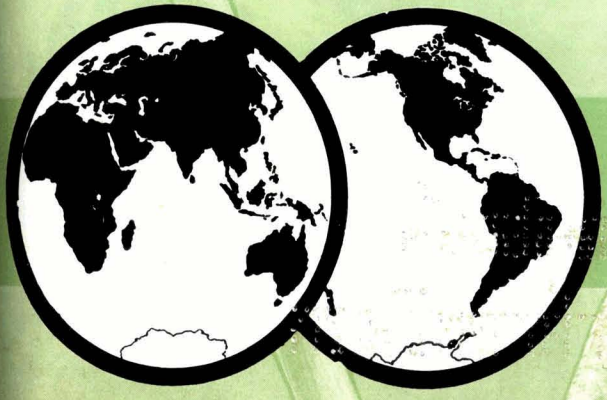
THE International Sugar Journal



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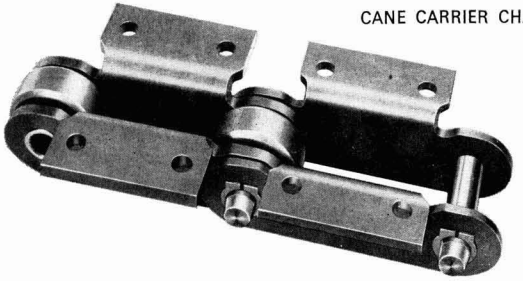
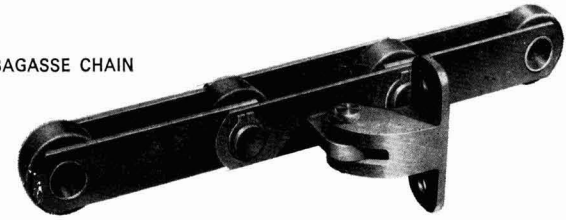
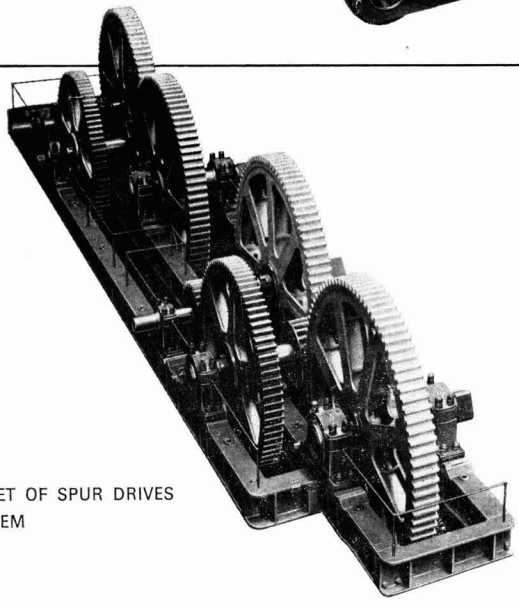


BAGASSE CHAIN





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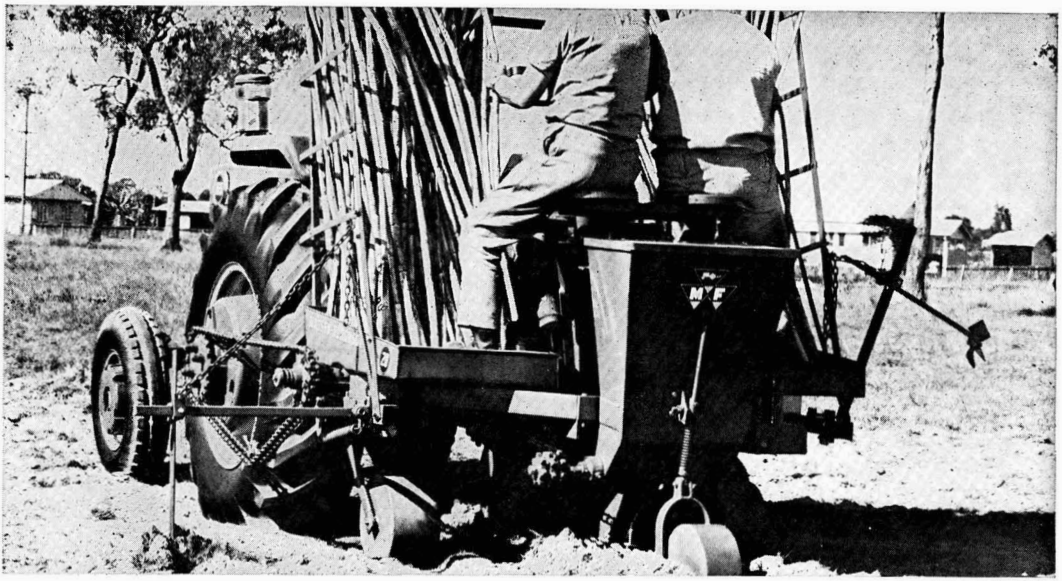

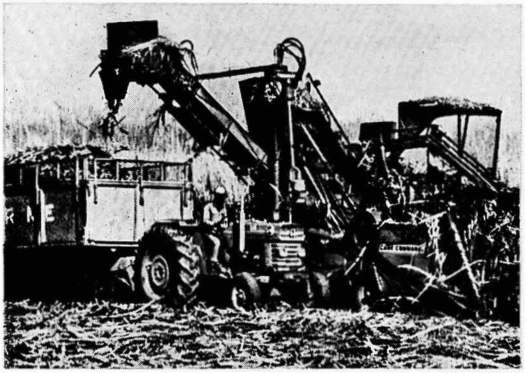

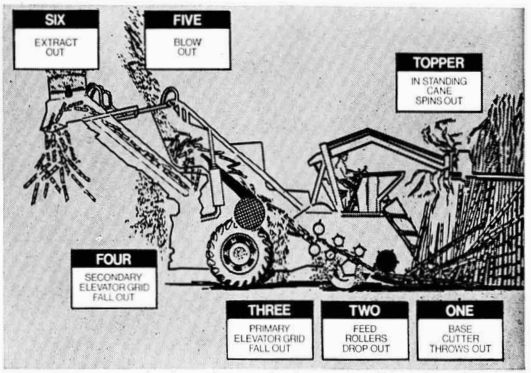

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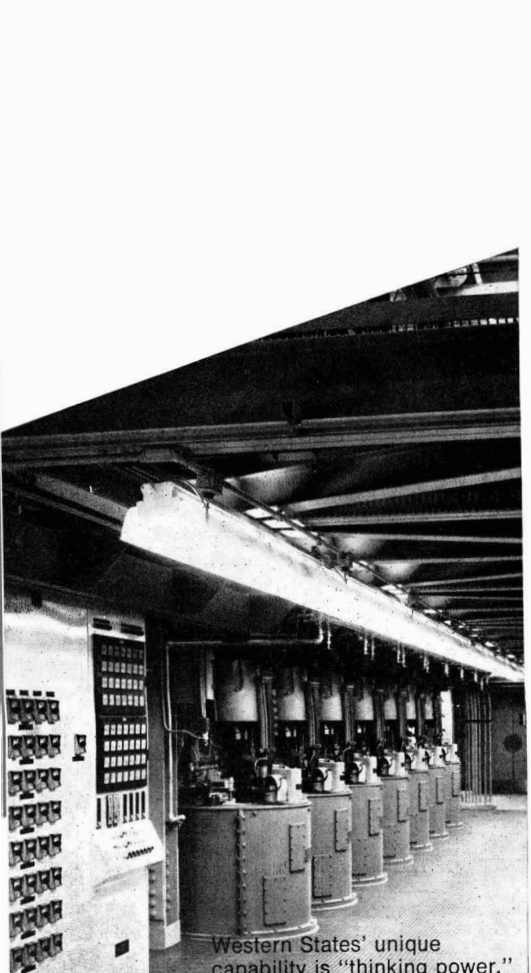
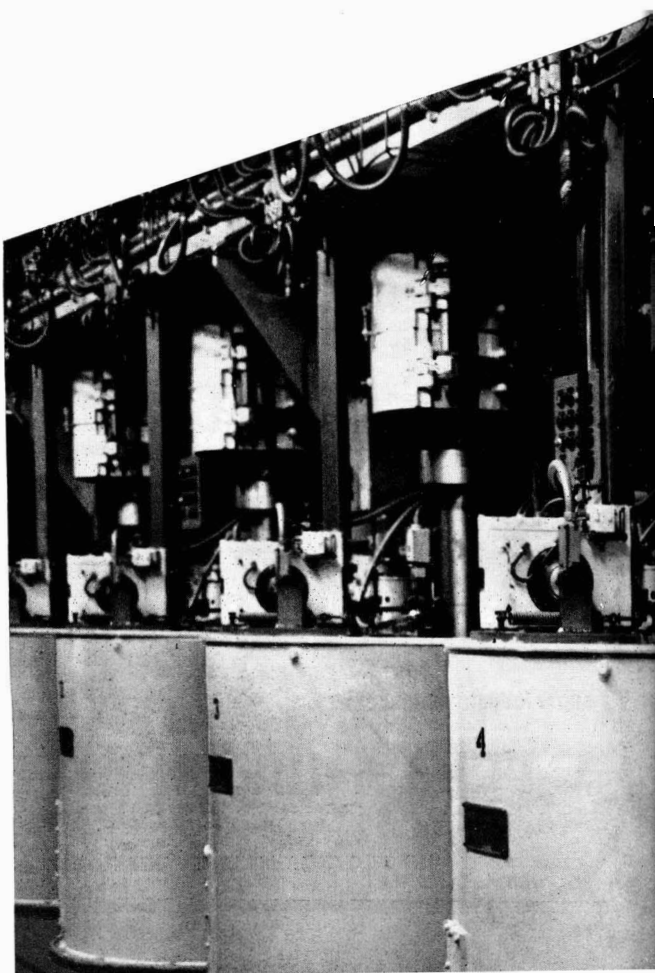


Western States' unique capability is "thinking power."



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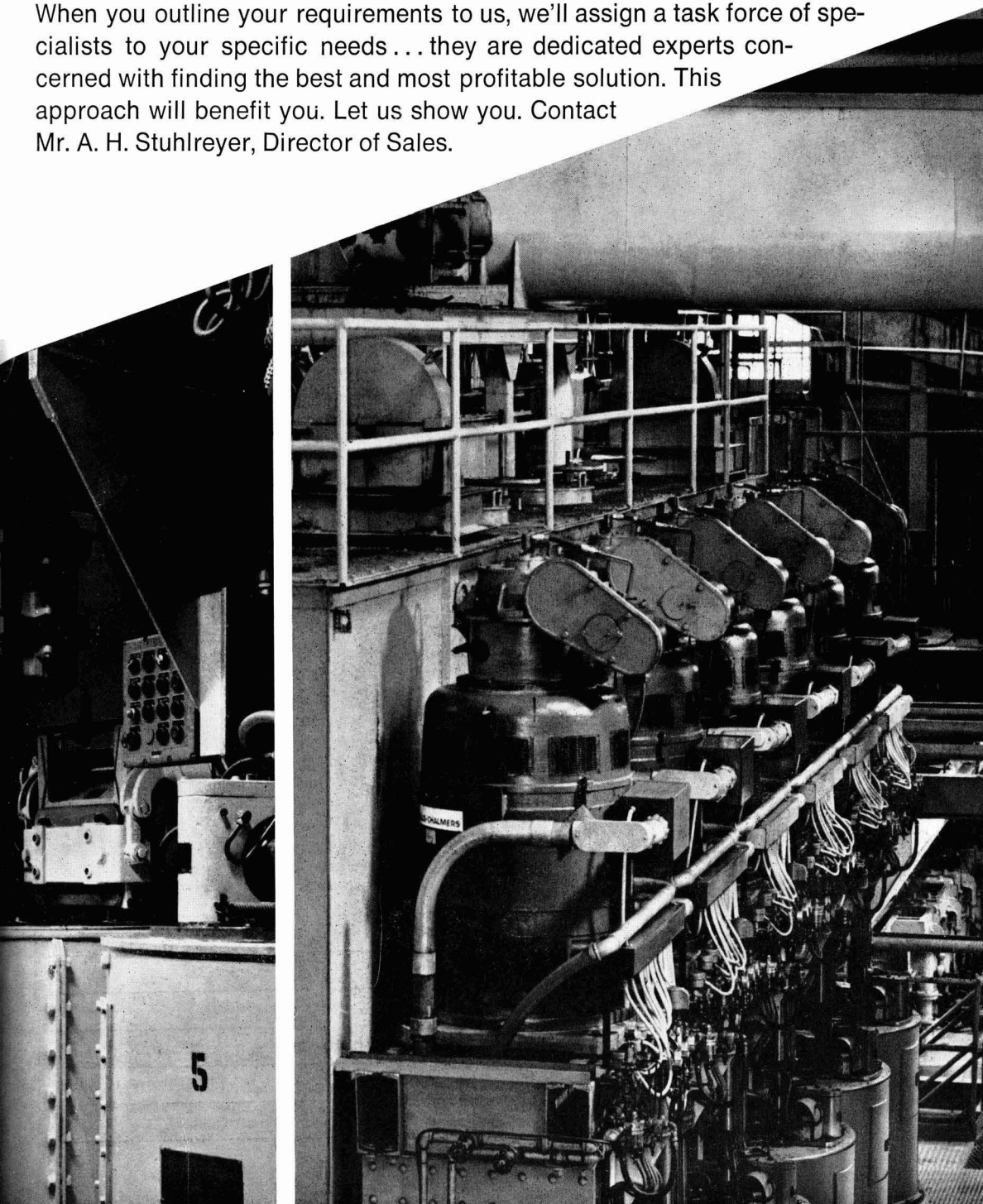

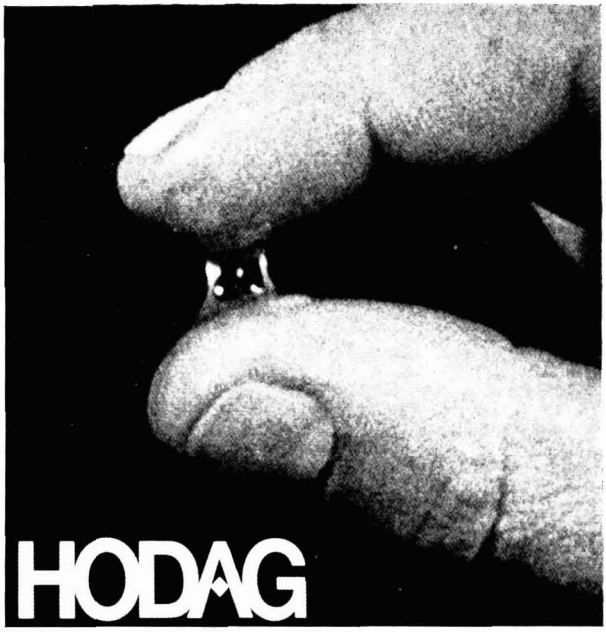

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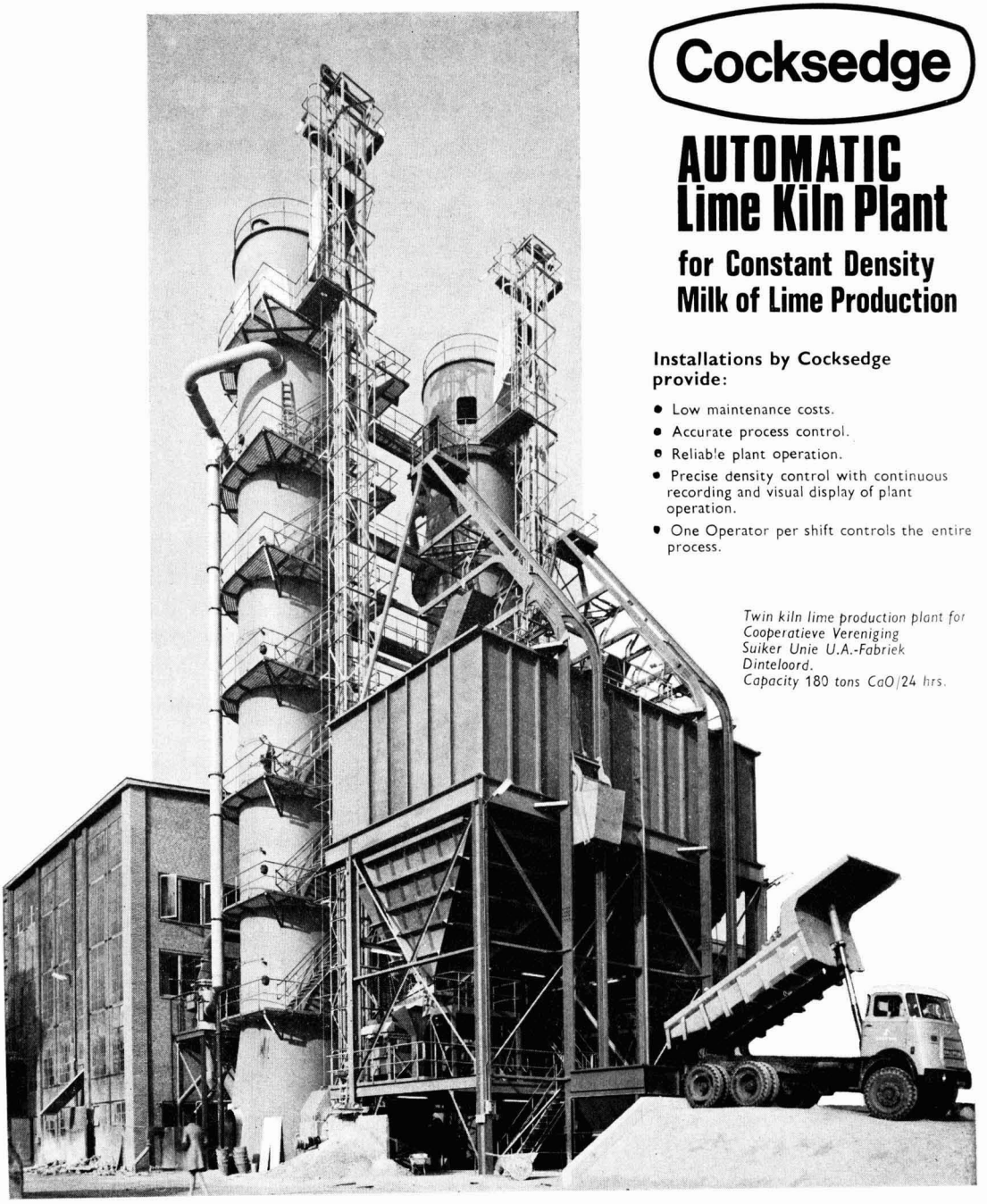

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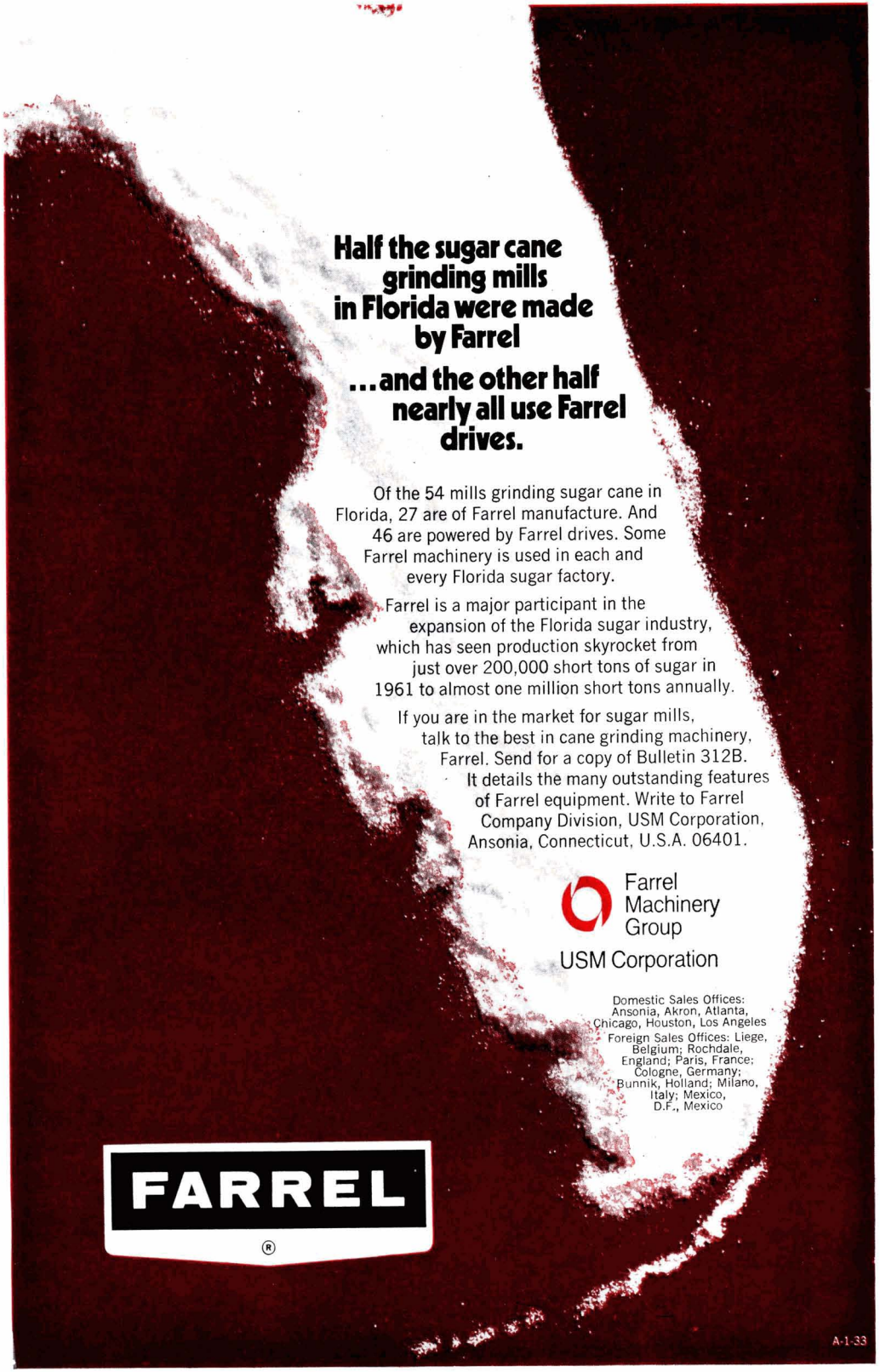
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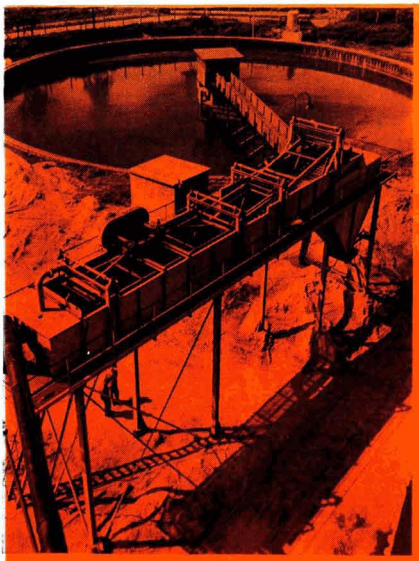

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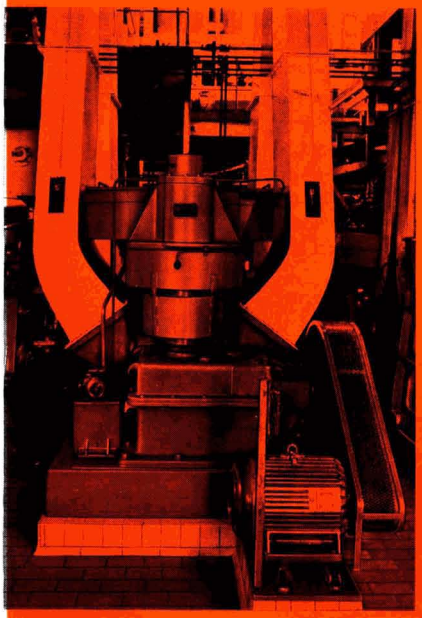

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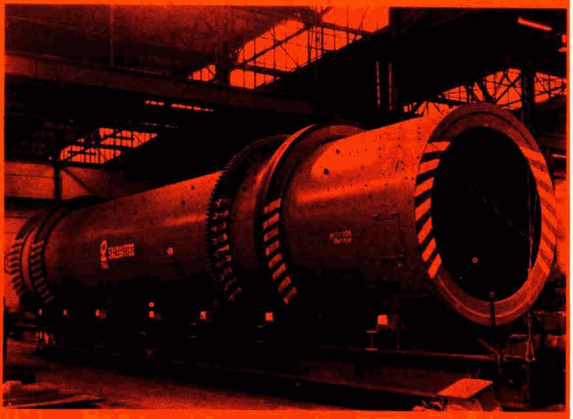

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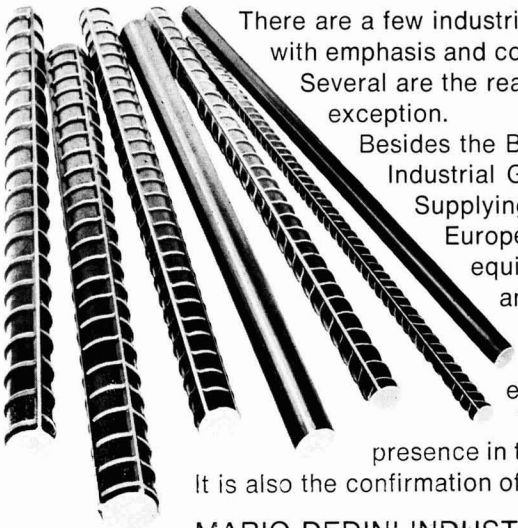

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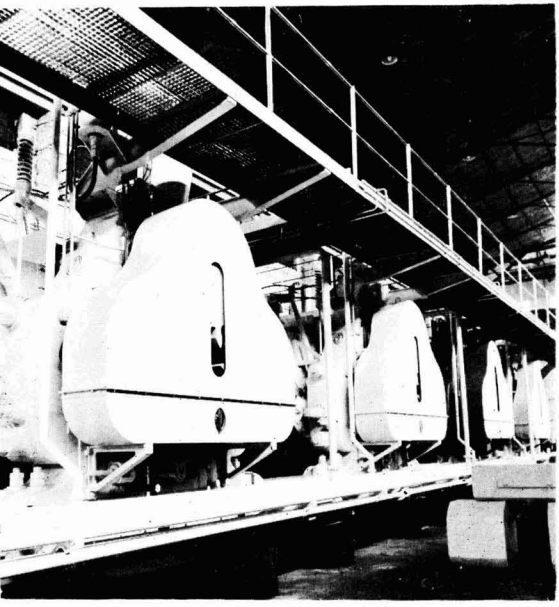

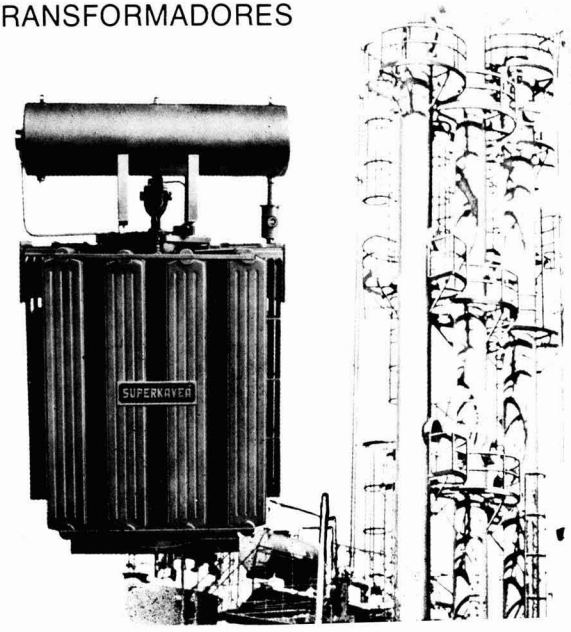

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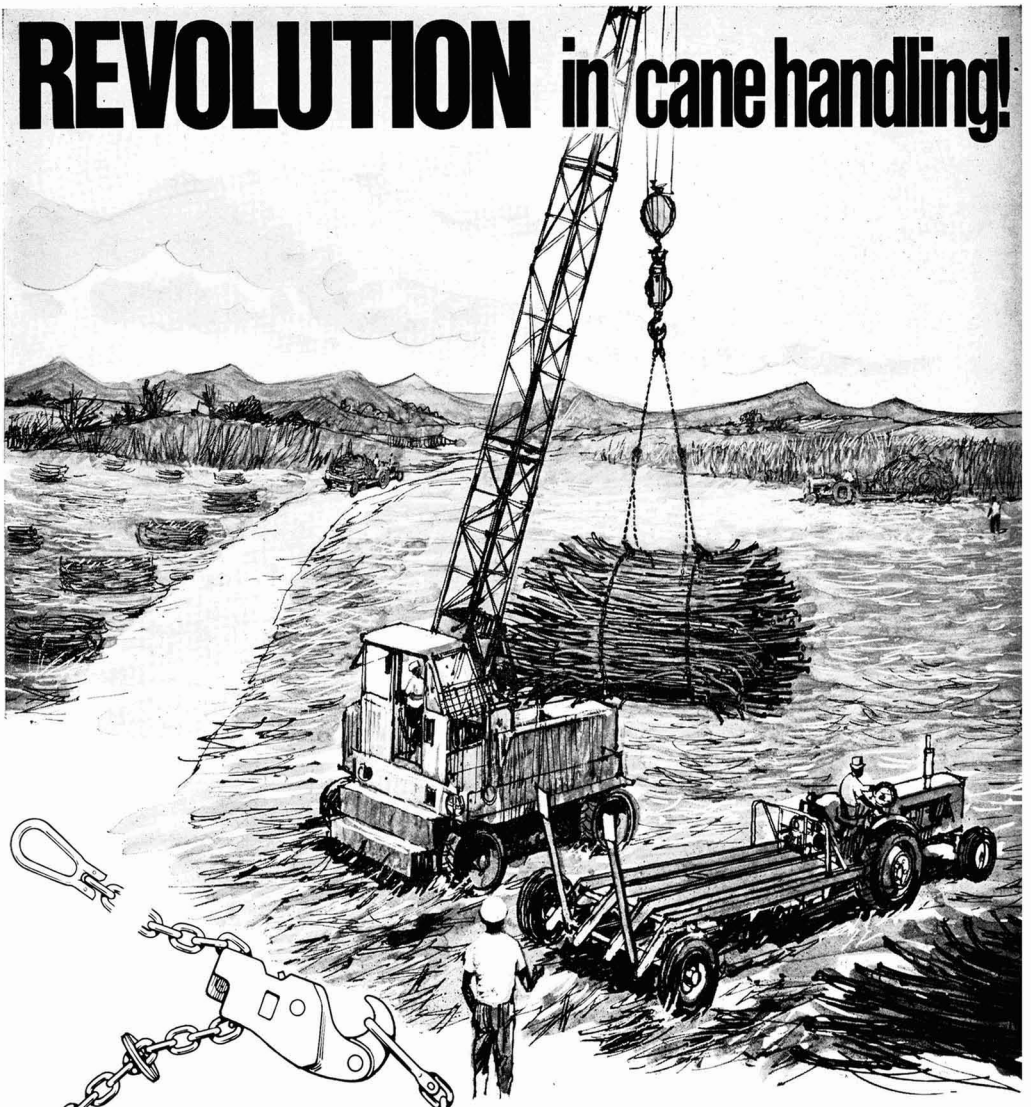

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PARSONS '05' 13/32" (10,3 mm.). The competitively priced sling that saves you money and is approximately 30% lighter than conventional ½" chain. So the slinger handles it easier. Proof load 4 tonnes. Recommended working load 2 tonnes with minimum safety factor of 4 to 1.

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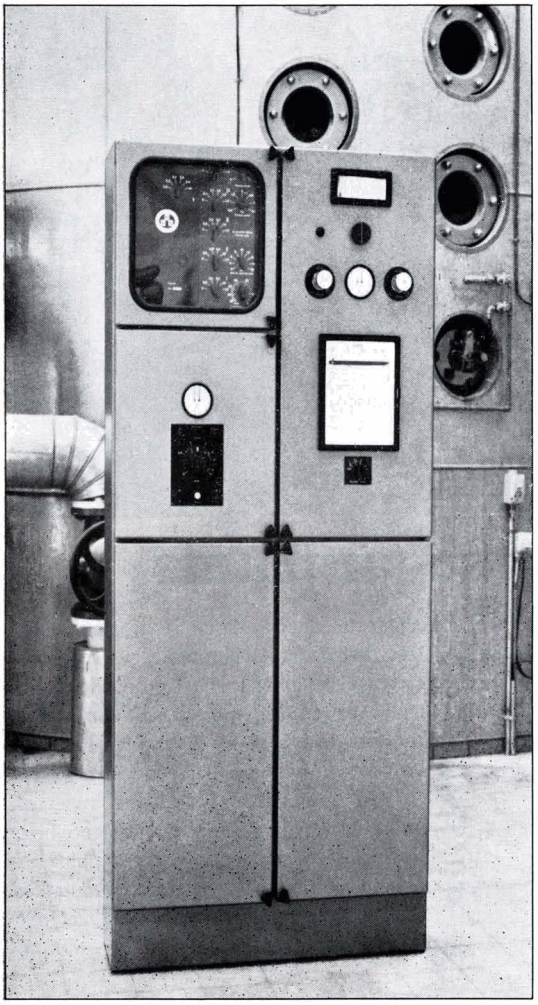

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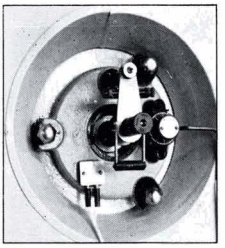
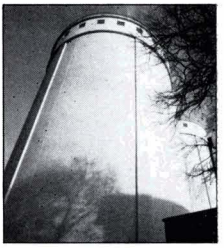
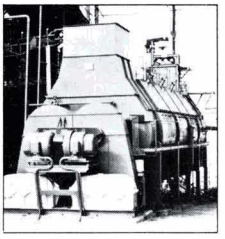


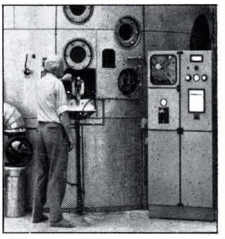
The direct view DDS Pan Microscope.



DDS Silo for storing white sugar in bulk.



DDS Diffuser.



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International Sugar Journal

September 1973

Contents

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Expérience avec le diffuseur à canne Saturne. J. PALACI. *p.* 267–271

L'auteur décrit d'abord en bref le processus opérationnel du diffuseur à canne Saturne. Il discute ensuite l'effet d'un nombre de variables sur la performance du diffuseur, tel qu'observé dans les systèmes utilisés à St. Antoine (Maurice) et à Umfolozi (Afrique du Sud). On présente des tableaux des résultats obtenus par la combinaison pressage-diffusion en 1972 à la première usine et en 1971 et 1972 à la seconde usine. Ces résultats sont comparés à ceux obtenus par simple pression avant l'installation de la diffusion Saturne. Les deux séries de données montrent les avantages de la diffusion Saturne au point de vue de la récupération du sucre avec une capacité plus importante, ainsi qu'au point de vue d'épuration, etc.

* * *

L'identification de bactéries hyperthermophiles obligates, anaérobies provenant de jus d'extraction de sucreries betteravières. IIe partie. F. HOLLAUS et H. KLAUSHOFER. *p.* 271–275

On fournit des détails sur les milieux utilisés par les auteurs pour détecter la formation de H_2S par les anaérobes (indiquée par le noircissement du milieu suite à la formation de sulfure de fer ou encore, dans le cas de la méthode utilisant du papier à l'acétate de plomb, par la formation du sulfure de plomb). Les résultats montrent qu'aucune variété ayant fait l'objet des recherches réduit le sulfate, tandis qu'elles forment toutes du H_2S aux dépens du sulfite et du thiosulfate. Les résultats sont discutés et les bactéries isolées sont identifiées.

* * *

Pureté de mélasse et teneur en chlorure. J. P. GUPTA, K. K. GUPTA, T. P. SAKSENA et S. C. GUPTA. *p.* 275–277

Parmi les différentes méthodes examinées pour la détermination des chlorures dans les produits de la sucrerie à canne, celle de DAVIES fut reconnue comme la plus appropriée. Elle fut appliquée aux échantillons de mélasses et on a déduit deux équations pour calculer la pureté de la mélasse en fonction de la teneur en chlorures. Les résultats, présentés sous forme graphique, montrent que la corrélation chlorure-pureté est plus significative que la relation pureté-sucres invertis:cendres. Elle permet de prédire la purete à ± 0,50 unités près dans 87% des cas. La prédiction sur la base des chlorures et du rapport sucres invertis:cendres est plus précise mais elle exige trois analyses au lieu d'une.

Erfahrungen mit dem Saturn-Rohrdiffuseur. J. PALACI. *S.* 267–271

Nach einer kurzen Zusammenfassung über die Arbeitsweise in einem Saturn-Rohrdiffuseur diskutiert der Verfasser den Einfluss einer Anzahl von Variablen auf die Leistung des Diffuseurs, wie er sich aus den in Saint Antoine auf Mauritius und in Umfolozi in Südafrika in Betrieb befindlichen Systemen ergibt. Die Ergebnisse mit der Kombination aus Mühle und Diffuseur für 1972 in der ersten Fabrik und für 1971 und 1972 in der zweiten Febrik sind in Tabellen zusammengestellt und mit den Daten verglichen, die mit der Mühle allein vor der Installierung des Saturn-Diffuseurs erhalten wurden. Beide Zahlenreihen lassen die Vorteile der Saturn-Diffusion durch die erhöhte Zuckerausbeute bei grösserem Rohrdurchsatz sowie die bessere Klärung usw. erkennen.

* * *

Identifizierung von hochthermophilen, obligat anaeroben Bakterien aus Rohsäften von Rübenzuckerfabriken. Teil II. F. HOLLAUS und H. KLAUSHOFER. *S.* 271–275

Es werden Einzelheiten mitgeteilt über die von den Autoren zum Nachweis der Schwefelwasserstoffbildung durch Anaerobier verwendeten Medien (zu erkennen durch Schwarzfärbung des Mediums durch Eisensulfid oder—bei der Benutzung der Bleiacetat-papier-Methode—durch Bildung von Bleisulfid). Es zeigte sich, dass keiner der untersuchten Stämme Sulfat reduzierte, während alle Schwefelwasserstoff aus Sulfit und Thiosulfat bildeten. Die Ergebnisse der Untersuchungen werden diskutiert; die isolierten Bakertien wurden identifiziert.

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Melassereinheit und Chloridgehalt der Säfte. J. P. GUPTA, K. K. GUPTA, T. P. SAKSENA und S. C. GUPTA. *S.* 275–277

Es wurde festgestellt, dass von den verschiedenen zur Bestimmung von Chlorid in Produkten der Rohrzuckerherstellung untersuchten Methoden die von DAVIES entwickelte am besten geeignet ist. Sie wurde auf Melasseproben angewandt. Zur Berechnung der Melassereinheit als Chloridgehalt wurden zwei Gleichungen abgeleitet. Die in einem Diagramm wiedergegebenen Resultate lassen erkennen, dass die Beziehung zwischen Chloridgehalt und Reinheit signifikanter ist als die Beziehung zwischen Reinheit und dem Verhältnis aus reduzierenden Zuckern und Asche und in 87% der Fälle die Angabe der Reinheit auf ± 0,50 Einheiten genau zulässt. Die Angabe auf der Basis des Chloridgehaltes und des Verhältnisses aus reduzierenden Zuckern und Asche ist genauer, erfordert aber statt einer Analyse drei.

Experiencias con el difusor de caña marca Saturne. J. PALACI. *Pág.* 267–271

Después de un breve sumario del procedimiento de operación de un difusor de caña marca Saturne, el autor discute los efectos de algunas variables sobre el cumplimiento del difusor como indican las sistemas que se operan en las fábricas de Saint Antoine en Mauricio y de Umfolozi en Sud-Africa. Las resultas de molienda-con-difusión para 1972 en la primera de estas fábricas y para 1971 y 1972 en la segunda se presentan en forma tabular y se comparan con dados obtenido con molienda solamente antes del instalación del difusor Saturne. Ambos juegos de dados indican los ventajes de difusión por la sistema Saturne en términos de recuperación de azúcar más alta con un capacidad más grande de caña, tanto como clarificación mejor, etc.

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Identificación de bacterias anaeróbicas obligatas hipotermofílicas de jugos de extracción de fábricas de azúcar de remolacha. Parte II. F. HOLLAUS y H. KLAUSHOFER. *Pág.* 271–275

Se indican detalles de los medios utilizado por los autores para percibir la formación de súlfido de hidrógeno por bacterias anaeróbicas (indicado por ennegrecimiento del medio por sulfido de hierro o, en el caso del método usando papel de acetato de plomo, por formación de súlfido de plomo). Las resultas indicaron que ninguna de las razas investigadas redució sulfato, mientras que todas formaron H_2S de súlfito y hiposúlfito. Se discuten resultas de las investigación y las bacterias isoladas se identifican.

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Pureza de melaza y contenido de cloruro en el jugo. J. P. GUPTA, K. K. GUPTA, T. P. SAKSENA y S. C. GUPTA. *Pág.* 275–277

De varios métodos investigado para determinar cloruro en produtos de la fábrica de azúcar de caña, élla de DAVIES resulta la más conveniente. Se aplicó a muestras de melaza y dos ecuaciones se derivaron para calcular la pureza de la melaza en términos de su contenido de cloruro. Las resultas, presentado en la forma de un gráfico, demuestran que la relación cloruro-pureza es más significante, estatisticamente, que la relación entre pureza y la proporción azucares reductores:ceniza, y permite predicción de pureza entre ± 0,50 unidades en 87% de casos. Predicción a base de cloruro y la proporción azucares reductores:ceniza es más exacto pero requiere tres analisises en lugar de uno.

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Notes & Comments

World sugar production estimates, 1972/73.

F. O. Licht K.G. have recently published[1] their third estimates of world sugar production for 1972/73 and these are reproduced elsewhere in this issue with corresponding figures for 1971/72. The second estimates were published in February[2] and since then there have been corrected estimates for the European beet sugar crops; consequently the latest estimates show little change from these which were, in most cases, official statistics. Outside Europe the US beet sugar crop is set 50,000 tons lower but other minor changes more or less cancel out each other.

In the cane sugar sector, a number of countries' initial estimates have been revised upwards, particularly those of Cuba (raised by 50,000 tons), India (by 300,000 tons), and the Philippines (by 130,000 tons).

The total of world production is now set at 77,518,757 metric tons, raw value, an increase of over 4½ million tons from the 73,070,234 tons of 1971/72.

* * *

EEC Commission proposals on sugar

The Commission of the European Economic Community met recently to discuss sugar affairs and its proposals were submitted on the 14th July to the Agricultural Ministers of the nine members. The Commission proposes that the EEC provide quotas of 1,400,000 metric tons, refined value, at guaranteed prices, for imports of sugar from the developing countries which are members of the present Commonwealth Sugar Agreement, for Surinam, the Malagasy Republic and Congo. The CSA members have quotas up to 1974 totalling 1,400,000 tons, raw value, equivalent to 1,345,000 tons, refined value, so that the balance is available for the former Dutch and French colonial suppliers.

It is proposed that the Community apply for membership of the International Sugar Agreement and seek an export quota of 600,000 tons; this would mean that, in contrast to the principle of self-sufficiency enshrined in the Common Agricultural Policy, an import-export balance of about 800,000 tons would exist.

Instead of concentrating production in the most efficient areas, which would cause closures in some areas and would thus be politically impossible, the Commission proposes the amendment of the present system to an equally inefficient (from an economic viewpoint) one in which each country would have a fixed production quota for domestic use at guaranteed prices and a flexible quota which could be adjusted to produce sugar in accordance with the world sugar balance of requirements. Thus, under present circumstances, the second quota would be unlimited to take advantage of the removal of quota limits by the ISO.

The fixed quota would be raised from the present 7·8 million to 8·4 million tons while the flexible quota would normally be about 10% of this, giving a total production of some 9·4 million tons. By comparison, the EEC producers have only once attained this level, in 1971/72 when output reached 9·6 million tons; in 1972/73 8·9 million tons were produced but it is likely that 9·4 million tons will be exceeded in 1973/74.

The proposals thus embody the repeated statement of the British Government that, in accordance with the agreement reached during its membership application negotiations, the Community would have as its firm purpose to safeguard the interests of the developing countries whose economies depend on sugar.

Perhaps sensitive to the fact that, a week later, developing countries of Africa and the West Indies were sending representatives to Brussels for a conference on renewal of the Yaoundé association, and that their reception of the proposals would be a clear test of the Community's claim to be outward-looking and concerned with the welfare of the "third world", eight of the Ministers welcomed the plans.

Not surprisingly, the French Minister for Agriculture rejected the proposals, describing them as ridiculous. The French sugar producers have, of

[1] *International Sugar Rpt.*, 1973, **105**, (18), 1–4.
[2] *I.S.J.*, 1973, **75**, 98.

course, done very well out of the Common Agricultural Policy and have expanded production very greatly; they hoped to be able under EEC rules to export sugar profitably to the UK market in place of Commonwealth supplies and this would be frustrated by the Commission's proposals since the UK would, in addition to receiving the CSA developing countries' raws, be allowed to increase home beet sugar production to replace Australian supplies as they were phased out after 1974.

The proposals were consequently referred to working groups for discussion and adjustment, and it is to be hoped that agreement can be reached in time for the second stage of the International Sugar Agreement negotiations this month.

* * *

World sugar balance, 1972/73

In the issue of F. O. Licht's *International Sugar Report*[1] directly after that containing their 3rd estimate of world sugar production, a new estimate is given for the world sugar balance for the crop year September 1972/August 1973, and this is reproduced below:

	1972/73	1971/72	1970/71
	(metric tons, raw value)		
Initial stocks	16,996,000	18,961,000	21,362,000
Production	77,458,000	73,852,000	72,772,000
Imports	24,350,000	24,490,000	23,502,000
	118,804,000	117,303,000	117,636,000
Exports	24,199,000	24,139,000	24,115,000
Consumption	78,450,000	76,168,000	74,560,000
Final stocks	16,155,000	16,996,000	18,961,000
Production increase	3,606,000 (+4·88%)	1,080,000 (+1·48%)	—1,574,000 (—2·12%)
Consumption increase	2,282,000 (+3·00%)	1,608,000 (+2·16%)	2,337,000 (+3·24%)
Stocks % Consumption	20·59%	22·31%	25·43%

As may be seen, in spite of a major increase in production of 3·6 million tons, there is still a shortfall of a million tons against consumption, with a consequent fall in stocks. The new figure for world production is considerably higher than expected at the time of the previous estimate of the world sugar balance; this has resulted from a number of upward revisions in the production estimates for Cuba and India, and also conversion of Brazilian figures from a tel quel basis to raw value.

* * *

Indian sugar situation.

The latest statistics from India, covering the period to the end of May 1973, indicate that consumption is currently running at less than 90% of last season's level, while production has already surpassed output in 1971/72 and seems likely to close at a figure second only to the record of 4,261,000 metric tons, tel quel, reached in 1969/70. Stocks at the end of May were more than 200,000 tons higher than at the corresponding date in 1972. C. Czarnikow Ltd. write[2]: "This improvement in the statistical position of India reflects the measures taken by the Government of that country. These include price increases at the various stages of production. It is understandable that a developing country, faced with a shortage and suffering from a lack of foreign currency, should find it necessary to take such steps, but it is an unfortunate commentary on the prevailing world arrangements that a country with so low a standard of living should find itself forced to reduce its consumption even further, while at the same time needing to maintain shipment to the developed countries with which it has special trading arrangements in order to acquire exchange".

* * *

European sugar beet area, 1973

F. O. Licht K.G. have recently published their third estimate of European sugar beet areas[3] and these are reproduced below together with the corresponding figures published by the International Association for Sugar Statistics[4].

	1973/74		1972/73
	IASS	*F. O. Licht*	*IASS*
	hectares		
IASS Members			
Austria	51,300	51,300	48,411
Belgium	105,000	105,000	103,000
Denmark	67,000	67,000	56,000
Finland	20,500	20,500	19,100
France	478,000	478,000	415,000
Germany, West	350,100	350,100	332,843
Holland	113,500	113,500	112,981
Spain	210,000	200,000	213,700
Sweden	42,000	42,000	42,200
Switzerland	9,900	9,935	9,843
Turkey	160,000	153,953	148,289
UK	189,000	189,400	179,000
	1,796,300	1,780,688	1,680,367
Non-IASS Members			
West Europe	*F. O. Licht*	*F. O. Licht*	*F. O. Licht*
Greece	25,300	25,300	21,100
Ireland	30,499	30,499	34,008
Italy	239,000	239,000	239,000
Yugoslavia	81,000	81,000	74,788
	2,172,099	2,156,487	2,049,263
East Europe			
Albania	6,000	6,000	6,000
Bulgaria	65,000	65,000	62,000
Czechoslovakia	180,000	180,000	180,000
Germany, East	226,000	226,000	221,700
Hungary	92,779	92,779	79,047
Poland	445,000	445,000	438,000
Rumania	200,000	200,000	195,000
USSR	3,500,000	3,500,000	3,435,000
Total Europe	6,886,878	6,871,266	6,666,010

As may be seen, the IASS and Licht estimates are very close, with only 15,000 hectares difference. The increase between 1972/73 and 1973/74 areas is 220,000 ha or 3%; coupled with the fact that good growing weather is being experienced, by contrast with last year, this augurs well for a considerable increase in sugar production in the 1973/74 campaign.

[1] 1973, **105**, (19), 1.
[2] *Sugar Review*, 1973, (1133), 113.
[3] *International Sugar Rpt.*, 1973, **105**, (21), 3.
[4] *ibid.*, (16), 1.

Experience with the Saturne cane diffuser

By J. PALACI

Ingénieur ENSIA (Sucatlan Engineering, Paris, France)

THE Saturne diffuser is different from other diffusers in that it is based on the continuous maceration principle and not on percolation.

It lends itself equally well to the equipment of new factories, such as the 5000 t.c.d. sugar complex of Ferkessedougou (Ivory Coast), or the easy economical expansion and modernization of existing factories.

The general design is so unsophisticated that there is practically no running-in period involving complicated and expensive adjustments which in many cases disturb the smooth operation of the extraction plant.

General installation data

The Saturne diffuser is, as yet, for bagasse only. The sugar cane to be processed is first passed through a primary extraction mill and the bagasse fed to the diffuser, which may be located and installed either inside or outside the extraction plant building (Fig. 1.)

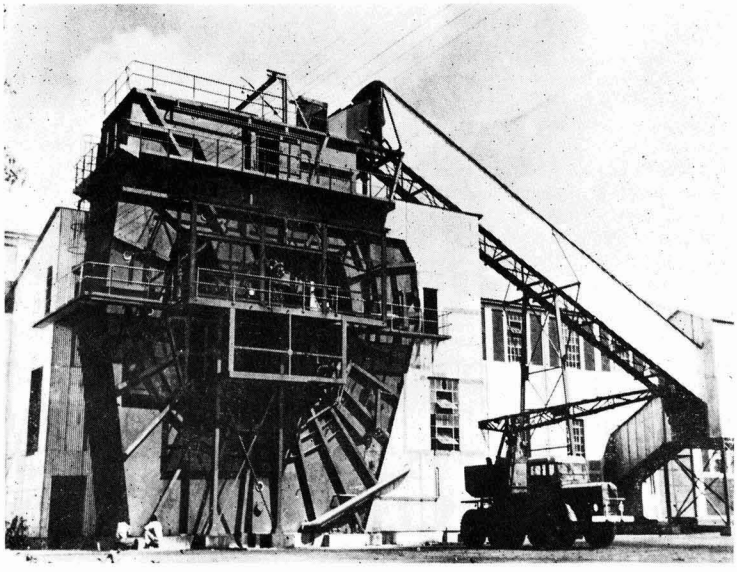

Fig. 1. Saturne diffuser at Saint Antoine (Mauritius)

A combination of conveying elevators transfers the bagasse from the primary extraction mill to the Saturne unit. Bagasse feeding to the diffuser is automatically controlled by a gamma-ray detector which starts the hydraulic jack drive only when a basket is fully loaded.

Juice circulation results from the difference of levels between the press water inlet and the diffusion juice outlet. A recirculation pump located at the lowest part of the diffuser creates a turbulence and improves the contact between the bagasse and the juice.

The diffused bagasse falls by gravity from the diffuser into the first dewatering device hopper. The speed of the dewatering device is automatically controlled in such a manner that the hopper is constantly loaded. This dewatering device, which is part of the Saturne diffuser itself, delivers the bagasse with a moisture content of approximately 70%. The amount of press water extracted (which is approximately half of the weight of the bagasse entering the dewatering device) is replaced by imbibition water which is sprayed over the bagasse as it is conveyed to the dewatering mills. Before the next crop at Saint Antoine, a secondary dewatering device will be installed to replace one of the two existing dewatering mills.

Future Saturne installations will require two mills only: one for primary extraction and the other for final dewatering. The Saturne installations for Ferkessedougou (Ivory Coast) and Gangavati (India) will be equipped accordingly and both are due to be commissioned in early 1974.

The scalding juice and press water before feeding to the diffuser are limed and heated to maintain within the diffuser a pH of 6·0 to 6·2 and a temperature of 72° to 75°C; under these near neutral conditions sucrose destruction by inversion is minimized as is also any microbiological sucrose loss. Moreover, reducing the natural acidity of the cane juice makes possible the use of mild steel in the construction of the Saturne unit; experience shows that corrosion is no problem.

The Saturne mechanical design is so simple and it has operated so smoothly during the past campaign at Saint Antoine that a 6 to 10% increase in capacity of the extraction plant was registered in 1972 as compared with the conventional milling plant in

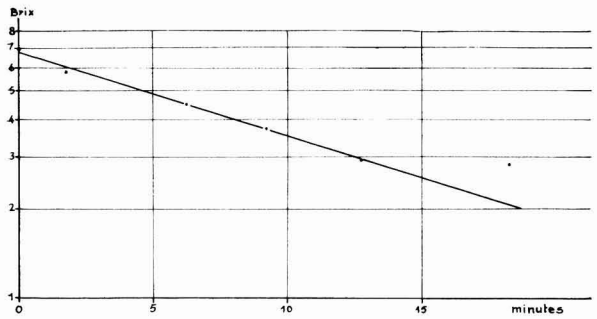

Fig. 2. Brix logarithmic extraction line for the Saturne diffuser

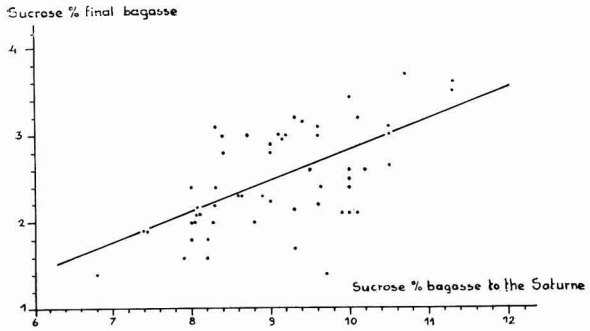

Fig. 3. Effect of 1st extraction on pol of final bagasse

use during 1971. At Umfolozi (South Africa), where the Saturne diffuser was designed for a nominal capacity of 150 t.c.h., satisfactory results could be obtained when operating at as low as 70 t.c.h. and up to 230 t.c.h. All this evidences the great flexibility of the Saturne system.

Saturne Diffuser Operation

Cane preparation

It has been observed that the extraction rate obtained from the Saturne diffuser improves as the bagasse is more finely disintegrated. Table I shows the extraction achieved at different values of the mean particle surface *S*.

Table I. Effect of cane preparation on extraction

S	*Reduced extraction*
41·4	93·96%
45·7	96·10%
53·8	96·43%

In factories equipped with Saturne diffusers particular attention has been paid from the outset to the preparation of the bagasse.

Experience has shown that the equilibrium of the concentration between bagasse and juice is reached after varying periods of time, depending on the manner in which the bagasse is prepared.

If the values *a* of the slope of the line which represents the graph of the function ln Brix = f (*t*), is considered[1], *t* being the number of minutes reckoned from the moment when the bagasse starts soaking in the juice and Brix being the Brix of the samples taken along the diffuser after a soaking period equal to *t*, then the values of *a* fluctuate from 0·020 to 0·030 min^{-1} for cane prepared with a shredder and a crusher and from 0·040 to 0·060 min^{-1} for cane prepared by cane knives only working ahead of the primary extraction mill (Fig. 2).

It is considered that a shredder is not desirable for cane preparation. Conventional cane knives are preferred but improved by the use of Sucatlan self-sharpening, thin-bladed cane knives as installed at Saint Antoine during the second half of the 1972 campaign.

Extraction resulting from the primary extracting mill

Examination of the results from all Saturne diffusers have shown that there is a statistically highly significant correlation between pol of the bagasse coming from the primary extraction mill (P_o) and the pol of the final bagasse (p). The general regression equation is as follows (Fig. 3):

$$p = 0{\cdot}353\, P_o - 0{\cdot}696$$

Imbibition

Tests conducted at Umfolozi have shown that the reduced extraction does not increase significantly with higher draft as indicated in Table II and Fig. 4.

Economics will decide whether or not the cost of additional evaporation will balance out the increase in extraction.

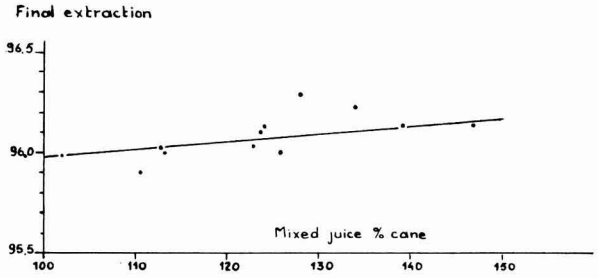

Fig. 4. Effect of draft on final extraction

[1] Palaci: *Sugar y Azúcar*, 1970, **65**, (3), 31–36.

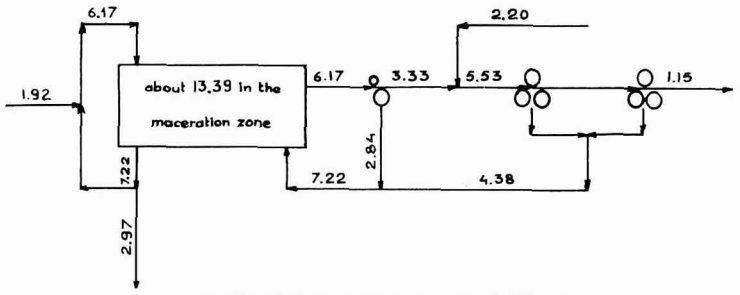

Fig. 5. Juice/fibre balance for Saturne milling-diffusion system

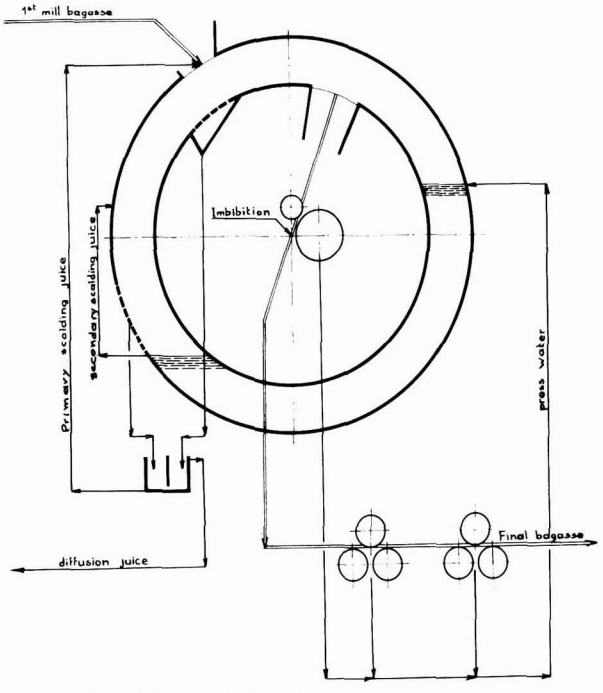

Fig. 6. Liquids and solids diagram for the Saturne diffuser

Table II. Effect of draft on reduced extraction

Draft, %	*Reduced extraction*, %
102·1	95·98
110·5	95·90
112·9	96·02
113·2	96·00
122·9	96·03
123·7	96·10
124·1	96·13
125·8	96·00
127·9	96·29
133·9	96·23
139·2	96·14
146·9	96·14

Liquids balance in the Saturne diffuser

It is of interest to compare the quantities of juice and fibre present in the Saturne diffuser as the process of bagasse diffusion consists in replacing the cane juice by water; fibre is the only cane component which remains constant during the whole extraction process (Fig. 5).

In the maceration zone, large quantities of juice surround the fibre, which favours the exchange of rich juice. A Saturne liquids and solids diagram is presented in Fig. 6.

Diffusion time

The active diffusion time, when the bagasse soaks in juice, has a duration of 12 to 20 minutes. Tests have proved that, within certain limits as shown in Table III, the speed of rotation of the diffuser, i.e. the diffusion time, has a negligible effect upon the extraction. This is illustrated in Fig. 7. Cycle time is the time elapsed between two successive thrusts of the hydraulic jack drive.

Diffusion temperature

As shown in the following Table IV and in Fig. 8, the extraction drops considerably when the diffusion temperature is lower than 40°C. FREUND[2] reports a drop of 0·64 to 1·1% in extraction for a temperature decline of 10°C over the range from 50° to 90°C. For the Saturne diffuser the drop in extraction is only 0·20% for the same temperature decline.

Diffuser efficiency

For HUGOT[3], the efficiency of the diffusion is measured by the ratio of the concentration of the juice remaining in the final bagasse to that of the diffusion juice. The efficiency is greater as this ratio ε is lower, viz.—

$$\varepsilon = \frac{M + F - 100}{(M + 2F - 100)\,\frac{100 - F}{M}\,e^{at} - F}$$

where M = mixed juice % cane, F = fibre % cane, a = slope of extraction line, t = retention time.

Table III. Effect of diffusion time on extraction

Cycle, sec	97	107	109	113	115	127
Extraction, %	95·90	96·00	95·99	96·00	96·15	95·95
Pol % final bagasse, *p*	1·87	1·75	2·10	1·86	1·74	

Table IV. Effect of temperature on extraction

Temperature, °C	79	48	42	38	36	35	33·5
Reduced extraction, %	97·67	97·07	96·88	96·72	95·81	95·51	94·54
Pol % final bagasse, *p*	1·7	1·7	1·9	2·0	2·6	2·8	3·4

[2] *Proc. 13th Congr. I.S.S.C.T.*, 1968, 133–140.
[3] "La Sucrerie de Cannes" (Dunod, Paris). 1970, p. 345.

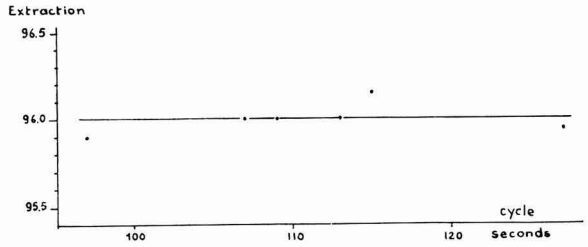

Fig. 7. Effect of diffuser speed on final extraction

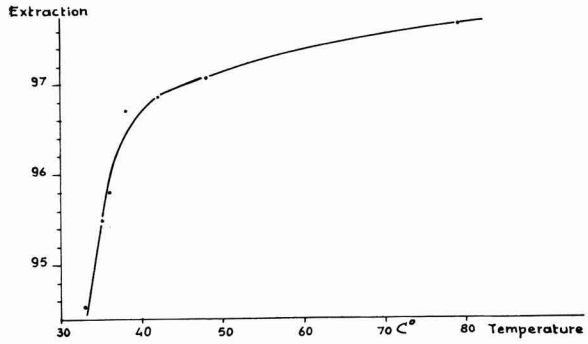

Fig. 8. Effect of diffusion temperature on final extraction

Theoretically, this formula shows that the factor which has the maximum effect on ε is *a*. When *a* increases, ε decreases. In other words, the diffuser efficiency increases when the slope of the extraction line increases also.

For cane prepared with knives and shredder, the value of ε is around 0·60. When the preparation is made with knives only, the value of ε drops to 0·39 which confirms the effect of cane preparation on the diffuser results.

Technological Results

The Saturne diffuser at Saint Antoine (Mauritius) has just completed its first campaign. Results are compared with those of straight milling in Table V, taking data from 6th December 1971 and 9th December 1972 for comparison.

Table V. Saint Antoine sugar factory results

	1971 (*straight milling*)	1972 (*milling-cum-diffusion*)
Tons cane crushed per hour	99·20	105·40
Sucrose % cane	13·72	12·15
Fibre % cane	14·87	16·68
Imbibition % cane	34·16	35·76
Mixed juice % cane	102·22	98·95
Purity of 1st expressed juice	88·80	87·60
Sucrose % final bagasse	2·45	2·01
Moisture % final bagasse	50·27	52·35
Reduced extraction	95·34	95·63
Loss in bagasse % cane	0·78	0·74
Loss in filter cake % cane	0·03	0·01
Loss in molasses % cane	1·32	1·19
Boiling house recovery	86·41	86·92
Overall recovery	81·49	81·60
Sugar polarization (mean figures)	99·15	99·22

The introduction of the Saturne unit during the 1972 campaign has given improvements as follows:

6% more cane crushed per hour,
27% less filter cake % cane owing to better clarification,
more sugar in the bag, and
less molasses in the tank.

At Umfolozi, where the Saturne has just completed its second campaign, a comparison of results is given in Table VI.

In this factory the installation of the Saturne diffuser has resulted in an increase of 11% in the capacity of the extraction plant. The straight extraction has improved by one unit.

Extraction of non-sugars

The mixed juice resulting from the Saturne process contains less impurities than that from the straight milling process. Hence at Saint Antoine it was found possible to discontinue the enzymatic process required to destroy starch in mixed juice from the straight milling process.

Lower extraction of non-sugars in mixed juice; gives easier clarification at Saint Antoine, the quantity of mud decreased from 2·88% on cane in straight milling to 2·11% with the Saturne unit.

In this factory the clarification improved noticeably and the clarifier had 35% surplus capacity.

Where juice is purified by double carbonatation, the filtration of the first carbonatation juice was definitely improved. The filtration coefficient F_k dropped from 10 when the mills only were operating to 5·4 when the Saturne diffuser was functioning, considerably improving the performances of the filters[4]. This result is probably due to the coagulation and adsorption of proteins and pectins on the bagasse during the diffusion process.

Table VI. Umfolozi results

	1970 (*straight milling*)	1971 (*milling-cum-diffusion*)	1972 (*milling-cum-diffusion*)
Tons cane crushed per hour	72·26	79·01	80·56
Sucrose % cane	13·65	13·08	13·81
Fibre % cane	14·36	13·38	14·01
Imbibition % cane	44·69	48·98	46·40
Mixed juice % cane	109·60	117·00	113·40
Purity of 1st expressed juice	85·40	85·50	—
Purity of mixed juice	84·00	83·40	86·10
Sucrose % final bagasse	2·00	1·92	1·75
Moisture % final bagasse	56·11	55·38	54·44
Extraction	94·83	95·33	95·83
Reduced extraction	95·60	95·68	96·35
Loss in bagasse % cane	0·705	0·612	0·577

A further effect is the better boiling house recovery; at Saint Antoine, the quantity of molasses % cane

[4] Barre: *Proc. 14th Congr. I.S.S.C.T.*, 1971, 1281–1291.

dropped from 3·73 for straight milling to 3·45 with the Saturne process. Sucrose lost in molasses decreased correspondingly from 1·32% to 1·19% cane. In addition, a noticeably better quality of sugar was produced. At Saint Antoine, the filtering qualities of sugar, which is of the utmost importance for the refiner, increased from 30–35 (Elliott Test) with straight milling, to 55 with the Saturne diffuser. This allowed Saint Antoine to sell its sugar without any allowance to the refiner. So as to improve the filtrability of the sugar produced by straight milling only, Saint Antoine has previously had to use an enzymatic process of starch destruction; operating the Saturne diffuser, Saint Antoine has been able to discontinue this enzymatic process, as stated above.

Conclusion

In commercial operation the Saturne equipment has completely vindicated the cane diffusion process. Sucrose extraction is quickly obtained through the continuous maceration principle, by gravity flow under practically neutral conditions. The bagasse remains completely soaked in juice for 12 to 20 minutes only and consequently the juice obtained is easily clarified and more sugar of better quality is obtained.

Being a compartment-equipped circular conveyor, the Saturne unit is very flexible. In South Africa, a 150 t.c.h. Saturne diffuser has given acceptable results when operating down to 70 and up to 230 tons cane per hour.

The design of the Saturne diffuser is so simple that maintenance is minimal and operation only requires unskilled labour. At Saint Antoine, down-time for Saturne was as low as 3% of total time worked; the maintenance cost for the whole campaign was lower than the maintenance costs for one mill only.

Since extraction in the Saturne diffuser is based on the maceration process, plant for the treatment of press water is not needed. Slight liming of the press water is recommended before it is introduced into the diffuser, so that mild steel is adequate for the diffuser construction.

Identification of hyperthermophilic obligate anaerobic bacteria from extraction juices of beet sugar factories*

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PART II

Formation of hydrogen sulphide

(*a*) Detection of hydrogen sulphide by media containing iron salts.

A variety of media containing sulphate or sulphite plus an iron salt is used for the detection of anaerobes forming hydrogen sulphide. A blackening of the medium caused by iron sulphide indicates the formation of hydrogen sulphide. The following media were used in our studies:

"Starkey's Sporovibrio medium"[29] for the detection of sulphate reduction: 0·5% peptone, 0·3% beef extract, 0·02% yeast extract, 0·15% $MgSO_4$, 0·15% Na_2SO_4, 0·02% ferrous ammonium sulphate, 0·7% (1·5%) agar, 0·5% glucose.

"Owen-agar"[34] for the detection of sulphite reduction: 1% tryptone, 0·05% (0·02%) Na_2SO_3, 0·7% (1·5%) agar; an iron nail is placed in each tube.

Oxoid iron-sulphite-agar[35]; for the detection of sulphite reduction: 1% tryptone, 0·05% Na_2SO_3, 0·05% iron citrate, 1·2% agar.

BBL-TSE medium[16]: 1% tryptone, 0·1% sucrose, 0·02% $FeSO_4,7H_2O$, 0·04 (0·02%) Na_2SO_3, 0·008% $Na_2S_2O_3,5H_2O$, 0·7% agar.

The results are listed in Table III.

The intensity of the blackening is influenced considerably by both the solubility of the iron salt (compare iron citrate and ferric chloride) and the concentration of the test substrate (0·04% or 0·02% Na_2SO_3 respectively) as may be seen from Table III. Owing to the solubility of iron sulphide in acid milieu the method of detecting hydrogen sulphide by formation of FeS in the medium is unreliable, expecially in the case of low H_2S-concentration and acid formation.

With the sulphite concentration used, growth of the strains tested was not inhibited. Only strains D 120-70 and T9-3R showed in a sodium sulphite concentration of 0·04% somewhat scanter growth than in media with 0·02% sodium sulphite.

[34] Honig: "Principles of Sugar Technology" Vol. III (Elsevier, Amsterdam), 1963, p. 421.
[35] Oxoid-Manual, 3rd Edn., London, 1967.

Table III. Blackening of the media by formation of iron sulphide

Medium	Isolates from extraction juices: 13 strains	Isolates from extraction juices: D 120-70	*Clostridium thermosaccharolyticum*: NCIB 9385	*Clostridium tartarivorum*: T9-1	*Clostridium tartarivorum*: T9-3R	*D. nigrificans*: NCIB 8395	*D. nigrificans*: 8706
1	++	—	++	++	—	++	++
2	++	—	—	—	—	++	++
3	+	—	+	+	—	++	++
4	+	—	—	—	—	++	++
5	+	—	+	+	—	++	++
6	—	—	—	—	—	++	++

Media: 1 .... BBL-TSE medium (0·4% Na_2SO_3)
2 .... BBL-TSE medium (0·02% Na_2SO_3)
3 .... "OWEN-agar" (0·05% Na_2SO_3)
4 .... Oxoid iron citrate-sodium sulphite medium
5 .... Oxoid iron citrate-sodium sulphite medium with additional 0·08% $FeCl_2,5H_2O$, $FeCl_3,7H_2O$, respectively
6 .... "STARKEY's Sporovibrio Medium"
— .... No blackening of the medium.
+ .... Blackening of the medium.
++ .... Deep black colouring of the medium.

None of the strains isolated from extraction juices was able to reduce sulphate (STARKEY's medium).

(*b*) Determination of hydrogen sulphide formation by means of lead acetate paper.

The finding of H_2S on the basis of lead sulphide formation is a much more sensitive method than the one described above. After incubation the culture solution is brought to a boil and kept in this state for about 1 minute in a test tube closed by a filter paper soaked in lead acetate. The presence of H_2S is indicated by a staining of the lead acetate paper ranging in colour from brown to black.

The organisms were cultivated in liquid media in "Jena anaerobic jars".

Media: For the study of hydrogen sulphide formation from tryptone (peptone, yeast extract): 1% tryptone (peptone, yeast extract), 0·1% glucose.

For the study of the reduction of inorganic sulphur compounds the test substrates were added to the tryptone-glucose broth (and to liver broth). Final concentrations: 0·08% $Na_2S_2O_3,5H_2O$, 0·04% Na_2SO_3, 0·04% Na_2SO_4.

It was demonstrated that all isolates and all comparative strains of *C. thermosaccharolyticum* and *Cl. tartarivorum* were able to release hydrogen sulphide from organic material (tryptone, peptone, yeast extract) some of them, however, only at low concentrations. Nevertheless tryptone-glucose broth may be used as a basal medium for studies on the reduction of inorganic sulphur compounds since in this case H_2S concentration in the culture solution is considerably higher than it would be as a result of H_2S formation exclusively from sulphur-containing amino-acids present in the tryptone.

Table IV indicates that all strains, with the exception of strains D 120-70 and T9-3R, are capable of reducing sulphite and thiosulphate to H_2S, provided tryptone-glucose broth is used as the basal medium. In a liver broth basal medium strains D 120-70 and T9-3R also decompose sulphite and thiosulphate with formation of H_2S. None of the strains listed in Table IV reduced sulphate.

IDENTIFICATION OF THE ISOLATED BACTERIA AND DISCUSSION OF THE RESULTS

The isolated organisms show great similarity in the biochemical features analysed, although—because of their individual properties—some of the strains are to be especially characterized. The organisms belong to the genus *Clostridium*; they multiply under strictly anaerobic conditions only and form round spores in terminal sporangia (plectridia type). Their poor proteolytic activity and their ability to utilize numerous carbohydrates indicate their close relationship to the group of "saccharolytic clostridia". The individual results are discussed below in the sequence used in the "Results" section above.

Sporulation

Only in a few media did sporulation take place. As a rule thermophilic anaerobes sporulate rather

Table IV. Hydrogen sulphide formation from organic and inorganic sulphur compounds (H_2S-test with lead acetate paper)

Sulphur compounds in the medium	Isolates from extraction juices: 13 strains	Isolates from extraction juices: D120-70	*Clostridium thermosaccharolyticum*: NCIB 9385	*Clostridium tartarivorum*: T9-1	*Clostridium tartarivorum*: T9-3R
Tryptone	+	(+)	(+)	+	(+)
Peptone	+	(+)	(+)	+	+
Yeast extract	+	(+)	+	+	+
$S_2O_3^{--}$ (TG)	+	—	+	(+)	—
$S_2O_3^{--}$ (L)	+	+	+	+	+
SO_3^{--} (TG)	+	—	+	+	—
SO_3^{--} (L)	+	+	+	+	+
SO_4^{--} (TG, L)	—	—	—	—	—

(+) .... Only traces of H_2S detected.
TG .... Basal medium: tryptone-glucose broth.
L .... Basal medium: liver broth.

poorly. SCHREYER[16] was not able to find spores in *Cl. thermohydrosulfuricum* when cultivated in meat or vegetable media generally used for the stimulation of sporulation of clostridia; however, she found some spores in cultures that had been grown in BBL-TSE medium (with 0·8–4·0 % sucrose). A number of test results on the sporulation of "thermophilic anaerobes" have since been published, revealing that for the formation of spores a carbon and energy source is actually required but under conditions that restrict the growth of the culture[24,36,37]. The taxonomic usefulness of spore morphology was not the only reason that motivated our efforts to achieve sporulation of the isolated bacteria strains, but also the better preservation conditions of well-sporulated cultures.

With regard to comparative cultures of *Cl. thermosaccharolyticum* and *Cl. tartarivorum*, the increase of sporulation by PHEIL and ORDAL[24] and by HSU and ORDAL[36] is confirmed by our test results.

No increase of sporulation of clostridia strains isolated from factory juices took place in "Gc" medium with arabinose. This is most probably due to the fact that none of these strains utilizes *l*-arabinose (Table II). The reasons for the relatively good formation of spores of these strains in soil extract medium to which xylose has been added have not yet been subjected to thorough investigation.

Morphology of vegetative cells and spores

No fundamental differences in the size of spores and cells can be observed between the isolated strains and *Cl. thermosaccharolyticum* and *Cl. tartarivorum*. The vegetative cells of the isolates are somewhat smaller than the one stated in the description of the species *Cl. thermohydrosulfuricum*[10,16]. This observation does not preclude an assignment of these strains to the species *Cl. thermohydrosulfuricum* as can be seen from the different dimensions of bacterial cells dependent on sucrose concentrations[16] or the different cell measurements found in sporulating and non-sporulating cultures.

Temperature

As regards the ability to multiply, strain D 120-70 as well as *Cl. thermosaccharolyticum* and *Cl. tartarivorum* show the same temperature limits. (Minimum temperature approx. 37°C, maximum 66–67°C). For all other 13 isolates, however, the upper temperature limit permitting growth was found to be 74°C–76°C and differs therefore from the growth limit of the two species mentioned above.

Biochemical features

Many biochemical properties of isolated strains do not differ from those of *Cl. thermosaccharolyticum*. Only quantitative differences, e.g. as regards the formation of gas, were observed. This property becomes especially apparent if cultures are grown in liver broth. Strain H 101-69 ferments carbohydrates without perceptible formation of gas, whereas a massive production of gas is apparent in other strains (D 121-70, L 110-69). Strain D 120-70 in which response to temperature is similar to that of *Cl. thermosaccharolyticum* and *Cl. tartarivorum* also demonstrates intensive gas formation when grown in liver broth; it thus resembles the two species. The 13 isolates characterized by growth at extremely high temperature differ also from *Cl. thermosaccharolyticum* and *Cl. tartarivorum* as regards the intensity of H_2S formation from tryptone (peptone). When grown in tryptone- (peptone-) glucose broth, only traces of hydrogen sulphide are released by the strains of these two species whereas the 13 strains mentioned produce some greater amounts of H_2S when cultivated in this medium. With respect to this characteristic, isolate D 120-70 resembles *Cl. thermosaccharolyticum* and *Cl. tartarivorum* too. It also hardly differs from *Cl. thermosaccharolyticum* with regard to carbohydrate cleavage. However, the test result according to which strain D 120-70 does not ferment tartrate is significant for identification, since it allows a clear differentiation from *Cl. tartarivorum*.

Thus strain D 120-70 could be identified as *Cl. thermosaccharolyticum*.

The remaining 13 strains cannot be defined as *Cl. thermosaccharolyticum* especially since they are able to grow at approx. 75°C. In this they resemble *Cl. thermohydrosulfuricum*; also the more intensive hydrogen sulphide formation from tryptone is characteristic for this species. The fact that all strains show growth when cultivated in liver broth whereas the description of *Cl. thermohydrosulfuricum*[10] contains the remarks "no growth in liver broth" does not preclude an attachment of these strains to this species. The criterion "growth in liver broth" should not be overestimated for the characterization of the species *Cl. thermohydrosulfuricum* because of two factors:

(1) In the first description SCHREYER[16] confirmed that *Cl. thermohydrosulfuricum* in liver broth reveals either only weak or no growth.

(2) Our investigations proved that the intensity of growth in liver broth may differ considerably between the individual isolates. Whereas strain L 77-66 only starts to produce gas and causes clouding of the medium approximately 40 hours after inoculation, from the majority of the other strains intensively growing cultures are obtained as early as 16–20 hours after inoculation.

The isolates D 121-70, E 100-69, E 101-69, H 100-69, H 101-69, H 103-70, L 77-66, L 110-69, L 111-69, S 100-69, S 101-69, S 102-70 and T 15-66 may thus be identified as *Cl. thermohydrosulfuricum*.

Although all organisms studied reduce sulphite and thiosulphate to hydrogen sulphide this property is particularly well developed in *Cl. thermohydrosulfuricum* strains. This is evidenced by the blackening of iron citrate-sodium sulphite agar. Owing to the low solubility of iron citrate the H_2S amount liberated in this medium by the type culture of *Cl. thermosaccharolyticum* or *Cl. tartarivorum* is apparently not sufficient to precipitate iron sulphide. However, the

[36] HSU and ORDAL: *Appl. Microbiol.*, 1969, **18**, 958.
[37] *idem*: *J. Bact.*, 1969, **97**, 1511.

adding of an easily soluble iron salt ($FeCl_2$, $FeCl_3$) does cause a blackening of the medium also in the cultivation of the strains mentioned.

In this connexion it is to be emphasized that hydrogen sulphide is produced from sulphite and thiosulphate also by *Cl. thermosaccharolyticum* strains. In the first description of the species by McCLUNG[17], the formation of H_2S is mentioned. However, the revised description of the species by the same author in Bergey's Manual[27] contains no reference to hydrogen sulphide formation. *Cl. thermosaccharolyticum* has frequently been characterized as "gas but non-H_2S-producing" in contrast to "H_2S producers" (*D. nigrificans*)[3,5]. McCLUNG[4], in his report on the isolation of *Cl. thermosaccharolyticum*, also uses the term "gas-forming (non-H_2S) anaerobes". This obviously refers only to the fact that this species cannot reduce sulphate and that in the case of absence of sulphite or thiosulphate such organisms do not produce H_2S; thus they cause no blackening of canned food whereas sulphate contained in food can be reduced to H_2S by *D. nigrificans*. The ability to reduce sulphite and thiosulphate differs also within the species of *Cl. thermosaccharolyticum* and *Cl. tartarivorum*. This is demonstrated by strains D 120-70 and T 9-3R which, other than in the type cultures of the species mentioned, do not reduce sulphite and thiosulphate in tryptone-glucose broth (whereas in liver broth as basal medium H_2S is liberated from these sulphur compounds).

In all cases, however, the hydrogen sulphide formation from sulphite is considerably more intensive than H_2S formation from tryptone (peptone); this raises the possibility that *Cl. thermohydrosulfuricum*, *Cl. thermosaccharolyticum* and *Cl. tartarivorum* are capable of a "sulphite respiration". More thorough investigations on the metabolism of *Cl. thermohydrosulfuricum* are not known. Investigations as to the carbohydrate metabolism have been carried out by various authors for *Cl. thermosaccharolyticum* only on the basis of nutrient media containing no sulphite. SJOLANDER[38] discovered that acetic acid, butyric acid and lactic acid, along with carbon dioxide and hydrogen, are the end products of glucose and xylose fermentation by *Cl. thermosaccharolyticum*. WILDER *et al.*[39] proved that ferredoxin is the electron carrier in the decomposition of pyruvate with the formation of acetyl-phosphate and molecular hydrogen. LEE and ORDAL[40] were able to show that resting cells of *Cl. thermosaccharolyticum* form considerable amounts of ethyl alcohol during glucose fermentation and that pyruvate causes an induction of enzymes of the hexose monophosphate pathway with repression of enzymes of the glycolytic pathway. It will be the object of further studies to find whether the production of hydrogen sulphide from sulphite (thiosulphate) is explained by "anaerobic sulphite respiration". A reduction of sulphite by the hydrogen produced to which reference is made in the ICUMSA report of 1970[7] may be excluded since only nascent hydrogen is able to reduce sulphite. Moreover, the blackening of iron sulphite medium by *Cl. thermohydrosulfuricum* strain H 101-69 which can ferment carbohydrates without a noticeable formation of gas does not differ in intensity from the blackening caused by the gas-producing (H_2 and CO_2) *Cl. thermohydrosulfuricum* strains.

The organisms studied reduce not only sulphite but also nitrite; higher levels of oxidation of sulphur and nitrogen (sulphate, nitrate) are not reduced.

Characterization of the species *Cl. thermohydrosulfuricum*, now carried out by means of a larger number of strains, indicates such a high degree of similarity with *Cl. thermosaccharolyticum* that the question arises whether it would be justifiable to consider *Cl. thermohydrosulfuricum* as a highly thermophile representative of the species *Cl. thermosaccharolyticum*, or to broaden the description of the species *Cl. thermosaccharolyticum* so that the extremely thermophilic strains may also be included. Electron microscopic examinations carried out by SLEYTR[41,42] by means of the freeze-etching technique do not provide support for this solution of the problem. The fine structure of the cell wall surface of *Cl. thermohydrosulfuricum* strains (hexagonally arranged particles) differs greatly from the cell wall structure of *Cl. thermosaccharolyticum* and *Cl. tartarivorum* strains (rectangular surface patterns). Differentiation in the size of the particles forming the outer layer of the cell wall emphasizes the differences in the cell wall surface structures of the species mentioned. The taxonomy of the hyperthermophilic anaerobes is reported in detail in another paper[42].

As a further result of this study it could be demonstrated that besides *Cl. thermohydrosulfuricum*, *Cl. thermosaccharolyticum* may also cause "anaerobe infections" of extraction juices. Strains of both species (*Cl. thermohydrosulfuricum* strain D 121-70 and *Cl. thermosaccharolyticum* strain D 120-70) had been isolated from extraction juices of a tower diffuser in which for the acidification of the supply water sulphuric acid is used exclusively. Infections by anaerobes in juices of the above-mentioned extraction plant cause pH decrease and gas production but do not lead to hydrogen sulphide formation, whereas in tower diffusers in which sulphurous acid (SO_2) is used for supply water acidification, infections by anaerobes are accompanied by hydrogen sulphide production. These observations emphasize the results according to which *Cl. thermohydrosulfuricum* and *Cl. thermosaccharolyticum* strains reduce sulphite but not sulphate. On the other hand the extraction temperatures lie obviously above the upper temperature limit permitting growth of sulphate reducing species (*Desulfotomaculum nigrificans*, *Desulfovibrio* sp.).

[38] *ibid.*, 1937, **34**, 419.
[39] *ibid.*, 1963, **86**, 861.
[40] *ibid.*, 1967, **94**, 530.
[41] SLEYTR *et al.*: *Mikroskopie*, 1968, **23**, 1.
[42] HOLLAUS and SLEYTR: *Arch. Mikrobiol*, 1972, **86**, 129.

SUMMARY

Fourteen hyperthermophilic strictly anaerobic bacteria isolated from extraction juices of Austrian beet sugar factories have been investigated as to morphological, physiological and biochemical features. 13 strains could be identified as *Clostridium thermohydrosulfuricum*, one strain as *Clostridium thermosaccharolyticum*. Both species have very similar biochemical reactions. They differ as to the limits for growth when incubated at high temperatures and as to the fine structure of their cell wall surface.

Owing to their ability to reduce sulphite to hydrogen sulphide, the occurrence of these organisms in extraction juices causes the formation of H_2S provided the supply water is acidified with sulphur dioxide. If supply water is acidified only with sulphuric acid anaerobe infections of extraction juices may also be observed but no H_2S is produced in this case. Neither *Cl. thermohydrosulfuricum* nor *Cl. thermosaccharolyticum* reduces sulphate and the high temperatures during extraction apparently prevent the growth of *Desulfotomaculum nigrificans* and of other sulphate-reducing anaerobes.

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Molasses purity and juice chloride content

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FACTORS affecting the exhaustibility of final molasses have been the subject of much research and formulae have been derived by investigators[1–17] who have studied the correlations between molasses exhaustibility and its constituents. Such formulae have concerned reducing sugars:ash ratio, ash:non-sugars, alkali:non-sugar, reducing sugars: non-sugar, calcium:non-sugar, (Ca + Mg):non-sugar, etc.

HONIG[18] has reported that in the milling of cane some of the inorganic non-sugars, viz. K, Na, Cl, are removed by the usual technique of extraction in the same proportion as the sugar. He also reported that removal of chloride from juice during the usual system of clarification is practically nil so that all of it passes to the final molasses. The chloride content of mixed cane juice is on average 150–300 mg/litre but in exceptional cases has been as high as 1500 mg/litre. It is known that the chloride content of cane is related to the chloride content of the soil and the soil moisture. Cane varieties with low fibre content are more sensitive to an excess of chloride than are those with high fibre content.

STARK[19], working with beet molasses, proposed a formula for prediction of the purity of final molasses from a knowledge of the chloride content of thin juice, thick juice or final molasses, viz. True Purity = 0·75 (% chloride) + 60·34, where % chloride is expressed on weight of non-sucrose solids. The predicted values obtained with this formula were in very good agreement with the observed values. STARK, MCCREADY and GOODBAN[20] have also reported that chloride determination can be used for predicting molasses purity and the amount of molasses produced; they have stated that 50% of the variation in purity of final molasses is due to variation in the chloride content. According to their work, 6·62 pounds of sugar is lost per pound of chloride, but RORABAUGH and NORMAN[21] reported the loss to be 5·0 pounds and SILIN[10] gave a figure of 5·5 pounds in the case of beet molasses.

We were unable to trace any record of work attempted previously to correlate the chloride content of cane juice with molasses purity, and the work of STARK pertained only to beet molasses; attempts were therefore made at this Institute to study the chloride content of cane juice and molasses and determine its relationship to the gravity purity of the final molasses produced from it.

Chloride determination

As a first step, attempts were made to find an accurate and quick method for determination of chloride in sugar house products which are mostly coloured. Various methods were examined[3–6, 22, 23] and

[1] GEERLIGS: "Cane sugar and its manufacture", 2nd End. (Norman Rodger, London). 1924, p. 296.
[2] *idem*: *Archief*, 1924, **32**, (12), 413.
[3] ANON: *Proc. 23rd Ann. Conv. Sugar Tech. Assoc. India*, 1955, 263, 334.
[4] SIJLMANS: *I.S.J.*, 1934, **36**, 437.
[5] BEHNE: *ibid.*, 1936, **38**, 174–175.
[6] BIRKETT: *ibid.*, 12–15, 62–64.
[7] MICHAEL and DE GYULAY: *ibid.*, 460–463.
[8] THIEME: *Archief*, 1930, **38**, (31), 713–727; *I.S.J.*, 1931, **33**, 131.
[9] DOUWES DEKKER: *I.S.J.*, 1950, **52**, 122–124.
[10] SILIN: *ibid.*, 1964, **66**, 255–258.
[11] GARCÍA and CLARK: *Sugar J.*, 1959, **22**, (12), 15–18.
[12] ANON: *Rpt. Taiwan Sugar Expt. Sta.*, 1952, 212.
[13] GUPTA *et al.*: *Proc. 33rd Ann. Conv. Sugar Tech. Assoc. India*, 1965, 149–161.
[14] SINGH and VARMA: *Proc. 36th Ann. Conv. Sugar Tech. Assoc. India*, 1968, Article XXXIX.
[15] ANON: *Proc. 4th Ann. Conv. Sugar Tech. Assoc. India*, 1935/36, 43.
[16] RAMAIAH and VISHNU: *Proc. 25th Ann. Conv. Sugar Tech. Assoc. India*, 1957, 275–277.
[17] GUPTA *et al.*: *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, 185–188.
[18] "Principles of Sugar Technology", Vol. I. (Elsevier, Amsterdam). 1953, pp. 294, 329.
[19] *J. Amer. Soc. Sugar Beet Tech.*, 1968, **14**, 704–708.
[20] *ibid.*, 1968, **15**, 73–84.
[21] *ibid.*, 1956, **9**, 238–252.

of these, that of DAVIES[23], which is applicable to coloured solutions, was found to be the most suitable as it gives an accurate and sharp end-point. The method followed by us for chloride determinations was exactly similar to that of DAVIES except for the minor difference that we used cold double-distilled water for dilution and heated the solution to boiling, as against the use of hot distilled water as specified by DAVIES for dilution before adding N/10 silver nitrate solution. This resulted in better oxidation of colouring matter and gave a lighter coloured solution for titration.

Experimental

The laboratory determination of chloride content gave results in conformity with the data reported by various workers for the chloride content of cane juices and molasses. Subsequently, extensive analytical work was undertaken for periods of about ten days each at two sugar factories in Central Uttar Pradesh which used the conventional double-sulphitation process of clarification. Thin juices were collected and analysed for Brix, pol, apparent purity, sucrose, reducing sugars, CaO content, gravity purity, etc. The corresponding final molasses samples were collected after a period of 36 or 48 hours, respectively, in the two factories, these intervals being the time required for juice concentration and sucrose crystallization.

Two four-hourly composite juice samples were taken simultaneously from the clear juice overflow from the Dorr clarifier using two buckets in one of which the juice was preserved by addition of mercuric chloride and used for determination of Brix, pol, sucrose, reducing sugar and purity, while the juice in the other bucket was used only for determination of its calcium and chloride content. The methods used for determining Brix, pol, apparent purity, sucrose, reducing sugars, ash and gravity purity were those described in the "System of Technical Control for Cane Sugar Factories in India".

The molasses samples were collected regularly at half-hour intervals over a four-hour period and the combined samples kept in bottles which were placed in a hot water bath at 70°C for about 20 minutes to dissolve sugar crystals present before analysis.

Empirical derivation of equations for predicting molasses purity

The data collected were critically examined and the method of least squares[24] used to derive a linear equation relating the chloride content of the thin juice with reasonable gravity purity (*GP*) defined as that obtainable in a sulphitation sugar factory having semi-automatic equipment and following the usual techniques of pan boiling, crystallizer treatment and curing. The chloride content of the juice, *Cl*, was expressed as g per 1000 g non-sucrose, non-sucrose being (Brix – sucrose). In this way was derived an equation

$$GP = 29{\cdot}31 + 1{\cdot}355Cl \quad \ldots\ldots\ldots\ldots\ldots\ldots (A)$$

The observation by HONIG that removal of chloride in the usual system of clarification is practically nil was confirmed by our results. Analysis showed that the average chloride content (g/1000 g non-sucrose) of all juice samples was 5·753 while that for all molasses samples was 5·832, giving a difference of 0·079 or about 1·3% which is within the limits of experimental error, and much smaller than the 5–7% variation between beet juice and molasses found by STARK. The slight increase in the chloride content between juice and molasses is due to the removal of some of the non-sucrose other than chloride during processing. As the difference was so small, however, it was not felt necessary to derive the equation on the basis of the chloride content of molasses.

The equation (A) obtained could be used to predict reasonable gravity purity, found for the data examined to be within a maximum difference of ±0·94 units from the actual purity and having an average difference of —0·005 units. In order to improve this, it was considered desirable to take into account the reducing sugars:ash ratio (*R*) which is considered to be a factor prominently affecting the exhaustibility of molasses. An equation was therefore derived using the procedure described by DAVIES[25] for multiple regression and correlation, viz.

$$GP = 31{\cdot}574 + 1{\cdot}277Cl - 0{\cdot}931R \quad \ldots\ldots\ldots (B)$$

Using this equation the reasonable gravity purity of molasses could be predicted within ± 0·81 units of the actual purity, the average difference being + 0·06 units. The limits of error in the two equations are indicated in Table I which shows the proportion of predictions falling within set differences from the actual purities.

Table I

Limit of purity difference	*Proportion of predicted values within the limit*	
	Equation A	*Equation B*
± 0·25	34·3%	35·5%
± 0·50	77·1%	87·1%
± 0·75	91·4%	96·8%
± 0·81	91·4%	100·0%
± 0·94	100·0%	100·0%

It may be seen that the gravity purities predicted using equation B, based on juice chloride content and reducing sugars:ash ratio, are in very good agreement with the observed values.

Table II shows the corresponding percentages of results differing within set proportions of the actual purities.

Table II

Purity difference as a proportion of observed purity	*Proportion of predicted values within the limit*	
	Equation A	*Equation B*
± 0·5%	28·6%	25·8%
± 1·0%	54·3%	51·6%
± 1·5%	82·9%	87·1%
± 2·0%	91·5%	96·8%
± 2·1%	91·5%	100·0%
± 2·6%	100·0%	100·0%

[22] *Ind. Eng. Chem., Anal. Ed.*, 1932, **4**, 379.
[23] *Analyst*, 1932, **57**, 79.
[24] DAVIES: "Statistical methods in research and production", 3rd Edn. (Oliver & Boyd, Edinburgh). 1957, pp. 159, 194.
[25] *ibid.*, 215–162, 256–258.

It is evident from the tables that the molasses purities predicted using equation B are closer to the actual values than those given by equation A, which is in agreement with earlier views that the reducing sugars:ash ratio is correlated to the exhaustibility of molasses. However, the molasses purities seem to be more dependent on chloride content than the reducing sugars:ash ratio since the predicted value from equation A was within 0·5 units of the observed value in 77·1% of the cases. This is borne out in Figs. 1 and 2; the former shows the relationship between the observed purity and the juice chloride content where all the observed values are close to the line representing equation A.

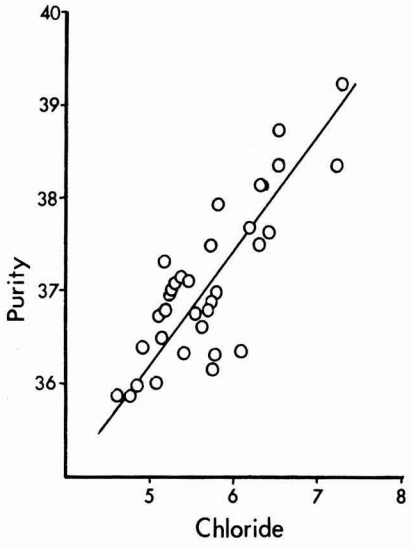

Fig. 1

In Fig. 2, however, are drawn the observed values of molasses purity against the ratio R; the points are quite widely spaced from the line which represents the regression equation linking the two. The chloride content thus bears a more significant relationship than the ratio R to molasses purity.

Knowledge of the chloride content may also be of significance when comparing the working efficiency of one factory with that of another or of the same factory in different periods. For example, a factory producing molasses of 36 purity but with a high chloride content may in fact be achieving a better boiling house performance than another factory producing molasses of 34 purity but with a low chloride content.

It has not been possible to test the equations for general applicability within India by making detailed analyses in any other commercial sugar factories. However, their validity could be judged by examination of molasses from factories in different states, and samples were obtained from Andhra Pradesh, Bihar,

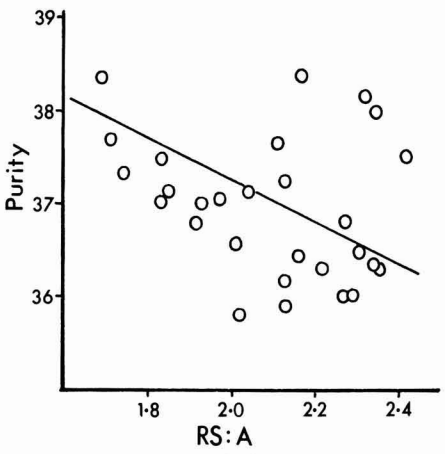

Fig. 2

Maharashtra, Orissa and U.P. These were analysed for chloride, reducing sugars, sucrose and ash and the values substituted in the equations to give predicted purities which were then compared with actual values.

The results showed very good agreement in 11 cases out of 16 with equation A and 13 out of 16 with equation B. Moreover, those samples which gave predicted values more remote from the actual values were mostly available from factories where working was known to be abnormal.

Conclusions

The two equations formulated can predict reasonable gravity purity of final molasses quite accurately from juice analysis. The first, based on the juice chloride, will give results within $\pm$ 0·50 units in 77·1% of cases and can well be recommended for predicting gravity purity of final molasses for daily control two days in advance of its actual production. Thus, any expected deviation for normal final molasses purity can be taken care of well in advance.

The second equation based on chloride content and the reducing sugars:ash ratio is more accurate and can predict results within $\pm$ 0·50 units in about 87·1% of cases. However, it is more time-consuming and complicated since it requires analysis of two more characteristics of the juice and may be recommended for ascertaining the reasonable gravity purity of final molasses for any week or period.

Both equations can be used generally in India for predicting final molasses purity as they have provided values showing very good agreement with actual molasses purities from normal working factories.

Acknowledgements

Our thanks are due to the managements of Oudh Sugar Mills Ltd., Hargaon, District Sitapur, and Hindusthan Sugar Mills Ltd., Golagokarannath, District Kheri, for providing facilities for conducting the investigation.

Sugar cane agriculture

Irrigation expands in Queensland. ANON. *Cane Growers' Quarterly Bull.*, 1972, **35**, 120.—A table is given showing the cane area under irrigation each year from 1961 to 1971. It demonstrates the marked expansion in use of irrigation—from 15·7% of the total cane area in 1961–62 to 24·3% in 1970–71.

* * *

How to calculate the correct amount of chemical. E. G. SPRY. *Cane Growers' Quarterly Bull.*, 1972, **35**, 121–124.—Advice is given on calculation and measurement of quantities of chemicals used in cane agriculture.

* * *

Labour saving planter. ANON. *Cane Growers' Quarterly Bull.*, 1962, **35**, 124.—The "Etwell" billet cane planter is described and illustrated. It is a large machine designed for group-planting large areas in a short time. It plants two rows at a time and is operated by three men. Two wire mesh bins fitted on either side each hold one ton of planting setts. Drill depth and width are variable and the fertilizer distributors may be regulated to deliver 1–4 cwt per acre.

* * *

Why do tractors overturn? I. G. R. CULLEN. *Cane Growers' Quarterly Bull.*, 1972, **35**, 129.—An average of 100 fatal tractor accidents and 8000 injuries take place in Australia every year. Accidents involving overturning sideways represent about two-thirds of all overturning accidents. Why they occur is discussed with the aid of diagrams demonstrating the effects of turning and of the part played by slopes. A brief mention is made of crawler tractors, and advice is given on how to avoid overturning.

* * *

Repeat treatments with "Dieldrin" for soldier fly control. B. E. HITCHCOCK. *Cane Growers' Quarterly Bull.*, 1972, **35**, 134.—Results are given of the analysis of cane soils to ascertain the degree of persistence of "Dieldrin" in the soil. Recommendations are made for re-treatment. Taking all factors into consideration, it is recommended that fields be re-treated at the rate of 4 lb per acre of "Dieldrin", provided 6 lb was applied not more than 4 years previously and incorporated in the soil soon after application.

* * *

Q 86—the major variety in the Isis area. C. D. JONES. *Cane Growers' Quarterly Bull.*, 1972, **35**, 135–136. This variety originated as a cross between N:Co 310 and Q 58, made at the Northern Sugar Experiment Station, Meringa. It was approved for planting in the Isis area in 1967 and the Bundaberg and Gin Gin areas in 1969. Low c.c.s. in relation to N:Co 310 restricted its popularity in some areas but it has risen to become the major variety in the Isis area.

* * *

Long-term phosphate trial, Mackay. L. S. CHAPMAN. *Cane Growers' Quarterly Bull.*, 1972, **35**, 139–141. The trial in question was carried out at the Mackay Experiment Station to determine the rate at which soil loses P, the rate at which P accumulates in the soil through fertilizer application and the extent to which rock phosphate could replace superphosphate. The results are reported.

* * *

Soldier flies appear at Giru. B. E. HITCHCOCK. *Cane Growers' Quarterly Bull.*, 1972, **35**, 142.—This is the first record of the pest in sugar cane in the Burdekin district. Larvae were found on two farms. Close examination of the larvae showed them to be different from those of the black and yellow species of soldier fly. It was thought that it could probably be controlled by the measures usually adopted for the common black species, i.e. 2 gal/acre of 30% "Dieldrin" broadcast, disced and ploughed.

* * *

Lime—is it necessary? A. P. HURNEY. *Cane Growers' Quarterly Bull.*, 1972, **35**, 143–144.—Although almost all the soils on which cane is grown in Queensland are acid, it is open to question as to whether applications of lime will improve growth. The subject is discussed and possible beneficial effects of lime (provided sufficient is applied) on soil structure considered as well as the economics of liming.

* * *

Notes on the harvesting, loading and transporting of sugar cane. C. RUIZ C. *Bol. Azuc. Mex.*, 1971, (264), 5–9.—Harvesting, loading and transportation of cane, as takes place on Mexican cane fields, is discussed from various angles.

* * *

Some economic aspects of mechanical cane harvesting in Queensland. E. H. CHURCHWARD and R. M. BELCHER. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 31–38.—Two factors that contributed much to the growth of the Queensland sugar industry in the 1960's were the development of mechanical harvesting and the completion of conversion to bulk handling of raw sugar. Matters discussed include the evolution of mechanical harvesting in Australia; deterioration of cane; c.c.s. and sugar quality; extraneous matter in cane; monetary savings from mechanization; and agricultural advantages of

group harvesting. It is considered that more attention should be given to infield transport, especially where wet weather flotation is concerned, and that this has not kept up with harvester advances.

* * *

Chopper harvester trials—central district. C. S. HENDERSON and L. K. KIRBY. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 39–45.—This paper summarizes results of field trials carried out to determine relationship between cane billet characteristics (long and short billets) and the rate of cane deterioration. The trials showed that there were several aspects of cane harvesting and storage where more stringent controls were needed. The recent trend towards the partial acceptance of shorter cane billets requires correction. Monetary losses to the grower can be considerable, and to these must be added the processing difficulties encountered and the losses incurred by the miller if short billet harvesting procedures are accepted.

* * *

Research into Australian tractor accidents. G. L. MCDONALD. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 47–56.—Requirements in tractor design for improved safety, which have become obvious from a survey of accidents, are listed.

* * *

Production functions for sugar cane land use investigations. B. J. WHITE. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 57–62.—Studies indicated a quantitative relationship between rainfall and cane yields, so that average yields could be estimated with satisfactory accuracy. Land slope was associated with reduction in cane yield. Analysis of yields by soil types for irrigated and non-irrigated land showed no significant differences between soil types. Variations in yield between farms with similar soils are attributed to management differences.

* * *

A managerial service for cane growers. O. W. STURGESS and R. J. HAMPSON. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 63–72.—Tests, over a 4-year period, on methods of electronic processing of cane growers' records and the creation of a cooperative basis for a farm business advisory service are discussed.

* * *

Split applications of nitrogen fertilizers on ratoon crops. G. C. BIESKE. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 73–76.—Results of trials showed no differences in cane yield per acre between application of one dose of N and two applications of N of the same total quantity, while three equal applications, with a final dressing in March, caused a reduction in cane yield compared with a single application. No differences in c.c.s. occurred between single and split applications, and no correlation was found between N quantity and time of application. Increase in quantity of N early in the season significantly increased cane yield but reduced c.c.s., whereas the effect on sugar content was reversed as the season progressed.

* * *

Computer modelling for improvement in sugar cane agriculture. R. H. FARQUHAR. *Proc. 39th Conf. Queensland Soc. Sugar Tech.*, 1972, 77–80.—The possibility of applying simulation modelling with the aid of computer programming to cane growing as is being applied to sugar beet[1] is discussed. Construction of sub-models relating productivity to limiting factors within various sections of the industry could lead to an optimum system of cane agriculture. Sufficient knowledge about limiting factors for cane growth in Australia is already available to make a start on crop simulation modelling.

* * *

Drought in Queensland—its occurrence and prediction. B. GORDON. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 121–126.—The susceptibility of Queensland to drought and the frequency at which droughts occur are discussed. The absence of a satisfactory method of predicting drought and the effect of this on forward planning are also considered.

* * *

Land classification—a basis for planning future development of the Isis district. H. S. PINK. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 127–135. Classification of land in this Queensland district was undertaken to determine those areas of unsuitable land being used for cane growing and to locate and determine the areas of alternative land for cane as well as obtain an overall picture for planning future use of the land in the district. How a land classification system is produced is explained.

* * *

An economic yield response from supplementary irrigation at Mackay. L. S. CHAPMAN and W. J. NICHOLSON. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 137–142.—Over a fifth of the cane farmers in Mackay now have irrigation plants serving about 27–28% of their cane area. Irrigation equipment is used as a farming tool, but the economics of supplementary irrigation have not been really assessed. The aim of the experiment reported here was to estimate and evaluate economically the yield response to supplementary irrigation. Two major points emerged from the trials. First, it has been shown that there was a marked response in yield to both one and two irrigations; a basic economic analysis shows that the application of these irrigations was profitable. Second, water use efficiency during November–December was much higher than that predicted.

* * *

An experiment in irrigation scheduling—further comments. G. KINGSTON. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 143–151.—This paper summarizes results of irrigation experiments in the

[1] LOOMIS *et al.*: *Rev. Plant Physiol.*, 1971, **22**, 431.

Bundaberg cane area[1], which has the lowest average rainfall (44·3 inches) of any non-irrigated cane-growing area of Queensland and a high incidence of drought. In 1968 some 35,000 acres of sugar cane were being irrigated from private sources of underground and surface water. Seven main points which emerged from the experiments involving one plant and three ratoon crops are enumerated. In retrospect, supplemental irrigation could not be justified in the plant and third ratoon crops because of above-average annual rainfall during the growing season. A drought year during the first ratoon crop resulted in a spectacular cane and sugar yield response to irrigation. A year of average rainfall during the second ratoon crop also produced a cane and sugar yield response to irrigation. When cane was subjected to severe soil moisture stress, up to eight days could elapse after the relief of the stress before normal growth was resumed.

* * *

A study of the sugar cane leafhopper *Perkinsiella saccharicida* Kirk in the Bundaberg district of south eastern Queensland. R. M. BULL. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 173–183. The sugar cane leafhopper occurs in all Australian sugar cane areas. It natural range covers many Asian countries. The ecology of the insect was studied in cane fields of the Bundaberg district over a 10-month period. Special attention was directed to population dynamics, with predators and parasites being examined as population-limiting factors. Agronomic practices, including harvesting, the use of soil insecticides and irrigation, were examined with relation to leafhopper population characteristics. The effects of leafhopper population on cane were investigated and its status as a pest considered. Feasibility of population control is discussed and possible methods suggested.

* * *

Fiji disease resistance trials at Condong Mill, N.S.W. A. G. HAYES. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 185–190.—Earlier trials had shown that effective transmission could be obtained from 24-, 48-, 96- and 192-hour exposure periods. The results were at least equal with an exposure of 24 hours as with the longer periods. The trial described in this paper was designed to confirm the relative efficiencies of 24-hour and 48-hour treatments and to determine whether transmission could be obtained in 12 hours. Three sugar cane varieties were used. Approximately 100 one-eye setts of each variety were cut and pre-germinated in moist vermiculite. After 21 days, 60 plants of each variety were selected for uniformity within and between varieties and transplanted into 6-cm peat pots. Fiji disease was transmitted in a 12-hour feeding period by the leafhopper vector *Perkinsiella saccharicida* in an insectiary trial. This result and other relevant observations are discussed.

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Fiji disease at Bundaberg. C. L. TOOHEY and P. J. NIELSEN. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 191–196.—See *I.S.J.*, 1973, **75**, 141.

Fiji disease—behind the scenes at Bundaberg. C. G. HUGHES. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 197–200.—Cane Pest and Disease Control Board employees traversing cane fields and dealing with Fiji disease-infected stools is evidence of the activity regarding this potentially dangerous disease. These are the visible signs but much goes on behind the scenes as well, as is described here. The proclamations governing the disease and applicable to all cane growers are described and the question of new or more resistant cane varieties discussed.

* * *

The 1971 yellow spot epidemic in north Queensland. B. T. EGAN. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 201–207.—This sugar cane disease was first recorded in Queensland in 1950 towards the end of the wet season. The history of yellow spot in Queensland is examined briefly, and changes in varietal susceptibility, probably caused by changes in races of the pathogen, are noted. The influence of weather on the 1971 epidemic and its extent are discussed and information given on the severity of infection. The present varietal position is discussed with respect to the changed yellow spot position. The influence on seedlings under trial is noted. The effects of yellow spot on sugar content and on the 1971 mill c.c.s. figures are discussed.

* * *

The incidence and bionomics of the brown cicada *Melampsalta puer* (Walk.) in north Queensland cane fields. K. J. CHANDLER. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 249–255.—This sugar cane pest was first recorded in Queensland in 1962. A survey of infested areas in 1971 revealed a considerable increase in damage since then. Results show damage to be concentrated in areas that have been treated with "Heptachlor" for the control of funnel ants. No insecticidal control of nymphs is yet available. Some natural control is exercised by a fungus, *Cordyceps heteropoda*, and two undescribed microhymenoptera. Life cycle studies in the field and laboratory are reported, together with mechanical methods of nymph control which minimize chances of re-infestation.

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"Dieldrin" residues in the soil at harvest of second and third ratoon crops. B. D. A. STICKLEY and B. E. HITCHCOCK. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 257–259.—"Dieldrin", a very persistent soil insecticide, has been recommended for soldier fly control since 1966 when it replaced BHC. A survey of "Dieldrin" residues from 40 fields, representing 4 soil types, is described. This survey showed that since virtually all fields retain at least 1 lb of "Dieldrin" per acre out of the normal application of 6 lb/acre after three ratoon crops, the maximum amount of "Dieldrin" necessary for re-treatment would be reduced to 5 lb/acre. However, in most fields significant re-infestation will not have occurred, and the application rate may be safely

[1] LEVERINGTON *et al.*: *I.S.J.*, 1971, **73**, 112.

reduced still further for the treatment of the next crop cycle. Taking all factors into consideration, it is recommended that, for the area in question, fields be re-treated with "Dieldrin" at the rate of 4 lb/acre provided the initial application of "Dieldrin" was made not more than about four years previously and it was incorporated into the soil soon after application.

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Gibberellic acid—local evaluation against "Phorone". A. C. ARVIER. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 261–266.—In experiments with four cane varieties, "Phorone" (a condensation derivative of acetone) on its own or together with gibberellic acid had no positive effect on stalk length, while gibberellic acid alone caused stalk elongation. The extra length appeared to contain a significant amount of extra sugar, although the stalk was thinner than normal. Similar effects were obtained from canopy sprays and spindle applications of gibberellic acid.

* * *

Tramway curve design and layout. A. K. ROSELER and R. N. MAZLIN. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 327–331.—Details are given of modifications to the cane rail system at Mossman and calculation of the various requisite parameters is explained.

* * *

Computer-assisted scheduling for cane railway systems. E. E. SHEPHERD and R. A. JAMES. *Proc. 39th Conf. Queensland Soc. Sugar Cane Tech.*, 1972, 333–341.—A system of programmes has been developed for the Sugar Research Institute computer to assist in cane locomotive scheduling. The data required for operation of the system are listed, the programmes briefly described and application of the system discussed. The system is adaptable to scheduling of road transport operations where the cane is brought straight to the mill or delivered to a railhead.

* * *

Behaviour of cane varieties during the processing period. G. E. SERRA, M. A. A. CESAR, A. J. DE OLIVEIRA and D. GODOY. *Brasil Açuc.*, 1972, **79,** 315–328.—Results are given of analyses of a number of cane varieties, including pol and fibre % cane and Brix, pol, reducing sugars, phosphate and ash % juice, determined at Piracicaba Experiment Station as a guide to their processing qualities.

* * *

Chopper-type cut-load harvester. L. L. LAUDEN. *Sugar Bull.*, 1972, **50,** (14), 4, 10.—Earlier experience with the chopper type of cane harvester in Louisiana is mentioned. A US company is now developing a cane combine harvester for possible use in Louisiana. It will be a chopper-type machine but will have a topper at the front similar to the topper on present-day Louisiana harvesters. Without this feature it will be impossible to discard and remove frozen tops from cane following severe frosts.

Air pressure incorporation of fungicides into short stalk sections of sugar cane for the control of red rot. L. ANZALONE. *Sugar Bull.*, 1972, **50,** (14), 7–8.—In Louisiana sugar cane is planted with seed pieces consisting of whole or half stalks ranging in length from 90 cm to 180 cm. The use of shorter seed pieces (stalk sections 20 to 40 cm long having 2 or 3 buds) would allow more advantageous use of mechanical planters and result in reduced cost of seed cane as well as labour. However, short seed pieces deteriorate more rapidly under Louisiana conditions, one of the principal causes being the red rot fungus, *Colletotrichum falcatum*. This paper describes a method of reducing deterioration of short seed pieces by treating 3-bud sections of sugar cane stalks with fungicides suspended in water under an air pressure of 10 psi for 15 minutes.

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Cleaning cane without burning. R. T. SYMES. *Sugar J.*, 1972, **34,** (12), 20–21.—Cane cleaning on harvesters, loaders and transfer units as an alternative to cane burning is discussed and the handling of trash briefly mentioned.

* * *

An economical loader for the small grower. ANON. *S. African Sugar J.*, 1972, **56,** 195.—The new "Sugarmech" fixed-boom, rear-mounted grab loader is described and illustrated. It is intended for the smaller grower and has been designed specifically for making stacks in the field and for loading stationary vehicles or rail trucks. Mounted over the rear wheels of a tractor it has good traction and can be operated successfully under a wide range of field conditions. The swivelling grab has a capacity of about 400 kg. The "Sugarmech" is not available commercially but can be built by most general engineering firms or by a grower himself.

* * *

Soils and agronomy (silicates). ANON. *45th Ann. Rpt. Queensland Cane Growers' Assoc.*, 1972, 28.—The Division of Soils and Agronomy of the Bureau of Sugar Experiment Stations continued studies on the relationship between crop growth and water, this constituting a major part of the work. The work with silicate applications to soils was continued and, in pot tests, pure calcium silicate, cement, and blast furnace slags from Australia and Japan all produced responses in growth. In one of these field trials a response in growth of 11 tons of cane per acre was achieved following a silicate application. Samples of water and silt from streams in the sugar areas were tested for insecticide residues. The levels detected were well below the maximum levels allowable by those authorities in charge of pollution control in the USA.

* * *

Cane breeding. ANON. *45th Ann. Rpt. Queensland Cane Growers' Assoc.*, 1972, 28.—A large research programme was continued, including inheritance and selection studies. Experiments on cross pollination resulted in the adoption of improved methods.

Breeding for disease resistance is becoming more important, especially Fiji disease resistance in South Queensland and yellow spot resistance in North Queensland. Flowering in 1971 was extremely early and profuse, and it was possible to make many experimental crosses with varieties which do not normally flower. A total of 541 crosses were made and, in general, very good germinations were obtained.

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Leaf scald disease. ANON. *45th Ann. Rpt. Queensland Cane Growers' Assoc.*, 1972, 29.—It has been shown conclusively that blady grass, well known to all Queensland cane growers, can and does act as a natural carrier of leaf scald disease, at least in the Moreton area. It appears almost certain that two other grasses, sour grass (*Paspalum conjugatum*) and *Brachiaria piligera*, can also act as hosts in the field. Transmission of the disease mechanically has been obtained under experimental conditions. This may help to explain some puzzling features of the spread of the disease in commercial crops.

* * *

Soldier fly control. ANON. *45th Rpt. Queensland Cane Growers' Assoc.*, 1972, 29.—"Dieldrin" continued to give good control of soldier fly and most growers have switched to this chemical in preference to BHC which has given variable results. Because of the popular outcry against persistent chemicals, efforts have continued to find an alternative to "Dieldrin" but no satisfactory replacement is in sight. In the Burdekin district, which in the past has been free of soldier fly damage, a species of the pest, new to cane, caused damage on three farms.

* * *

Chopped cane deterioration. ANON. *45th Ann. Rpt. Queensland Cane Growers' Assoc.*, 1972, 29.—An investigation was carried out. This was a comparison of the deterioration rates in long and short cane billets from chopper harvesters. There was an obvious and severe increase in the losses from the short billets.

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Cane extraction winch. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 10.—The hydraulic winch designed in 1969/70 to haul cane bundles uphill to contour roads has proved to be a very manoeuvrable and successful piece of equipment. It can draw two bundles each of 120 kg or a single bundle of 240 kg up any slope to form a windrow at the roadside. A winching rate of about 11 metric tons/hr can be maintained with an average haul of about 64 metres. The system works best where separate cutting and stacking gangs are employed. The cutters are not interfered with and the stackers are able to maintain a high output.

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Nematicide fumigant applicator. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 10.—A soil fumigant applicator has been constructed locally for field trials which is designed to determine optimum placement and rates of application of fumigants in relation to cane yield. The machine, which incorporates many adjustments to cater for various methods of application, has so far given satisfactory results.

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Two-wheel horticultural tractors. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 11.—A number of two-wheeled small horticultural tractors were tested to determine whether these hand-operated machines could be used in place of mule-drawn equipment for inter-row cultivation on hillsides which are too steep to be negotiated by standard wheeled tractors. Five makes of machine were tested. Most proved easy to operate and gave satisfactory results on flat terrain, but they all proved to be quite unusable on slopes steeper than 8°.

* * *

Residual effects of subsoiling. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 14. Experiments on the subsoiling of ratoon crops showed that no economic advantage was likely to result from the treatment. Growth was, in fact, retarded in the first year, probably because of root damage, but subsequently improved slightly compared with the controls.

* * *

Stubble shaving. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 15.—Four methods of removing a 5-cm stubble left after harvesting were compared with leaving the stubble untouched. It was apparent that shaving the stubble did not improve yields, and that the mechanical methods used could, in some instances, depress the yields of the succeeding ratoon crop.

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Leaving bullshoots at harvest. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 16.—In the superhumid area of Mauritius it has been found essential to leave young bullshoots when harvesting in order to obtain satisfactory ratooning. The practice was tried at an experiment station but did not appear to offer any advantage under South African conditions.

* * *

Control of *Eupatorium odoratum*. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 18.—This weed has increased considerably in the coastal or sugar belt of Natal over the past few years. Although it is not a serious threat in sugar cane lands at present, it is a potential threat to the indigenous vegetation of surrounding areas. Two herbicides proved to be effective against the weed, these being (i) 2,4-D (1·67 litres) and surfactant (0·5 litres) diluted to 100 litres with water, and (ii) "Tordon 22 K" (0·21 litres) diluted to 100 litres with water. The 2,4-D treatment was the cheaper.

* * *

2,4-D damage and a surfactant. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 19.—The phytotoxic effects on cane of 2,4-D in the presence or

absence of a surfactant were compared. Application when about 7 leaves had emerged on the cane shoots (at a canopy of 50–60 cm above the ground) was made by spraying over the cane row. Addition of a surfactant reduced cane yields in all instances, the damage being generally much greater when a high rate of 2,4-D was used compared with a normally recommended rate, but even at the lower rate the plant crop was severely affected when a surfactant was used.

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"Gesapax H", "Ametryne", "Diuron" and 2,4-D. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 19.—For post-emergence control of grasses and *Cyperus* spp., "Gesapax H" (a liquid "Ametryne" formulation plus 2,4 D) was compared with "Diuron" + 2,4-D and found to have a quicker knock down effect on the grasses which, however, lasted for only slightly more than half the time of effect of "Diuron" + 2,4-D; the "Diuron" mixture was also more effect in controlling *Panicum maximum*. Only high rates of either mixture controlled grasses at the late post-emergence stage of 7–8 leaves. "Gesapax H" has the advantage of being a liquid formulation.

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Residual effects of 2,4-D damage. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 19. Significant reductions in yield were caused by application of 2,4-D by spraying over the cane row at later stages of growth. Comparison of the effects of the herbicide on the 2nd ratoon crop with 3rd ratoon crop not sprayed with 2,4-D showed that even with the severest effects (caused by a high rate of herbicide at the 7–8 leaf stage) in 2nd ratoons, there was sufficient recovery by the 3rd ratoon crop for there to be negligible yield differences.

* * *

Phytotoxicity of 2,4-D + "Diuron". ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 20. Spraying 2,4-D + "Diuron" plus a surfactant over the cane row caused no decrease in yield even though early indications of phytotoxicity were apparent. In fact, the effects of the herbicides on weeds may have caused the increase in yields compared with those of cane in hand-weeded plots.

* * *

Sulphur determinations. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 23.—Of six methods assessed for accuracy, precision, rapidity and simplicity in determining sulphur in cane leaf tissue, the one selected for routine analysis was that involving digestion with a mixture of nitric acid and perchloric acid followed by turbidimetric determination. Two laboratory assistants can complete 50 analyses in a day using this method. For soils, a standard method based on leaching with normal ammonium acetate solution followed by determination of sulphate turbidimetrically has been selected. The need for suitable methods to determine sulphur has arisen because of concern over the sulphur status of cane and soils in areas where urea and double superphosphate have been used continually for some time.

* * *

Cane deterioration. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 24.—In experiments conducted in August-September, lowest sugar losses occurred in unburnt cane cut into 11-stalk samples after harvest and analysed 0, 1, 2, 3, 4, 5, 6, 7, 9, 11, 15 and 21 days after harvest. Deterioration was gradual, in contrast to the rapid process in burnt cane left standing and harvested as 11-stalk samples on succeeding days. Rapid deterioration in burnt, chopped cane occurred only after the 7th day. In 9-stalk samples analysed in a November-December trial the pattern of deterioration was approximately the same. In March-April experiments there was little difference in losses between burnt and unburnt chopped cane.

* * *

Height of topping. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 25.—In experiments to determine the height at which a grower should top his cane in order to obtain maximum recoverable sugar, 15- and 21-months-old cane was analysed and stalks having green leaves outside the range 7–12 discarded. Where the stalks carried 7–10 green leaves, topping to the base of the 7th internode gave maximum recoverable sugar; only where the stalks had more than 10 leaves did topping to the base of the 8th internode give maximum recoverable sugar.

* * *

***Numicia* life cycle and rate of development.** ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 29.—In studies conducted in the insectary, the length of time taken in the development stages from egg to adult increased as the host plants deteriorated. Leaf symptoms did not depend entirely on the number of insects present nor on the length of time during which feeding occurred. Aversion to strong light found in nymphal stages diminished with maturity, although even adults eventually moved away from bright light.

* * *

Trash caterpillar. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 29.—Each of four chemicals tested reduced populations of trash caterpillars by about one-third, but even after 10 days large numbers of healthy caterpillars were still present, almost certainly because of the inability of the chemicals to penetrate the thick trash cover under which the caterpillars sheltered. The harmful effect of this pest on young cane is shown in a photograph.

* * *

Nematicides at Tongaat. ANON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1970–71, 31.—In terms of height of 4-month cane, "Temik" ("Aldicarb") proved the most successful chemical in nematode control tests. D-D applied in the planting furrow also gave promising results.

Sugar beet agriculture

Response of sugar beets and weeds to "Cycloate", "Propachlor" and "Pyrazone". J. H. DAWSON. *Weed Sci.*, 1971, **19,** 162–165; through *Weed Abs.*, 1972, **21,** 105.—"Cycloate" incorporated 3 inches deep in moist or dry soil gave complete control of the grass *Echinochloa crus-galli* and 85–90% control of *Chenopodium album*, *Amaranthus* spp. and *Solanum sarachoides* with only temporary injury to the crop. No application of "Pyrazone" consistently controlled weeds without reducing beet stands, but in general the treatments that controlled weeds effectively caused much less injury in 1967 than in 1966 when warmer temperatures followed the application.

* * *

The problem of volunteer beet in fields of beet crops. M. DEPREZ. *Proc. 2nd Int. Meeting on Selective Weed Control in Beet Crops* (Rotterdam), 1970, 255–257; through *Weed Abs.*, 1972, **21,** 106.—Attention is drawn to the problem of volunteer beet seedlings in beet crops, and information is provided concerning their origin, spread, identification and control.

* * *

Glasshouse observations concerning the action of certain herbicides on the germination of non-pelleted and pelleted seeds of beet and on seedling development. A. E. DEPEYRE and P. A. SEMENT. *Proc. 2nd Int. Meeting on Selective Weed Control in Beet Crops* (Rotterdam), 1970, 177–181; through *Weed Abs.*, 1972, **21,** 106.—The growth of sugar beet seedlings in soil treated with PCA (62·5% "Pyrazone") and IPC (50% "Propham") was studied under glasshouse conditions. Increased dosage rates caused a corresponding rise in phytotoxicity but no difference was noted in the reactions of seedlings grown from (a) non-pelleted and (b) pelleted seed.

* * *

Weed control in sugar beets. E. F. SULLIVAN. *Weeds Today*, 1971, **2,** 14–17; through *Weed Abs.*, 1972, **21,** 106.—Summarized information is given on some troublesome weeds of sugar beet and the herbicides used for their control. Notes are included on application techniques, herbicide mixtures, the effects of irrigation and other factors on herbicide activity, sequential herbicide applications and management practices.

* * *

An apparatus for the measurement of carbon dioxide and water vapour exchange of attached sugar beet leaves. N. TERRY, L. J. WALDRON and A. ULRICH. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16,** 471–478. The apparatus, described in detail and illustrated, was designed primarily to investigate the effects of mineral nutrient deficiency and the toxic properties of air pollutants on photosynthesis, respiration and diffusion resistances of sugar beet leaves. It measures leaf temperature, carbon dioxide and water vapour exchange. The living leaf is located in a test chamber which has an air stream entering and leaving it. Carbon dioxide concentration was determined by an infra-red gas analyser, and water vapour concentration by a dew point hygrometer and thermistor psychrometer.

* * *

Some agronomic factors affecting processing quality of sugar beets. F. W. SNYDER. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16,** 496–507.—Results are reported of a survey in the Great Lakes region, involving 3200 samples analysed by the latest methods for sucrose content, clarified juice quality, α-amino nitrogen, potassium and sodium. It was found that the environment in which the beets grew altered the clarified juice quality more than the genetic differences of varieties grown at one location. Altering row width affected juice quality. Potassium in the clarified juice increased nearly 2% for each additional inch of row width.

* * *

***In vitro* zoospore production, motility and germination of *Aphanomyces cochlioides*.** L. J. HERR. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16,** 508–515.—In the investigation of black root disease (*Aphanomyces cochlioides*) of sugar beet adequate numbers of zoospores may be required. A suitable technique for their production is here described. Four-day-old mycelial mats grown on 0·3% keptone at 24°C were used. These were washed in double deionized water and transferred to a special salt solution made up of $CaCl_2$, KCl and $MgSO_4$. Retention of motility after harvest was highest and longest at 12, 16 and 20°C, with 16°C being superior. Motility was lost rapidly at 24–32°C and at 5°C. Germination was highest at 32°C.

* * *

Oxidative inactivation of invertase and polygalacturonase of *Cercospora beticola* Sacc. G. S. RAUTELA and M. G. PAYNE. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16,** 516–523.—The significance of oxidative enzymes on disease resistance is referred to and discussed. The effects of peroxidase *o*-diphenol oxidase and 3-hydroxytyramine in *Beta vulgaris* on the activities of invertase and polygalacturonase produced by *C. beticola* were studied. Invertase was inactivated

only slightly by peroxidase or *o*-diphenol oxidase. Under similar conditions polygalacturonase was more susceptible to oxidative inactivation. The addition of 3-hydroxytyramine in the reaction mixtures enhanced the inactivation of fungal enzymes and in all cases inactivation in excess of 95% was observed. It was suggested that the oxidative inactivation of enzymes may be involved in the sugar beet resistance mechanism.

* * *

Weeds taboo in '72. J. J. NIEDERER. *Sugar Beet J.*, 1972, **35,** (3), 2–5.—Pre- and post-emergence herbicide treatment is discussed and the need mentioned of adequate soil moisture for pre-emergence treatment to be successful. A pre-emergence application of 1¼ lb "Pyramin" plus 1½ lb TCA per acre on a 7-inch band has proved to be an extremely good combination. Post-emergence treatment must be applied while weed seedlings are small and not too difficult to kill. For nearly all the common broad-leafed weeds and annual grasses a tank mix of ⅔–¾ lb "Pyramin" and ⅔ lb "Dalapon" plus 1 quart of non-phytotoxic crop oil on a 7-inch band is very effective.

* * *

A new look at the nematode. R. F. RUPPEL and C. W. LAUGHLIN. *Sugar Beet J.*, 1972, **35,** (3), 10–12.—The sugar beet cyst nematode (*Heterodera schachtii*) has long been a pest in the Bay area of Michigan and infests about 4,000 to 6,000 acres each year. A general account is given of the pest. The control long practised and still recommended in Michigan is a 4- or 5-year rotation of infested fields with clean cultivated non-host crops. Beans, potatoes, small grains, maize, hay and forages and most other crops can be used in this rotation if they are kept free of weeds. Tare soil is blamed for much spreading of the nematode. Such soil should only be dumped on land not to be used for sugar beet. Modern chemical nematicides and their use are discussed, such as "DD", "Telone", and "Vorlex". The value of "Aldicarp" ("Temik") and its ease of application at planting time are discussed. It is thought that other new methods of control of the nematode may be expected in the near future.

* * *

Present status of pelleted seed. G. E. NICHOL. *Sugar Beet J.*, 1972, **35,** (3), 12–13.—The history of the use of pelleted seed in the US sugar beet industry is discussed, as are arguments for and against its use today. The present tendency is to drop its use for various reasons. Germination is often considerably delayed because of the coating preventing soil moisture reaching the seed. The seed is also more expensive than non-coated seed. Although sugar beet seed pellets have a uniform size, the coating material often crumbles easily in the seed container. Three larger sugar beet companies in Michigan have now completely ceased to use pelleted seed.

* * *

Spraying for leaf spot control in Ohio. F. B. RUSSELL. *Sugar Beet J.*, 1972, **35,** (3), 14–15.—Sugar beet leaf spot or leaf blight, caused by the fungus *Cercospora beticola*, has been causing appreciable losses in Michigan in recent years. In Ohio, yield decreases of over 4 tons per acre and a reduction in sugar content of more than 1% on beets have occurred. Relevant matters discussed here include varietal resistance, effects of unusual weather, sources of infection and spraying or fungicide problems. Planting beet in an area where beet trash is present from the previous year usually causes a large build-up of the disease. The value of systemic fungicides against the disease is discussed.

* * *

The diffusion resistance and water status of leaves of *Beta vulgaris*. P. V. BISCOE. *J. Exp. Bot.*, 1972, **23** 930–940.—Pot-grown sugar beet plants were deprived of water in two experiments until they wilted completely. Leaf resistance to water vapour transfer was measured directly with a diffusion porometer and compared with values calculated from measurements of transpiration. There was good agreement between the two estimates. Leaf turgor pressure decreased only gradually owing, apparently, to an increase in tissue solute concentration with increasing water deficit. Relationships between leaf water potential, soil water potential and leaf resistance were established and the effective control of transpiration by small changes in leaf resistance was clearly demonstrated.

* * *

Inbreeding expression in diploid and autotetraploid sugar beet, *Beta vulgaris*. R. J. HECKER. *Euphytica*, 1972, **21,** (1), 106–111; through *Biol. Abs.*, 1972, **54,** 2256–2257.—The effect of inbreeding on vegetative vigour, as measured by root yield, was evaluated in two diploid (2×) and equivalent autotetraploid (4×) sugar beet strains, and on additional 2× and one 4× strain. Root yields of the 2× and 4× S_1 progenies each averaged 86·7% of their comparable open pollinated progeny. Inbreeding depression of root yield was variable from strain to strain. The selfed 4× populations, when compared with their 2× equivalents, suffered more yield depression than was expected. Sucrose content within strains and within ploidy levels was not significantly affected in one generation of selfing.

* * *

Shelter effects on microclimate, growth and water use by irrigated sugar beets in the Great Plains. K. W. BROWN and N. J. ROSENBERG. *Agric. Meteorol.*, 1972, **9,** 241–263; through *Biol. Abs.*, 1972, **54,** 2824–2825.—Two rows of corn (maize) windbreaks spaced at 15 m were used to protect an irrigated sugar beet crop in Nebraska. Yield data for wind-protected sugar beet crops from three consecutive years indicate that yield increases of as much as 25% are possible during years when yields are low. During years of high yield, however, the windbreaks did not increase sugar beet yield further. Except in the immediate vicinity of the windbreak where shading occurred, no differences were found in net radiation between the sheltered and open plots. Data are given on other changes in the environment caused by the windbreaks.

Interaction of temperature and salinity on sugar beet germination. L. E. FRANCOIS and J. R. GOODIN. *Agron. J.*, 1972, **64,** 272–273; through *Biol. Abs.*, 1972, **54,** 2825.—It is known that, in the south western USA, high temperature and soil salinity adversely affect sugar beet germination. The experiments here reported showed that salinity had little effect on germination at 10°C and 15°C but was increasingly inhibitory as temperatures increased from 25°C to 40°C. Germination was maximum at 25°C, with low salinity, and almost completely inhibited at 45°C with all salinity levels. Of the four sugar beet varieties studied, US-H2 was most sensitive to salinity over the 30–40°C range.

* * *

Studies on the supply of boron to sugar beets on various soils. H. H. MAYR and W. FROHNER. *Bodenkultur*, 1972, **23,** (1), 1–9; through *Biol. Abs.*, 1972, **54,** 5097. The effect of B fertilization on sugar beet was tested on 5 soils with a pot technique. On these soils B deficiency symptoms under field conditions had been observed, even though B fertilization had been applied. In the pot experiments no case of B deficiency on sugar beet occurred. Therefore these symptoms of B deficiency, reported from field observations, must be due to influences not primarily connected with the supply of B in these soils, but with other factors (e.g. soil structure, water supply) which affect the availability of B. The experiment further showed that the increase in the B content of "Bor-Nitramoncal" (a compound fertilizer of ammonium nitrate, lime and boron) up to 5% boric acid is an advantage. With this amount in the fertilizer, the appearance of B deficiency was avoided or restricted, even under extreme growing conditions.

* * *

Effect of trace elements on the technological qualities of sugar beet. K. G. MAZEPIN, D. M. IEVLEV and A. S. KOROL'KOV. *Sakhar. Prom.*, 1972, (5), 40–41. Tests in which manganese, magnesium, zinc, molybdenum and boron sulphates and ammonium molybdate were applied to soil before beet sowing showed that yield of beet and sugar (% and per ha) were greater and raw juice and syrup purities higher while beet noxious nitrogen and ash contents were lower than in the case of control beet not treated with trace elements.

* * *

Spring demonstration at Cantley: problems of spring work continue to draw growers. ANON. *British Sugar Beet Rev.*, 1972, **40,** 165–174.—An illustrated account is given of the 1972 sugar beet spring demonstration held in Norfolk. Efficient seed bed preparation, involving 18 pieces of equipment, was one of the main features. Drilling equipment also received much attention.

* * *

Trials of commercial varieties of sugar beet. L. A. WILLEY. *British Sugar Beet Rev.*, 1972, **40,** 159–164. The trials were held at 21 centres in 1971. Owing to a variety of causes, mainly uneven establishment, only 15 were successful. Results are shown in 13 different tables. The most notable feature of the 1970 trials had been the achievement for the first time by a monogerm variety, Bush Mono, of a sugar yield above the average of the recommended varieties. This was followed in 1971 by a further advance with Hilleshog Monotri exceeding in sugar yield all other recommended varieties. Thus a situation appears to be arising where multigerm varieties, whether diploid or polyploid, may no longer possess any advantage in yield over monogerm varieties. The results for 1969, 1970 and 1971 are compared in tables.

* * *

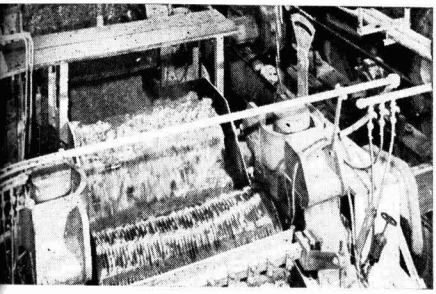
A time-of-spraying trial at Witham in 1971. G. D. HEATHCOTE and R. L. CATTRALL. *British Sugar Beet Rev.*, 1972, **40,** 180.—Virus yellows infection of beet in autumn was greater (11·3% of plants) when spraying with an aphicide was done in July than with spraying in late June (7·2%), early June (3·7% and late May (3·3%). Infection was greatest (17·6%) in unsprayed beet. Yields fell from 24·2 tons/acre with May spraying to 22·1 tons/acre without spraying. The sugar contents also fell with lateness of spraying.

* * *

Cleaner beet and concrete bases. P. ROYLE. *British Sugar Beet Rev.*, 1972, **40,** 182.—The writer, who farms 240 acres, explains how a concrete base or clamping area, large enough to take the clamp, cleaner and lorry, reduced his dirt tare from 14·6 to 8·09 lb per ton. This means that, in an average year, he does not pay for something like 18 tons of top soil to be carted to the factory, and, because of the great saving in time, the best bargain can be made with the haulier who much appreciates the convenience. Dirt tares, too, are far more even.

* * *

Agricultural factors that affect sugar beet yield and quality. A. P. DRAYCOTT and D. C. THOMSON. *Paper presented to the 21st Tech. Conf., British Sugar Corp.*, 1972.—The results of numerous fertilizer trials in the UK on beet yield and sugar content are summarized. While applications of nitrogen up to a certain level increase the sugar yield, further amounts do not result in any further increase and they depress the sugar content and juice purity. Phosphorus does not affect sugar content and juice purity and little response has been found in sugar yield, indicating that most soils have adequate P. Na and K increase sugar yield (but interact negatively) and also raise the sugar content slightly while leaving juice purity unaffected. Where the soil suffered from Mg deficiency, Mg fertilizer gave improved sugar content and juice purity. Fertilizer usages during 1940–70 are compared; K and P reached peaks in 1960 and have since declined, while N usage has continued to increase and is blamed for reduced sugar contents during the period. Corporation statistics show the speed with which new products and techniques have been adopted by growers, i.e. the use of chemical herbicides, pelleted and monogerm seed, wider seed spacing, etc. With the exception of varietal choice, the factors leading to higher cash returns for the grower also tend to produce better quality roots for processing. The statistics also show that growers are using on average about 30% more nitrogen than the recommended level.



Cane sugar manufacture

Oliver cake hold-up and its transport at the Ugar Sugar Works. THE UGAR SUGAR WORKS LTD. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.59–G.61.—Mud from Oliver belt filters is removed by one dumper truck only, entailing filling the chute feeding the mud to a belt conveyor and allowing a hold-up of mud on the conveyor (totalling the equivalent of about 1 hr). However, this releases six cane trailers, previously used for mud disposal, for their normal work of cane transport. The saving is calculated as Rs.50,000, based on a 150-day season.

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Khandsari industry in India—technical control to recover higher sugar from cane. V. M. BHALATOR. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.89–G.95.—Advice is given on how to increase cane sugar yield in the khandsari industry.

* * *

A case study of spontaneous combustion of final molasses in storage pits. D. J. MEHTA and D. C. KARHADKAR. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.103–G.108.—See *I.S.J.*, 1971, **73**, 145.

* * *

Capacity indices for the cane sugar industry. II and III. R. QUESADA G. *CubaAzúcar*, 1971, (Jan./Dec.), 2–100.—The survey commenced by R. PEDROSA P.[1] is continued, the areas of cane sugar equipment covered including the remainder of the factory from milling plant gearing to the boiler house, clarification, filtration, evaporation, boiling, crystallizers, centrifugalling, drying, weighing, sugar handling and molasses handling, as well as steam piping, pumps, tanks and electrical equipment, etc.

* * *

Studies on the causes of corrosion in the copper tubes of evaporators in the sugar industry. H. SHIMBAR, G. CABRERA and S. MÜLLER. *CubaAzúcar*, 1972, (Jan./March), 2–13.—Copper tubes in the 3rd and 4th vessels of a quadruple-effect evaporator are subject to occasional severe attack while normally suffering little corrosion. The corrosion of the copper was measured in NH_4Cl solution of various pH values and the speed determined from stationary polarization curves. On a basis of the results and of data from the literature, it is concluded that: the corrosion arises from the presence of ammonia and other substances in the incondensable gases which can form complex copper ions; the attack is not uniform owing to differences in movement of the electrolyte, different aeration and deposition of solids on the tube surface; corrosion is possible if the pH exceeds 7·2, which is possible if it is not automatically controlled; high nitrogen fertilization is not responsible for a high nitrogen content in the juice; poor incondensable gas extraction favours attack; and the infrequent coincidence of the factors explains the infrequency of rapid attack. Good automatic control of neutralization and good gas extraction can remove the problem completely.

* * *

Bulk sugar in Cuba. G. GONZÁLEZ. *CubaAzúcar*, 1972, (Jan./March), 14–19.—The history of bulk sugar shipment from Cuba is surveyed, with information on the tonnages handled since 1962 by the terminal at Guayabal, since 1963 at Matanzas, and since 1967 at Cienfuegos. In 1970 total sugar shipped in bulk amounted to 3,498,600 metric tons, compared with 53,900 tons in 1962.

* * *

Experience with a mill-diffuser system in the Cuban sugar industry. A. VALDÉS, S. ORTEGA and V. CRESPO. *CubaAzúcar*, 1972, (Jan./March), 20–34.—See *I.S.J.*, 1971, **73**, 147.

* * *

Computers and control of Cuban sugar production. R. PEDROSA P. and G. BENAZET. *CubaAzúcar*, 1972, (Jan./March), 35–45.—An account is given of the use of a digital computer for processing data supplied by Cuban sugar factories, with examples of the records produced, of the relationships used in the calculations, a discussion of the advantages, and a note on future development.

* * *

Air filters for sugar dryers. ANON. *Bol. Azuc. Mex.*, 1972, (266), 12–13.—Arguments are advanced for the filtration of air entering sugar dryers but it is calculated that with good operation of a dryer, with the correct air throughput, the quantity of dust entering with the air should be negligible, and so the filter should be installed only as a precautionary measure to prevent entry of larger objects such as insects. The filter porosity should not be too fine as it will increase the resistance to air flow sufficiently for more powerful fans to be required.

* * *

The mechanical loading plant at Veracruz. I. GURZA I. *Bol. Azuc. Mex.*, 1972, (267), 4–10.—An illustrated description is given of the bulk handling, storage and loading facilities at this port in Mexico which exported 446,207 tons of sugar in 1971.

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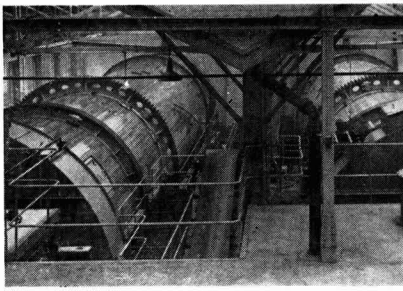
[1] *I.S.J.*, 1972, **74**, 114.

Beet sugar manufacture



Comparative systems calculation. E. BENZ. *Zucker*, 1972, **25**, 486–490.—A diagram is presented relating the purities of massecuite and run-off on the basis of solubilities at 40–80°C (in 10° intervals). The system of calculations is extended to include affination and high green syrup and another diagram is presented for establishing massecuite and low green syrup Brix on the basis of the non-sugar:water ratio. An example shows how the high and low green syrup quantities can be found from analysis of massecuite and its products and from the amount of affined sugar produced. The amount of wash water required and its dissolving capacity are also found by this means. The relationship between wash water requirements and the amount of syrup adhering to raw and affined sugars is also plotted.

* * *

Sulphitation in sugar factory juice purification. K. VUKOV. *Cukoripar*, 1972, **25**, 34–36, 59–61.—The advantages and primary aims of sulphitation are discussed with reference to the literature. Best results are considered to be obtainable by sulphitation of 2nd carbonatation juice. The use of sodium bisulphite is advocated.

* * *

The use of wetting agents in low-grade boiling. O. KRIEGER and I. CSILEK. *Cukoripar*, 1972, **25**, 69–71. Comparative tests with Stockhausen "Intrasol FK" and Hodag "CB-6" surface-active agents added to low-grade massecuite at two Hungarian sugar factories showed that both reduced molasses viscosity, "Intrasol FK" having a slightly greater effect. At one factory "Intrasol FK" gave a noticeably higher white sugar yield than did the same amount of "CB-6", while at the other factory it gave a slightly lower yield, both surfactants giving more sugar and less molasses sugar than without the treatment.

* * *

Powdered sugar production. J. DÁVID. *Cukoripar*, 1972, **25**, 72–73.—Production of a new (for the Hungarian industry) powdered white sugar, which is mixed with edible starch, is reported and the unit for precise mixing of the starch and sugar at Selyp sugar factory is described.

* * *

Dependence of some physical properties of the sugar beet on variety. K. VUKOV. *Zeitsch. Zuckerind.*, 1972, **97**, 376–379.—Of the four major physical properties affecting beet response to diffusion, three have been found to depend on varietal factors, i.e. the slicing resistance is generally lower in beets selected for resistance to sprouting, the sucrose diffusion coefficient in beet tissue is higher in polyploid than in diploid varieties, and the marc content is greater in high sugar-yielding varieties than in high-yielding varieties. The modulus of elasticity was found to be independent of variety.

* * *

Selection of rational parameters of continuous centrifugal feed devices. S. M. GREBENYUK, V. G. ANDREEV and V. F. KOLOMIETS. *Sakhar. Prom.*, 1972, (7), 10–12.—Experiments on a test plant showed that the greater the height of the acceleration cup feeding massecuite to the conical basket of a continuous centrifugal the greater was the rate of separation at a given acceleration and massecuite viscosity.

* * *

Parameters of electrochemical protection of St.3. steel in raw juice. V. V. SUPRUNCHUK *et al. Sakhar. Prom.*, 1972, (7), 13–15.—Laboratory experiments are described which were designed to show the optimum current density and cathode polarization for protection of St. 3 steel against corrosion caused by immersion in raw juice.

* * *

Effect of circulation rate, boiling point, pH and time of evaporation on sugar solution colour in vessels with reverse forced circulation. M. A. GEISHTOVT, V. V. GONCHAR and V. V. MAIOROV. *Sakhar. Prom.*, 1972, (7), 16–21.—Under reverse forced flow conditions, colour of juices and syrups increased with temperature and evaporation time and at a given temperature rose with solution concentration, although at identical pH fall the colour of dilute solutions rose to a greater extent than that of concentrated solutions.

* * *

System of automatic control of an evaporator with steam-jet compressors. B. A. EREMENKO, A. I. TSENZURA and A. V. KAPATS. *Sakhar. Prom.*, 1972, (7), 29–34.—A system is described in which steam-jet compressors maintain a required vapour balance in each effect of a multiple-effect evaporator. Tests indicated an average Brix increase of 8·3° with a 3·8% reduction in steam consumption (on weight of beet).

* * *

Use of a contactless conductimeter for control of sugar factory products. A. M. BUNYAK, I. I. TSAPIV and V. I. RADALOVSKII. *Sakhar. Prom.*, 1972, (7), 35–37. A system for regulating syrup Brix, embodying a high-frequency, contactless conductimeter, is described. Over 10 days there was only slight deviation from the zero point.

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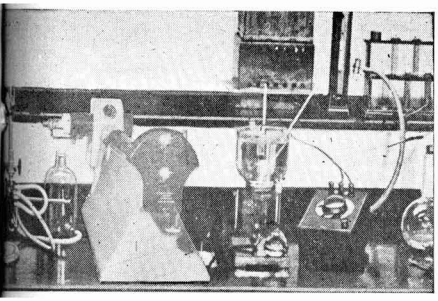


Laboratory methods & Chemical reports

The problem of the number of samples taken from a grower to determine beet sugar content by polarization. K. METELSKI. *Gaz. Cukr.*, 1972, **80**, 127–129.—The problem is examined statistically and a table given showing the number of beet loads from which 1 or 4 samples should be taken depending on the total number of loads in the delivery.

* * *

Sucrose crystallization in the presence of KCl and NaCl. V M. KHARIN and V. F. DOBROMIROVA. *Izv. Vuzov, Pishch. Tekh.*, 1972, (1), 134–137.—Crystallization experiments showed that KCl and NaCl have an inhibiting effect on both nucleation and crystal growth and increase the surface tension at the crystal-solution boundary. The effect on nucleation was found to be greater than on crystal growth, so that at the end of the process there were fewer but larger crystals than in crystallization from pure sucrose solution.

* * *

Method of separating sugar colorants on DEAE-SS cellulose. I. F. BUGAENKO and M. MUKHAMED. *Izv. Vuzov, Pishch. Tekh.*, 1972, (1), 161–162.—A brief description is given of tests in which colorants in molasses solution were successfully separated on a DEAE-SS cellulose column regenerated with 1% NaOH solution. Elution was carried out with Na_2HPO_4, NH_4Cl and NaOH in various molar concentrations. The fractions were then subjected to absorption spectrophotometry in U.V. light.

* * *

Methods of quantitative determination of sucrose in cane raw sugar processing. L. P. REVA and L. A. LENEVA. *Sakhar. Prom.*, 1972, (6), 37–41.—In a comparison of various methods of determining sucrose, the most suitable for purities in the range 60–100 were found to be the CLERGET-HERZFELD and JACKSON-GILLIS acid inversion-polarization procedures, which had a relative error of $\pm$ 0·3%.

* * *

Determination of average crystal size of sugar by a percolation method. A. I. GROMKOVSKII and N. A. REMIZOVA. *Sakhar. Prom.*, 1972, (6), 41–45.—The method described is based on the relationship between the effective diameter of particles of a granular filtering medium and the coefficient of percolation (K) of a sugar solution through it. The average crystal size of sugar is then calculated in terms of K using formulae based on crystal diameter and crystal surface area. Good accuracy is obtained for crystal sizes in the range 0·1–0·6 mm.

Determination of sugar losses in beet fluming and washing. J. F. T. OLDFIELD, J. V. DUTTON, N. D. MORGAN and H. J. TEAGUE. *Paper presented to the 21st Tech. Conf., British Sugar Corp.*, 1972.—Of five methods tested for measuring the change in sugar content of beet flume and wash water, the resorcinol method (a modification of the method of ROE[1]) was best, the other (polarization, the tetrazolium method, the anthrone method and the Molisch test) all being subject to interference. The method is simple and the only special equipment needed is a constant temperature bath and an absorptiometer. Uptake of sugar in flume water was measured as 50–390 ppm for different factories while wash water uptake was estimated at 100–300 ppm. In the laboratory it was found that little sugar diffused from undamaged beets and the losses are therefore attributed mainly to continual abrading and bruising of the beets. High levels and rapid changes in Na and sugar concentration in flume water made difficult the measurement of flow rate by measuring the dilution of added brine or molasses, and it is proposed to assess flow rate from recording ammeters on the beet pump motors.

* * *

Sugar crystal content apparatus or sugar estimator. S. K. CHATTOPADHYAY and R. L. PERUMAL. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, E.39–E.41.—Massecuite or molasses is allowed to percolate under pressure through a fine screen placed across a sealed, hot water-jacketed vertical cylinder which is screwed into a lower cylindrical section acting as receiver. A measuring scale is then inserted in the upper cylinder and the % volume of crystals in the liquid measured.

* * *

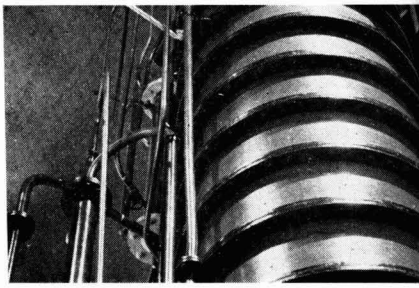
Studies on sugar cane bagasse—water-soluble fraction of sugar cane bagasse. S R PATHAK and V. R. SRINIVASAN. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.23–G.25.—Paper chromatography of a bagasse water-soluble extract revealed the presence of D-fructose and D-glucose plus two unidentified components having R_f values below the two sugars, possibly D-glucans and D-glucuronides of low molecular weight.

* * *

Cane crushing for analysis. R. DADANT. *Rpt. Inst. Recherche Agron. Trop. Réunion*, 1971, 43–44.—Information is given on the procedure used by IRAT to maintain the grid and knives of a "Jeffco" cane disintegrator in a sharpened state.

[1] *J. Biol. Chem.*, 1934, **107**, 15.

By-products



Production of feed concentrate from dry pulp, molasses and urea. V. ŠEVČÍK, R. DUPAL and H. KNOFLIČKOVÁ. *Zucker*, 1972, **25**, 261–263.—Details are given of production of a wet concentrated fodder containing 80% dry pulp, 15% molasses, 4% urea and 1% phosphoric acid (50% solution), the last three components being made up into solution and then adsorbed by the crushed pulp. Slow desorption of the urea in the rumen of cattle permits better utilization of the urea-N than with similar dry fodder and the risk of ammonia poisoning is eliminated. The fodder can be granulated if required.

* * *

Neutralization of vinasse with limestone. N. A. DA GLORIA, A. A. DELGARDO and A. G. SANTA ANA. *Brasil Açuc.*, 1972, **79**, 135–142.—Acidity of distillery wastes leads to corrosion and lime has been used for its neutralization. Limestone is a cheaper neutralizing agent and studies have been made of factors affecting its use; these include its composition and fineness, temperature, agitation and reaction time. The quantity of lime needed should be determined experimentally before use.

* * *

Production of mixed fertilizer from distillery spent wash. A. C. CHATTERJEE *et al. Sugar News* (India), 1972, **3**, (12), 14–17.—The yields and costs relating to distillery waste treatment to give (i) a mixed fertilizer (by evaporation and drying) and (ii) potash, obtained by burning the so-called "spent wash coke" obtained as end-product in (i), are calculated and analyses given of the two products.

* * *

Production of oxalic acid from sugar cane molasses. S. BOSE, S. MUKHERJEE and A. N. SHRIVASTAVA. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, G.17–G.21.—Details are given of oxalic acid production from diluted cane molasses by action of nitric acid. Yield in experiments was 42–45% on weight of molasses; oxalic acid purity was 93·7%.

* * *

Studies on the synthesis of protein in yeast from methane. K. A. AROJ and K. A. PRABHU. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.27–G.30.—Cultivation of *Candida* sp. in a gas mixture containing 63–65% methane and 34–36% CO_2 (plus 1% other gases) obtained by anaerobic fermentation of bagasse is described. Optimum gas:liquid ratio (by volume) was 2:1 and that of methane:air 2:3. (See also AROJ: *I.S.J.*, 1970, **72**, 185.)

Studies on the factors influencing the treatment of distillery waste by ammonifying micro-organisms. D. S. DAHIYA and K. A. PRABHU. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.31–G.36. See *I.S.J.*, 1972, **74**, 220.

* * *

Continuous fermentation of molasses for the production of ethanol. K. A. PRABHU. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.37–G.40.—Details are given of experiments in which *Saccharomyces cerevisiae* was cultured on molasses after treatment with ammonium sulphate.

* * *

Studies on the utilization of carbon dioxide from a distillery for preparation of carbonates. I. D. L. N. RAO and A. GANI. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, G.47–G.58.—Details are given of experiments on sodium and calcium carbonate production from distillery CO_2 (regarded as a waste product) and NaOH and CaO from calcined shells. To obtain pure $CaCO_3$, factory lime was dissolved in dilute HCl and the solution gassed; the filtrate from the chalk preparation also yielded NaCl. Product qualities and yield are described as excellent.

* * *

Synthesis and evaluation of the chemical derivative carboxymethyl cellulose from sugar cane bagasse cellulose. C. J. TRIANA F. and A. A. LÓPEZ D. *CubaAzúcar*, 1972, (Jan./March), 46–56.—Experiments on production of carboxymethyl cellulose showed that bagasse cellulose is a suitable raw material giving a product with properties in the range of imported material and of products synthesized from imported cellulose while it was of higher standard in some respects. Cuba's requirements could be met by use of bagasse cellulose.

* * *

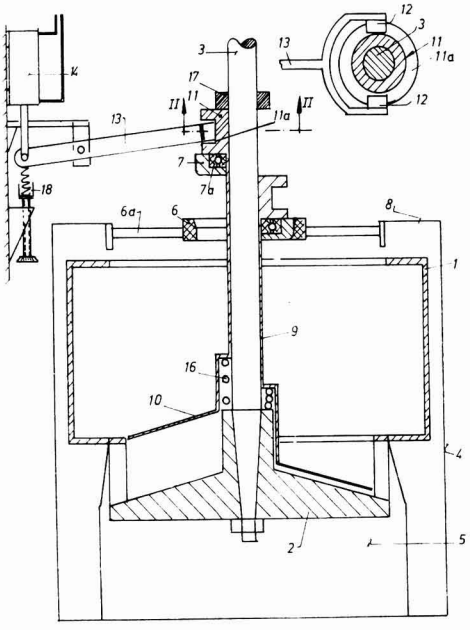
Use of citrus pulp to replace cereal grain in a molasses-based diet for dairy cows in semi-confinement with restricted grazing. V. RODRÍGUEZ. *Rev. Cubana Cienc. Agric.*, 1972, **6**, 15–18.—It was found that an average daily milk production of 14 kg is obtainable with a semi-confinement feeding system based on restricted pasture, final molasses *ad lib.*, a protein supplement and an energy supplement in the form of maize, rice, sorghum grain or dehydrated orange pulp. Milk production and composition and feed intake were the same regardless of the energy supplement incorporated.

Patents

UNITED KINGDOM

Centrifugals. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **1,280,576.** 10th April 1970; 5th July 1972.

In order to be able to discharge the contents of a centrifugal at 200–300 r.p.m. and thus reduce cycle time by avoiding the need to brake to 50 r.p.m., the basket is suspended in a manner which prevents deflections. This is achieved by providing a centring ring 6 carried by radial arms from the upper part 8 of the housing 4 of the centrifugal. Surrounding the shaft 3 is a sleeve 9 normally held in its upper position (shown on the left side of the drawing) by the spring 16, against a stop ring 17 mounted in a fixed position on the shaft.



At the top of the sleeve 11 is a bearing 7a protected by a casing 7. A fork engages with the sleeve 11 by means of prongs 12 and, under the action of e.g. a hydraulic or pneumatic drive 14 causes the sleeve 11 and casing 7 to move down the shaft where the casing engages with the central aperture in ring 6, this being aided by the upper bevelled edge of the ring. After discharging, the sleeve is allowed to rise to its upper position against the stop ring 17.

* * *

Edible sugar product. W. R. GRACE & CO., of New YORK, N.Y., USA. **1,282,878.** 26th November 1968; 26th July 1972.—See U.S. Patent 3,600,222[1].

* * *

Cane diffuser. HULETT'S SUGAR CORPORATION LTD., of Durban, Natal, South Africa. **1,283,573.** 21st October 1969; 26th July 1972.—See U.S. Patent 3,597,163[2].

* * *

Centrifugals. SOC. FIVES LILLE-CAIL, of Paris, France. **1,284,549; 1,284,550.** 8th December 1969; 9th August 1972.—See U.S. Patent 3,647,135[3].

UNITED STATES

Separation of fructose and glucose. R. TATUKI, of Goshogawara, Japan. **3,671,316.** 1st February 1971; 20th June 1972.—The pH of a sugar solution containing glucose and fructose (e.g. invert sugar) is adjusted to 7–9 (8·5), (more than) sufficient NaCl added to form a double salt with the glucose, the solution concentrated and cooled, the double salt crystals separated and the glucose recovered by deionization and concentration. Fructose is recovered from the residual liquor by deionization and concentration.

* * *

Cane harvester. J. M. MIZZI, of Ingham, Queensland, Australia. **3,673,774.** 23rd November 1971; 4th July 1972.

* * *

Method for drying sugar solutions. R. H. GRAY, of Baltimore, Md., USA, *assr.* W. R. GRACE & CO. **3,674,557.** 3rd May 1971; 4th July 1972.—Droplets of a sucrose-containing solution (affination or refinery last strike liquor) are dried in a current of heated air in the presence of 0·5–4 parts by weight of separately introduced recycled product solids (introduced at the periphery of the drying zone) [after preliminary

[1] *I.S.J.*, 1973, **75**, 124.
[2] *ibid.*, 92.
[3] *ibid.*, 229.

reduction to <200μ (50–150μ) average particle size]. The hot air is maintained at an inlet temperature of at least 400°F while the average residence time in the drying zone is 60 seconds or less. The dried solids are collected, part recycled, and the remainder recovered.

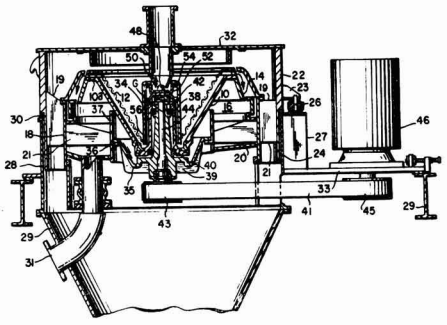
* * *

Beet harvester. S. L. SJOVALL, of Kavlinge, Sweden, *assr.* SVENSKA SOCKERFABRIKS AB. **3,680,638.** 28th October 1970; 1st August 1972.

* * *

Continuous centrifugal. A. MERCIER, of La Madeleine, France. **3,682,373.** 8th December 1969; 8th August 1972.

Tilting is avoided and vibrations limited to the horizontal plane by constructing the continuous centrifugal in such a fashion that the upper part is mounted resiliently above a fixed lower part and the centre of gravity of the upper part is brought to the same level as the geometric centre of gravity of the interior surface of the bowl. The resilient upper part includes the cover 32 and thick side walls 22, the feed



pipe 50, hub 38, solid cone 10, screen 12, skirt 14, cylindrical walls 18, 36 and their supporting brackets and bottoms, and the molasses discharge pipe 31. The hub 38 surrounds the drive shaft 44 but is mounted with bearings 40, 42 while the upper part of the housing is supported by brackets 23 attached through resilient mountings 26 to the fixed lower housing, a seal 30 separating the housings.

* * *

Di- and trisaccharide derivatives as detergent constituents. W. I. LYNESS and J. E. THOMPSON, *assrs.* THE PROCTOR & GAMBLE CO., of Cincinnati, Ohio, USA. **3,686,124.** 1st June 1971; 22nd August 1972.—Detergent compositions include detergent builders (in a proportion from 1/6th to 10/11ths) which are carboxymethylated di- or trisaccharides (sucrose, raffinose or lactose), the degree of substitution being greater than 4 (greater than 5 in the case of raffinose).

* * *

Sucrose recovery from beet molasses. R. G. E. VANDEWYER, of Vissenaken, Belgium, *assr.* RAFFINERIE TIRLEMONTOISE. **3,687,727.** 2nd July 1970; 29th August 1972.—In the cold precipitation of a sucrose-lime combination by addition of lime to molasses diluted with water, several [3–7 (4–5)] volumes of treated molasses are recycled and mixed with one volume of untreated molasses before addition of lime. In this way an alkalinity gradient is generated which increases from the diluted molasses/recycled molasses mixture up to the point where lime is added.

* * *

Bagasse pith and fibre separation. E. J. VILLAVICENCIO, of Brennan, Peru, *assr.* PROCESS EVALUATION AND DEVELOPMENT CORP. **3,688,345.** 13th July 1970; 5th September 1972.—Bagasse pith and fibre are separated in a device similar to that described in US Patent 3,537,142.[1] A carrier liquid (water) is added to the raw material in a proportion of about 4·5 (5–10) parts by weight per part of dry fibre; this adheres to the pith which is separated by the hammers, increasing its density and aiding its removal through the perforations in the wall surrounding the hammer chamber.

* * *

Manufacture of hard ashless charcoal briquettes. A. E. VELOSO, of Quezon City, Philippines, *assr.* INTERNATIONALE ERFINDER- UND PATENTANSTALT. **3,689,233.** 20th October 1970; 5th September 1962.—Vegetable carbonaceous material, including bagasse, is contacted with 50–100% H_2SO_4 to remove substantially all carbohydrate, cellulose, lignin, etc., to give a finely-divided carbonaceous raw material. This is (mixed with finely ground charcoal and) charged into a porous container in an electrolytic cell containing 5–40% H_2SO_4 as electrolyte and electrically connected to one electrode and a potential applied (at 3·5–24 volts, 40–80 $A.ft^{-2}$, for at least 10 minutes) (to convert inorganic matter present to soluble ionic form, the potential being deactivated and reversed for periods of 1–12 minutes). The treated material is water-washed to remove soluble impurities, (treated with a 10–20% HF solution to remove silicate impurities,) dried and compressed under a pressure of at least 200 $tons.in^{-2}$ and at least 550°C and the briquettes cured at a pressure of at least 50 $tons.in^{-2}$ for at least 20 hours.

* * *

Weed control in beet fields. J. L. AHLE, of Shawnee Mission, Kansas, USA, *assr.* GULF RESEARCH & DEVELOPMENT CO. **3,690,865.** 8th December 1970; 12th September 1972.—Weeds of both *Amaranthus* and *Kochia* species in beet fields are combated by pre-emergence application of at least 1 lb/acre of a combination of 1 part by weight of N-benzyl-N-*iso*-propyl pivalamide and $1\frac{2}{3}$–3 (about $1\frac{2}{3}$) parts of N-benzyl-N-*iso*-propyl 3,5-dichlorobenzamide.

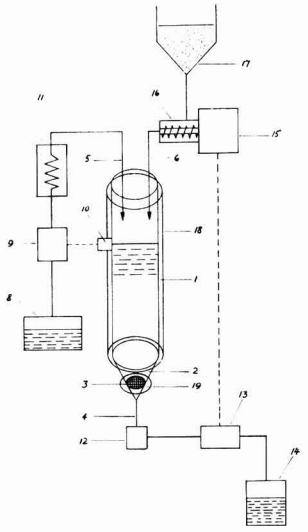
* * *

Continuous production of sugar solutions. K. LAUER and P. STEPHAN. **3,692,579.** 15th January 1970; 19th September 1972.

Dissolving liquid (water or a relatively dilute aqueous sugar solution) is pumped from reservoir 8

[1] *I.S.J.*, 1972, **74**, 60.

by pump 9 through a thermostatic temperature controller 11 into an inlet 5 of a dissolving tube 1, the pump being controlled by a level sensor 10. Sugar from hopper 17 is carried by a conveyor worm also into the dissolving tube through inlet pipe 6, the worm 15 being controlled by a concentration measurement cell 13 through which the solution from



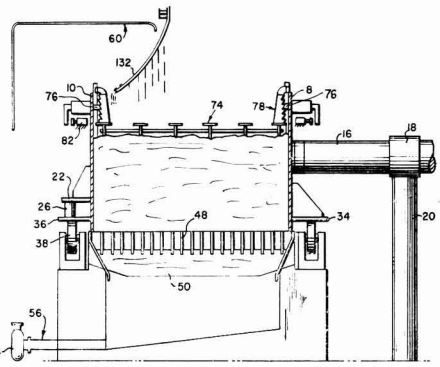
the tube is delivered by pump 12 to tank 14 after being withdrawn from the lower conical end of the tube. A sieve 3 is mounted on the bottom of the tube with a flanged fitting 19 so that it can be easily removed for cleaning or replacement. The tube may contain a number of internal cones each with sieve bottoms or alternatively have sloping elliptical baffles part of which are fitted with sieve sections.

* * *

Separation of fructose from the glucose in invert sugar. A. J. MELAJA, of Kantvik, Finland, *assr.* SUOMEN SOKERI OY. **3,692,582.** 31st July 1970; 19th September 1972.—An aqueous invert sugar solution of 25–55% dry solids content is applied uniformly at a flow rate of 0·2–1·5 $m^3.hr^{-1}$ per m^2 of cross sectional area to a 2·5–5 (3–4) metre column of an alkaline earth metal (Ca) salt of a polystyrene sulphate cation exchange resin, cross-coupled with divinyl benzene, which is initially submerged in water. From the downstream side of the column are recovered successively: (1) a (<95%) glucose fraction, (2) a fraction containing glucose and fructose and (3) a (<95%) fructose fraction. Fraction (2), containing >35% (>25%) dry material by weight on invert input, is returned to the feed stock. To the column is then applied water and a new supply of invert sugar solution. The respective hexoses are recovered by evaporation and crystallization of fractions (1) and (3).

Cane diffuser. F. DAMBRINE, of Marcq-en-Baroeul, France, *assr.* FIVES LILLE-CAIL. **3,693,540.** 23rd March 1971; 26th September 1972.

The diffuser is in the form of a ring of cells rotating around a hub 18 on a central axial shaft 20. The cells are formed by outer and inner cylindical walls 10, 8 provided with radial walls. The cylindical walls have brackets supporting them on rollers 38, while rotation is obtained by a series of hydraulic jacks operating on pins 26 located in the outer wall between the plates 22, 36. The cells are bottomless and pass over a grid in the form of circular bars 48 supported by radial bars 50 such that the radial cell walls pass close to the grid surface. The grid is interrupted at two places; in one the grid is removed so that there is no bottom to the cell, and in the next the cell bottom is solid.



Under the grids are pans which receive juice from each cell; this drains through pipes 56 to pumps which send it via pipes 60 for distribution above the cell nearer the cane feed and of the diffuser. A screen 132 is interposed so that, while juice is distributed over the cane in the cell, bagacillo fines are directed to the outer edge of the cells. A cover 74 is fitted to each cell and comprises a series of T-sectioned bars linked with cylindical rods. At the inside and outside are brackets 78 with teeth engaged by fingers 76 operated by hydraulic jacks 82.

Exhausted bagasse is discharged from the cell over the interruption in grid 48; the cell moves to the next position over the solid bottom and jacks 82 are operated to withdraw fingers 76 from the teeth of bracket 78. An electromagnetic plate is lowered by a jack, grips the cover 74 and raises it, thereupon a supply of fresh cane is fed into the cell. The cover is then lowered and the cane in the cell compressed by the jack; the cover is locked in place by operating jacks 82 to engage fingers 76 with the teeth of brackets 78, and the cane in the cell is then moved to the next cell position around the diffuser where it is treated with water supplied from pipe 60 above. Juice from the pan below this cell goes to process. The use of a cell closed by a cover reduces the air spaces within the cane bed and increases the permeability of the cane, improving the diffusion of sugar.

World sugar production estimates 1972/73[1]

BEET SUGAR	Campaign	Estimate 1972/73	1971/72
EUROPE		*metric tons, raw value*	
Belgium/Luxembourg	Sept./Jan.	685,000	857,777
Denmark	,,	349,000	332,222
France	,,	3,046,664	3,268,886
Germany	,,	2,263,165	2,395,830
Holland	,,	772,800	856,785
Ireland	,,	167,500	191,811
Italy	July/Oct.	1,255,000	1,274,443
United Kingdom	Sept./Jan.	986,762	1,206,951
Total EEC		*9,525,891*	*10,384,705*
Austria	Sept./Jan.	406,867	278,124
Finland	,,	93,270	66,076
Greece	July/Oct.*	131,000	158,313
Spain	July/March	818,317	1,045,570
Sweden	Sept./Jan.	299,000	273,333
Switzerland	,,	68,424	75,867
Turkey	Aug./Feb.	833,333	930,462
Yugoslavia	Aug./Jan.	395,377	388,539
Total West Europe		*12,571,479*	*13,600,989*
Albania	Aug./Jan.	19,000	18,000
Bulgaria	,,	230,000	210,000
Czechoslovakia	Sept./Jan.	760,000	730,000
Germany, East	,,	650,000	542,222
Hungary	,,	329,665	266,949
Poland	,,	1,826,000	1,712,500
Rumania	Aug./Feb.	610,000	510,000
USSR	Sept./Jan.	8,500,000	8,200,000
Total East Europe		*12,924,665*	*12,189,671*
Total Europe		25,496,144	25,790,660
OTHER CONTINENTS			
Afghanistan	Nov./Feb.	10,000	10,139
Algeria	June/Nov.*	20,000	18,778
Azores	June/March	8,000	7,606
Canada	Oct./Dec.*	127,611	152,039
Chile	April/June†	120,000	156,204
China	Jan./Dec.†	850,000	850,000
Iran	Oct./March	610,000	595,555
Iraq	,,	10,000	5,000
Israel	May/July†	30,000	28,889
Japan	Oct./Feb.	418,000	374,345
Lebanon	June/Nov.*	24,444	20,000
Morocco	May/Aug.†	260,000	246,222
Pakistan	June/July†	26,792	21,079
Syria	May/June†	35,000	37,800
Tunisia	May/April	6,000	4,807
United States	July/June	3,200,000	3,192,785
Uruguay	May/April	45,295	43,636
Total Other Continents		5,801,142	5,764,884
TOTAL BEET SUGAR		31,297,286	31,555,544

CANE SUGAR			
EUROPE			
Spain	March/Sept.	33,000	33,942
NORTH AND CENTRAL AMERICA			
Belize	Dec./June	71,000	71,086
Costa Rica	,,	195,000	190,744
Cuba	Nov./July	5,400,000	4,388,362
Dominican Republic	Nov./Sept.	1,270,000	1,200,000
Guadeloupe	Jan./June†	140,000	81,945
Guatemala	Dec./June	240,000	235,686
Haiti	,,	70,000	73,000
Honduras	,,	70,000	68,752
Martinique	Jan./June*	30,000	25,000
Mexico	Nov./July	2,775,000	2,525,906
Nicaragua	Dec./June	172,000	172,364
Panama	,,	110,000	87,251
Puerto Rico	Jan./July†	270,000	267,452
El Salvador	Nov./June	195,000	194,000
USA—Mainland	Oct./June	1,450,000	1,094,471
Hawaii	Jan./Dec.†	1,048,000	1,015,028
West Indies—Barbados‡	Jan./June†	120,000	113,127
Jamaica‡	,,	350,000	379,197
St. Kitts‡	,,	20,000	26,346
Trinidad‡	,,	202,000	234,582
Total North and Central America		14,198,000	12,444,299
SOUTH AMERICA			
Argentina	July/Dec.*	1,328,959	1,015,162
Bolivia	May/Sept.†	186,000	136,227
Brazil	June/May	6,200,000	5,610,746
Colombia	Jan./Dec.†	860,000	823,681
Ecuador	June/Jan.	250,000	249,253
Guyana‡	Oct./June	294,640	319,634
Paraguay	July/Nov.*	58,722	62,502
Peru‡	Jan./Dec.†	964,000	927,818
Surinam	Aug./May	12,000	12,170
Uruguay	May/April	28,386	14,917
Venezuela	Sept./Aug.	545,000	539,777
Total South America		10,727,707	9,711,887
AFRICA			
Angola‡	May/March	85,000	85,218
Cameroun	April/Sept.*	17,000	15,280
Congo (Brazzaville)	May/Nov.*	39,957	70,000
Egypt	Dec./June	680,000	652,750
Ethiopia	Nov./June	146,111	129,667
Ghana	April/Sept.*	10,000	8,300
Kenya	July/June	117,000	119,964
Madeira	March/Sept.*	3,301	3,016
Malagasy Republic	July/June	110,000	99,038
Malawi	May/Nov.*	37,514	36,026
Mali	April/Sept.	10,000	8,000
Mauritius‡	July/Jan.	727,410	657,296
Mozambique‡	May/Nov.*	370,000	327,181
Nigeria	,,	30,278	25,480
Réunion	July/Jan.	232,183	186,181
Rhodesia	May/Nov.*	200,000	200,000
Somalia	Dec./April	50,000	50,000
South Africa	May/April	2,040,000	1,981,554
Sudan	Dec./June	90,000	80,000
Swaziland	May/Dec.*	181,901	187,981
Tanzania	July/June	119,000	104,682
Uganda	,,	120,000	153,865
Zaire	May/Nov.*	39,481	42,041
Zambia	May/Nov.*	51,119	41,546
Total Africa		5,507,255	5,265,066
ASIA			
Afghanistan	Oct./April	10,000	10,110
Bangla Desh	Nov./May	21,439	26,646
Burma	Nov./April	100,000	100,000
China	Jan./Dec.†	2,500,000	2,450,000
India, excl. khandsari	Oct./July	4,300,000	3,446,663
Indonesia	May/Dec.*	909,000	878,000
Iran	Oct./April	60,000	54,778
Japan	Nov./June	260,000	216,560
Nepal	Oct./April	10,000	4,535
Pakistan	Nov./May	463,070	375,181
Philippines	Nov./July	2,270,000	1,864,905
Sri Lanka	Nov./June	10,000	10,000
Taiwan	Nov./June	850,000	746,118
Thailand	Oct./April	778,000	669,000
Total Asia		12,541,509	10,852,496
OCEANIA			
Australia	May/Dec.*	2,893,000	2,866,000
Fiji	,,	321,000	341,000
Total Oceania		3,214,000	3,207,000
TOTAL CANE SUGAR		46,221,471	41,514,690
TOTAL BEET SUGAR		31,297,286	31,555,544
TOTAL SUGAR PRODUCTION		77,518,757	73,070,234

[1] F. O. Licht, *International Sugar Rpt.*, 1973, **104**, (18), 1–4.
* 1972, 1971 † 1973, 1972 ‡ tel quel

International Society of Sugar Cane Technologists 15th Congress 1974

AFTER delegates to the 15th ISSCT Congress have registered on the 13th June 1974, at the Carlton Hotel, Johannesburg, they will leave the following evening by train for the Kruger National Park, one of the most famous game reserves in the world. Before entering the park, a visit will be made to the nearby Malelane factory and estates of Transvaalse Suiker Bpk., the most northerly of the South African sugar industry, where all cane is grown under irrigation. After sightseeing in the park, the home of more than 1000 lion, 1500 elephant and thousands of other wild animals including buffalo, wildebeest, zebra, giraffe, hippopotamus, baboon, leopard, cheetah, etc., delegates will rejoin the train and sleep aboard on the way to Pretoria, the legislative capital, where they will visit the headquarters of the Council for Scientific and Industrial Research.

After a short bus ride to Johannesburg, delegates will fly to Durban where a reception will be given in the evening at the Congress headquarters in the Elangeni Hotel, overlooking the Indian Ocean. After the official opening the following day the Congress proper will commence and field and factory delegates will alternate technical sessions in the hotel with tours. The traditional farewell banquet will take place on the 29th June. The cost of the package tour for the Congress, including meals apart from six evening meals, will be R.525 per person for single and R.475 for shared accommodation.

The post-Congress tour in Mauritius commences with transfer from airport to hotel on Sunday, 30th June and ends on the 4th July. Delegates will have an opportunity to visit fields and factories where they will see the paramount rôle that sugar has played in shaping the island's economy and the life of the Mauritian people. They will see the efforts being made for agricultural diversification, and, as in South Africa, a special programme has been arranged for the ladies. The cost of the post-Congress tour will be 740 rupees per person for single and 620 rupees for shared accommodation.

Bookings must be made not later than 31st December 1973, and registration forms should be obtained from and returned to the General Secretary-Treasurer, Mr. J. L. DU TOIT, with a deposit of R.100. For the post-Congress tour payment should be made to the nearest office of Thomas Cook & Son or their representative who will issue an exchange order on the Mauritius Travel and Tourist Bureau Ltd.; a deposit of 75 rupees per person is required when booking for this part of the 1974 activities of the Society.

Ghana sugar development[1].—A group of US and Japanese finance companies is to invest $30–$50 million in Ghana. According to an announcement by the President of one of the companies concerned, Durum Securities Corp. of New York, construction of a sugar factory in Ashanti, in Central Ghana, is involved.

Brevities

The late Dr. Hugo Ahlfeld.—We regret to report the death on the 12th July of Dr. HUGO AHLFELD, head of F. O. Licht K.G., the internationally renowned sugar information service. He was born in 1902 and studied economics, joining the Licht organization in 1927 and becoming its Managing Director in 1939. During World War II the premises and all the records of the firm were destroyed and the re-establishment of the firm was entirely due to his vigorous efforts, the success of which is evident in the high standing of F. O. Licht K.G. among sugar economists today.

* * *

New Brazilian sugar factory[2].—The local concern Agrovale is to instal, at a cost of 50 million cruzeiros, a sugar mill at Juazeiro, Bahia, with an initial production capacity of 48,000 metric tons.

* * *

New Indian sugar factory[3].—The Indian Prime Minister, Mrs. GANDHI, will inaugurate a new sugar factory at Kichha in Uttar Pradesh in October 1973.

* * *

Tongaat Group Ltd., 1972/73 Annual Report.—The expectations of a record sugar season were not realised, mainly owing to the poor spring and summer rainfall experienced on the Natal North Coast. The crop was significantly lower at 1,513,747 tons as against 1,745,132 tons in 1971/72, grown on almost the same area. The quality of the cane milled was higher, however, with 13·01 pol % cane (12·59 in 1971/72), and the outturn of 171,831 tons of sugar, compared with 191,282 tons in 1971/72 corresponds to a cane:sugar ratio of 8·81 for 1972/73 as against 9·12 in the previous season. Research is continuing on fertilizer application, scientific weed control, field layout, subsoil drainage and the production of seed cane by special nurseries. An area of 60 ha has been laid out and planted as a working experiment for complete mechanization of all cane growing and harvesting operations. A new Tongaat-designed shredder was put into operation on one tandem and performance exceeded expectations; a similar unit has been installed on the other tandem and has operated successfully from the start of the 1973/74 season.

* * *

Colonial Sugar Refining Co. Ltd. 1972/73 report.—The Company's Queensland mills produced 403,000 tons of sugar, about 10% less than the record 1971 output of 449,000 tons. Cane crops were lighter, mainly owing to cyclone damage before harvesting. In New South Wales cane crops were extensively impaired first by drought and later by flooding, so that production, at 97,000 tons, was 17% less than in 1971. Additional crushing capacity has been installed at some mills and a start made in applying computer technology to process control. Crop prospects for 1973 are good and on current estimates sugar production should almost reach the 1971 levels. In Fiji, South Pacific Sugar Mills made 300,000 tons from the 1972 crop which had been damaged by both drought and hurricane. The CSR shareholding passed to the Fiji Government on 1st April 1973. Sales of refined sugar were about 2·3% higher in Australia, at 663,000 tons, and 5% higher in New Zealand, at 161,000 tons. Research has continued in many fields including a new system of sugar mill effluent treatment at Victoria mill, and disposal of distillery waste by using it for irrigation at the Sarina distillery of the subsidiary Australian National Power Alcohol Co. Pty Ltd. It is proposed that the name of the company be changed to CSR Ltd.

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[1] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (15), 7.
[2] *Bolsa Review*, 1973, **7**, 292.
[3] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (21), 9.

Brevities

Brazil sugar industry rationalization[1].—While in former years mill tandems have comprised 4 to 6 units they are now increasing to 6–10 units. Rollers of 26 × 48 in and 30 × 54 in are no longer in demand and the current size used is 40 × 84 in. Smaller sugar factories with quotas of 200,000–250,000 bags (12,000–15,000 metric tons) are to be closed and their quotas transferred to other factories or to new factories in other States in which sugar cane cultivation is being expanded.

* * *

Sugar research expansion in Jamaica[2].—A research institute is to be set up by the Sugar Industry Authority to carry out research on cane farming as well as sugar manufacture. It will take over the assets of the Research Dept. of the Sugar Manufacturers' Association which, being financed solely by the Association, had confined its efforts to sugar production. A special cess is to be levied on sugar by the SIA and this will be used to finance the research.

* * *

Pakistan sugar shortage[3].—An acute sugar shortage developed in Pakistan during the last quarter of 1972 which resulted in prices more than doubling. To stop the price increase and to ensure equitable distribution of sugar, the Government prohibited trading of sugar in the open market; all sugar stocks in private hands were taken over by the Government and the sugar industry was instructed to sell its total production to Government-authorized dealers. A sugar rationing system was introduced for the entire country and sugar is now available from Government-controlled sales depots at a uniform price which is about 10% higher than the average price during the first half of 1972. Pakistan is going to be deficient in sugar production in the foreseeable future although efforts are under way to grow more sugar cane of higher quality as well as to expand the cane area. Until these goals are achieved, Pakistan will continue to import refined sugar in limited quantities.

* * *

Guyana sugar production 1972.—The Guyana Sugar Producers' Association has issued statistics relating to sugar production in the country's 11 estates last year. A total of 3,595,777 tons of cane were crushed as against 4,244,900 tons in 1971. The pol content was slightly higher at 10·67% against 10·53% but so was the fibre content at 16·16% against 15·85%. As a consequence the pol recovery was slightly lower and sugar produced totalled 314,600 tons of 97·96 average pol, compared with 368,843 tons of 98·02 average pol in 1971. The yield of 96° sugar per acre, at 2·47 tons, is the lowest of the last twelve years and compares with 2·80 tons in 1971 and the highest figure of 3·35 in 1963.

* * *

Mauritius sugar industry development.—A study report "The Rôle of the Sugar Industry in the Development of Mauritius" has been unanimously adopted by the sugar industry[4]. Experts have concluded that the following targets should be reached by 1980: (*a*) the creation of approximately 15,000 jobs, (*b*) annual sugar production of over 800,000 tons reached during the next decade, and (*c*) a return of at least 11% on investment. According to the report, these targets can be attained if additional investment is made in agriculture, tourism and industry, if extraction of sugar per arpent is increased and if steps are taken to reduce costs and thus increase profitability.

* * *

New US sugar refinery[5].—The President of Tootsie Roll Industries Inc., of Chicago, Ill., announced in March that the company was to install a sugar refinery to serve its confectionery plants. Some $500,000 will be invested and refinery capacity will total 1800 tons per week. The object will be to improve quality control while reducing costs. The new refinery will involve all stages from reception of raw sugar to storage of the liquid sugar to be used for confectionery manufacture.

The late Frank M. Chapman

We regret to report the death on 2nd August of FRANK CHAPMAN, whose life was devoted to the sugar industry. His introduction to sugar was with John Walker & Co. Ltd. in Greenock where he worked, at the same time studying at the Royal Technical College in Glasgow. After graduating in sugar technology he spent two years in a white sugar factory in Brazil and then went to Australia where he spent four years with the Colonial Sugar Refining Co. Ltd.

In 1930 he went to North America and spent the year between the Spreckels Sugar Refinery in Yonkers, N.Y., USA and the Atlantic Sugar Refinery in St. John, New Brunswick, Canada. The next year he joined the Lincolnshire Sugar Co. in England and in 1933 joined Tate & Lyle Ltd. at Plaistow Wharf refinery. There he stayed until his retirement in 1967. From 1948, however, by agreement he spent several months a year as General Consultant to Savannah Sugar Refining Corporation in Savannah, Ga., USA, as well as to Sucrest Corporation from 1957.

Subsequent to his retirement from Tate & Lyle, Mr. Chapman acted as a consultant to a number of other companies, operating from his home in Vancouver, and was in harness right up to the time of his death. He had a tremendous wealth of knowledge of beet and cane sugar technology as well as being one of the foremost experts in sugar refining. During his career he made friends all over the world who will be saddened at his death. We too mourn him and remember with gratitude the years he spent on our Panel of Referees.

Turkey sugar exports, 1972[6].—Exports of sugar by Turkey rose from 29,293 metric tons, raw value, in 1971 to 122,134 tons in 1972. The principal destinations were Iraq with 54,347 tons (10,870 tons in 1971), the UK with 34,239 tons (16,402 in 1971), Iran with 10,869 tons (nil), France with 10,326 tons (nil) and Switzerland with 10,326 tons (nil). Italy received 1375 tons (nil) and the remaining 652 tons went to Cyprus (1304 tons in 1971). Malta received 717 tons in 1971, but none in 1972.

* * *

Jamaican sugar factory closure[7].—Serge Island sugar factory in Jamaica, which has been under the threat of closure for nearly four years, is definitely to close at the end of the 1974 crop, according to reports in the Jamaica *Gleaner*. The report suggests that the factory, recently the subject of a Government rescue programme and currently being run by a cane farmers' consortium, is to close because of erratic receipt and the low quantity of cane.

* * *

New Bolivian sugar factory[8].—Cía. Azucarera Boliviana is to build a sugar factory in the Alto Beni, with a processing capacity of 4,000 tons of sugar cane per day. A Swiss group is to grant a DM 50,000,000 loan for the project and the machinery is to be provided by Maschinenfabrik Buckau R. Wolf AG. of West Germany.

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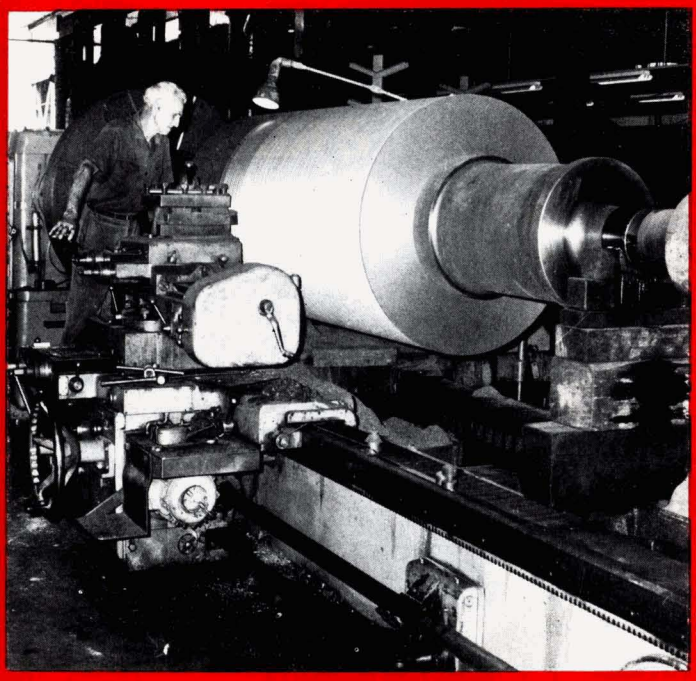
[1] *Zeitsch. Zuckerind.*, 1973, **98**, 296.
[2] *Daily Gleaner*, 19th February 1973; through *The Cane Farmer* (Trinidad), 1973, **14**, 65.
[3] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (19), 8.
[4] *Barclays Int. Review*, May 1973, 14.
[5] *Sucr. Belge*, 1973, **92**, 215.
[6] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (15), viii–ix.
[7] *W. Indies Chron.*, 1973, **88**, 239.
[8] *Bolsa Review*, 1973, **7**, 287.



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