percolation diffuser consisted of a "Perspex" pipe of 4 inches diameter fitted with a batch flow meter for measuring percolation rates and a heated surge tank with thermostatic control to ensure temperature stability. Recirculation was achieved through a small Mono pump to avoid aeration and the recycle stream was fed above the cane column through a device which maintained a small constant head of juice above the cane bed. The submerged diffuser consisted of a U-shaped trough 12 inches in diameter and 12 inches long with transparent "Perspex" ends. The trough was fitted with a rake-type rotating agitator and a perforated plate was fitted at one end so that liquid could be withdrawn without solid and recirculated by means of a pump to the other end of the trough. In this way the liquid phase could be sampled representatively. The trough was fitted with an outer jacket through which was circulated warm water from a thermostatically controlled tank. This maintained the contents of the trough at constant temperature.

For all diffusion runs 2 kilograms of prepared cane and 7·5 litres of water were used. The water was preheated to give the desired operating temperature (usually 70°C) after addition to the cane. Small samples were withdrawn from the pump discharge during each test run for analysis.

PERCOLATION AND EXTRACTION RATES

Percolation Rates

Percolation rates through first mill bagasse measured in the diffusion column were generally higher than those found in commercial diffusers. Rates of 10 gal/min/sq.ft. were measured on the average compared with 6 gal/min/sq.ft. for commercial diffusers. This was probably due to the small diameter of the column and consequent increase in voidage caused by the additional support of the bed by the walls. It was found that the presence of air in the column reduced the percolation rate. By reversing the juice flow and percolating in the upward direction until the bed was flooded the subsequent downward percolation was doubled. Fig. 3 shows the effect of dropping the liquid level of a flooded bed. In this case the percolation rate was approximately halved. After upward washing to flood the bed the subsequent percolation rate increased to its former value.

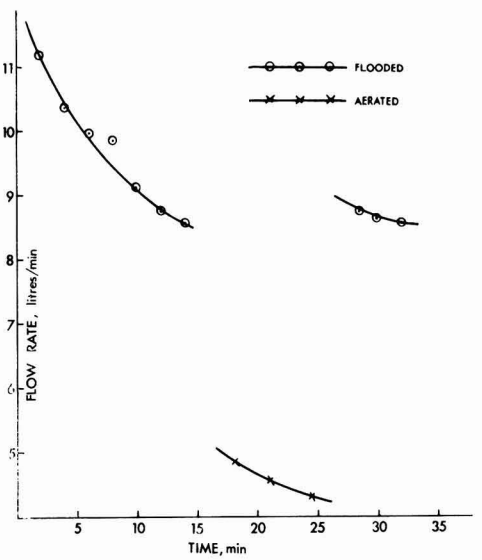

Fig. 3. Effect of aeration on percolation rates through a first mill bagasse bed due to lowering of liquid level and subsequent deaeration by upward washing

For extended runs on aerated and flooded columns it was found that the higher percolation rates in flooded columns were maintained throughout the diffusion cycle in spite of the fact that even using a positive displacement pump a small amount of air was introduced to the column in the recycled juice. Under both flooded and aerated conditions the per-

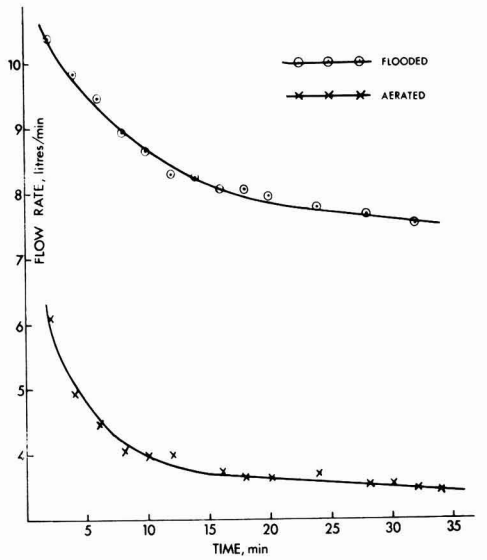

Fig. 4. Graph showing the more rapid decrease in percolation rates with time in an aerated column as opposed to a flooding column using first mill bagasse

colation rate decreased towards the end of the diffusion cycle owing to compaction of the bed. However, the fall off in percolation rate with time was greater in the case of the aerated column. Fig. 4 illustrates these latter points. Percolation rates were reduced by finer preparation as might be expected but the most severe retardation of percolation was caused by segregation of fine bagacillo particles which were present in high proportions in finely prepared bagasse. These segregated particles were recycled to choke the surface of the bed. Alternative flooding and aeration was found to effect only small changes in the rate of extraction but plugging by bagacillo resulted in serious retardation of extraction rates.

Extraction Rates

The approach to equilibrium was studied by taking regular timed samples during the diffusion runs and recording the refractometer Brix. Parallel tests were conducted using the submerged and percolation diffusers. In both cases extractions of 90 to 95% were obtained in the first ten minutes with shredded cane and 75 to 80% with first mill bagasse. However, examination of the equilibrium curves typified by Fig. 5 showed that the submerged diffuser gave consistently higher equilibrium points after 80 minutes of diffusion than those of the percolation diffuser. Analysis of the cane and bagasse showed that the percolation diffuser achieved about 5% lower extraction than that of the submerged diffuser at the end of the run. In contrast, however, the percolation diffuser was found to give an appreciably faster rate of approach to equilibrium as shown in Fig. 6. In the latter figure the percentage of the final extraction is plotted against time.

These results suggest that channelling in the percolation diffuser reduces the area of wetted particle in the percolation diffuser and hence reduces the degree of extraction at the apparent equilibrium point. The higher rate of approach to equilibrium achieved in the percolation diffuser would appear to be due to the initial positive displacement of concentrated juice since in the initial stages of diffusion it was observed that very high concentrations existed momentarily in the surge tank below the column. Because of this, it was difficult to draw any quantitative conclusions regarding the first few minutes of diffusion. However, this observation agrees with the opinions expressed by PAYNE[6] regarding "displacement washing". This point has an important bearing on the operation of commercial multistage diffusers in which the interstage time of about 5 min is too short to reach equilibrium at each stage. In the latter case, high initial rates of mass transfer are essential and the above observations suggest that this is most efficiently achieved in the percolation diffuser. The reduced final extraction due to incomplete wetting is, however, a distinct disadvantage and suggests low diffusion rates through the matrix of particles to the juice channels. It should be stressed that the preparation in these tests was characterized by a very heterogeneous particle size distribution. A fine and even preparation with high even voidage appears to be desirable for efficient stagewise washing during percolation. This also is consistent with the conclusions of PAYNE[6].

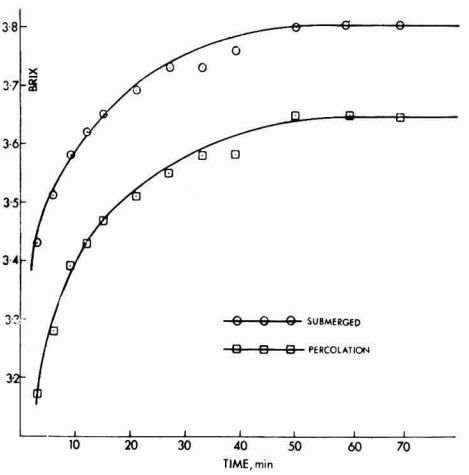

Fig. 5. Extract concentration curves for percolation and submerged diffusion of shredded cane indicating reduced final extraction by percolation diffusion due to channelling

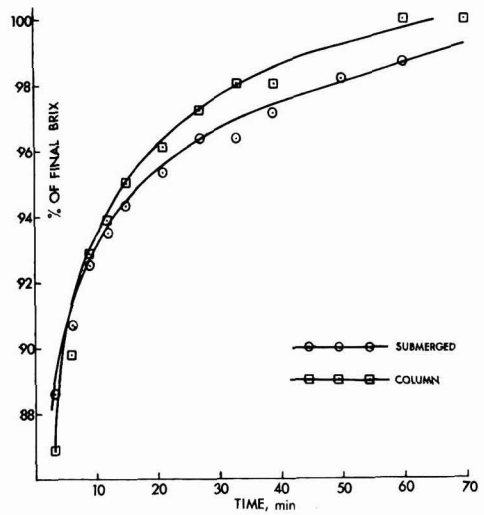

Fig. 6. Progressive extraction to equilibrium (100%) for tests in Fig. 5 showing greater initial extraction rate for percolation diffusion

In Fig. 7 the equilibrium curves of Fig. 6 are replotted to relate the rate of change of concentration, dC/dT, to the concentration. Towards the end of the extraction a distinct change in the relationship occurs for both percolation and submerged diffusion. It is suggested that this point marks the transition from washing to diffusion-controlled extraction. The transition is reached earlier in the case of the percolation diffuser and this is consistent with the earlier observation that channelling in the percolation diffuser renders less solute available to washing.

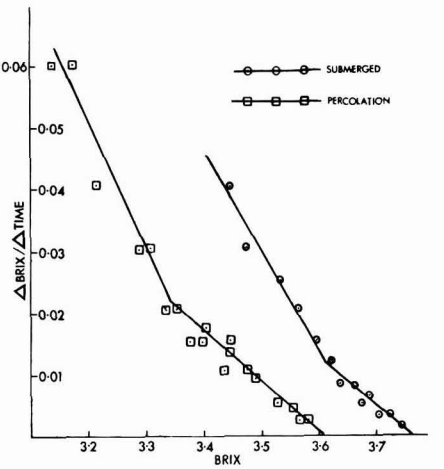

Fig. 7. Rate of change of concentration *vs.* concentration showing mass transfer rate transition points

(To be continued)

Screening methods for large clonal populations of sugar cane

1. The use of a hydraulic press to estimate fibre % fresh weight concentration

By N. D. STEVENSON, J. DANIELS, D. R. HORSLEY and A. S. MASILACA
(South Pacific Sugar Mills Ltd., Lautoka, Fiji.)

Introduction

FIBRE % fresh weight is an important economic characteristic of sugar cane. If fibre is too low, a sugar factory has to burn other fuel in addition to the bagasse produced. If fibre is too high, sugar losses by retention in the larger amount of bagasse are increased, the surplus bagasse must be disposed of or utilized, and horsepower requirements are increased to crush the same weight of cane.

In normal unselected hybrid sugar cane populations, there are usually appreciable numbers of clones too high in fibre concentration for commercial exploitation[1]. Many such clones are eliminated early in selection programmes because there are significant genetic correlations between high fibre and thin stalks[2,3] and possibly between high fibre and heavy flowering[4,5], all of which are undesirable characteristics.

[1] Brown: *Proc. 12th Congr. I.S.S.C.T.*, 1967, 754–759.
[2] James & Falgout: *Crop Science*, 1969, **9**, 88–91.
[3] Brown, Daniels & Latter: *Theoretical and Applied Genetics*, 1969, **39**, 1–10.
[4] López Hernández: *Sugar y Azúcar*, 1965, **60**, (2), 41–42.
[5] Evans: *Proc. B.W.I. Sugar Tech.*, 1966, **1**, 119–132.

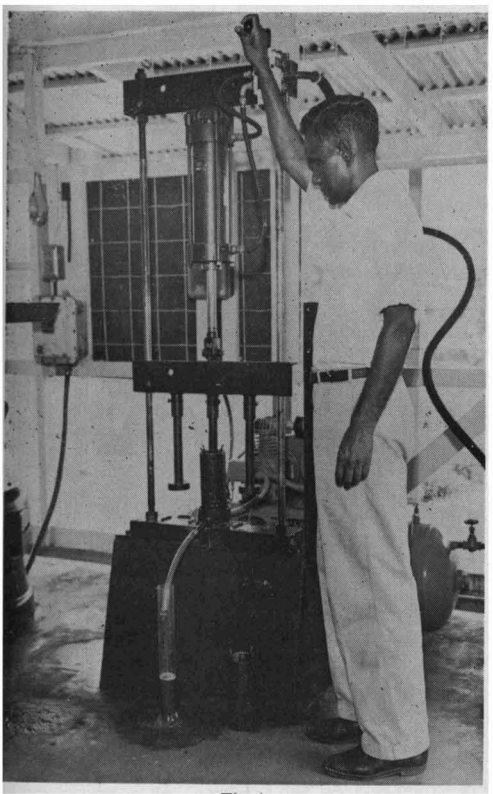

Fig. 1

However, following the early stages of selection programmes, there still remain high fibre clones not recognisable other than by analysis for fibre concentration. Recognition of these clones has necessarily been delayed until relatively late in selection programmes because of the lack of a sufficiently rapid, reliable method of fibre estimation.

If a rapid test for fibre % fresh weight concentration could be devised, then clones could be eliminated on high fibre alone early in a selection programme. Rapid fibre determination could thus be used to speed up the selection process or to fill more entries in the mid- and late-testing stages with clones of suitable fibre level. The second alternative would lead to an increase in the effective population size for selection for other desirable characteristics, hence improving the chances of obtaining new commercial clones. Similar ideas have been presented by DAVIDSON[6].

At this station, the older traditional methods of fibre determination[7,8,9] have been speeded up by using a cutter grinder to disintegrate cane stalk samples and washing machines (with spin driers) to aid in the fibre separation process[1]. The validity of this method modification has been confirmed in Australia[10,11] and the U.S.A.[2,12]. These improvements enabled extensive

[6] *Sugar J.*, 1968, **31**, (5) 9–11.
[7] SAVAGE: *I.S.J.*, 1910, **12**, 498–501.
[8] "Laboratory Manual for Queensland Sugar Mills", 2nd Edn., 1939.
[9] "Methods of Chemical Control", 2nd Edn., 1931.
[10] STEWART: *Proc. 13th Congr. I.S.S.C.T.*, 1969, 1006–1012.
[11] *idem.: Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 157–160.
[12] HEBERT: *Sugar y Azúcar*, 1969, **64**, (9), 42–44.

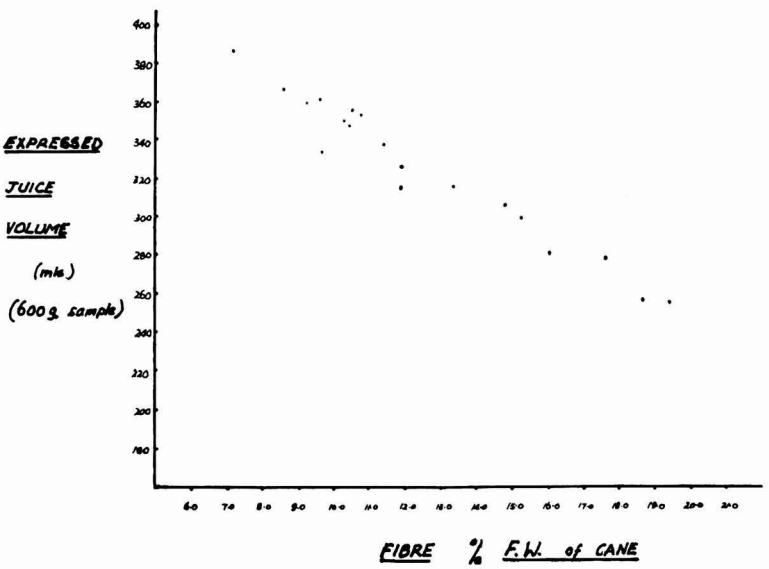

Fig. 2

Table I

Regression and correlation results between fibre % fresh weight of cane and volume of expressed juice for Experiments 1, 2 and 3

Experiment Number	*Correlation Coefficient*	*Regression Coefficient* ‡	*Standard error of Regression Coefficient*	*Regression equation*
1	—0·95**	—12·3**	±1·0	$Y = -12{\cdot}3X + 479$
2	—0·85**	—16·4**	±0·9	$Y = -16{\cdot}4X + 626$
3	—0·88**	—17·9**	±0·1	$Y = -17{\cdot}9X + 640$

** significant at 1% level. ‡ ml expressed juice per unit of fibre % fresh weight

genetic studies on fibre % fresh weight of cane which were not previously possible[1,3].

However the above method and others described recently[10, 11, 12, 13, 14] are still laborious and take at least a day to produce a result; they cannot be used for on-the-spot screening of large numbers of clones.

As an alternative to direct fibre estimation by analysis, several authors[6, 15] have used rind hardness and obtained satisfactory correlations with fibre. We have confirmed these authors' correlations but find, like them, that multiple measurements of rind hardness are necessary to obtain sufficient accuracy. When large numbers of clones are tested, a heavy computational load results and the method is not applicable where less than four stalks per clone are available.

We have developed a method described below which can produce an estimate of relative fibre concentration in cane almost immediately. The test is based on the proposition that if juice is squeezed out of the cane under standardized conditions, then the volume of juice must correlate with the remaining constituent, fibre.

This method has additional potential advantages because meaningful measurements can also be made on the juice (e.g. whole sample mean Brix and ash concentration by conductivity).

Materials and Methods

The basic procedure is to fibrate cane stalks in a cutter-grinder and then to express the juice from the fibrated material in a custom-built hydraulic press (Fig. 1). Details of the equipment and method are: Cane is fibrated in a Jeffco cutter-grinder size 10 model 262. A known mass of fibrated material is packed into a 2-inch diameter perforated steel cylinder. The juice is expressed by a plunger which is activated by a 4½-inch bore, 9-inch stroke hydraulic ram. The

[13] Tanimoto: *Hawaiian Planters' Record*, 1964, **57**, 133–150.
[14] Henderson *et al.*: *Sugar Bull.*, 1968, **46**, (13), 8–15.
[15] Buzacott: *Tech. Comm. Bureau Sugar Expt. Sta.* (Queensland), 1940, (8).

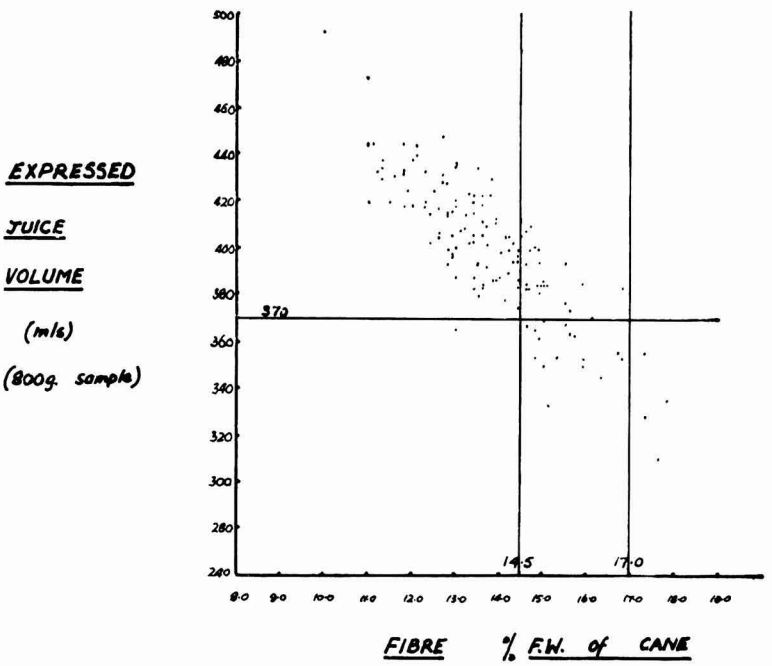

Fig. 3

ram is powered by a Broom & Wade model RM5 air compressor unit delivering 100 p.s.i.

Three experiments were carried out to test the correlation between volume of expressed juice and fibre % fresh weight (Experiments 1–3). The results were so promising that the investigations were extended to determine the effect of sample size (Experiments 4 and 5) and varying expression pressure (Experiments 6 and 7). Experimental details were as follows:

Experiment 1. Six stalks each of twenty clones known to range between very high and very low fibre concentration were cutter-ground and one 600g sample of fibrated cane material from each clone was used for juice expression. Also, fibre concentration was determined for each sample using the modified traditional method referred to above[1].

Experiment 2. Single stalk samples of 136 clones were cutter-ground to obtain an 800g sample of each. There were four replications of each clone and the volume of expressed juice and fibre % fresh weight were averaged over the four replicates. The clones were a random selection from an unselected seedling population maintained for genetical experiments.

Experiment 3. Twelve stalks each of 20 clones were sub-sampled taking a third of each stalk (4 top sections, 4 middle sections and 4 bottom sections). Each sub-sample was then cutter-ground and 800g aliquots of fibrated cane material were used for juice expression. There were four replications for each clone. The clones were from an advanced stage of our clonal testing programme.

Experiments 4 *and* 5. These experiments aimed at determining optimum sample size. Stalks of two clones were cutter-ground and variable sample weights of each from 300g to 900g were used for juice expression at 100 p.s.i. pressure. Seven replications were used.

Experiment 4 utilized a commercial clone, Ragnar, which at the time of the experiment analysed 11% fibre on fresh weight.

Experiment 5 utilized an experimental clone, 60R1231, which at the time of the experiment analysed 14½% fibre on fresh weight.

Experiments 6 *and* 7. These experiments aimed at determining the magnitude of the effect on expressed juice volume of pressure variations from the standardized 100 p.s.i. The clones utilized were the same as in Experiments 4 and 5. 800g samples were used along with ten replications for each pressure (80, 90 and 98 p.s.i.).

Results and Discussion

Table I shows regression and correlation coefficients between fibre % fresh weight of cane (independent variable) and volume of expressed juice (dependent variable) for Experiments 1, 2 and 3. Scatter diagrams for each of these experiments are shown in Figs. 2, 3 and 4 respectively.

Figs. 2, 3 and 4 show that the respective experiments contained clones with fibre concentrations ranging from 6–20 fibre % fresh weight, and that, by virtue of the high degree of correlation observed between fibre % fresh weight and volume of expressed juice (as

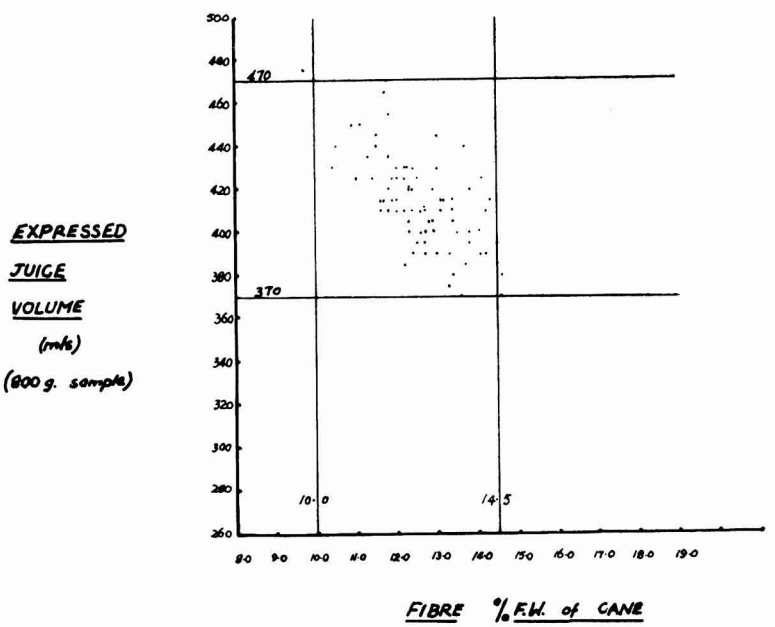

Fig. 4

shown in Table I), it is possible, by judiciously setting minimum volume levels of expressed juice, to screen out all the very high fibred clones and a proportion of the medium-to-high fibre concentration clones.

For example, in Experiment 2 (Fig. 3), there were 43 clones with fibre concentrations exceeding 14·5% fibre on fresh weight. If all clones giving 370 ml of juice or less were discarded, 20 clones or almost half the clones with fibre concentrations exceeding 14·5 units would have been eliminated. None over 17·0% fibre would have survived.

One clone (at about 13% fibre) would have been eliminated wrongly. However, it is possible that it is particularly hard to express juice from the fibre of this clone. If this was the case, then the removal of such a clone on the basis of poor juice expression, even though its fibre concentration may have been acceptable, would appear to be desirable as it may also be difficult to express juice from such clones in a sugar mill.

Experiment 3 utilized a population of clones from an advanced stage of our clonal testing programme. These clones had already been subjected to selection for acceptable fibre % fresh weight (10% to 14½%) in an earlier selection stage. Fig. 4 indicates that the use of the volume of expressed juice method would not have been worthwhile on these clones. In later stages of testing, it would seem better to expend the extra effort and actually measure fibre % fresh weight of cane. The only justification for its use at this stage would be to detect clones from which it is difficult to express juice.

Experiments 1 to 3 showed that there is a good overall correlation between fibre % fresh weight and volume of juice extracted, but that the correlation is not close enough for absolute estimation of fibre.

The test could be used in several ways: firstly to detect all very high fibre clones and a good proportion of the medium to high fibre clones, thus allowing the assembly of populations of clones of more suitable fibre for the mid- and late stages of testing. This is in effect an increase in the effective population size of these later stages; hence chances of success should be increased.

Table II

Effects of sample size on volume of juice expressed per 100 g of fibrated cane material (Experiment 4)

(low fibre clone)

Sample size, g	*Mean (7 determinations) juice volume, ml*	*Standard error*	*Coefficient of variation (%)*
300	35·8	±1·5	4·2
400	47·9	±0·9	1·9
500	53·8	±1·3	2·4
600	54·4	±1·3	2·4
700	53·7	±2·1	3·9
800	55·0	±1·1	2·0
900	56·0	±1·4	2·5

5% L.S.D. of means of 7 determinations 1·5

Table III

Effect of sample size on volume of juice expressed per 100 g of fibrated cane material (Experiment 5)

(high fibre clone)

Sample size, g	*Mean (7 determinations) juice volume, ml*	*Standard error*	*Coefficient of variation (%)*
300	36·6	±1·5	4·0
400	49·4	±0·5	1·1
500	53·3	±1·7	3·2
600	53·2	±1·4	2·7
700	53·4	±1·4	2·7
800	55·2	±1·3	2·3
900	56·0	±2·0	3·6

5% L.S.D. of means of 7 determinations 1·3

Secondly, it may be used to speed up existing programmes by discarding many high-fibre clones early in the selection programme, thus reducing the number of clones remaining for detailed testing in later stages.

It should be noted that the test has the advantage that a result is available immediately, thus allowing on-the-spot decisions which are most desirable in *population* screening. With all other methods there is

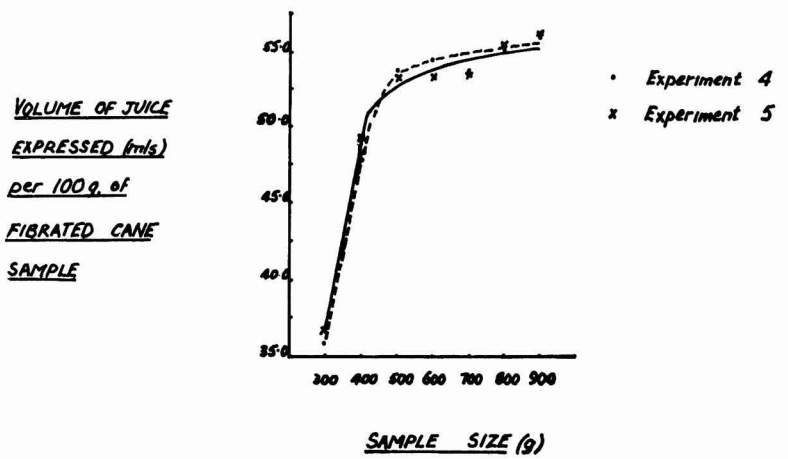

Fig. 5

Table IV

Effect of varying pressure on volume of juice expressed from 800g fibrated cane material

Pressure (*p.s.i.*)	*Experiment* 6				*Experiment* 7			
	80	90	98		80	90	98	
Mean (10 determinations) volume of expressed juice, ml	443·2	449·9	455·3	l.s.d. 5%= 3·6	413·3	420·5	422·0	l.s.d. 5%= 6·3
Standard error, ml	±10·2	±13·0	±9·3		±17·2	±15·8	±16·9	
Coefficient of variation (%)	2·3	2·9	2·1		4·2	3·8	4·0	

at least one day's delay before analytical results are available.

Experiments 4 and 5 aimed to assess optimum sample size for our equipment. The results are presented in Tables II and III and graphically in Fig. 5. Expressed juice volume per unit weight increased as sample size was increased. The greatest increase was from 300g to 500g after which it virtually became constant. The standard errors and coefficients of variation (Tables II and III) showed all sample sizes tested gave similar error variability, i.e. no sample size was optimum with respect to minimizing error.

The increase in fibre concentration from 11 to 14½% fresh weight between Experiments 4 and 5 did not influence error variability. However, an important feature was that although there was a fibre difference of 3½ units between the two experiments, the volumes of expressed juice were similar between the two experiments for respective sample sizes.

This result no doubt reflects the different sampling times; and the nature of the material. The material for Experiment 4 was harvested after a long period of slow growth and near the end of our dry season. The material for Experiment 5 was obtained after a period of rapid growth and near the end of our wet season.

It is apparent that a particular juice volume may not correspond to the same fibre % fresh weight in different experiments. Hence, standard clones of known relative fibre concentrations must be included with each group of clones to be tested to enable the setting of action levels for discard of any clones from the population under test.

We have been able to test one hypothesis formulated to explain why the test does not provide absolute figures. It was thought that differences in Brix between different periods could alter the juice surface tension or some other juice property causing less juice to be retained on the fibre at lower Brix. We investigated this hypothesis using data of varying Brix derived from Experiment 2, and found no evidence to support it[16]. The reason must be associated with some other factor e.g. alteration in the nature of fibre induced by different climatic conditions, time of the year, soil type, etc., or differences in preparation of fibrated material and/or expression of the juice, e.g. wearing of grinder blades, etc.

The lack of absolute measurement is no serious disability because, as explained above, clones under trial are always assessed relative to standard clones from the same trial.

Experiments 6 and 7 aimed at determining the effects of variable pressure on volume of expressed juice. It is possible that pressure could vary under routine conditions so it is desirable to estimate the possibility of error from this source. Ten samples were each pressed at 80, 90 and 98 p.s.i. in each experiment. Table IV summarizes the results which show that variable pressure could exert a small but significant effect on expressed juice volume, i.e. the regression coefficients presented in Table I (which are applicable to Experiment 6) indicated that approximately 17 ml of juice from a 800g sample were equivalent to one unit of fibre % fresh weight of cane. If pressure was allowed to vary from 80 to 100 p.s.i. as in Table IV, such variation in this case could cause errors of 0·7 units of fibre.

The data in Table IV suggests that the error could be slightly reduced with higher fibre clones (compare Experiments 6 and 7) and perhaps would increase with lower fibre clones.

It is considered advisable to aim to control pressure at least within a 10 p.s.i. range (i.e. 90 to 100) in order to control this small but significant source of error.

Summary

The experiments presented indicate that it is practicable to screen for fibre % fresh weight concentration by measuring the volume of juice expressed from a weighed quantity of cutter-grinder fibrated cane. The method enables on-the-spot decisions to be made about the fibre concentration in a clone.

The method will enable the speeding-up of programmes by the early removal of many clones which would, without a rapid fibre determination method, survive to later stages of testing only to be discarded ultimately because of grossly unsuitable fibre concentration for milling. Alternatively more of the available places in the later stages of testing could be occupied by clones of acceptable fibre concentration thus increasing the effective population size for selection for other characters.

The instrument used is described and the effects of three major variables, sample weight, expression pressure and time of sampling have been investigated.

The data indicate that repeatable results could be obtained using sample sizes varying from 300g to 900g, that standard clones of known relative fibre concentrations and from the same crop should be included in each population to be tested, and that variable hydraulic pressure exerts a significant but non critical effect.

[16] Unpublished data.

Sugar refining - Notes on unit processes

Part VI. Thoughts on sugar boiling

By F. M. CHAPMAN (Chapman & Associates, Vancouver, B.C., Canada)

THE vacuum pan is not a particularly good tool for conducting the growth of sugar crystals, nor is it very well employed. However, sugar boiling is a commercial process and a vacuum pan must be designed for practical use in the production of a wide range of crystal sizes. The complexity of the relationships between time, growth and crystal geometry makes it inevitable that the simultaneous requirements of versatility in crystal mean aperture* and small standard deviation† will be incompatible.

The quality of the sugar produced will be affected by the size of the crystals; small crystals have lower included water, lower ash, lower colour and higher thermo-stability. Full seeding is general for the production of the best large-grained sugars of 800–1000 microns. Crystallization is more effective in reducing ash and invert content between liquor and sugar than it is in reducing colour. Considerable colour is made during the boiling process and, of the total colour in a massecuite, up to 15% may be retained by the washed sugar; at Plaistow Wharf an average for the 1st boiling was 13%, with 5% for 2nd and 3rd boilings. YAMANE's work shows that the adsorption of colour by sugar crystals is complicated by the type of colour body, by its charge, and by pH.

Longer boiling times, with lower average rates of crystal growth, result in less conglomerate formation. Correspondingly, the more the pans are rushed the worse is the quality of the grain. Advantages of a conglomerate-free sugar are great; the bulk density is considerably higher, inclusions of ash, colour and water are reduced, and the crystals have less insoluble matter and higher thermostability.

Conglomerates appear to be avoidable, and many factories produce grain which is reasonably free. During a recent tour, it was observed that grain from pans fitted with circulators was good in Denmark, Holland, Ireland and the UK. In general, where white sugar pans were not stirred, conglomeration was rather bad. Decreased conglomeration was reflected by a 50% improvement in included ash and in some cases also by a large decrease in colour. Reports from Toronto are also uniformly favourable to the use of circulators; the four-fifths reduction achieved in conglomerates not only halved the residual moisture in the granulated sugar but so improved the behaviour of the sugar in bulk silo storage that conditioning is thought to be superfluous. It may be noted that the cost of conditioning plant can be $400/ton capacity!

In order to reduce conglomeration in batch boiling, stirrers appear to be essential. For continuous boiling, with a high density of crystal population, stirrers *may* be less important. It is logical to suppose that power input to a stirrer should not be constant throughout the boiling but should perhaps be high in the crucial 5–10 minutes after graining, lower during boiling, and low—and slow—when heavying-up.

Further, it is observed that "slip" in pan circulators can be as high as 60–80%, but this is also likely to be variable. In any case, to use the same specific speed to pump liquor and massecuite around a pan is illogical.

At the Liverpool refinery of Tate & Lyle Refineries Ltd., it is thought that the more power supplied the better, while at the Long Island City refinery of National Sugar Refining Co. 4-speed circulators were early used. Variable speed stirrers are used at Tirlemont, at the Lebaudy-Sommier refinery in Paris, and by the Finnish Sugar Company. An important development is the growing use of hydraulic drive for pan circulation in Hawaii. But, as the British Sugar Corporation have found, not all circulators improve pan performance to the same extent.

The rate of growth of sugar crystals depends on various factors and, while a common figure for white sugar is about 4 microns per minute, SMYTHE in the C.S.R. Research Laboratories has observed a rate of 11 microns/min at 70°C. Data collected over a period are tabulated below and illustrated in Fig. 1.

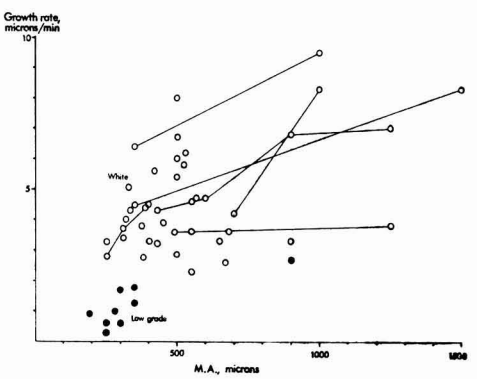

Fig. 1

The values quoted in the table are averages based on M.A. and the time of crystallization (graining to dropping). It could be argued that the rate of growth should be calculated on the "half-life", which would double the observed values. In Fig. 2 are plotted the observed rates of growth against the purity of the massecuite. From this and Fig. 1 three points of interest emerge: (a) the rate of growth is much

* The aperture which will retain 50% by weight of the sugar.
† The variation in crystal size between the smallest or largest 16% by weight and the mean aperture.

Table I. Observed rates of growth of sugar crystals

	Seed size, microns	*Crystal size, microns*	*Graining to dropping, min*	*Rate of growth, μ/min*	*Remarks*
White sugar					
Belgium (Tirlemont)		650	195	3·3	
Canada (C & D)		350	55	6·4	
		350	77	4·5	
		420	75	5·6	
		1000	90	9·5	
		1500	180	8·3	
„ (B.C.)	100	900	240	3·3	
		430		3·2	
		380		2·8	
„ (St. Lawrence)		375	100	3·8	
Denmark		490		3·6	
		1250		3·8	
Finland (Porkkala)		500	75	6·7	Run-off 98 purity
		500	92	5·4	Liquor
France (Lebaudy-Sommier)		525	90	5·8	
„ (Nassandres)		500	170	2·9	
Germany (Uerdingen)		550	240	2·3	
„ (Waghäusel)		550	240	2·3	
Hawaii (Aiea)		320	79	4·0	
Holland		700		4·2	
		1000		8·3	
„ (C.S.M. Research)				25	Maximum for 99 purity
Ireland		564		4·7	95 purity
Sweden		450		3·9	
UK (Greenock)		550		4·6	No pre-evap.
„ (Liverpool)		500		6–8	
„ (Plaistow Wharf)		530		6·2	
„ (York)		550		3·6	94 purity
US (Amalgamated Sugar)		335	77	4·3	
„ (Betteravia)		400	90	4·5	
„ (Chalmette)		310	90	3·4	
„ (Crockett)		250	91	2·8	
		310	83	3·7	
		330		5·1	
		390	88	4·4	
„ (Gramercy)	250	1250	135	7·0	
	250	900	95	6·8	
	250	600	75	4·7	
		430	100	4·3	
„ (Imperial Sugar)		250	75	3·3	
„ (Utah-Idaho Sugar)		680		3·6	94 purity
		670		2·8	
„ (Yonkers)		400	120	3·3	
Low-grade sugar					
Hawaii		250		0·6	
				3·3	
Holland (C.S.M. Research)				5	80 purity
				0·4	65 purity
				0·1	56 purity
Ireland		350		1·25	80 purity
		280		1·0	80 purity
Sweden		250		0·3	80 purity
UK (Plaistow Wharf)		300		0·6	60 purity
US (Crockett)		350		1·8	Remelt
„ (Okeelanta)		900		2·7	80 purity
„ „		300		1·7	60 purity
„ (Utah-Idaho Sugar)		190		0·9	

depressed at low purity, (b) the spread in rate of growth for white sugar massecuites is very large (this, to some extent, may be due to variations in Brix of feed, low steam pressures and/or conglomerate formation, but the variations are also perhaps a measure of the possibilities for progress!), and (c) the lines drawn for individual refineries show an obvious slope with large crystals growing more rapidly although, given equal crystallization pressure‡, the rate should be independent of MA.

Why do average rates of growth apparently vary with crystal size? The answer lies in the word *average*. In a vacuum pan there is no possibility of uniform over-saturation; between the heating surface and the sight glasses can exist temperature differences up to 100°C so that local degrees of over- and under-saturation can vary tremendously. At any one moment there must be a high crystal birth rate on the surface of the massecuite and a high mortality rate in films

‡ FOUQUET's index of oversaturation ($S/100W$ *vs.* $S_{sat}/100W$)

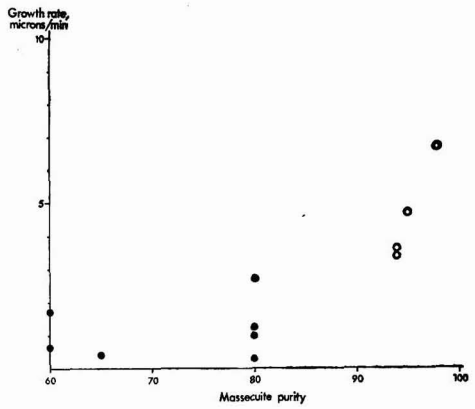

Fig. 2

near the heating surface. The movement of individual crystals must be random so that many will be reduced in size by under-saturated conditions and will have to make a second start in their growth. Eventually the crystal population will achieve a statistical distribution with 68% within normal limits near the mean aperture and about 0·7% with characteristics widely different.

But for the average crystals, growth will depend on the crystallizable sucrose available, and it is suggested that variations in rate of growth of sugar crystals are due, probably, to variations in the sucrose availability as a result of evaporation.

In the early stages of boiling, sucrose deposition on the population of exclusively small crystals will not be limited by the steam supply and will be at the maximum rate. When the pan is full, however, sucrose deposition will be limited by the evaporation rate which may be achieved and crystal growth will depend on the surface area. If we consider crystals of 250 and 1000 microns, there will theoretically be 64 of the former for every 1 of the latter. Their surface area ratio will be as the square of their length ratio. i.e. 1:16 so that the total surface of the smaller crystals will be in a ratio of 4:1 compared with the larger. Thus under full pan conditions, a larger number of smaller crystals will be "starved" while a smaller number of larger crystals will flourish.

A second factor is the presence of conglomerates; these have a considerably lower bulk density than perfect crystals so that their presence in a sample subjected to sieve analysis will overstate the mean aperture. This has the effect of understating the surface, so that the apparent rate of growth will be fictitiously high.

The coefficient of variation (C.V.), used as a measure of the spread in the size of crystals, can be very misleading. It is the value of the mean aperture (M.A.) divided by the standard deviation (S.D.) and, being a ratio, varies with M.A. It is preferable tc follow the example of Denmark and quote the S.D. In the second place, C.V. (or S.D.) means little if the crystals are conglomerated. This is illustrated at Liverpool refinery where over the past five years the white sugar pans have been equipped with stirrers. During the period the crystal regularity index, which is a valid measure of conglomeration, has shown a steady improvement from 126 to 180. At the same time, the C.V. has shown a steady deterioration from 28 to 36.

At the other end of the C.V. scale a disturbing factor is dust, and it has been shown in Sweden that much dust may be made by ploughing and hard charges. However, the effect of dust on S.D. will be small compared with the effect of heavy conglomerates.

There is a great lack of experimental data on the S.D. (or C.V.) of sugars in massecuite. It is hoped to minimize S.D. by control of the degree of oversaturation, which is assumed to be uniform throughout the massecuite. This is absurd; a change of ± 6 points in oversaturation is brought about by a variation of $\pm$ 0·25°Brix in the mother syrup and this corresponds to a temperature difference of $\pm$ 2°C, i.e. a range of 4°C. But at Plaistow Wharf the temperature difference between the heating surface and an uninsulated sight glass was up to 100°C and, in addition, every foot valve, proofstick bushing and small joint must leak some air at room temperature. These very large local temperature differences guarantee very large differences in local oversaturations. A deep vacuum check will remove the bulk of the tiniest crystals and reduce the size of the larger ones while a return to normal conditions will allow the emaciated crystals to grow again while there will be little formation of new crystals. Without such periodical "checking" there seems no real hope of controlling the S.D. in normal batch boiling of white sugar.

(To be continued)

Yugoslavia beet campaign 1969[1].—Provisional data put the 1969 beet crop in Yugoslavia at 3,650,000 metric tons, from which 475,000 tons of sugar has been produced.

* * *

Australian sugar industry literary award[2].—A $2000 award is being launched from Queensland to celebrate the State's sugar industry. This major award is for a novel based on the sugar industry and its people in the Bundaberg district and it is intended that the theme of the winning novel should serve as a requiem for the now almost-defunct manual cane cutter. It will be known as the Millaquin Literary Award and entries close on 1st December 1970.

* * *

Italy beet campaign, 1969[3].—The 1969 campaign in Italy ended in October with a total slice of 10·23 million tons or 8·4% less than in the previous year when 11·14 million tons were sliced. The average sugar content was higher, however, at 14·95% compared with 13·21% in 1968.

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[1] *Zeitsch. Zuckerind.*, 1969, **94**, 692.
[2] *Queensland Newsletter*, 11th December 1969.
[3] *Zeitsch. Zuckerind.*, 1969, **94**, 692.

Sugar cane agriculture

Locusts in relation to sugar cane. J. A. WHELLAN. *Proc. 42nd Congr. S. African Sugar Tech Assoc.*, 1968, 167–171.—Reference is made to serious damage to sugar cane at Hippo Valley by the tropical migratory locust (*Locusta migratoria migratorioides*) in 1965. It was controlled by insecticidal treatment with "Dieldrin" and "Carbaryl". This attack was somewhat surprising as the locust endemic in the area is the red locust (*Nomadacris septemfasciata*). An account is given of the history of locusts as they affect sugar cane in South Africa and the development of international organizations for the control of the two species concerned.

* * *

Sugar cane in Fiji. ANON. *Ann. Rpt. Fiji Dept. Agric.*, 1967, 2 pp.—Three new cane varieties, bred in Fiji, were given suitable names after having been proved as suitable commercial varieties for growing in Fiji, the names being WAYA (51 R 182), VOMO (56 R 1551), and MALI (57 R 5104). These varieties are not all suitable for the same soil types, farmers being advised about this. The campaign to eradicate Fiji's two main cane diseases, Fiji disease and downy mildew, has been continued and intensified.

* * *

Intensive sugar cane cultivation in South Bihar. V. S. BHIDE. *Crops in India*, 1968, **1**, 27–31.—Details are given of steps taken by the State, since 1963, to improve the standard of cane cultivation and production among peasant cultivators. In trial plots the methods adopted have resulted in increasing production by 30–35%. The steps taken include the use of improved varieties, deep ploughing, sett treatment, better fertilizing and pest and disease control, and co-operative financing and marketing.

* * *

Sugar cane: requirements for its cultivation and results of several years' trials conducted in Sicily. R. SARNO. *Quad. Agron.*, 1967, **4**, 165–243; through *Hort. Abs.*, 1969, **39**, 208.—Trials are described with 9 varieties of cane over a 3-year period. Annual rainfall, concentrated in autumn and winter, was 650 mm. This was supplemented by irrigation between May and September (twice weekly). The best three varieties were CP 29-291, Tucumán and Blanca 27-27. They yielded an average of 74 tons of cane or 5 tons of sugar per hectare. Some modern varieties might have given higher yields.

Influence of row spacings on yield and quality of sugar cane in Georgia. K. C. FREEMAN. *Agric. J.*, 1968, **60**, 424–425; through *Hort. Abs.*, 1969, **39**, 209. Three sugar cane varieties were planted at row spacings of 107, 122, 137, 152 and 168 cm. The mean cane yield from 107-cm rows was significantly higher than from the other row spacings except 137 cm. No relationship was observed between spacing and varieties, and row spacings had no significant influence on juice percentage or Brix.

* * *

The effect of some fumigants on growth and nutrition of sugar cane. S. P. JAISWAL and A. K. RISHI. *Sci. and Cult.*, 1968, **34**, 127–128; through *Hort. Abs.*, 1969, **39**, 210.—The effects were assessed of soil fumigation with DD, "Nemagon" and "Fumazone" on the growth, yield and nutrition of sugar cane setts planted in pots. Soil fumigation resulted in the development of denser and more vigorous root systems, taller canes, enhanced yields and greater uptake of N, P and K. The quality of the juice was not, however, improved.

* * *

The effect of different depths of planting on germination and yield of sugar cane on fine sandy soil. V. G. CASTRO *et al. Philippine Sugar Inst. Quarterly*, 1967, **13**, (3), 75–79; through *Hort. Abs.*, 1969, **39**, 210. The variety Phil. 53 33 was used in trials, planting depths being 15, 20, 25, 30 and 35 cm. The highest germination percentage was from the 25-cm planting. Cane and sugar yields of the plant crop were closely correlated with the germination percentage. Depth of planting had no effect on the cane and sugar yields of the ratoon crop.

* * *

Tolerance of sugar cane varieties to herbicides. R. W. MILLHOLLON and R. J. MATHERNE. *Weed Sci.*, 1968, **16**, 300–303; through *Hort. Abs.*, 1969, **39**, 211. Five herbicides were applied after emergence to three Louisiana sugar cane varieties. Some marked differences in varietal reaction were found and are described. All varieties were tolerant to "Fenac" at 4–12 lb/acre. "Diuron" injured a sensitive variety both when the foliage was sprayed and when only the ground at the base of the cane was sprayed. Plants treated in May were injured more than those treated 30 days earlier.

Sugar cane. A. D. HANNA. *Pest Articles News Summ.*, Sect. B, 1968, **14**, 211–225; through *Hort. Abs.*, 1969, **39**, 213.—Symptoms and control are briefly described of important fungal, bacterial and virus diseases of sugar cane in the major cane growing countries.

* * *

Sugar cane diseases in the Punjab—a survey report. S. S. SANDHU, N. S. MANN and D. S. BHATTI. *J. Res., Ludhiana*, 1967, **4**, 533–5; through *Hort. Abs.*, 1969, **39**, 213.—Survey data collected during 1960–63 on 16 sugar cane diseases in 9 cane growing districts of the Punjab are presented. Pineapple disease was reported for the first time. The possibility of bacterial red stripe developing into a serious disease is noted. Ratoon stunting disease was observed on all important commercial varieties.

* * *

The rosy mealybug, *Saccharicoccus sacchari*, of sugar cane in Mozambique. M. L. GONCALVES. *Agron. Moçamb.*, 1968, **2**, 57–64; through *Hort. Abs.*, 1969, **39**, 215.—Infection was nil in 6 months-old cane. It increased between 12 and 18 months, but did not reach economically significant levels.

* * *

Optimum dose of nitrogen for different soil series in sugar factory zone Jagadhri (Punjab). S. S. SAINI, J. M. SHARMA and D. R. DHINGRA. *J. Indian Soil Sci.*, 1968, **16**, 289–292; through *Soils and Fertilizers*, 1969, **32**, 313.—In two trials on cultivators' fields, involving four soil series, maximum cane yields were obtained with 140–168 kg/ha N.

* * *

Manurial responses of sugar cane in sugar factory zone, Bhogpur, Punjab. J. M. SHARMA, J. S. SAWHNEY and R. P. CHAWLA. *J. Indian Soc. Soil Sci.*, 1968, **16**, 293–296; through *Soils and Fertilizers*, 1969, **32**, 313. Optimum rates for nitrogen for sugar cane varied from 84 to 168 kg/ha, according to four soil series investigated.

* * *

Lesser known diseases of sugar cane. I. Bacterial mottle. D. R. L. STEINDL. *Sugarcane Pathologists' Newsletter*, 1969, (2), 2–3.—This Queensland disease of cane is troublesome with some cane varieties in low-lying areas and is due to the bacterium *Pectobacterium carotovorum* var. *graminarum* (first established in 1957). Various grasses are known to be alternative hosts. An account of the disease is given[1]. Control measures consist of the selection of healthy planting material and the use of more resistant varieties where the disease is severe. Destruction of infected grasses along water courses, where possible, is also recommended.

* * *

Commercial varieties of sugar cane hosts for maize dwarf mosaic virus. A. G. GILLASPIE. *Sugarcane Pathologists' Newsletter*, 1969, (2), 4–5.—An account is given of a survey of susceptibility of 8 sugar cane varieties to this disease. After mechanical inoculation with the disease it was found that some varieties could remain symptomless but capable of re-infecting maize.

* * *

Relationship between sugar cane mosaic virus and maize dwarf mosaic virus in Australia and America. R. D. PARES. *Sugarcane Pathologists' Newsletter*, 1969, (2), 6.—Studies of the viruses in the two countries, with the aid of an electron microscope, are recorded and differences described.

* * *

Methods for testing the resistance of sugar cane to disease. V. Sugar cane smut. K. V. SRINIVASAN. *Sugarcane Pathologists' Newsletter*, 1969, (2), 7.—The technique of inoculation (immersion of cuttings or setts in a suspension of spores of the smut pathogen just prior to planting) is described. In wet soils infection is often unsatisfactory. This may be overcome by holding the setts immediately after inoculation in a humidity tent for a period of 4 days and then planting them in the soil.

* * *

Mosaic intercepted in quarantine in Rhodesia. ANON. *Sugarcane Pathologists' Newsletter*, 1969, (2), 8.—The discovery of sugar cane mosaic disease in an open quarantine plot, on a Louisiana variety (L 63-124) is recorded. All stools were destroyed and the area sprayed to kill aphids if present. No further outbreaks took place. The incident emphasizes the necessity of controlled importation of cane varieties.

* * *

Proposed list of names of sugar cane diseases and disorders. P. B. HUTCHINSON. *Sugarcane Pathologists' Newsletter*, 1969, (2), 8–14.—The desirability of having internationally standardized names for individual sugar cane diseases is pointed out. A list is given which has been adapted from one which appears in the Proceedings of the 13th Congress of the International Society of Sugar Cane Technologists.

* * *

Earth pearls in Rhodesia. ANON. *Sugarcane Pathologists' Newsletter*, 1969, (2), 14.—Pearl scale or earth pearl (*Margarodes*) may cause stunted cane in the Rhodesian lowveld. What is known of its life history is outlined, as are possible methods of control. Infestations on lawns have been successfully treated by means of water-miscible ethylene dibromide (EDB) at a rate of 86 lb active ingredient per acre.

* * *

Outbreak of leaf blight in Taiwan. L. S. LEU and W. H. HSIEH. *Sugarcane Pathologists' Newsletter*, 1969, (2), 15–16.—With the replacement of the cane variety N:Co 310 by new varieties, notably F 154 and F 157, this fungus disease (*Leptosphaeria taiwanensis*) has again become important, with more than 3000 ha affected. The nature of the disease, varietal susceptibility and control measures are discussed.

[1] *See I.S.J.*, 1957, **59**, 174–175.

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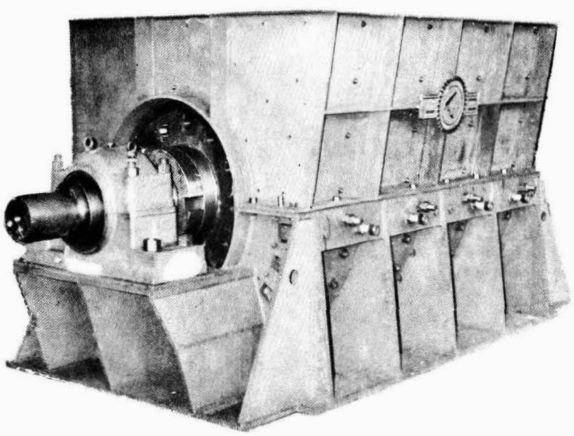

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Sterile leafhoppers and Fiji disease. A. W. OSBORN. *Sugarcane Pathologists' Newsletter*, 1969, (2), 17. Fiji disease is still a matter of concern in New South Wales and involves constant inspection and roguing, the only known vector of the disease being the sugar cane leafhopper *Perkinsiella saccharicida*. Proposed experimental work on inducing sterility by means of cobalt-60 irradiation, which takes only 15 minutes, is discussed.

* * *

The international collection of slides illustrating diseases of sugar cane. ANON. *Sugarcane Pathologists' Newsletter*, 1969, (2), 18.—A list is given of new slides (35 mm mounted transparencies) of sugar cane diseases acquired since the publication of the last list[1].

* * *

International cane disease index. ANON. *Sugarcane Pathologists' Newsletter*, 1969, (2), 19–24.—Progress made with this project so far is outlined, the project having been enthusiastically received. Two lists are given, the one being of literature currently scanned and the other of literature still requiring scanning.

* * *

Methods of testing the resistance of sugar cane to disease. VI. Leaf scald. C. A. WISMER. *Sugarcane Pathologists' Newsletter*, 1969, (2), 24–26.—The author outlines the methods currently in use for testing the leaf scald reaction of new varieties at the Experiment Station of the Hawaiian Sugar Planters' Association.

* * *

Current programmes on sugar cane disease research centres. I. Uganda. P. ROGERS. *Sugarcane Pathologists' Newsletter*, 1969, (2), 30.—This is the first of a new series of thumb nail sketches of the work in progress at the sugar cane disease stations and research laboratories of the world. The author is plant pathologist of the recently established Sugarcane Breeding Division of the East African Agriculture and Forestry Research Organization. A table is given showing sugar cane diseases in Indian Ocean and African regions which pose a serious potential threat to the industry in East Africa.

* * *

Lightning damage. ANON. *Sugarcane Pathologists' Newsletter*, 1969, (2), 31.—The alarming appearance of cane damaged by lightning is described. It might well be suspected of being due to some strange disease.

* * *

Chlorotic streak not affected by tetracyclines. B. T. EGAN. *Sugarcane Pathologists' Newsletter*, 1969, (2), 31–32.—Preliminary work indicated that the pathogen responsible for this sugar cane disease is not sensitive to tetracycline antibiotics.

* * *

Leaf scald in Mozambique. C. RICAUD. *Sugarcane Pathologists' Newsletter*, 1969, (2), 33.—Methods for diagnosing this disease (*Xanthomonas albilineans*) are discussed. This is the fourth record of the disease on the African continent where it has only recently been found for the first time.

* * *

The upright: an experimental form of sugar cane. G. T. A. BENDA. *Sugarcane Pathologists' Newsletter*, 1969, (2), 34–37.—It is pointed out that for much experimental work, especially in connexion with disease, it is advantageous to have a sugar cane plant whose growth is limited in quantity, time of development and number of shoots. The "upright" may achieve this. To produce an "upright" the seed-piece is planted vertically so that the node (or nodes), which is buried to form sett roots, has all its buds excised, and the node (or nodes) which is exposed and has a shoot is prevented from developing roots which reach the soil. The potential value of the "upright" in many lines of work is discussed.

* * *

Nematocide trials in Florida. J. A. WINCHESTER. *Sugarcane Pathologists' Newsletter*, 1969, (2), 41–43. It is pointed out that nematodes are responsible for much of the premature decline of sugar cane yields in Florida. Results of trials with various nematocides are given.

* * *

The effect of early summer aerial application of fertilizer nitrogen on yields of sugar cane. L. E. GOLDEN. *Sugar Bull.*, 1969, **47**, (14), 6, 10–12.—Experiments were carried out during several seasons to determine the effect of splitting the applied nitrogen between ground and aerial application. Yield increases were obtained in all 3 experiments where ammonium nitrate was used for aerial application but increases were obtained in only 2 of 7 experiments where urea was used, suggesting that ammonium nitrate is a better source of N for each application. It was concluded that the splitting of N application should be considered as a regular practice under conditions prevailing in Louisiana.

* * *

Controlling Johnson grass and Raoul grass on ditchbanks in the Louisiana sugar cane area, 1969. ANON. *Sugar Bull.*, 1969, **47**, (14), 13–14.—Both "Dalapon" and MSMA can be effective in controlling these two grasses. An interesting point is that the type of vegetation that will follow varies with the type of herbicide used. Recommendations are made regarding rates of application and treatment generally.

* * *

Soil erosion control in sugar cane fields. F. Y. PANOL. *Sugarland*, 1969, **6**, (1), 20–24, 78–84.—Attention is drawn to the liability of Philippine sugar cane fields to be subject to severe soil erosion, especially as the annual rainfall in some districts averages over 100 inches and rainfall intensity of as much as 2 inches per hour is not uncommon. The many different evil effects of soil erosion are described besides the remedial measures that may be taken.

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[1] *Sugarcane Pathologists' Newsletter*, 1968, (1), 51–54.

Sugar beet agriculture

New directions in beet selection. M. JASSEM. *Sakhar. Svekla*, 1968, **13,** (11), 38–39.—Trends in Polish beet breeding research are discussed. Among polyploid varieties characterized by high sugar content and yield per ha, one attracting particular interest is "A7 Poly Kama", which has a low bolting tendency and an ash content of only 0·379%. The importance attached to work on disease- and pest-resistance is emphasized. In studies on seedling development at low temperatures, some selections have proved capable of germination at 4–5°C. On the basis of these findings, it is considered possible to find non-bolting varieties suitable for early sowing which would permit the growth period to be prolonged by 2–3 weeks.

* * *

The agricultural executive looks at the future of the sugar beet industry. B. E. EASTON. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15,** (1), 13–20.—To ensure the future of the American sugar beet industry the author considers a major requirement is the complete elimination of hand labour. This can come with better emerging seed and surer herbicides. Secondly there must be a drive for higher quality. This means better sugar or more disease-resistant sugar beet varieties, better cultivation and reduced storage losses.

* * *

Soil moisture conditions, nutrient uptake and growth of sugar beets as related to method of irrigation of an organic soil. D. W. HENDERSON, F. J. HILLS, R. S. LOOMIS and E. F. NOURSE. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15,** 35–48.—The special nature of the highly organic sugar beet growing soils in the delta region of the Sacramento and San Joaquin rivers in California is described. These soils have high water permeability, preventing furrow irrigation. The advantages of sprinkler irrigation under these conditions are discussed. It markedly improves soil moisture conditions, nutrient uptake, top growth and root and sugar yields. It was concluded that the higher moisture levels with sprinkler irrigation created more favourable conditions for nitrogen uptake.

* * *

Potassium in sugar beet fertilization. M. SIMON, N. ROUSSEL and R. VAN STALLEN. *Publ. Trimestrielle Inst. Belge pour l'Amél. Betterave*, 1968, **3,** 51–81.—The need to apply correct dressings of potash, according to type of soil, is stressed. Excess is wasteful and may lead to magnesium deficiency. With most Belgian soils a dressing of 240 kg of potash is adequate. Method of application is important. Late surface dressings encourage capping of the soil and consequently suppression of seedlings.

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The present position of spring mechanization work with sugar beet. M. MARTENS. *Publ. Trimestrielle Inst. Belge pour l'Amél. Betterave*, 1968, **3,** 83–111. This is a general report summarizing contributions from specialists in various countries. The rapid strides made in European countries in the last 3 or 4 years are discussed, especially in regard to precision drilling, use of selective weedkillers and drilling to stand.

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Nematodes—the number one killer. G. D. BEIERLE. *Sugar J.*, 1968, **31,** (7), 13–14.—The sugar beet nematode, *Heterodera schachtii*, belongs to a large group, for there are over 8000 nematodes (or roundworms). They may live in sea water, fresh water, soil, plants and other animals. The sugar beet nematode has caused much potentially good land for beet to become unprofitable for the crop and caused some beet sugar factories to close. Measures to lessen nematode damage are discussed.

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Chemical weed control, the key to reduced labour requirements. R. A. FOGG and W. E. MEGGITT. *Sugar Beet J.*, 1969, **32,** 4–5.—In Canada many areas are fast approaching 100% of their beet acreage sprayed for weed control but in some parts of eastern Canada there are growers that still have not adopted the practice. With the favourable results of pre-emergence weed control some growers have raised sugar beet without hand labour. In this article chemical weed control as it relates to reduced labour requirements is discussed. Four different methods or approaches to the situation are now practised in the eastern area, all based on a pre-emergence spray programme. These are described.

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Chemical weed control in sugar beet. W. E. BRAY. *British Sugar Beet Rev.*, 1969, **37,** 127–133.—In Britain the percentage of sugar beet acreage treated with chemicals for weed control has increased from 40% in 1965 to 80% in 1968. The herbicides currently available are listed and arranged in three groups according to application time: (1) pre-drilling, (2) between drilling and beet emergence, and (3) post emergence (residual or contact). These are discussed, particularly in regard to their value for specific weeds.

Techniques in spraying with herbicides. D. R. ROEBUCK. *British Sugar Beet Rev.*, 1969, **37**, 145–148, 151. Soil incorporation of certain weedkillers and the application of pre-emergence and post-emergence sprays are discussed from the grower's angle, as is the technique of band-spraying.

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Influence of field emergence on yield and quality of sugar beets when planted to stand. O. NEEB and C. WINNER. *Zucker*, 1969, **22**, 153–160.—A report is given of field trials carried out over 3 years on loess soil concerning the decrease in yield and quality of sugar beet on account of inadequate field emergence when planting to stand (15 to 18 cm spacing and 50 cm row width).

* * *

Influence of herbicides on the density of sugar beet populations. W. KAMPE. *Zucker*, 1969, **22**, 188–191. Herbicides reduced the density of plant populations during the emergence of sugar beets. At harvest time, however, more plants were found on the plots treated with herbicides than on the untreated ones.

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Influence of top-dressing with increasing doses of nitrogen on the yield and quality of sugar beet. G. COVARELLI. *Ind. Sacc. Ital.*, 1969, **62**, (1–2), 1–18. Results are given of ammonium nitrate top-dressing trials with sugar beet during three seasons (1966–68) without irrigation. The first season was very dry and the other two very wet. Results were beneficial for each season. Dressings of 160 and 200 kg/ha gave the highest increases in sugar. Sugar content of the juice was slightly decreased and ash content increased. The sodium content was doubled but there was very little increase in potassium.

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"Heptachlor" seed dressing and chemical weed control with "Pyrazon" in field trials with sugar beet. W. R. SCHAÜFELE and C. WINNER. *Zucker*, 1969, **22**, 208–212.—Field trials for 2 seasons are reported in which the use of "Heptachlor" as a seed dressing and "Pyrazon" ("Pyramin") for weed control were studied. The treatment did not adversely affect emergence and yield. Where spring-tails were very prevalent the "Heptachlor" increased yield.

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Trials with different fungicides in the control of *Cercospora* leaf spot of sugar beet in Turkey in 1968. M. GÖBELEZ. *Sucr. Belge*, 1969, **88**, 199–203.—The damage caused to sugar beet by leaf spot in Turkey is discussed, as is the efficiency of different fungicides under Turkish conditions. "Brestan" and Du Pont 1991 gave particularly good results.

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The results of comparative trials of sugar beet varieties in Belgium from 1964 to 1968. N. ROUSSEL and R. VAN STALLEN. *Publ. Trimest. Inst. Belge pour l'Amél. Betterave*, 1968, (4), 115–141.—Some 34 varieties of sugar beet were tested in the trials, carried out at 3 different locations. Details of the trials are given in 15 tables. Special trials were carried out with polished and graded seed.

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Weed control with herbicides, crop rotation. A. D. DOTZENKO and M. OZKAN. *Sugar J.*, 1969, **31**, (9), 26–27.—Studies are reported on herbicides, or combinations of herbicides, that give the best weed control in sugar beet grown in rotation with corn, barley and beans. Amounts of weed seed present in the soil were studied. A table shows weed seed numbers per 400 g of soil. Where chemical weed control was practised the number of weed seeds was half that in soils where mechanical weeding only was done.

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Diseases of sugar beet in Arizona. E. G. RUPPEL. *Plant Disease Reporter*, 1969, **53**, (1), 56–58.—In the Salt River Valley of Arizona sugar beet has been grown for seed since 1935. In 1964 an acreage allocation was made to grown sugar beet for sugar. Diseases that occur are discussed. They include beet yellows, beet western yellows, curly top, beet mosaic, cucumber mosaic, yellow vein and rosette virus disease. At the higher altitudes root rots and leaf spots are troublesome. Rust (*Uromyces*) is of little economic importance.

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Influence of soil reaction on yield and quality of sugar beet. G. SCHMID. *Zucker*, 1969, **22**, 268–271.—From 1925 to 1968 about 25 field trials were conducted in several parts of Bavaria to study the response of sugar beet to liming. Results are discussed. Where pH was raised from 6·0 to 7·3 by liming, beet yields showed an average increase of 13%.

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Relative damage of *Cercospora* leaf spot in sugar beet varieties. G. E. COE. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 95–100.—Three sugar beet varieties differing in leaf spot resistance were used in experiments with mist spray applications of copper oxychloride in oil emulsion, at a rate of 2/3 lb per acre at weekly intervals. Treatment increased gross sugar yields, root weights, sucrose percentages and purities under severe disease exposure.

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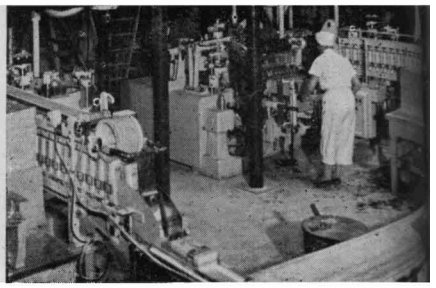
Effect of low colchicine concentrations on inducing autotetraploidy in sugar beets. H. SAVITSKY. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 101–106.—In inducing tetraploidy in sugar beet the best results are obtained by treatment of pre-germinated seed. Ten sugar beet strains were used in the experiments. A concentration of 0·05% colchicine was too low to induce tetraploidy in the majority of strains; 0·1% was effective with most strains but did not produce a large number of tetraploids. The 0·4% concentration produced the largest number of tetraploids in all strains. It is considered that the suitable concentration for any variety should be found by experiment.

Sugar refining



Spheroidal graphite cast iron in industry. W. N. BYSANTSON. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 397–400.—The properties and uses of spheroidal graphite cast iron are described and applications of various types of high-alloy austenitic grades of S.G. iron. which is highly resistant to corrosion and oxidation at high temperatures, are indicated.

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Sugar transportation by ship. W. D. TALKENBERGER. *Zeitsch. Zuckerind.*, 1969, **94**, 287–289.—The article covers shipping of bagged and bulk sugar, special ships for sugar, the use of special containers for crystal sugar, and sugar ventilation in ships.

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A preliminary report on cane washing in Luabo, Mozambique. T. COVAS. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 37–38.—Installation of a turn-over rail truck unloader and cane washer feeder table at Luabo posed two major problems (blockage of the factory drain with trash and mud, and unreliability of factory control values), but also brought a number of benefits, including lighter colour of mixed juice and syrup, and increase in the capacities of the milling train, clarifier, filter and evaporator stations. A substantial monetary saving was obtained during the first year of operation.

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Investigations into vacuum clarification at Darnall mill. R. D. ARCHIBALD. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 39–44.—Results of vacuum clarification at Darnall are discussed. Of various methods of juice preparation tested, liming to pH 8·7 after the juice has been heated to 60°C, followed by addition of calcium monophosphate to pH 8·2, has proved the most suitable, reducing the starch content from 820 to 230 p.p.m. on average. The phosphate can be replaced with phosphoric acid. Comparative tests are being conducted on proprietary flocculants.

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Enzymatic hydrolysis of starch in cane juice. J. BRUIJN and R. P. JENNINGS. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 45–52.—Laboratory and factory tests showed that bacterial amylases, particularly those derived from *Bacillus subtilis*, are effective in destroying large quantities of starch in cane juices. At Darnall an average dosage of 7·2 p.p.m. of amylase reduced the starch content in mixed juice by an average of 86% in 15 min. Promising results have also been obtained in enzyme treatment of syrup and clarified juice. The economics of the process are briefly discussed.

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Dissolved starch in mixed juice. P. A. PRINCE. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 53–54. Investigations revealed that the quantity of dissolved starch (defined as starch which can pass through a filter of 0·65μ pore diameter) in mixed juice fell only very slightly during vacuum flotation, while the total starch content was drastically reduced. Calculations show that the higher the proportion of dissolved starch, the poorer will be the flotation efficiency even though the % removal of granular starch is the same. The possibility of seasonal fluctuations in the dissolved starch content in mixed juice is noted.

* * *

The calculation of stage efficiency and its application to diffuser design. E. J. BUCHANAN. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 65–73.—The MCCABE-SMITH method is used to determine the number of ideal stages for an average diffuser at constant underflow. The stage efficiency is calculated from values of the diffusion coefficient and particle size distribution in the feed (obtained from laboratory and pilot-scale tests), while from the number of ideal stages and stage efficiency is calculated the number of actual stages. The results are in close agreement with the true number of stages used in existing cane and first bagasse diffusers, from which it is concluded that the theory is applicable to cane diffuser design and that molecular diffusion within the cane particles is the controlling mechanism.

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The design of belt conveyors for bulk sugar handling. A. M. GUTHRIE and J. R. PILCHER. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 81–90.—Problems involved in the design of high-speed belt conveyors for handling granular materials, particularly sugar, are discussed with reference to the conveyor system at the Durban sugar terminal.

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Automatic control of boiler plant in the cane sugar industry. N. MAGASINER. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 91–101.—The effect of boiler operation parameters on automatic control system design is discussed. Typical control circuits are described and their approximate costs given. Particular reference is made to experience at Noodsberg Sugar Co. Ltd., and boiler charts from other

sugar factories are reproduced. The point is emphasized that an adequate feed water control system must be applied before automatic combusion control is attempted.

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Perforated steam coils—an aid to circulation in "C" boilings. E. H. PHIPSON. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 102–103.—Difficulties experienced in the boiling of *C*-massecuite at Felixton sugar factory were overcome by installing two $\frac{3}{4}$-in steam coils with $\frac{1}{16}$-in perforations below the calandria. False graining ceased and exhaustion was improved, with a resultant drop of several units in *C*-molasses purity.

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Cía. Azucarera Hondurena S.A. and Ingenio Santa Matilde. J. M. SANTIAGO. *Sugar J.*, 1969, **31,** (11), 9–15.—Details are given of the equipment and layout of Villanueva and San Matilde sugar factories in Honduras, both of which are owned by Cía. Azucarera Hondurena S.A. and for which the author acts as consultant.

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Steam turbine maintenance procedures. J. R. SIEKERT. *Sugar J.*, 1969, **31,** (11), 18–19.—Maintenance procedures applicable to most steam turbines are discussed, although it is emphasized that requirements will vary between installations, so that the procedures should be flexible.

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Reduction and control of calcium salts. J. A. CASEY. *Sugar J.*, 1969, **31,** (11), 20–24.—The occurrence of lime salts in various sugar factory stations is discussed and means of reducing the quantity are described. The use of sequestering agents in evaporators and vacuum pans is shown by results from a number of cane sugar factories to be beneficial in raising efficiency and increasing the interval between stoppages for cleaning.

* * *

Productivity in the Argentine sugar industry. V. HEMSY. *Misc. Univ. Nac. Tucumán Fac. Agron. Zootecn.*, 1968, (23), 27 pp.—The system of evaluating productivity in the sugar industry reported by LEFFINGWELL[1] has been applied to Argentina and calculations made for 1960–65 in terms of man-hours per ton of cane and per ton of sugar. By taking wages and salaries into account, the productivity is also expressed in terms of US dollars per ton of sugar. This figure was higher in 1964 and 1965 than in the four earlier years and is much higher than corresponding figures for the US sugar areas and Puerto Rico in 1946–60. This demonstrates the need for reorganization of the Argentine sugar industry.

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Control of inversion with "Biocide" avoids sugar losses. G. A. TRAUTENBERG. *Brasil Açuc.*, 1969, **73,** 218–222.—The action of "Biocide 280" as a bacteri cidal agent, reducing losses of sugar by inversion, is discussed with a description of tests made on the action of the material added to mill juices.

Treatment of sugar factory effluents in relation to the tolerance limit of biochemical oxygen demand. D. R. PARASHAR. *Indian Sugar*, 1969, **18,** 879–885.—Three different methods of treating sugar factory effluent (auto-oxidation, lagooning and biological treatment) are described and the merits of each discussed.

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Weighed mixed juice; simple automatic sampler. S. C. JAGGI. *Indian Sugar*, 1969, **18,** 887–890, 897.—A simple automatic juice sampler is described and its advantages listed.

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Automation of low and high grade massecuite crystallization processes. A. JOSEPH. *S. African Sugar J.*, 1969, **53,** 350–357.—For low-grade massecuite boiling control a scheme is advocated which uses conductivity as the primary variable and water addition to the boiling massecuite to maintain the desired supersaturation to avoid false grain. The massecuite conductivity changes with progress of the strike and the set point of the controller is therefore adjusted automatically in accordance with the level of the massecuite which also varies with the progress of the strike. The rate of rise of level is compared with a pre-determined programme and if it is too great, owing to syrup of too high a Brix, water is added automatically to compensate. For high-grade massecuites (of purity greater than 90), a scheme involving control of supersaturation in terms of b.p.e., by measuring the massecuite temperature and pan vacuum and using a small computer to calculate the pure sucrose b.p. corresponding to the latter is adequate up to about 25% crystal content; control by power consumption of a mechanical stirrer thereafter is recommended. Where no stirrer is installed, a pilot agitator flanged at the pan wall may be used. Graphs and flow diagrams are presented to illustrate the schemes.

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Steels for application in sugar production. J. M. WAGENET. *Rpts.* 1968 *Meeting Hawaiian Sugar Tech.*, 1–6.—A survey is presented of the types of steel available for use in the sugar industry, with information on their properties and possible applications.

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"Mapp" gas. T. J. GRIPPEN. *Rpts.* 1968 *Meeting Hawaiian Sugar Tech.*, 25–28.—Properties of "Mapp" fuel gas, described as "stabilized methyacetylene propadiene" and manufactured by The Dow Chemical Co., are reported and its used for welding discussed.

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Adapting "Programma" 101 for sugar calculations. R. LEE. *Rpts.* 1968 *Meeting Hawaiian Sugar Tech.*, 29–33. Operation of the Olivetti "Programma 101" desk-top computer is described and an example given of its application to cane sugar factory calculations.

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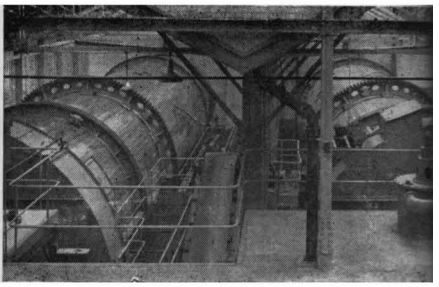
[1] *Sugar y Azúcar*, 1959, **54,** (1), 25.

Beet sugar manufacture



Heat losses in steam expansion. V. SÁZAVSKY. *Zeitsch. Zuckerind.*, 1969, **94**, 284–285.—It is shown that at one Czechoslovak sugar factory, taking into account the small heat losses resulting from isoenthalpic steam expansion in boiler plant, the true cooling water consumption was slightly lower than the calculated value. The difference (0·74% on expanded steam) meant an extra 1·74 kg of boiler steam needed per kWh of current generated by the turbo-set.

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Application of a computer to optimization of DDS diffusion. J. OLEDZKI. *Gaz. Cukr.*, 1969, **77**, 83–87. Computer application to calculation of the optimum control parameters for a DDS beet diffuser is discussed, and a function is derived which relates the optimum control index to loss and cost factors throughout diffusion. The control system is programmed to give a minimum value to this function, and depends on continuous feed of diffusion data to the computer, which then calculates the appropriate input signals for control.

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Preliming of raw juice with calcium hydrosol. J. MIJAKOWSKI. *Gaz. Cukr.*, 1969, **77**, 88–91.—Addition of 0·1% of calcium hydrosol (a colloidal suspension of Ca hydroxide) by volume to raw juice in preliming, followed by addition of 0·2% CaO by volume in the form of milk-of-lime gave juice filtration properties that were much better than with milk-of-lime addition alone. Results are given of laboratory and factory trials.

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Use of covers in sugar beet storage. W. TRZCIŃSKI and J. MALEC. *Gaz. Cukr.*, 1969, **77**, 91–94.—Results from the 1967/68 campaign showed that the use of straw, reed or wicker covers for beet pile protection reduced the sugar losses by 20–30% compared with unprotected piles, the costs being covered within 1 year with the straw and reed, and within 2 years using the wicker mats.

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Automatic boiling of white and refined sugar. H. HARTL and K. WELLENHOFER. *Zucker*, 1969, **22**, 291–302.—Tests carried out at Tulln sugar factory with an automatic boiling control scheme previously described[1] are discussed with the aid of numerous photomicrographs of crystals. Comparison of the results achieved with and without boiling control indicated the advantages of the scheme as regards sieve analysis and proportion of clean, unbroken crystal. A diagram of the control system is given.

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Production of sugar in Denmark. H. BRÜNICHE-OLSEN. *F. O. Licht's International Sugar Rpt. Suppt.*, 1969, 25–30.—A survey is presented of the Danish sugar industry with details of the processes and equipment used. The use of DDS equipment outside Denmark is mentioned.

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"Antipenit FM III" anti-foam agent and its use in the sugar industry. R. BRETSCHNEIDER, P. KADLEC and A. SVOBODA. *Listy Cukr.*, 1969, **85**, 83–97.—Tests with "Antipenit FM III" and other anti-foam agents, using a method proposed by the authors, in which the anti-foaming properties are expressed in terms of the weight of the agent required to reduce foaming by 50%, showed that with beet factory juices "Antipenit" was as effective as "Ista CS" oil, but was twice as effective with molasses solution when both agents were added at 100 g/litre.

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Use of flocculation aids for muddy water clarification. P. DEVILLERS, C. CORNET and J. P. LESCURE. *Sucr. Franç.*, 1969, **110**, 280–283.—Laboratory tests in which a number of flocculation aids were applied to muddy water are described and the results tabulated. Industrial tests on effluent treatment with a selection of the same aids were carried out at four sugar factories and the results recorded in graph form. In concrete tanks with raked bottoms, addition of 1–2 p.p.m. of flocculant reduced the solids content from 10–250 g/litre to zero after 2–3¾ hours' retention, the effluent discharge rate being 500–2000 cu.m./hr.

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Conversion of North Caucasian sugar factories to prolonged cold-hot liming. V. A. KOLESNIKOV and V. A. MAKSYUTOV. *Sakhar. Prom.*, 1969, **43**, (6), 15–20.—Details are given of tests which showed that liming raw juice for 15 min at 50–55°C and subsequently for 15 min at 85–90°C gave lower colour, reducing matter and amide contents in carbonatation juice than did the conventional scheme with liming at 80°C.

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Sugar factory operation in Kirgiziya without evaporator boiling-out. A. S. GAL'PERIN. *Sakhar. Prom.*, 1969, **43**, (6), 20–22.—The system used to adjust evaporator performance when syrup Brix falls below

[1] HARTL: *I.S.J.*, 1969, **71**, 278.

the required level involves raising 1st carbonatation juice alkalinity to 0·10–0·12% CaO, doubling the quantity of sodium triphosphate or carbonate added to 2nd carbonatation juice, and raising the pressure of steam fed to the 1st evaporator effect by 0·2–0·3 atm. This takes effect after 2–3 days and obviates the need for evaporator stoppage for cleaning.

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Operation and modernization of the Sangerhausen PFZ centrifugal. N. F. BONDARENKO, D. L. SKORBUN and A. P. PARKHOD'KO. *Sakhar. Prom.*, 1969, **43,** (6), 22–25.—Modifications to this automatic centrifugal are described, including changes to the times of the various stages in the total cycle, which is reduced from 273 sec, as rated by the manufacturers, to 210 sec.

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Erection, start-up and adjustment of a KDA-25-59M tower diffuser at Sokolovsk sugar factory (USSR). A. V. POKANEVICH, G. Z. KHARCHENKO and P. F. NAZAROV. *Sakhar. Prom.*, 1969, **43,** (6), 25–31.—The diffuser in question has a daily throughput of 2500 tons of beet. Its operation is described and some performance data are given. Ways of reducing the losses, which are above the permissible level, are listed.

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Sucrose crystallization rates under factory and laboratory conditions. S. A. BRENMAN, A. L. SOKOLOVA and YU. D. KOT. *Sakhar. Prom.*, 1969, **43,** (6), 32–35. The higher crystallization rates achieved in laboratory tests with an artificial massecuite containing yellow sugar and 3rd massecuite run-off compared with factory crystallization of a 3rd massecuite were attributed to the larger crystals in the artificial massecuite. Hence, reduction of factory massecuite crystal content or increase in the crystal size will increase crystallization rate and improve molasses exhaustion.

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Sugar packaging and transport. I. S. CHUPAK and L. A. ROZENTAL'. *Sakhar. Prom.*, 1969, **43,** (6), 36–38.—Various facets of the problems facing the Ukrainian sugar industry with regard to sugar packaging and bulk storage and transport are discussed.

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Tensometric and magneto-striction measuring devices in beet sugar factories. A. A. ROZINSKII and V. I. KOSTYUK. *Sakhar. Prom.*, 1969, **43,** (6), 40–43. Automatic measuring of the weight of beet in a hopper, of factory intermediate products (including milk-of-lime) and sugar, and of the forces created in the various pieces of beet sugar factory equipment are discussed.

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Sugar beet storage with moistening of the ventilated air. V. Z. ZHADAN, A. A. MOVCHAN, A. S. KLEINERMAN and A. V. PIVOVAROV. *Sakhar. Prom.*, 1969, **43,** (6), 55–57.—Ventilation of stored beet with moist air immediately after piling was found in tests to reduce losses by allowing beet "wounds" to heal properly.

Schemes without final product affination. P. SIMON and O. KRIEGER. *Cukoripar*, 1969, **22,** 85–88.—Details are given of two 3-massecuite boiling schemes, each used at a Hungarian sugar factory during the 1968/69 campaign, in which the final product was not affined.

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Operation of programmed Sangerhausen centrifugals. G. MALATINSZKY. *Cukoripar*, 1969, **22,** 89–92. Mechanical and electrical defects in automatic Sangerhausen centrifugals are discussed and ways of preventing frequent breakdown of the machines are described. Possible causes of cracks in the screens are suggested.

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Modern washing of massecuite in centrifugals. J. DÁVID. *Cukoripar*, 1969, **22,** 98–101.—The effect of spinning and washing on the quality of the final sugar is greater with the more modern centrifugals, as exemplified in this article on West German machines. Data are presented on the subject and some test results are discussed.

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Pneumatic conveying of pressed pulp. I. HARSÁNYI and R. KUBOVICS. *Cukoripar*, 1969, **22,** 120–122. Equipment used to convey pressed pulp from the press to the dryer is described and its maintenance discussed.

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Mechanical stirring in vacuum pans. J. BLAUDE. *Sucr. Belge*, 1969, **88,** 307–311.—Although the advantages of mechanical stirring of massecuite during boiling include an improvement in crystal uniformity, the reduction in crystal colour and ash content reported by some authors has not been found in all cases as evidenced by published data. The exact nature of the ash and colour present in crystals and the manner in which they are retained by them are still not completely clear, and the author considers it desirable to increase our knowledge on the subject. The various facets of mechanical stirring and its effects are discussed, and the economic factors briefly considered.

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Standard liquor storage. L. R. LOTT and G. R. HALES. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15,** 209–213. Details are given of the system used at the Moses Lake beet sugar factory of Utah-Idaho Sugar Co. for pumping surplus standard liquor to storage for inter-campaign processing and recovering it from storage when required. Advantages of liquor storage are listed and means used to prevent yeast and mould formation are reported.

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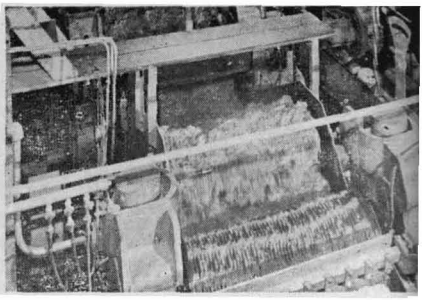
Sugar deterioration during storage and micro-organisms. Y. SARAY. *Seker*, 1969, **18,** (72), 12–17.—Details are given of micro-organisms found in stored sugar and of moulds formed on sugar sacks in humid weather. Moulds isolated during dusty weather are also listed. The data were obtained from all 17 of the Turkish beet sugar factories.

Cane sugar manufacture



Removal of non-sugars and colouring matter during purification by adsorption and ion exchange of cane raw sugar remelt. N. A. ARKHIPOVICH and B. A. KUTSENKO. *Sakhar. Prom.*, 1969, **43,** (2), 18–20. Results of laboratory tests showed that treatment of cane raw remelt liquor with AGS-3 granular carbon followed by AV-16G anion exchange resin in Cl^- form gave better non-sugar removal, higher decolorization and purity rise than did treatment with the carbon alone, although the results achieved with the resin alone were only slightly poorer than those with the combination.

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New refined sugar warehouse for Imperial's Sugar Land refinery. ANON. *Sugar y Azúcar*, 1969, **64,** (2), 30–31.—Details are given of the new warehouse at this Texas sugar refinery which can store up to 22,000 short tons of bagged or packeted sugar (stacked on pallets five high). Thermostatically-controlled heating is effected by 18 suspended gas-fired units, and Acme Engineering and Manufacturing Co. fans and ventilators ensure a complete change of air for the entire warehouse every 6 min. Conveyors and palletizers were supplied by the Alvey Conveyor Manufacturing Co.

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Effect of reducing matter on the quality of carbonatated remelt liquor from affined raw sugar. KH. I. MICHEV, P. S. BOGDANOVA and I. F. BUGAENKO. *Sakhar. Prom.*, 1969, **43,** (4), 9–12.—Tests showed that separate liming and gassing of affined sugar remelt liquor removed all of the reducing matter but produced a liquor of higher colour and lime salts content than did simultaneous liming and gassing with an identical quantity of lime and to the same pH, which removed very little of the reducing matter. The juice treated by simultaneous defeco-saturation was of higher quality even after heating, despite its lower thermal stability than the other juice.

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Investigation of a counter-current adsorber with a moving bed of granular active carbon at Cherkassk refinery. YA. O. KRAVETS, A. K. KARTASHOV, YU. D. GOLOVNYAK, M. V. DVORNICHENKO, T. I. SHCHULKO and L. I. ONISHKO. *Sakhar. Prom.*, 1969, **43,** (4), 25–28.—Results are given of tests with a pilot-scale continuous adsorber in which refinery syrup rose at a velocity in the range 0·5–1·0 mm/sec against a moving bed of AGS-3 granular carbon fed under gravity. Initial syrup Brix and colour were in the ranges 65·0–67·6° and 0·90–12·0°St/100°Bx, respectively. Decolorizing efficiency ranged from 23·1% to 58·4% and rose with increase in the initial colour. The exhausted carbon was sweetened-off with hot water after steam treatment and then regenerated.

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The use of reinforced plastic materials minimizes contamination with metals and reduces the cost of substitution and of maintenance of the apparatus in sugar refining plants. N. ROSENBERG. *Ind. Sacc. Ital.*, 1969, **62,** 23–25.—See *I.S.J.*, 1969, **71,** 376.

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***Optimum* plan for sugar refining.** J. BURÍANEK. *CubaAzucar*, 1967, (Nov./Dec.), 11–14, 32–34.—In order to optimize sugar refining processes, those in existence should be recorded as a flow diagram with quantities of sucrose and other components recorded in order to provide balances. The balances of the various components are calculated and set out in the form of simultaneous linear equations and the effect of variations in the process calculated from these equations. In this way the optimum values of the factors may be determined.

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Reduction in the number of intermediate massecuites in refining. S. A. BRENMAN, A. L. SOKOLOVA and I. F. ZELIKMAN. *Sakhar. Prom.*, 1969, **43,** (5), 15–19. With the aim of reducing the number of intermediate massecuites in a given refining scheme, tests were conducted on decolorization of sugar solutions with various adsorbents and ion exchange resins so as to raise their purity to a level at which they could be boiled with high-purity syrups. Results are given of the laboratory tests, and a number of boiling schemes are compared, showing the quantities of the various massecuites and the molasses yield.

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Florida's Everglades Sugar Refinery. J. W. ALBERINO. *Sugar y Azúcar*, 1969, **64,** (5), 36–39.—The equipment at this US refinery is described and illustrated.

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The sugar refining industry in Finland. G. HERNBERG. *Sugar y Azúcar*, 1969, **64,** (5), 40–44.—See *I.S.J.*, 1969, **71,** 376.

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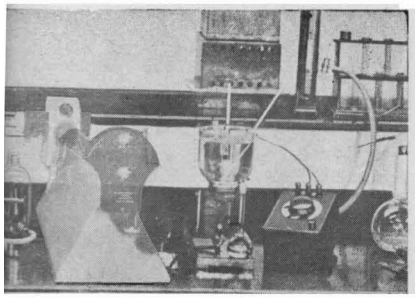
Sugar refining in Japan. T. YAMANE. *Sugar y Azúcar*, 1969, **64,** (5), 46–48.—The Japanese sugar refining industry is surveyed and information given on processes in the refineries, including two new fully-automatic refineries.



Laboratory methods & Chemical reports

Size distribution studies in sugar crystallization. P. G. WRIGHT and E. T. WHITE. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 299–309.—The considerable spread of crystal sizes found during growth under well-stirred conditions in a batch crystallizer increased with a drop in growth rate and with increase in purity, but was not greatly affected by temperature, seed size or agitation conditions. The spread is believed to be associated with crystal growth mechanism rather than poor pan circulation, and variations in the number of imperfections (dislocations) between crystals are considered to be the basic cause. A size dispersion function is defined and appears to be about "normal" in shape and to vary in a simple manner with the degree of growth. With a knowledge of size spreading effects, it is suggested that a more accurate prediction of size distribution is possible.

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A modified permanganate value test for the estimation of carbonaceous substances in sugar mill waste waters. D. BEVAN and J. C. STEVENSON. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 317–324. A method is described which permits the BOD of sugar factory effluent to be easily and rapidly determined by oxidizing with N potassium permanganate in the presence of 25% sulphuric acid, adding 0·8N potassium oxalate and titrating with 0·1N potassium permanganate. The amount of permanganate consumed in titration (ml) is convertible to BOD_5 or carbohydrate content (p.p.m.). Reasonable agreement was found between the COD oxygen consumed and the POT (permanganate oxidation test) oxygen consumed in standard sugar solutions.

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The determination of soil in cane. A. L. JONES. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 325–328.—A visual method of assessing the soil content of cane delivered to the sugar mill is described which is based on the preparation of a number of colour standards from ashed cane samples corresponding to varying ash contents (%). The ash content corresponding to the soil is obtained by deducting 1% absolute from the total value to allow for the cane ash. Good agreement has been found between visual assessment and determination by ignition. Different sets of standards would have to be prepared for cane grown on different soil types, e.g. sandy, red and black soils.

Colour formation in sugar factory products, and the significant factors in colour measurement. S. SUBAYGIL. *Seker*, 1969, **18**, (70), 19–25.—The literature on light and colour, colour terminology, and the factors (dilution, pH and filter-aids) affecting colour measurement with sugar factory products is reviewed, and results given of tests at Ankara beet sugar factory to determine the effects of the various factors.

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The osmolality of sugar beet press juices. A. E. GOODBAN and R. M. MCCREADY. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 120–124.—In attempts to correlate sucrose content with osmolality in tests with press juice from field- and pot-grown beets, the results were considered sufficiently promising to warrant further studies.

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Rheological and circulation characteristics of massecuites. YU. G. ARTYUKHOV and V. T. GARYAZHA. *Sakhar. Prom.*, 1969, **43**, (5), 11–14.—Results of tests with pure sugar solutions and massecuites containing 15–52% crystal by weight are discussed. In the experimental unit used the effects of Reynolds' number on friction and flow resistance at varying crystal contents, and of crystal content on relative viscosity at varying crystal sizes were determined as well as massecuite rheological properties at atmospheric pressure and 500 mm Hg vacuum. The temperature range was 30–50°C.

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The method of polarization of sucrose in the presence of glucose and fructose by addition of borax. J. FERNÁNDEZ B. and J. MARINELLO M. *CubaAzucar*, 1967, (Nov./Dec.), 16–20, 34–37.—LÓPEZ HERNÁNDEZ believed that borax formed non-optically active complexes with glucose and fructose and did not form a complex with sucrose, so that his proposed method[1] of addition of borax to a mixture of these sugars permitted measurement of the polarization of the sucrose alone. This has met with the disagreement of other workers and the authors aver that the fructose polarization is not entirely suppressed, that complexes are formed preferentially with fructose rather than glucose, so that some optical activity from the latter will remain if insufficient borax is added, and that some complex formation takes place

[1] *I.S.J.*, 1963, **65**, 46–48, 73–75, 107–109.

with the sucrose present. Consequently, it is considered necessary to carry out a thorough study to determine the limits within which the technique can be applied as a routine method for sucrose determination.

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Beet molasses formation and composition. IX. Molasses with exchanged cations; calcium chloride; phase theory. G. VAVRINECZ. *Cukoripar*, 1969, **22**, 47–52. On the basis of the data obtained by PIECK *et al.*[1], the author proves the validity of the saturation functions and indicates the effects of the cations and temperature on the saturation coefficient. These effects are described in some detail. It is considered premature to apply the phase theory to molasses, since no melassigenic non-sucrose substance is known which is present in ordinary molasses in a saturated state.

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The properties of the coloured products from the alkaline decomposition of glucose. S. KARA-MURZA, M. D. ZAJAROVA and M. DE LOS ANGELES M. *Cuba-Azucar*, 1967, (Nov./Dec.), 23–25, 37–38.—Studies on the coloured products show that they do not contain α-glycol groups, aldehyde or hexose groups, that they depolymerize easily in acid media but repolymerize in alkaline conditions, that they are acid, the acidity being highest in the most polymerized components, and that they tend to form stable complexes with various metal cations such as Fe^{++}. This complex formation increases colour intensity in the visible region, and brings about considerable changes in the U.V. spectra.

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The composition of separated material in the sugar factory. G. VAVRINECZ. *Zeitsch. Zuckerind.*, 1969, **94**, 276–280.—Detailed analyses are given for various materials separated in a sugar factory, including filter-cake, muds and incrustation in juice purification equipment, evaporator scale, and residual material in syrup and molasses tanks.

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Application of radio-isotopes to sugar factory control. J. K. BASSON. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 29–36.—Radio-isotope applications in the sugar industry are surveyed, including weight control, flow measurement and investigations using tracers. Radio-isotope properties, types of radiation, radiation detection and protection against it, and health hazards are also covered.

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The distribution of impurities during crystallization. R. P. JENNINGS. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 74–80.—Results from four South African sugar factories operated by the author's company are used to demonstrate the value of the inclusion ratio (100 A/B, where A is the ash, starch and gum content in the crystal sugar and B is the total amount of ash, starch and gum in the crystal and molasses which is available for inclusion) used in conjunction with the true crystal impurity content as a guide in evaluating the efficiency of a new process. Remelting is shown to be of advantage in reducing crystal ash content, and, to some extent, the starch and gum contents, while vacuum clarification is an efficient means of reducing the starch content in mixed juice.

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Variations in the technological characteristics of some varieties of sugar beet during the ripening process. G. C. LUCCI and G. MANTOVANI. *Ind. Sacc. Ital.*, 1969, **62**, 82–87.—Four varieties of beet were examined and analyses made during the 1968 growing season to determine the changes occurring in a number of factors. Noxious nitrogen and conductivity were found to decrease during ripening, while the sucrose content, purity and content of raffinose, 6-kestose and 1-kestose increased to their maxima at the time of the third cultivation, i.e. 3rd August, falling thereafter up to the 30th September. Treatment to counter *Cercospora* leaf spot disease affected the factors studied, the effect increasing with time; the treatment increased root weight, sucrose content, purity and 1-kestose content, and decreased the conductivity and 6-kestose content. In two varieties the noxious nitrogen content was increased by the anti-*Cercospora* treatment and in the other two decreased, while the effect on the raffinose content similarly depended on the variety.

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Heat transfer coefficient for raw sugar solutions. J. B. CORDINER *et al. Sugar J.*, 1969, **31**, (12), 13–15. Regression analysis of results obtained with a laboratory-scale evaporator has given the following expression for calculation of U_o, the overall heat transfer coefficient: $\ln U_o = 1{\cdot}473 \times 10^{-6}P^3 - 2{\cdot}453 \times 10^{-4}P^2 + 1{\cdot}543 \times 10^{-3}P + 6{\cdot}2812$, where P = syrup Brix. Good agreement was found between experimental and calculated values of U_o (correlation coefficient = 0·9876 at the 99·9% level).

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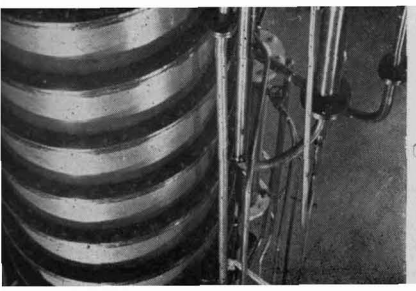
Effect of pH and temperature on sucrose stability in solutions. A. R. SAPRONOV and S. E. KHARIN. *Sakhar. Prom.*, 1969, **43**, (6), 10–15.—Investigations by various authors have shown that at temperatures in the range 60–140°C the sucrose decomposition rate is minimal at pH 7·5–8·0, the rate rising sharply with a pH shift to either side of these values. Equations are given for calculation of the sucrose decomposition rate constants over a wide range of temperatures and pH values. Values obtained in evaporation at two Soviet sugar factories agree with the findings.

[1] *I.S.J.*, 1968, **70**, 120.



By-products

Technical and economic analysis of the drying of yeast cream by use of drum dryers *vs.* atomization dryers. O. ARGUDÍN. *CubaAzúcar*, 1967, (July/August), 28–37.—A comparison is made between the costs of drying with a steam-heated drum dryer and a dryer in which the yeast cream, of 15% solids content, is sprayed into a flow of hot air. The former dryer is much more economical, requiring only 40% of the cost of spray drying.

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Ritter bagasse process. T. MACDONALD. *Pulp & Paper International*, 1963, (Sept.), 45–47; through *S.I.A.*, 1968, **30**, Abs. 68–544.—A process for biological pretreatment of bagasse for paper making is described, which was put into operation in 1956 at Ngoye Paper Mills, Felixton, South Africa. The fresh bagasse is mixed with a "biological liquid" (composition not given) before fluming to the bulk storage pile. The liquid initiates the loosening of pith from the bagasse fibres, and reduces the subsequent chemical consumption in pulping. Biological liquid draining from the pile is re-used. The bagasse has been stored up to 20 months without loss of fibre strength. The process is illustrated by an aerial view of the factory area, including the adjacent sugar factory. The process is being installed in other locations, including Ledesma factory, Argentina[1].

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Sugar in feeding of pigs. ANON. *Sucr. Franç.*, 1968, (8/9), 257–259.—Experiments are described on the use of sugar as a major constituent of pig fodder. In the first trials the weight gain was greater with the sugar-fed animals but the cost per kilo of meat was also somewhat higher, and the quality of the meat was such that it fetched a lower price than the meat of pigs fed on the standard diet. Nevertheless, it is considered that further tests could produce a sugar-containing fodder which would be competitive with standard fodder.

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Manufacture of fodder yeast from sugar industry by-products. L. DELVAUX. *Sucr. Belge*, 1968, **87**, 747–766.—Homogeneity of the yeast culture in the Lefrançois yeast fermentation process is discussed and a description given, with illustrations, of three different types of circulation vessel. Agitation and aeration, and their effect on the speeds of diffusion, circulation and fermenter operation are discussed as well as maintenance of microbiological purity. A detailed account is given of the manufacturing plant at Ruysbroeck distillery, a division of Raffinerie Tirlemontoise S.A., which produces 5 tons of yeast per day. The composition of fodder yeast is surveyed and the place of yeast in animal feeding discussed. Tables are presented of the proportions of essential amino acids, vitamins, and minerals in fodder yeast and other fodder of animal and vegetable origin.

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Introduction of "Canex UK" surfaced particle board. C. S. L. CHIU. *Taiwan Sugar*, 1968, **15**, (3), 17–20. A new product from the Kaohsiung factory is described and its application as a building material illustrated. It is a bagasse particle board surfaced with kraft paper impregnated with a urea-formaldehyde resin. An illustrated account is given of its manufacture and specifications.

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Hot air treatment of (bagasse) hardboards. M. C. CHAO. *Taiwan Sugar*, 1968, **15**, (3), 26, 20.—It is common practice for hardboards derived from wood to be heat treated by subjection to a temperature of 160°C for 2–3 hours, when the physical properties of the boards are improved by chemical changes occurring, e.g. linking of adjacent cellulose molecules by elimination of water from two hydroxyls. An exothermic reaction starts at 140°C and could lead to spontaneous combustion of the board, but this is not a danger provided the temperature is kept below 160°C by the in-flow of sufficient unheated air. It has been found in Taiwan that boards, suitably spaced apart, can be heated by recirculating air, heating of the air being stopped when its temperature reaches 160°C. At this point the boards are at a temperature of 175°C, and their water absorption and coefficient of thickness swelling on immersion in water at 20°C for 24 hr are reduced.

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Taiwan's Changhwa bagasse board factory. H. C. TAO. *Sugar y Azúcar*, 1968, **63**, (9), 52–53.—An account is given of the manufacture of boards from surplus bagasse by a process of depithing, acid digestion, and refining of the pulp produced between abrasive discs, rosin sizing, forming into boards, drying, trimming, pressing and humidification.

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[1] *I.S.J.*, 1968, **70**, 314.

Sugar: by-product of molasses. J. RESENDE P. *Brasil Açuc.*, 1968, **72**, 288–294.—The use of molasses as cattle fodder is discussed with reference to the system developed at Fazenda Brasilia using a urea-molasses compound feed.

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Applications of cane molasses in fermentation industries and in microbiology laboratories. J. A. ROSEMBERG. *Brasil Açuc.*, 1968, **72**, 311–313.—Micro-organisms and the products synthesized by their fermentation on molasses are tabulated and three methods used for preparing industrial fermentation media from molasses are briefly described. Seven corresponding media for fermentation of various micro-organisms in the laboratory are similarly described.

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Sugar cane as a raw material for industry. O. VALSECHI. *Brasil Açuc.*, 1968, **72**, 385–401.—Morphological and anatomical characteristics of the sugar cane are surveyed as is its chemical composition and that of cane juice. Use of juice for invert syrup manufacture and direct alcoholic fermentation is mentioned as well as the usual purification and boiling to sugar. The composition of Oliver filter cake is tabulated and discussed as is that of molasses and vinasse from molasses and cane juice fermentation. The composition of bagasse is tabulated and its use as a fuel and for production of cellulose and furfural and other purposes discussed.

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Derivatives of sucrose. IV. Preparation and properties of sucrose-N-alkylsulphonyl urethanes. W. GERHARDT. *Tenside*, 1968, **5**, 10–13; through *J. Appl. Chem. Abs.*, 1968, **18**, ii–384.—Sucrose-N-alkylsulphonyl urethanes were prepared by reacting sucrose with alkanesulphonyl chlorides in the presence of alkali cyanates in $HCONMe_2$ as solvent. The surface activity, foaming power, foam stability, wetting power and detergency properties of the urethanes, which are very soluble in water, are discussed. They reduce surface tension, possess good wetting powers, medium to low foaming power and low foam stability at 80°C, at which temperature, by introducing an alkali skeleton, they are comparable to standard products and thus are suitable for use in washing machines.

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Change in betaine content during deionization of green syrup at a glutamic acid plant. K. P. ZAKHAROV, S. A. BUKHTOYAROVA and N. V. ORLOVA. *Sakhar. Prom.*, 1968, **42**, (10), 12–15.—In order to reduce betaine losses in the glutamic acid sections at three Soviet sugar factories, where green syrup is treated with "Allasion CS" strongly acid cation exchanger in H^+ form and "Allasion AWB-3" anion exchanger in OH^- form, it is shown to be desirable to use 14 cu.m. of the anion exchanger and 17 cu.m. of the cation exchanger instead of 17 and 13 cu.m., respectively, per column as used at present. Each unit comprises three cation and three anion exchanger columns in pairs.

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Reactions of sodium sucrate in solution. Preparation of pure long-chain ethers of sucrose. J. A. REEDER, H. B. RAYNER, G. AITKEN, D. BRADLEY and J. ATKINSON. *Ind. Eng. Chem., Prod. Research Dev.*, 1968, **7**, 230–234.—Surface-active ethers of sucrose were prepared by reacting sodium sucrate with long-chain alkyl bromides in dimethyl sulphoxide. The ethers were isolated from solution and obtained in an analytically pure state by a technique involving precipitation with barium hydroxide. Dodecylsucrose was produced in 87% conversion at 73% yield, 97% of the unreacted sucrose being recovered. The product was a mixture of isomers. Octyl-, decyl-, hexadecyl- and octadecylsucrose were also prepared, but in lower yields. Concentrated solutions of sodium sucrate in liquid ammonia were prepared in the presence of excess sucrose. The sodium sucrate in these solutions reacted readily with methyl iodine at reflux temperature, but not with long-chain alkylating agents. At higher temperatures under pressure, long-chain alkylating agents reacted preferentially with the ammonia solvent. The properties of sucrose ethers are discussed.

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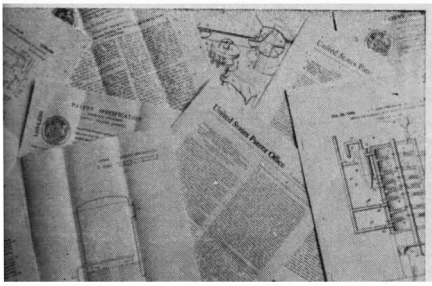
Intensive beef production from sugar cane. IV. Molasses/urea as a substitute for grain in low-fibre diets. A. ELIAS, T. R. PRESTON, M. B. WILLIS and T. M. SUTHERLAND. *Rev. Cubana Ciencia Agric.*, 1968, **2**, 55–63. V. **Nitrogen retention and dietary digestibility in calves given molasses/urea diets and different forages.** J. L. MARTIN, T. R. PRESTON and A. ELIAS. *ibid.*, 65–70.

IV. Tests in which Brahman bulls were fed *ad lib.* on an aqueous solution of molasses/urea (14% soluble solids) and limited amounts of forage and protein supplement are discussed. About 76% of the metabolizable energy was consumed in the form of molasses, and about 57–60% of the total dietary N was in the form of urea and ammonium sulphate. The daily weight gain and metabolizable energy conversion were, respectively, 0·78 kg/day and 24·9 Mcal/kg. Almost half of the livers had a pale, yellowish-brown appearance and 21% were rejected on veterinary inspection. However, it would appear that under certain conditions sugar from molasses can be effectively substituted for grain starch in high-energy diets where non-protein N utilization is maximum.

V. Alfalfa, maize, sorghum and Napier grass as sources of green fodder were compared in diets containing high proportions of molasses and area, the molasses supplying more than 60% of the total dry matter and urea more than 50% of the N. There were no significant differences between the rations as regards N balance and dry matter or N digestibility.

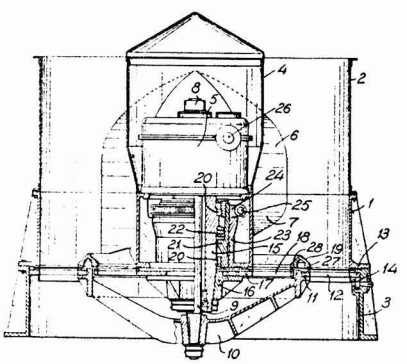


Patents

UNITED KINGDOM

Beet slicer. S. A. DE FONDERIES ET ATELIERS L. CHOQUENET, of Chauny (Aisne), France. **1,155,494.** 29th January 1968; 18th June 1969.

From the reduction gear 5 a central shaft 9 is connected to arms 10 forming the spokes of a wheel 11. The periphery 13 rolls on ball bearings 14 housed for vertical adjustment in the base 3 while between the ends of the spokes and the periphery, the flange is provided with recesses 12 for knife-boxes. Also concentric with shaft 9 is the hollow shaft 15 which supports a plate 17 at its lower end with recesses 18 for knife-boxes similar to those in recesses 12. The shaft and plate are supported by bearings 20, 22 in a movable bush 21 the upper end of which is threaded and engages with a nut 24. The latter is rotated by a worm gear 25 having a shaft which extends outside the casing 2 for vertical adjustment of the shaft and so of the knife-boxes in recesses 18. A similar adjustment shaft 26 governs the vertical position of the shaft 9 and knife-boxes in recesses 12.



The gap between the plate 17 and the wheel 11 is covered by a ring with an apex at its upper surface, which is held by guide plates 7 within the housing 2. These and the plates 6 above them direct beet roots downwards to the knife-boxes. The speeds of shafts 9 and 15 are controllable so that one or other or both provide the optimum linear velocity to cut perfect cossettes. At the same time one or other is independently adjustable so that, in order to vary the throughput of the machine, one set may be operated at optimum speed giving perfect cossettes while the other may be operated at a higher speed but giving not so good cossettes. In this way at least a substantial proportion of the cossettes will be perfect even though the high capacity is achieved.

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Continuous analysis of a liquid stream containing dissolved optically-active solids. HAWAIIAN DEVELOPMENT COMPANY, of Honolulu, Hawaii, USA. **1,157,718.** 28th November 1967; 9th July 1969.—An apparatus receives a sample from a stream of liquid containing sugar, passes a portion through a suitable (e.g. membrane) filter so as to obtain an optically clear specimen which is split and sent to an automatic continuous refractometer and an automatic continuous polarimeter. The latter produce D.C. signals corresponding to the optical rotation of the solution and its refractive index which are related to the sucrose content and dissolved solids content. The signals are sent to a computer which is designed to convert these signals providing a visual indication of the pol content of the stream, its Brix value and purity.

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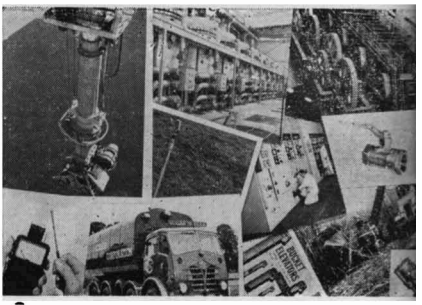
Sugar recovery improvement. DIVERSEY LTD., of Barnet, Herts., England. **1,170,770.** 23rd December 1966; 19th November 1969.—In order to reduce contamination of juice by micro-organisms, with consequent losses, the equipment used for extraction and, if desired, the juice itself are treated (by spraying) with an aqueous sterilizing solution containing 5–150 p.p.m. (5–25 p.p.m.) on weight of juice of mixed available chlorine and bromine (0·5–5 p.p.m. on weight of cane) plus a water-soluble alkali metal phosphate.

Copies of Specifications of United Kingdom Patents can be obtained on application to The Patent Office, Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington, Kent (price 4s 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. 20231 U.S.A. (price 50 cents each).

Trade notices



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

Rotary pump. Stainless Steel Pumps Ltd., Finmere Rd., Eastbourne, Sussex, England.

A new version of the Model 400 ND 4-inch positive rotary pump incorporates a jacketed rotor case suitable for cold or hot water or steam at pressures up to 50 p.s.i. The jacketed case can also be provided with a by-pass or relief valve if required. The pump is intended to meet the requirements of users who wish to maintain the temperature of the product at a given level during pumping. The pump can readily handle a number of liquids, including sugar solutions, and is one of a series of 14 positive rotary pumps made of ND stainless steel which has a number of advantages, including freedom from risk of contamination of the product being pumped, since there is no metal-to-metal contact between moving parts in the pumping chamber.

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Fluid density meter. Anacon Inc., 62 Union St., Ashland, Mass., 01721 USA.

A new fluid density meter announced by Anacon Inc. uses frequency-modulating transducers and can measure the density of liquids and gases very accurately irrespective of fluid pressure or compressibility. The sensing element is a tube thickened at each end which is set in the circumferential mode of oscillation, so that the density of the fluid surrounding it has a damping effect on the oscillations, which are monitored by a frequency meter. This can be calibrated to read out directly in the required density units. The instrument is applicable over an extremely wide density range.

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Belt filter. Dorr-Oliver Inc., Stamford, Conn., 06904 USA.

A new 4-page bulletin (No. Belt-1) describes the new Dorr-Oliver belt filter which has a number of applications, including the processing of cane muds and sugar juices. It has a two-roll edge gripper device that provides a gentler line rather than point contact with the belt, and a new wash and discharge system designed and constructed as a single unit which eliminates splash and gives a drier cake. More effective cake discharge is obtained, even with cakes from $\frac{1}{16}$ to $1\frac{1}{2}$ in thick, and enables minimum or no blinding to be obtained with a cleaner operation. The filter is available in diameters of 6, 8, 10 and 12 ft and in lengths from 1 to 20 ft drum face, inclusive. The belt discharge conversion unit can be used to modernize most existing drum filters.

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PUBLICATIONS RECEIVED

"THE PRINCIPLES OF THE DDS THICKENING FILTERS". A/S De Danske Sukkerfabrikker, Langebrogade 5, 1001 Copenhagen K, Denmark.

This 16-page booklet describes the development and operation of the DDS thickener-filter for 1st and 2nd carbonatation juices as well as listing its advantages. Details are given of the filter-thickener stations at six Danish sugar factories.

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RUBBER BELT CONVEYOR IDLERS. Rex Chainbelt Inc., P.O. Box 2022, Milwaukee, Wisconsin, 53201 USA.

Bulletin 6968 gives information on Rex Chainbelt rubber series belt conveyor idlers, including impact, self-cleaning and catenary idlers. The self-cleaning type covers both return and troughing idlers. Features of each type of idler are listed.

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LENS CLEANING MANUAL. J. Barcham Green Ltd., Hayle Mill, Maidstone, Kent, England.

The 11th Edition of this handy lens cleaning manual gives advice on the care and cleaning of all lenses, optical systems and other delicate instruments, as well as details of the well-known Green's 105 tissue which is especially made for lens cleaning.

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JONES CRANES. Jones Cranes Ltd., Letchworth, Herts., England.

In Issue No. 66 of the Jones Newsletter appears an illustration showing a Jones crane owned by the Hellenic Sugar Co. being used in work on extension to Platy beet sugar factory in Salonika, Greece.

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Broadbent centrifugals.—Thomas Broadbent & Sons Ltd., of Huddersfield, England, have received an order worth £47,000 for five of their automatic 1500 r.p.m. centrifugals to be delivered to Ingenio Rio Grande, Jujuy, Argentina. In January 1970 they also received orders for 23 other sugar centrifugals, both batch and continuous.

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BMA dryers.—Braunschweigische Maschinenbauanstalt have received an order for four beet pulp dryers from Süddeutsche Zucker AG. Each dryer will have a drum diameter of 3·25 m.

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Corrigendum.—In an item on p.64 of our February issue it is reported that the new Malaysian sugar factory to be supplied by Kawasaki Heavy Industries Ltd. and Sumitomo Shoji Co. will be the first integrated manufacturing unit in the country. This information has proved to be incorrect, since Fletcher and Stewart Ltd. are supplying equipment for a cane sugar factory which is expected to start operations in January 1971 and will thus be the first integrated manufacturing unit in Malaysia. The factory, owned by Gula Perak Berhad, will be in the Dindings area of Malaysia and will produce 50,000 tons of refined sugar annually, handling 2000 tons of cane per day during the season.

Brevities

Cuban sugar expansion programme.—The well-publicized five-year plan for 1965–70 has been intended to raise sugar production to 10,000,000 metric tons by the current crop, although most observers believe this to be unlikely. Nevertheless, the programme of expansion of factory capacity intended to achieve the target, recently published[1], is of interest. According to the plan, the 152 mills are to have reached a total capacity of 670,000 tons of cane per day, 120,000 tons or 21·8% more than that of 1960, equivalent to the erection of 33 new mills of 3600 tons/day capacity each. By 1970 14 mills are to crush between 900,000 and 1,400,000 arrobas (10,500 and 16,100 metric tons) per day. The 9000-km network of mill railway is to have been modernized, with a fleet of 800 locomotives, 29,000 cage-type cars and a large number of miscellaneous wagons, which will transport over 600,000 tons of cane per day as well as sugar and by-products. In the cane fields there are to be 1000 combine harvesters, 4500 hydraulic loaders and 400 cane conditioning centres (dry cleaning tables). In addition to the raw sugar target, it is planned to produce 1,400,000 tons of refined sugar, 2,500,000 tons of molasses, 24,000 tons of fodder yeast and 2,700,000 hl of alcohol, while bagasse and cachaza will total 21,000,000 and 2,500,000 tons, respectively.

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Swedish sugar factory closure[2].—The Mörbylanga factory of the Swedish Sugar Corporation is to be closed after the 1969/70 campaign.

* * *

Puerto Rico sugar crop, 1969[3].—The 1969 sugar crop ended with the closing of operations at Central San Francisco, a total of 5,896,836 short tons of cane having been crushed to yield 477,858 tons of sugar, representing an average yield of 8·10%. The cane crop was 693,460 tons or 10·5% smaller than in 1968 and sugar production was 159,430 tons or 25·0% less. In addition the yield of sugar on cane was 16·2% lower in 1969 compared with 1968.

* * *

St. Kitts sugar crop, 1969.—The St. Kitts sugar factory ceased crushing operations late in October, having processed a total of 36,001 tons of sugar from 383,819 tons of cane[4]. According to the Company's interim report in mid-October, the late finish was caused mainly by the delay in starting harvest owing to protracted wage negotiations, and by the abnormal rains which hampered field operations and brought much trash and other foreign matter into the factory. Because of the late start, the factory could not take full advantage of the optimum period for harvesting when there is most sugar in the cane; the heavy rains caused a drop in the quality of the juice and the volume of fibre from the cane increased. In the 1968 crop, almost as much sugar—34,832 tons—was produced from a much smaller cane crop of 321,464 tons, and it is anticipated that the factory will have made a loss in 1969. Encouraging progress has been made in experiments for the utilization of cane by-products.

* * *

Peru sugar production, 1968/69[5].—Sugar outturn in Peru in the 1968/69 season came to about 630,000 metric tons, raw value.

* * *

Sugar production in Guyana, 1969[6].—The Guyana Sugar Producers' Association has announced that the Autumn crop is complete and that total production for the year was 364,465 tons, a record crop which compares with total output in 1968 of 316,848 tons.

Brazil sugar exports, 1969[7].—The Export Director of the Brazilian Sugar and Alcohol Institute has announced that Brazilian sugar exports during the calendar year 1969 amounted to 1,161,202 metric tons, of which 611,431 tons were shipped to the US market and 449,741 tons to the world market. These figures compare with exports in 1968 amounting to 1,095,450 tons, of which 626,552 tons went to the US and 468,898 tons to the world market.

* * *

French West Indies sugar industry revival plan[8].—An inter-Ministerial Council, under President POMPIDOU, met in November 1969 with the revival of the sugar industry of the French West Indies as its aim. Production in the area has fallen continually since 1963 as a result of meteorological, economic and technical factors so that Martinique which made 45,000 tons before 1963 had fallen to 32,000 tons in 1968 while Guadeloupe, which is less subject to the incidence of cyclones, had decreased from an outturn of 195,000 tons to 165,000 tons in the same period. The fall in production has had serious social and economic consequences because sugar provides a living for 150–180,000 out of a population of 700,000. The Elysée Council decided to act in three directions: to stimulate the replanting of cane, essentially in Martinique, to promote the remodelling of land to permit improvement of cultivation methods and use of mechanical equipment, and to aid the regroupment of sugar factories which are currently too numerous, too dispersed and of small size.

* * *

Mauritius sugar in 1969[9].—Harvesting of the 1969 crop started on the 23rd June and ended on the 13th December 1969. The 22 mills crushed 5,732,523 long tons of cane, i.e. about 157,000 tons less than the record figure of 1965. Total sugar output amounted to 658,142 tons which ranks second after the 1963 crop and compares with 587,155 tons produced in 1968. Average cane yield equalled the record figure of 29·1 tons per acre achieved in 1965 and the average sugar recovery was 11·48%. The yield of sugar per acre amounted to the all-time record of 3·35 tons per acre, beating the 3·33 tons/acre achieved in 1963. Domestic consumption during the year was 30,488 tons as against 28,864 tons in 1968 and exports totalled 582,290 tons, slightly more than the 568,901 tons exported during the previous year. The bulk of the exported sugar went to the UK (380,000 tons in 1969 as against 414,301 tons in 1968) and to Canada (176,140 tons as against 139,200 tons), while 15,000 tons was exported to the USA (15,400 tons in 1968) and 11,150 tons to Malaysia (nil in 1968).

* * *

US sugar import limitations[10].—The limitations of imports against US sugar supply quotas during January-March 1970, set originally at 800,000 tons and later raised to 850,000 tons[11], has now been removed completely. The quantities already committed for entry must, however, be fulfilled.

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[1] *Cuba Economic News.*
[2] *Zeitsch. Zuckerind.*, 1969, **94**, 693.
[3] *Sugar y Azúcar*, 1969, **64**, (11), 64.
[4] *Barclays Overseas Review*, December 1969, 53.
[5] *Zeitsch. Zuckerind.*, 1969, **94**, 694.
[6] *Public Ledger*, 3rd January 1970.
[7] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (1), 6.
[8] *Sucr. Francaise*, 1970, **111**, 23.
[9] *Mauritius Sugar News Bull.*, 1969, (12).
[10] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (3), 5.
[11] *I.S.J.*, 1970, **72**, 34.

Brevities

Trinidad sugar production, 1969[1].—Sugar production in Trinidad in 1969 amounted to 237,231 long tons, compared with 239,556 tons in 1968. The first estimate of 1970 sugar production is 235,000 long tons.

* * *

Philippines sugar production[2].—Final production for the 1968/69 crop in the Philippines amounted to 1,759,414 short tons, tel quel, marginally higher than the 1,758,126 tons produced in 1967/68. The 1969/70 crop is under way and the official preliminary estimate of production is 2,104,877 short tons.

* * *

South African sugar exports, 1969[3].—Sugar shipments during 1969 amounted to 710,519 short tons, compared with 1,091,235 tons shipped during the year 1968. Both totals include the sugar equivalent of high test molasses. During 1969 exports were limited to South Africa's quota allocation under the new International Sugar Agreement, while there were no restrictions on exports in 1968.

* * *

Moroccan sugar beet crop destruction[4].—Morocco's entire sugar beet crop in the Sebou Valley has been officially reported destroyed by the January floods. The beet sugar factories at Mechra Bel Ksir and Sidi Slimane are consequently expected to be idle this season. Their normal joint output is about 80,000 metric tons of sugar per year.

* * *

Argentina sugar production, 1969/70[5].—Final sugar production during the 1969/70 season amounted to 906,428 metric tons, tel quel, including 737,099 tons of granulated sugar, 84,457 tons of raw sugar, 80,994 tons of "pilé" and 3878 tons of "bajo producto". Expressed in raw value, total production was 997,326 metric tons. An official limit of 970,000 tons has been set for the 1970 crop[6].

* * *

Barbados sugar industry rationalization proposal[7].—Efforts are being made to reorganize the manufacture of sugar in Barbados and a report to the Sugar Producers' Association has recommended that this sector be amalgamated into one company which would own and operate all sugar-producing factories on the island. A scheme has been prepared in which owners of existing factories would transfer their interests to a holding company in return for shares in that company.

* * *

Peru by-products study[8].—The Government of Peru has commissioned W. R. Grace and Company to undertake a feasibility study for an industrial complex to produce synthetic rubber using sugar cane derivatives as raw material.

* * *

Indian sugar strike call[9].—More than 200,000 workers in the Indian sugar factories were planning to strike on the 23rd February, in order to force nationalization of the sugar industry as well as for higher wages. The decision to strike was taken on the 11th January and will affect 211 mills. The Government of Uttar Pradesh has announced that it would change the sugar industry of the state into cooperatives. The Minister of Industry recently stated that the problems of the sugar cane planters, who up to now have not been paid according to the sugar content of their cane, could be solved if shares in the cooperative mills were granted to the planters. The Minister refused complete nationalization of the mills; this would be welcomed only if the Central Government issued uniform directions for the whole country.

* * *

South African sugar industry metrication[10].—On 1st May 1970 the South African sugar industry is to switch to the metric system of weights and measures, while from January 1970 all new land transactions have been effected in metric terms, i.e. hectares instead of acres or morgen.

Sugar smuggling in Argentina[11].—Smuggling of Brazilian sugar has been discovered in Argentina and an inquiry opened. It appears to have reached important proportions and is explained by the fact that Brazilian sugar costs appreciably less than the official price of Argentine sugar. The authorities assert that the development of this smuggling has resulted in a notable decrease in sale of Argentine sugar, particularly in the provinces of Corrientes and Entre Ríos.

* * *

West Germany 1969/70 campaign results[12].—The West German Sugar Association has published the final results of the 1969/70 campaign, according to which a total of 13,354,632 metric tons of beet was sliced, compared with 13,951,840 tons in 1968/69. In spite of the smaller beet tonnage, sugar production was nearly 90,000 tons higher at 1,883,791 tons, white value, compared with 1,795,477 tons in 1968/69. This resulted from an extraction which at 14·11% in 1969/70 was much better than the 12·87% achieved in the previous campaign. The beet yield was lower, however, the smaller crop having been grown on an area of 309,508 hectares as against 302,050 ha in 1968/69.

* * *

Sugar Industry Technologists Inc. 1970 Meeting.—The 29th Annual Meeting of Sugar Industry Technologists Inc. is to be held in New Orleans during the 12th–14th April 1970. The titles of papers to be presented at the Technical Sessions have not as yet been announced, but interested sugar technologists should write for further and up-to-date information to Mr. Curtiss L. Taggart, Executive Secretary, P.O. Box 47, Medford, Mass., 02155 USA.

* * *

Cane juice sampling[13].—An electronic juice sampling system installed at Qunaba sugar factory in Queensland is similar to one previously operated with a high degree of reliability at Millaquin[14] and includes five components. An electronic console is located in an office above the tip point of the mill and the operator has a clear view of unloading operations at the carrier. His task is to start and end the samples and he maintains direct telephone contact with the juice laboratory and weighbridge. Displayed before him is a continuous visual indication (a moving light display) of the sample's progress. To facilitate checking, the console also indicates the number of samples processed. Alarm indicators on the console warn the operator of any malfunction. A pump sends juice from No. 1 mill to the laboratory, the flow being timed automatically by the console and automatically halted in the event of a mill stoppage. Sampling during crushing of cane from a number of cane cars from one farmer may be interrupted, and a new sample collected, if cane from another source is interposed in the mill supply. The sample is cross-checked in the laboratory by an electronic display unit which ensures correct allocation of the respective samples.

* * *

New Czechoslovakian sugar factory[15].—The sugar factory being built by Polish concerns at Hrušovany nad Jevišovkou in Czechoslovakia is due to be completed in time to start operations in autumn 1970. Its slicing capacity will be 4000 tons of beet per day.

* * *

Sugar factory proposal for the Sudan[16].—A Czechoslovakian economic delegation has discussed with the Sudan Government proposals for new sugar, fertilizer and tanning factories, for which a loan of $40 million will be offered.

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[1] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (3), 6; (4), 6.
[2] C. Czarnikow Ltd., *Sugar Review*, 1970, (955), 21.
[3] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (3), 6.
[4] *Public Ledger*, 17th January 1970.
[5] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (3), 6.
[6] C. Czarnikow Ltd., *Sugar Review*, 1970, (956), 25.
[7] *Barclays Overseas Review*, December 1969, 50.
[8] *Bank of London & S. America Review*, 1969, **3**, 774; 1970, **4**, 48.
[9] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (2), 5.
[10] *S. African Sugar J.*, 1969, **53**, 846–847.
[11] *Agence France-Presse*, 6th December 1969.
[12] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (4), 4, 11.
[13] *Australian Sugar J.*, 1969, **61**, 374–375.
[14] MALAN: *I.S.J.*, 1970, **72**, 57.
[15] *Czechoslovak Heavy Industry*, 1970, (1), 33.
[16] *Barclays Overseas Review*, December 1969, 36.

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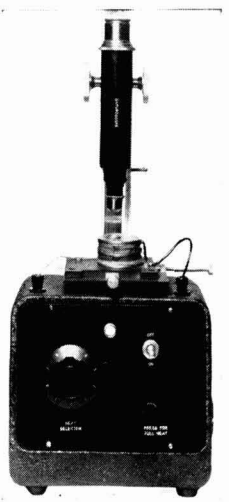

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Printed by JOHN ROBERTS & SONS, Salford, Manchester; and published by the Proprietors, THE INTERNATIONAL SUGAR JOURNAL LTD., at 23a Easton Street, High Wycombe, Bucks. Entered at the New York Post Office as Second-Class Matter.
PRINTED IN GREAT BRITAIN.