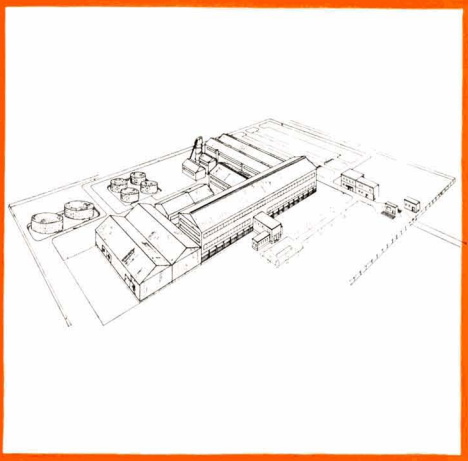
THE International Sugar Journal

DECEMBER 1969



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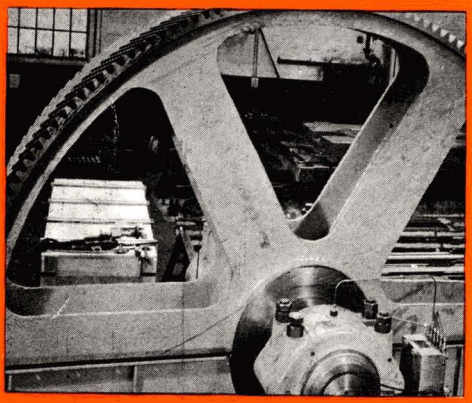

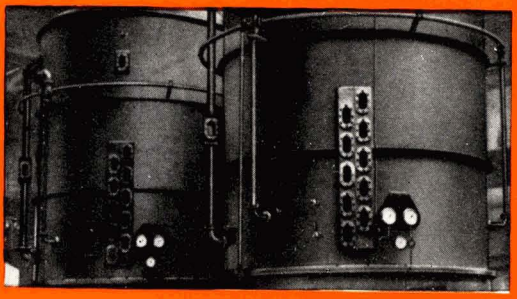

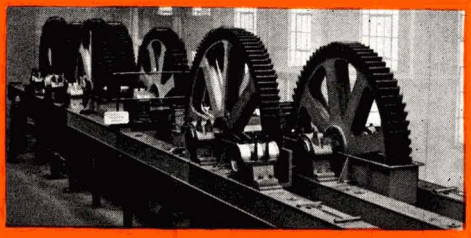

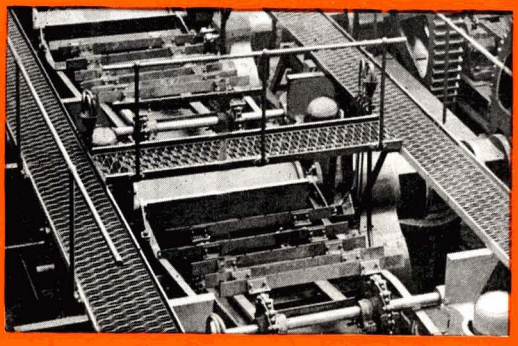

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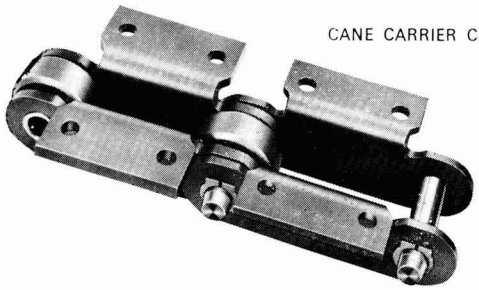
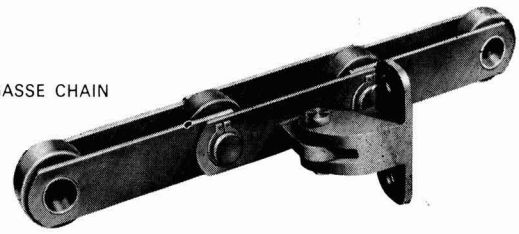
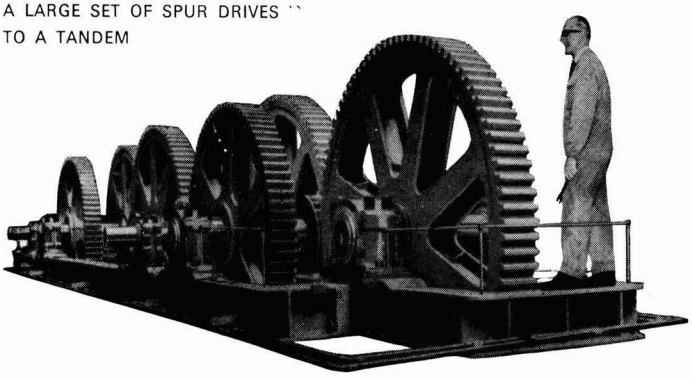


BAGASSE CHAIN



A LARGE SET OF SPUR DRIVES TO A TANDEM



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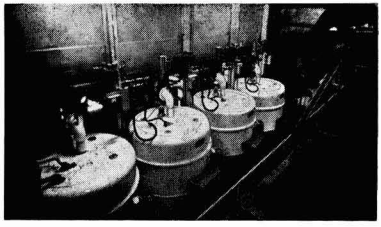

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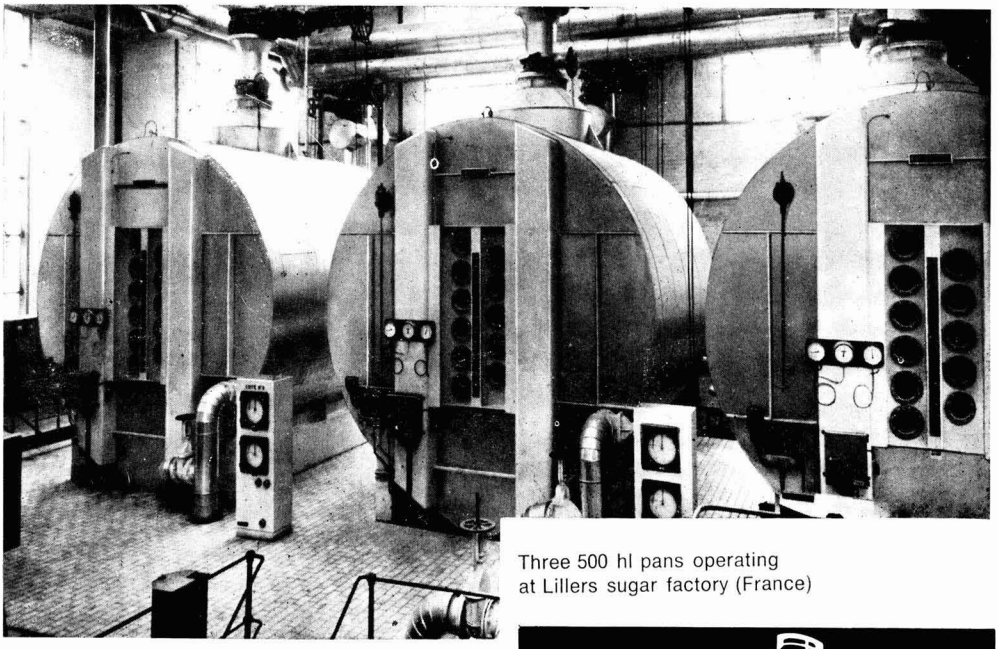
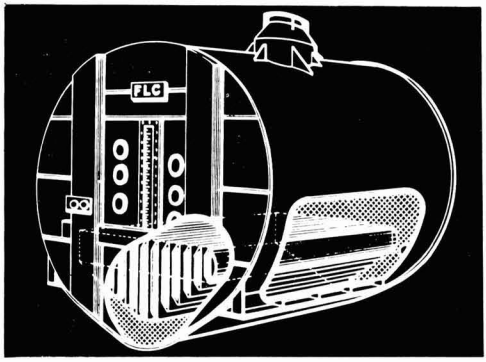
'Flora von Thüringen' Vol. 12, J. C. Zenker, Jena, 1855



Three 500 hl pans operating
at Lillers sugar factory (France)



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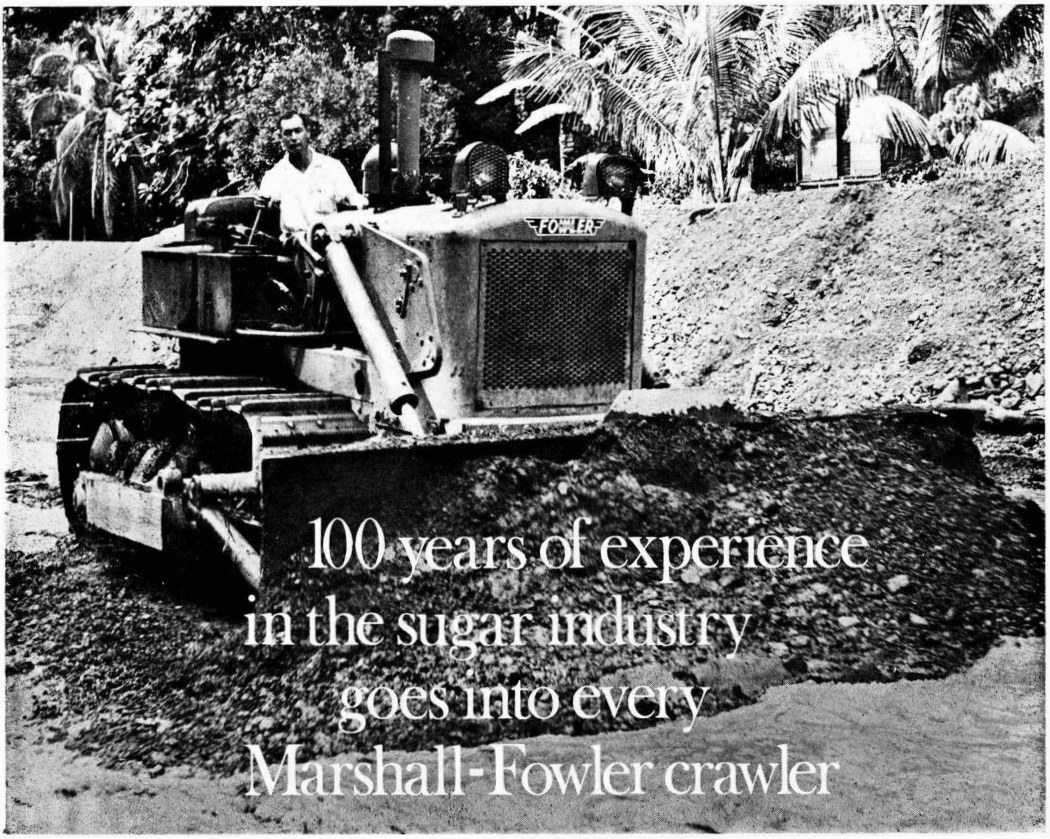

A Challenger 33 with hydraulic angledozer working on flood control on the perimeter of a sugar plantation

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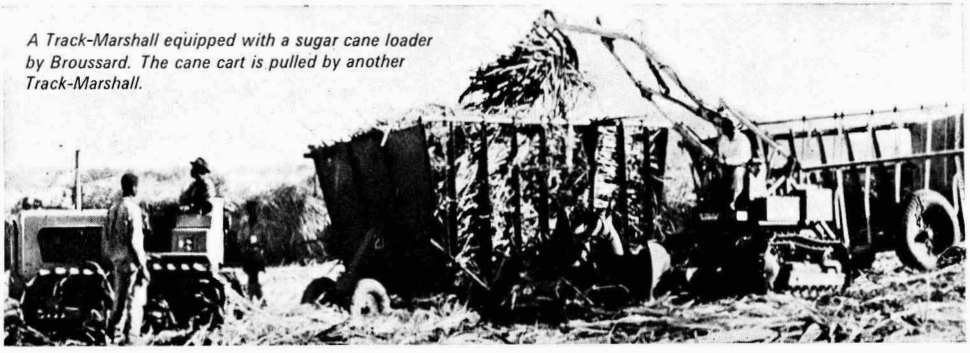

A Track-Marshall equipped with a sugar cane loader by Broussard. The cane cart is pulled by another Track-Marshall.

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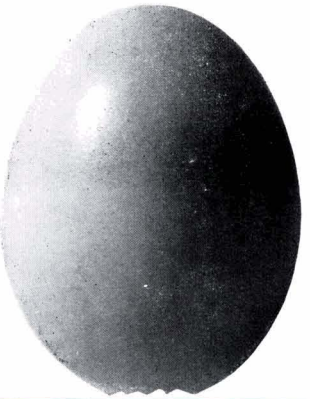

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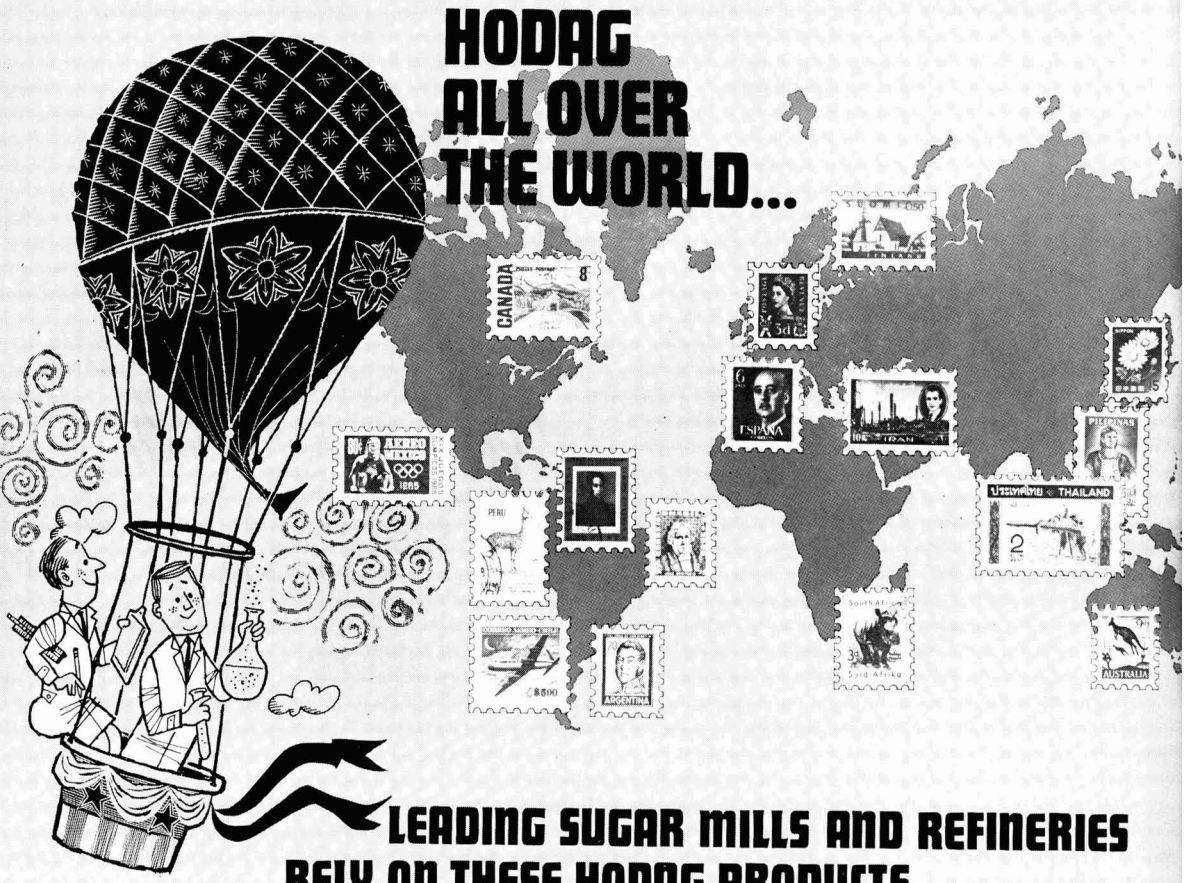

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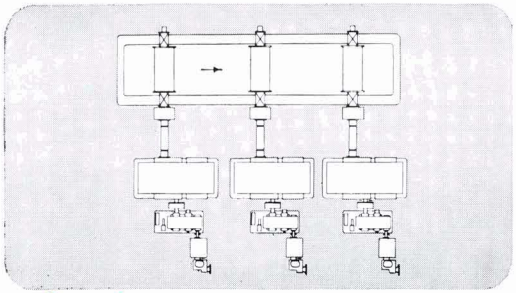
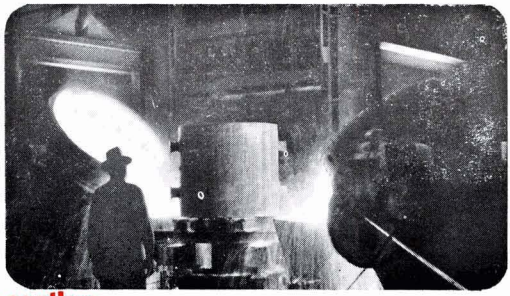


engineering



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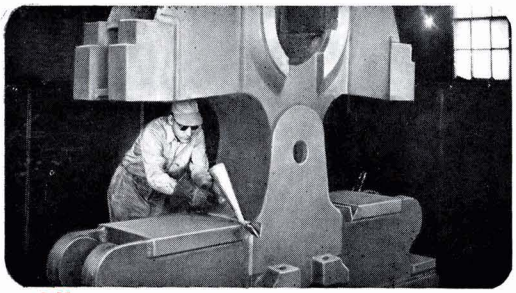

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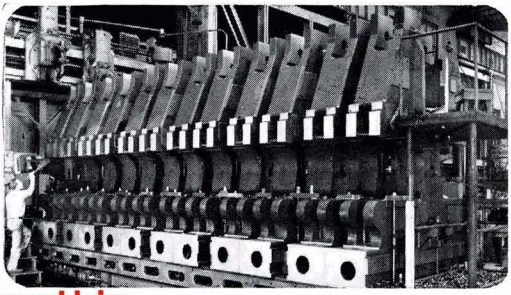

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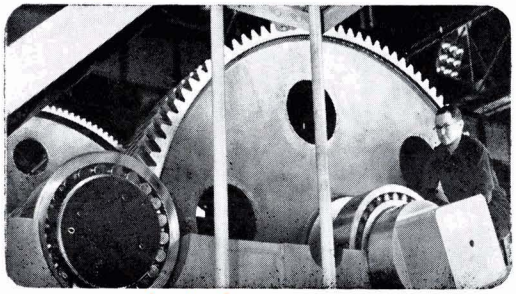

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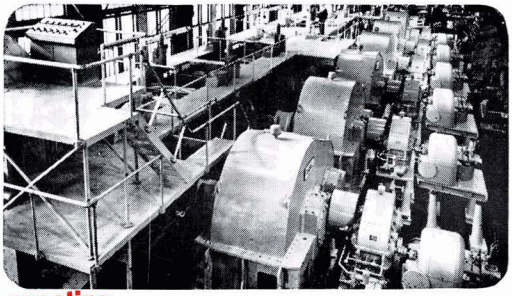

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Remplacement de moulins à canne par des presses à hélice dans l'industrie du sucre de cannes. S. G. SMART. *p.* 355–359

On présente quelques calculs théoriques pour indiquer le degré d'extraction du sucre de canne d'une composition donnée qu'on pourrait attendre en employant des presses à hélice pour réduire l'humidité de la bagasse à 44%, que l'auteur prends pour la valeur constamment obtenue dans la pratique. Quelques calculs pour différents systèmes et quantités variées d'eau de macération avec des trains de 3 et 4 presses montrent la plus grande extraction qu'on peut obtenir que dans la cas de moulins à canne. L'auteur discute des autres avantages de l'opération de presses à hélice.

* * *

Le destin de quelques des aminoacides principaux du jus de canne pendant la formation de la mélasse. III. La distribution des résidus des aminoacides dans des polymères brunissants de modèle mélasse à canne finale avec l'emploi d'aminoacides contenant charbone-15 et tritium comme indiquateurs. W. W. BINKLEY. p. 359–361

Dans des essais de laboratoire on a trouvé que l'asparagine était le principal aminoacide de jus de canne participant dans la formation de polymères "brunissants" dans la mélasse finale. On a trouvé que les plus importants résidus d'aminoacides après l'asparagine étaient: l'acide γ-aminobutyrique, la proline, l'acide aspartique, l'acide glutamique, l'alanine et la valine.

* * *

Recherches sur la canne à sucre dans l'Afrique du Sud. *p.* 362–364

On présente une sommaire du rapport annuel (1967–68) de la Station d'Essais de la South African Sugar Association. La sommaire traite de variétés, sélection, physiologie, agronomie, et fertilisation de la canne, le compactage du sol, l'irrigation, la génie agricole, et les maladies et insectes nuisible.

Die Ersetzung von Rohrmühlen mit Schraubpressen in der Rohrzuckerindustrie. S. G. SMART. *S.* 355–359

Man gibt einige theoretische Berechnungen, um das Zuckerextraktionsgrad zu zeigen, das man durch die Anwendung von Schraubpressen erwarten kann. Der Verfasser setzt eine Verminderung der Bagasse-Feuchtigkeit auf 44% voraus, d.h. eine in Praxis stetig erhaltene Wert. Mittels Berechnungen für verschiedene Systemen und Mengen von Mazerationswasser mit Anlagen von 3 und 4 Pressen zeigt der Verfasser die grössere Extraktion im Vergleich mit üblichen Rohrmühlen. Andere Vorteile von Schraubpressen werden diskutiert.

* * *

Das Schicksal von einigen der Hauptaminosäuren in Rohrsaft während der Melassebildung. III. Die Verteilung von Aminosäurerückstände in brünierenden Polymeren von Modellrohrendmelasse mit Anwendung von mit Carbon-14 und Tritium bezeichneten Aminosäuren. W. W. BINKLEY. *S.* 359–361

In Laborversuchen hat man gefunden, dass Asparagin die Hauptaminosäure in Rohrsaft war, die in der Bildung von "brünierenden" Polymeren in Endmelasse sich beteiligt. Nach Asparagin waren die Hauptaminosäurerückstände in den Polymeren wie folgt: γ-Buttersäure, Prolin, Asparaginsäure, Glutaminsäure, Alanin und Valin.

* * *

Zuckerrohr-Forschungsarbeit in Südafrika. *S.* 362–364

Man gibt eine Zusammenfassung des Jahresberichts (1967–68) der Versuchs-Station der South African Sugar Association. Sie betrachtet Rohrsorten, -Züchtung, -Physiologie, -Agronomie, -Düngung, die Erdkompaktion, Bewässerung, das landwirtschaftliches Ingenieurwesen, und Rohrkrankheiten und -Schädlinge.

Sustituto de molinos por prensas de tornillo en la industria de azúcar de caña. S. G. SMART. *Pág.* 355–359

Cálculos teóricos se presentan, para indicar el grado de extracción de azúcar, de caña de una dada composición, que puede anticiparse por uso de prensas de tornillo para reducir la humedad de la bagaza a 44 por ciento, que se toma como un nivel obtenido consistentemente en el práctico. Cálculos para varias sistemas y cantidades de agua de imbibición, con tandemes de tres y de cuatro prensas, demuestran que puede obtenirse un extracción superior a ellos con molinos convencionales. Otras ventajas de operación con prensas de tornillo se discuten.

* * *

El destino de algunos de los principales amino-ácidos del jugo de caña durante formación de melaza. Parte III. Distribución de residuos de amino-ácidos en modelos polímeres apardantes de melaza final de caña, utilizando amino-ácidos rotulado con carbón-14 y tritio. W. W. BINKLEY. *Pág.* 359–361

En ensayos de laboratorio, se halló que aspáragina es el principal amino-ácido en jugo de caña participando en la formación de polímeres apardantes de melaza final. Los mayores residuos de amino-ácidos en los polímeres, detrás de aspáragina, son ácido γ-aminobutírico, prolina, ácido aspártico, ácido glutámico, álanina y válina.

* * *

Experimentos sobre caña de azúcar en Sud-Africa. *Pág.* 362–364

Se presenta una condensación de la memoria anual (1967–68) de la Estación Experimental de la South African Sugar Association. Trata de variedades de caña, crianza, fisiología, agronomía, nutrición, consolidación del suelo, regadío, ingeniería agrícola, enfermidades y plagas.

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Notes & Comments

Problems for the International Sugar Council.

The Statistical Committee of the International Sugar Council met on the 7th November to prepare for a full Session of the Council during the 17th–24th of the month, and C. Czarnikow Ltd.[1] took the opportunity to review the tasks facing the Council.

"As this is the first year of the life of the present Agreement it has been necessary to spend a great deal of time formulating the rules for its orderly functioning, and many of these have been accepted. Work has recently been undertaken on the rules referring to the Supply Commitment under Article 30 of the Agreement and new recommendations will have to be considered by both the Supply Committee and the Executive Committee before they can be adopted by the Council. This Article deals with the various assurances of exporting member countries to make sugar available to importing member countries in the event of the world market price rising to high levels. It is to be hoped that these rules, which are the last important group to be considered, will be accepted, but they are immensely complicated and there may be one or two sections which will have to be set aside for further consideration.

"No doubt the 1969 statistical position will also be reviewed once again, but so far as the market is concerned the most important step which must be taken by the Council is the review of the supply and demand situation for 1970 and the consequent decision on initial quotas. The task of the Council will be particularly difficult on this occasion in view of the considerable doubts regarding Cuba's likely production in the 1969/70 crop. There are few market observers who believe that Cuba's avowed intention of producing 10 million tons will be realized in this present season but a very large output will presumably lead to substantial shipments to eastern European countries which may in turn encourage substantial exports of white sugar. If this should eventuate the Council may be hard pressed to hold prices above the minimum level mentioned in the Agreement. On the other hand, should the Cuban crop be about 7·0 million tons it seems likely that price movements can be kept within bounds by the quota mechanism.

"One further task of the Council at this meeting will be to decide upon the Soviet Union's export entitlement during 1970. It will be recalled that the quantity she may export to the world market under the Agreement has been set this year at 1·1 million tons while next year's figure will be within the range 1·1 to 1·25 million tons. It is to be hoped that the quantity which will be decided upon will be nearer to the lower than to the higher figure both from the point of view of the overall statistical balance and in view of the abundance of white sugar recently available and likely to be forthcoming in the new year.

"When the International Sugar Agreement came into operation many of the major exporters had already committed substantial proportions of their export quotas for forward shipment. Accordingly the tonnage over which the Council had control was of quite small proportions while there were only limited outlets for which sugar was not already committed. Now, with the Agreement in operation and a better statistical situation prevailing, sales of sugar for shipment in far forward positions are smaller, which leaves a far greater supply under the control of the Council."

* * *

Cyclamate bans.

On the 18th October the US Secretary of Health, Education and Welfare announced that the artificial sweeteners known as cyclamates were to be withdrawn from general use by early next year. The cyclamates were to be removed immediately from the GRAS ("generally recognized as safe") list of substances for use in food and to be transferred to drug status permitting their use only under medical supervision.

This action followed confirmed reports that malignant bladder tumours were found in rats fed strong dose levels of cyclamates for long periods. These dose levels were some 50 times the maximum amount previously proposed for adult human ingestion. The work was quite separate from other experiments that had indicated that cyclohexylamine, a product of the metabolism of the cyclamates, could,

[1] *Sugar Review*, 1969, (943), 191.

in large doses, cause chromosome damage with resulting death and deformity of chick embryos.

Following the US Government's action, similar bans either by Government or by voluntary action were imposed in many countries all over the world. In announcing the UK Government's decision to ban cyclamates in food and drink, the Minister of Agriculture, Fisheries and Food referred to the fact that the cyclamates had been tested for many years and had been kept under continuous review since first permitted in food in 1965. There was no evidence that cyclamates have caused cancer in humans, as emphasized by the US authorities; nevertheless, in view of the new evidence there could not be certainty about the safety of cyclamates without further investigations and thus, in the meantime, a halt should be called to the addition of cyclamates to food and drink as a matter of prudence.

The obvious reaction of the sugar markets was to examine the likely increased outlets for sugar—but these are hard to judge. In the two largest consumer countries—the US and Japan—cyclamate usage amounted to 7700 and 7550 tons/year while Britain consumed only 400 tons. The sweetening power of cyclamate is about 30 times that of sugar so it could be argued that some 470,000 tons of sugar would be needed to replace the cyclamates in the first two countries. However, most cyclamate usage in the US is in the form of non-caloric soft drinks and it had been found that these had found a market of new consumers instead of being a market of former consumers of sugar-containing drinks. It was therefore likely that many of these new consumers would not switch to sugar-containing drinks although some might do so.

Thus it has been estimated that the best the world sugar market can hope for is an increase of about 100,000 tons in sugar demand which, although it is only a tiny part of the 70,000,000 tons of annual consumption, provided optimistic sentiment in the sugar industry and contributed to the rise in the world price on the New York and London Markets.

* * *

US sugar crops forecast[1].

The Crop Reporting Board of the US Dept. of Agriculture has estimated sugar beet production for 1969 at 27,678,000 tons against 25,392,000 tons of beets produced in the 1968 crop, representing an increase of 9%, and 44% higher than the 1967 crop. In previous years the difference between the 1st September estimate and the final figure has ranged from zero to 1·5 million tons, averaging 700,000 tons.

Expectations for the 1969 cane crop are for a total of 23,100,000 tons of cane as against 24,825,000 tons last year, a decrease of 1,725,000 tons, equivalent to 6·9%. The indicated average yield per acre of 43·4 tons is above the 41·0 tons per acre in 1968 and the 1967 average yield of 42·5 tons.

UK sugar surcharge reductions.

In view of the rise in the world price of raw sugar, the Minister of Agriculture, Fisheries and Food made orders under the Sugar Act, 1956, reducing the surcharge from 2¾d per lb (25s 8d per cwt) to 2½d per lb (23s 4d per cwt) from the 23rd October and then to 2¼d per lb (21s 0d per cwt) from the 31st October. These were the 14th and 15th changes in the rate of surcharge in the past 12 months and reflect the greater flexibility of the Board and frequency of changes so as to avoid the building-up of large surpluses or deficits in its accounts.

* * *

World sugar balance.

F.O. Licht K.G. have recently published their fourth estimate of the world sugar balance for 1968/69,[2] this time with the modification that figures are taken on a strict September/August basis, whereas before they were adjusted to include campaigns and crop years rather than splitting campaign figures. A result of this new method is that although increases and decreases are relatively unchanged, the stock figure at the end of August is higher than set on the former basis. Even so, the reduction from 1967/68 to 1968/69 is greater than calculated at the time of the third estimate[3], and the August 1969 stock is barely more than the normal level of three months' consumption (or even less than three months' if it is consumption in 1969/70 which is considered the basis for calculation of the stocks percentage).

	1968/69	1967/68	1966/67
	(*metric tons, raw value*)		
Initial stocks, 1st Sept.	19,145,851	19,048,278	19,179,850
Production	68,742,973	67,889,497	65,616,562
Imports	22,224,099	22,200,383	21,398,183
	110,112,923	109,138,158	106,194,595
Exports	22,323,677	22,127,984	21,513,797
Consumption	70,001,942	67,864,323	65,632,520
Final stocks, 31st Aug.	17,787,304	19,145,851	19,048,278
Production increase..	853,476 (1·26%)	2,272,935 (3·46%)	2,514,893 (3·99%)
Consumption increase	2,137,619 (3·15%)	2,231,803 (3·40%)	2,885,828 (4·60%)
Final stocks % consumption	25·40	28·21	29·02

* * *

Our Frontispiece.

This year our frontispiece shows the construction of a cane diffuser designed by Extraction De Smet S.A. and built at the Derby works of Fletcher and Stewart Ltd. for the H.V.A. sugar factory at Metahara in Ethiopia.

[1] *Lamborn*, 1969, **47**, 145, 151.
[2] *International Sugar Rpt.*, 1969, **101**, (25), 1.
[3] *I.S.J.*, 1969, **71**, 290.

Replacement of mills by screw presses in the cane sugar industry

By S. GORDON SMART, A.R.C.S.T., A.R.I.C.

IN a paper presented by B. STARRETT of the French Oil Mill Machinery Company before the Hawaiian Sugar Technologists' meeting in Honolulu on the 15th November 1966[1], mention was made that, at the factory where a press was being tested, "for the final 16 hours of operation, the pressure was removed completely from the top roll of the fourth mill and the press juice return was diverted to the bagasse discharging from No. 2 mill so that, for all practical purposes, the fourth mill was completely ineffective. No juice whatsoever was expressed by the fourth mill . . . the average results obtained with three mills and the French press system are indeed interesting and it is anticipated that considerable development will be directed toward the prospect of doing more of the work with screw presses and less with the mills in the very near future".

The results given over the final three days of crop operation were as shown in Table I.

A previous paper[2], published in 1959, showed that the screw press had some possibilities in the further extraction of sugar from the final bagasse of a 7-mill tandem. It was found that the purity of the press juice was of a similar order to that obtained from the seventh mill while the pol content of the bagasse was reduced. The experiments were carried out merely to ascertain whether the press was a suitable piece of equipment for this type of operation but the results obtained were encouraging and shifted the emphasis of using the press from lowering the bagasse moisture content to extraction of sugar, with the possibility in mind of eventually a complete substitution of the mills.

Unhappily, up to the time of writing, no plant using screw presses alone is in operation, although more and more factories are adding a press to their existing tandems, with beneficial results. Consequently it is not possible to make a direct comparison of the working of a press tandem with that of a milling tandem, and theoretical comparisons based on a standard cane composition cannot be calculated because of the reabsorption experienced with mills but not apparent with the press. Nevertheless, data from those sugar factories with presses indicate consistently that, in practice, whatever the moisture content of the feed to the press, the moisture content of the discharged bagasse is always the same.

Table I

	JUICES						*BAGASSE*			
	1st mill		*4th mill*		*Press*		*4th mill*		*Press*	
	Pol	*Purity*	*Pol*	*Purity*	*Pol*	*Purity*	*Pol*	*Moisture %*	*Pol*	*Moisture %*
31st October	11·48	80·8	3·01	66·7	1·70	59·8	2·41	46·6	1·44	43·4
1st November	11·14	83·6	2·48	71·1	1·44	66·1	1·90	47·0	0·97	44·3
2nd November	—	—	3·28	70·7	1·86	67·8	2·29	48·8	1·18	44·4

During the last sixteen hours operation, with the fourth mill completely ineffective, the average results given were as shown in Table II.

Table II

JUICES				*BAGASSE*			
3rd mill		*Press*		*3rd mill*		*Press*	
Pol	*Purity*	*Pol*	*Purity*	*Pol*	*Moisture %*	*Pol*	*Moisture %*
3·73	73·7	2·09	71·5	2·51	48·9	1·33	44·6

During these 16 hours the cane was effectively handled in a tandem comprising three mills and a press, while previously the tandem comprised four mills and a press. By examination of the work of the fourth mill in the latter case and of the press during the 16 hours, it is possible to obtain an indication of their relative performance. Thus, while the purities of the juices obtained were similar (66·7–71·1 *vs.* 71·5), the pol in the 4th mill bagasse was considerably higher than that of the press (1·90–2·41 *vs.* 1·33) as was the moisture level (46·6–48·8 *vs.* 44·6). The press therefore appears to have reduced the bagasse pol by approximately 40% while also reducing the moisture content. During the trials the press, a French Model J-88, was handling bagasse from some 80 t.c.h. of approximately 14% fibre. The power required was 400 hp or 5 hp per t.c.h., corresponding to 34 hp per ton of bone-dry fibre per hour. It was ascertained that the three mills plus press tandem attained an extraction of 96% compared with 92% for a four-mill tandem.

Utilizing a moisture figure of 44% which has been attained in practice, it is possible to calculate the progressive and overall extractions, juice Brix from each unit and the final mixed juice Brix under different maceration conditions using a standard cane composition. It is the object of this paper, by means of such calculations, to demonstrate the writer's opinion that this possible alternative extraction method using presses will give results superior to those obtained using mills, and to bring it to the attention of the cane sugar industry in order to stimulate the practical trial of a tandem of presses. It is suggested that the

[1] *I.S.J.*, 1968, **70**, 245.
[2] SMART and CARR-BROWN: *I.S.J.*, 1959, **61**, 205–206.

calculated figures be examined and compared with existing milling data to see the potential benefits which might be obtained.

Calculations

For the purposes of these calculations it is assumed that the cane is composed of 15% fibre and 17% soluble solids with 68% of water. An adequate preparation for the cane is assumed and a system of operation such as is indicated in Fig. 1, where prepared cane is delivered from a buffer screw feeder to the first press, squeezed to give a first press juice and a bagasse which is mixed thoroughly with maceration water in a screw conveyor-mixer which delivers the wetted bagasse to the second press. This is repeated a number of times and the bagasse leaving the final press goes to the store while the mixed juice is screened before being sent to process. Fig. 1 shows one alternative method of operation, with last press juice returned to the first press feed and maceration water added to the bagasse from the first, second and third presses.

For the first calculation, however, it is supposed that for 100 tons of cane passing through the tandem, 40 tons of maceration water in 10-ton amounts, is added to the prepared cane, first press bagasse, second press bagasse and third press bagasse.

Under these conditions, for every 100 tons of cane, the composition of the feed to the first press will be

Fibre	15·0 tons
Soluble solids*	17·0 tons
Water	78·0 tons
	110·0 tons

* hereafter referred to as "solids" for simplicity

If we let X = the water content % pressed bagasse, and Y_1 = the weight of water extracted, then the water remaining in the bagasse is $(78 - Y_1)$ tons and, assuming perfect mixing, with 78 tons of water is associated 17 tons soluble solids and with Y_1 tons of water $17Y_1/78$ tons of solids which is the amount extracted in the expressed juice. Hence the solids remaining in the bagasse $= (17 - 17Y_1/78)$ tons. Thus after the pressing we have, per 100 tons of cane :

Water remaining	$78 - Y_1$ tons
Fibre	15 tons
Solids	$17 - 17Y_1/78$ tons

giving a total bagasse weight of $110 - Y_1 - 17Y_1/78$

$$= \frac{(110 \times 78 - 95Y_1)}{78}$$

Therefore the water content $X\% =$

$$(78 - Y_1) \times \frac{78}{(110 \times 78 - 95Y_1)}$$

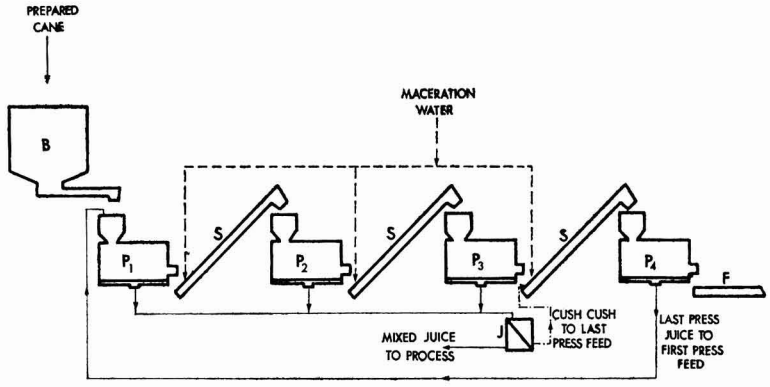

Fig. 1. B = Buffer feed screw, P_1, P_2, P_3, P_4 = presses, S = screw conveyor-mixers, J = juice screen, and F = final bagasse conveyor.

Table III

Number of presses	*Maceration employed*	*Extraction* %	*Mixed juice Brix*
4	40% (10% + 10% + 10% + 10%)	97·12	14·70
3	45% (15% + 15% + 15%)	96·73	14·02
3	40% (20% + 10% + 10%)	95·42	14·51
3	40% (0% + 20% + 20%)	97·04	14·69
4	50% (0% + 20% + 20% + 10%)	98·37	13·63
4	50% (0% + 20% + 20% + 10%) with return of last press juice to first press feed	98·82	13·67

But we are assuming that this figure is the 44% repeatedly obtained in practice so that

$$\frac{78\,(78 - Y_1)}{(110 \times 78 - 95Y_1)} = 0{\cdot}44$$

from which

$Y_1 = 63{\cdot}78$ tons,
Solids extracted = 13·90 tons,
Brix of extracted juice = 17·89
and extraction = 81·76%.

The first bagasse composition is therefore:

Fibre	15·00 tons
Solids	17·00 — 13·90 = 3·10 tons
Water	78·00 — 63·78 = 14·22 tons

giving a total weight of 32·32 tons/100 tons cane.

To this is added 10 tons of maceration water, bringing the water content to 24·22 tons and the total weight to 42·32 tons. This is intimately mixed in the screw conveyor-mixer to the second press and then squeezed to reduce the moisture content to 44%. By a similar calculation for the value of Y_2,

$$\frac{24{\cdot}22\,(24{\cdot}22 - Y_2)}{(42{\cdot}32 \times 24{\cdot}22 - 27{\cdot}32Y_2)} = 0{\cdot}44$$

and hence $Y_2 = 11{\cdot}12$ tons

Solids extracted = 1·42 tons
Brix of extracted juice = 11·35
and extraction = 8·37%.

The composition of the second bagasse is:

Fibre	15·00 tons
Solids	3·10 — 1·42 = 1·68 tons
Water	24·22 — 11·12 = 13·10 tons

giving a total weight of 29·78 tons. To this is added 10 tons of water and, after intimate mixing, the bagasse is pressed to 44% water content in the third press. By a similar calculation to the first,

$$\frac{23{\cdot}10\,(23{\cdot}10 - Y_3)}{(39{\cdot}78 \times 23{\cdot}10 - 24{\cdot}78Y_3)} = 0{\cdot}44$$

from which $Y_3 = 10{\cdot}61$ tons

Solids extracted = 0·77 tons
Brix of extracted juice = 6·78
and extraction = 4·53%.

The composition of the third bagasse is:

Fibre	15·00 tons
Solids	0·91 tons
Water	12·49 tons

giving a total of 28·40 tons to which is added 10 tons of water, the bagasse mixed and then pressed to 44% moisture. By a similar calculation to those above,

$Y_4 = 10{\cdot}33$ tons
Solids extracted = 0·42 tons
Brix of extracted juice = 3·88
and extraction = 2·46%.

This leaves a final bagasse composition of

Fibre	15·00 tons	54·22%
Solids	0·49 tons	1·78%
Water	12·17 tons	44·00%

The progressive extractions (81·76% + 8·37% + 4·53% + 2·46%) give a total extraction of 97·12% and the cumulative solids extracted divided by the cumulative weight of juice give a mixed juice Brix of 14·7.

A similar series of calculations can be made on the basis of only three presses but compensating by the use of 15% maceration water at each, i.e. a total of 45% instead of 4 × 10% = 40%. Using a basis of cane of the same composition as before, results are obtained as indicated below.

	Y	*Solids extracted*	*Juice Brix*	*Extraction*
1st press	68·95 tons	14·12 tons	17·00	83·08%
2nd press	18·27 tons	1·61 tons	9·02	9·47%
3rd press	15·56 tons	0·71 tons	4·37	4·18%
Cumulative	102·78 tons	16·44 tons		96·73%

The mixed juice Brix obtained is 14·02 while the final bagasse is composed of

Fibre	15·00 tons	54·00%
Solids	0·56 tons	2·01%
Water	12·22 tons	43·99%

A third series of calculations has been made to determine whether comparable results could be obtained using less maceration water, with 20% added to the prepared cane and 10% each to first and second bagasse, i.e. a total of 40% instead of 45%. The results were as follows:

	Y	*Solids extracted*	*Juice Brix*	*Extraction*
1st press	74·11 tons	14·32 tons	16·19	84·24%
2nd press	10·96 tons	1·23 tons	10·08	7·24%
3rd press	10·53 tons	0·67 tons	5·95	3·94%
Cumulative	95·60 tons	16·22 tons		95·42%

The final bagasse composition is:

Fibre	15·00 tons	53·23%
Solids	0·78 tons	2·77%
Water	12·40 tons	44·00%

While the extraction figure falls from 96·73 to 95·42% as a result of the smaller amount of water, the mixed juice Brix increases slightly to 14·51.

Next was considered the pressing of prepared cane without added water, followed by the addition of 20% maceration to 1st and 2nd bagasse in a three-press tandem. The results were calculated as follows:

	Y	*Solids extracted*	*Juice Brix*	*Extraction*
1st press	53·33 tons	13·33 tons	20·00	78·43%
2nd press	21·82 tons	2·31 tons	9·57	13·58%
3rd press	20·67 tons	0·86 tons	3·98	5·03%
Cumulative	95·82 tons	16·50 tons		97·04%

The composition of final bagasse is, per 100 tons cane:

Fibre	15·00 tons	54·19%
Solids	0·50 tons	1·81%
Water	12·18 tons	44·00%

and it appears that with maceration held at 40% on cane the extraction may be increased to 97% with an increase in the mixed juice Brix which becomes 14·69%.

The effect of treating this final bagasse with a further 10 tons of water per 100 tons of cane, making a total of 50% maceration, was then calculated. After a fourth pressing, the following results were calculated.

	Y	*Solids extracted*	*Juice Brix*	*Extraction*
4th press	10·18 tons	0·23 tons	2·20	1·33%

This raises the overall extraction to 98·4% and lowers mixed juice Brix to 13·63, while the final bagasse composition becomes:

Fibre	15·00 tons	55·01%
Solids	0·27 tons	0·99%
Water	12·00 tons	44·00%

so that the soluble solids content of the bagasse is almost halved.

It has been established in practice at one factory that a reduction in the sucrose content of bagasse from 3·89 to 2·59% (about one-third) resulted in a saving such that the entire cost of the press added to the existing tandem was fully met in the one crop. In addition, other savings resulted from the reduction in bagasse moisture which increased its calorific value and permitted a saving in supplementary fuel oil. It is reasonable, therefore, to suppose that a reduction in bagasse soluble solids content of about a half could also be profitable to the factory provided that the press juice purity was reasonably high. The reduction in Brix from the 20° of the absolute juice to 13·6° in the mixed juice is not unreasonable and is in line with present milling practice acceptable to the factory.

However, the Brix of the last press juice in this case is only 2·2 and it might be better, therefore, to employ it to aid extraction of sugar from earlier in the tandem rather than for dilution of the mixed juice. Accordingly, calculations were made for an extraction system as shown in Fig. 1, where the last press juice is added to the fresh prepared cane and the mixed juice is that from the first three presses. The last press juice, as calculated above, comprises 10·23 tons of water and 0·23 tons of soluble solids per 100 tons of cane, and its addition to the cane produces a progressive dilution of the juices extracted through the tandem, including the last press. It would thus be more accurate to repeat the calculation with return of the more dilute last press juice but, in fact, the difference in the concentration of the last juice is so small that it makes no practical difference to the figures calculated without correction.

	Y	*Solids extracted*	*Juice Brix*	*Extraction*
1st press	63·93 tons	14·09 tons	18·06	82·88%
2nd press	21·55 tons	1·98 tons	8·41	11·65%
3rd press	20·58 tons	0·73 tons	3·43	4·29%
Cumulative	106·06 tons	16·80 tons		98·82%

Mixed juice Brix is 13·67 and the final bagasse composition is:

Fibre	15·00 tons	55·15%
Solids	0·23 tons	0·85%
Water	11·97 tons	44·00%

Thus return of the last press juice raises extraction from 98·4 to 98·8% while giving a mixed juice of slightly higher Brix—13·67 *vs.* 13·63.

It is of some interest to determine the effect of fibre content on extraction with a tandem of presses and a calculation was made for the system with prepared cane alone being fed to the first press and 20% maceration being applied to the first and second bagasse in a three-press tandem. The composition of the cane in this instance was assumed to be 12% fibre, 18% soluble solids and 70% water (which gives an absolute juice Brix of 20·45 compared with 20·0 for the higher fibre cane). The results were as follows:

	Juice Y	*Solids extracted*	*Brix*	*Extraction*
1st press	58·18 tons	14·96 tons	20·45	83·11%
2nd press	21·63 tons	2·07 tons	8·72	11·50%
3rd press	20·52 tons	0·66 tons	3·11	3·66%
Cumulative	100·33 tons	17·69 tons		98·27%

The final bagasse composition is:

Fibre	12·00 tons	54·60%
Solids	0·31 tons	1·41%
Water	9·67 tons	43·99%

while the mixed juice Brix is 14·99.

This calculation shows that decrease in the fibre content of the cane, while maintaining the absolute juice Brix at approximately the same level, results in an increase in the overall extraction, the first press achieving 83·11% without added water. It is of interest to compare the figures quoted by CRAWFORD in an article on the Walker pressure feeder mill[3] for the first mill extractions obtained in Queensland factories crushing cane of about the same fibre content:

	% Fibre	*% Extraction*
Mill A	12·04	74·41
Mill B	12·06	77·72
Press	*12·00*	*83·11*

Experience so far obtained with these screw presses has shown that maintenance costs are very much lower than for mills and that the capital investment in a press is approximately two-thirds that of a mill of similar capacity. On the basis of such costs and on the above theoretical calculations, it is suggested that the employment of screw presses entirely, working as a tandem, merits some consideration as an attractive alternative extraction process for the cane sugar industry. For the gradual replacement of existing mills as and when they become worn or where an entirely new installation is contemplated, thought should be given to this proposed system of operation.

The presses have shown reliability in operation in successive crops and a further advantage is that, should one unit become inoperative, it can be bypassed easily until operational again by use of a mobile, floor-mounted or suspended independently-driven conveyor of sufficient length to cover one press. This would be placed in a position to accept the feed from the unit before the inoperative press and to deliver it to the subsequent mixer-screw conveyor (or final bagasse conveyor in the case of a

[3] *I.S.J.*, 1968, **70**, 196.

breakdown of the last press). In this way the factory can be kept running with only a temporary drop in extraction of say 1·4%—e.g. from the 98·4% of a four-press tandem to 97·0% of a three-press tandem by altering the maceration application—whereas with a milling tandem the breakdown of a single mill causes a complete shut-down of the tandem.

All drives for the screw conveyors would have adjustable speed devices so that the presses can be maintained fully fed for proper operation. Once the adjustments were made at start-up there should not be any need for further adjustment unless the cane feed supply was affected. In such circumstances it would be necessary to shut off the cane feed, clear the tandem and await correction of the fault to the main supply.

With regard to capacities of screw presses, machines now in operation can handle the fibre from 8000 short tons of cane per day of approximately 12% fibre content. These large units when added to existing tandems have reduced the pol in bagasse by at least 40% with a corresponding reduction in moisture by some 6% on the original final bagasse figures. This latter effect increases the calorific value of the bagasse to an extent which more than compensates for the additional steam generation necessary to produce the power for the presses.

Summary

Theoretical calculations have been made, based on a cane composition of 15% fibre, 17% soluble solids and 68% water, to indicate the degree of extraction to be expected from screw presses by reduction of the moisture content of the feed to 44%, a level consistently obtained in practical operation. Various systems and amounts of maceration water are considered for 3- and 4-press tandems and the results are summarized below. The data indicate the improved extraction likely in addition to the other advantages of operation with screw presses rather than mills.

The fate of some of the principal amino-acids of cane juice during molasses formation

III. Distribution of Amino-Acid Residues in Model Cane Final Molasses Browning Polymers Utilizing Carbon 14 and Tritium Labelled Amino-Acids

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THE "browning" polymers resulting from the reaction of a single amino-acid with a single reducing sugar are so complicated that their sturctures for the most part are still to be determined. Little wonder that the "browning" polymers of cane final molasses are so complex. These polymers are formed in reaction media containing 26 amino-acids and four reducing hexoses[1]. These media are modified by high concentrations of sucrose and the buffering action of the salts of as many as eleven organic acids[1] during a shift in pH from 8 to 5. The resulting molasses polymers isolatable by dialysis, of molecular weight 27,000 ± 1000, were deduced to be random coils[2] with the empirical formula of $C_{17-18}H_{26-27}O_{10}N$ as the probable repeating units[3]. Some characterization of these polymers has been achieved. They are depolymerized by hydrogenolysis with substantial yields of hexitols indicating the probable presence of intact hexose units in the polymers[4]. These findings strongly suggest that the polymer repeating units contained two six-carbon units of hexose origin and one five-carbon nitrogen-bearing unit derived from the amino-acids. Acetylation studies[5] supported by periodate[6] and chelation[7] data revealed the probable presence of 6 to 7 hydroxyl groups in the repeating unit offering further evidence for the component intact hexose units. Hydrogen[8] and bromine[9] uptake pointed to the probable presence of one or two unsaturated groups in the repeating unit.

Model systems have been used to study the mode of cane molasses "browning" polymer formation, heated cane juice yielding the most representative polymers[8]. Preliminary studies utilizing this juice with added C-14-labelled amino-acids[10] showed that

[1] BINKLEY: *Zeitsch. Zuckerind.*, 1966, **91**, 195.
[2] *idem I.S.J.*, 1960, **62**, 36.
[3] *idem ibid.*, 1957, **59**, 178.
[4] *idem ibid.*, 64.
[5] *idem ibid.*, 1958, **60**, 322.
[6] *idem ibid.*, 1957, **59**, 178.
[7] *idem ibid.*, 1961, **63**, 239.
[8] *idem ibid.*, 1962, **64**, 39.
[9] *idem ibid.*, 1958, **60**, 62.
[10] *idem ibid.*, 1959, **61**, 364.

these acids underwent the expected MAILLARD[11] reaction during polymer formation. The present study reports our findings utilizing both the H-3 and C-14 forms of the principal constituent cane juice amino-acids in an effort to ascertain the relative contribution of these amino-acids to the composition of cane final molasses "browning" products.

EXPERIMENTAL

The cane juice used in this work was reconstituted from Louisiana lyophilized clarified cane juice. The juice was clarified and lyophilized in the pilot plant facilities of the United States Department of Agriculture at the Audubon Sugar Factory, Louisiana State University, Baton Rouge, La., USA.

Preparation of Model Final Molasses Browning Polymers

Eighteen grams of lyophilized cane juice solids were dissolved in sufficient distilled water to produce 150 g of solution of pH 6·18 at 20°C. The labelled amino-acids were added (the amount, form and location of the radioactivity in the added amino-acids are shown in the appropriate Table) and aliquots (1 ml each) of the juice were taken for lyophilization and radioassay. The polymers were produced by heating the juice at 95°C until optical density was 0·67 at 490 mμ in a 2·53 mm cell (optical density being equivalent to that of Louisiana clarified cane final molasses of the same solids concentration). The pH of the juice after heating was 4·3–4·7. The polymers were isolated as described previously[4]. The radioactivities of the cane juice solids and the polymers were determined by the New England Nuclear Assay Corp., Boston, Mass., USA.

DISCUSSION

Application of ion-exchange column chromatography[12] to Louisiana cane juice[13] led to the quantitative determination of its principal constituent amino-acids, specifically 0·52% asparagine group, 0·09% aspartic acid, 0·04% glutamic acid, 0·04% alanine, 0·03% γ-aminobutyric acid, 0·03% valine and 0·02% proline in the juice solids. Alanine was available in several labelled forms, DL-alanine-2,3-H-3, 3-H-3, 2-C-14 and 3-C-14 and this amino-acid was selected for evaluation as the labelled reference reactant in the polymerizations (Table I). Since the other principal cane juice amino-acids were available specifically labelled with C-14, DL-alanine-3-H-3 was chosen as the reference reactant and appeared at the outset to be useful at both high and low levels of activity.

Model molasses "browning" polymers were generated in cane juice with the ratio of the activities of the added C-14 amino-acid to the H-3 activity of the added reference amino-acid (DL-alanine-3-H-3) near that of their concentration relationships in the juice in a preliminary study (Table II). Radioassays showed that quantitative measurements of the H-3 activities could not be made with the reference amino-acid at low levels of H-3 activity (Table II, A and B) as exemplified by the assay of the polymer from Reaction 7 in which the high C-14 activity interferes

Table I

Evaluation of radioactive DL-alanine as a reference amino-acid in the preparation of model molasses browning polymers from cane juice

Reaction No.	*Added amino-acid*	*Activities, μc/g*		*(C)*	*(D)*
		Cane juice solids (A)	*Browning polymers* (B)	*B / A*	*C-14 / H-3 in C*
1	DL-Alanine-2-C-14*	2·08, 2·08	2·09	1·00	1·01
	DL-Alanine-2,3-H-3*	4·45, 4·48	4·43	0·99	
2	DL-Alanine-3-C-14*	3·04, 3·08	4·24, 4·29	1·39	1·045
	DL-Alanine-3-H-3†	16·00, 16·17	21·43, 21·50	1·33	

* Nuclear Equipment Chemical Corp., Farmingdale, N.Y., USA. † New England Nuclear Corp., Boston, Mass., USA.

Table II

Preliminary determination of the participation of the cane juice principal amino-acids in browning polymer formation utilizing labelled amino-acids at low levels of H-3 activity

Reaction No.	*Added amino-acids*	*Activities, μc/g*		*Ratios of C-14 activities*	
		Cane juice solids (A)	*Browning polymers* (B)	(C) *B / A*	(D) *C / B*
3	DL-Aspartic-3-C-14 Acid*	4·1	6·7	1·63	
	DL-Alanine-3-H-3†	3·5, 3·9	2·8, 3·7		1·00
4	DL-Glutamic-3,4-C-14 Acid*	2·1	6·9	1·63	
	DL-Alanine-3-H-3†	2·2	7·0		2·02
5	DL-Alanine-3-C-14*	6·3	10·3	3·29	
	DL-Glutamic-3-H-3 Acid†	3·2	5·5		1·00
6	γ-Aminobutyric-4-C-14 Acid*	3·3	21·2	1·63	
	DL-Alanine-3-H-3†	1·8, 2·0	5·7, 7·2		3·94
7	γ-Aminobutyric-2-C-14 Acid‡	2·7	17·7, 18·0	6·62	
	DL-Alanine-3-H-3†	2·4	4·0, 7·1		4·06

* Nuclear Equipment Chemical Corp., Farmingdale, N.Y., USA. † New England Nuclear Corp., Boston, Mass., USA.
‡ Dhom Products Ltd., North Hollywood, Calif., USA.

[11] *Compt. rend.*, 1912, **154**, 66; *Ann. chim.*, 1916, **5**, (9), 258.
[12] MOORE & STEIN: *J. Biol. Chem.*, 1951, **192**, 663.
[13] ROBERTS & MARTIN: *Sugar*, 1956, **51**, (1), 32.

Table III

Determination of the participation of the cane juice principal amino-acids in browning polymer formation utilizing labelled amino-acids at high levels of H-3 activity

		Activities, μc/g		(C)	(D)	(E)
				B*	C-14	D
Reaction No.	*Added amino-acids*	*Cane juice solids* (A)	*Browning polymers* (B)	*A*	H-3 *in* C	1·045
8	DL-Asparagine-3-C-14†	2·84, 2·88	19·5, 19·7	6·85	3·95	3·78
	DL-Alanine-3-H-3‡	29·1, 29·8	51·1, 51·3	1·73		
9	DL-Aspartic-3-C-14§	2·38, 2·40	2·94, 2·98	1·24	0·78	0·75
	DL-Alanine-3-H-3‡	28·0, 28·4	44·6, 45·1	1·59		
10	DL-Alanine-3-C-14§	3·04, 3·08	4·24, 4·29	1·39	1·045	1·00
	DL-Alanine-3-H-3‡	16·00,16·17	21·43, 21·5	1·33		
11	DL-Glutamic-3,4-C-14 Acid§	3·11, 3·14	10·2, 10·3	3·28	1·91	1·83
	DL-Alanine-3-H-3‡	26·0, 26·3	44·6, 45·4	1·72		
12	γ-Aminobutyric-2-C-14 Acid†	2·56, 2·57	18·3, 18·3	7·13	4·24	·06
	DL-Alanine-3-H-3‡	52·4, 52·4	88, 88	1·68		
13	DL-Valine-4-C-14**	2·94, 2·94	4·47, 4·48	1·52	1·01	0·97
	DL-Alanine-3-H-3‡	30·1, 30·7	45·0, 45·9	1·50		
14	DL-Proline-5-C-14‡	2·24, 2·25	12·4, 13·1	5·68	3·84	3·67
	DL-Alanine-3-H-3‡	28·3, 28·5	41·7, 42·5	1·48		

* Averages used. † Dhom Products Ltd., North Hollywood, Calif., USA. ‡ New England Nuclear Corp., Boston, Mass, USA. § Nuclear Equipment Chemical Corp., Farmingdale, N.Y., USA. **Amersham/Searle Corp., Des Plaines, Ill., USA.

Table IV

Distribution of the cane juice principal amino-acids in cane final molasses model browning polymers

	Cane juice solids		*Model browning polymers*		
Cane juice amino-acids (A)	%A (B)	A *relative to alanine* (C)	*Relative concentration of* A* (D)	*Relative number of amino-acid residues* (E)	(F)
		B / 0·04	C × E†	D × 1000 / MW‡	E / 6·23
Asparagine	0·52	13·00	49·14	327·3	52·54
Aspartic Acid	0·09	2·25	1·69	12·71	2·04
Alanine	0·04	1·00	1·00	11·22	1·80
Glutamic Acid	0·04	1·00	1·83	12·44	2·00
γ-Aminobutyric Acid	0·03	0·75	3·05	29·58	4·5
Valine	0·03	0·75	0·73	6·23	1·00
Proline	0·02	0·50	1·84	15·98	2·57

* Based on availability in cane juice[18]. † Column E of Table III. ‡ Molecular weight of respective amino-acid.

markedly with the H-3 measurements. However, the C-14 assays using DL-alanine-3-C-14 as the reference reactant (Reaction 5) did permit an estimate of the relative occurrence of these acids in the model polymers (Table II, D); this relationship was found to be 1:1:2:4 for alanine:aspartic acid:glutamic acid: γ-aminobutyric acid residues. DL-Alanine-3-H-3 at high levels of H-3 activity was found then to be a suitable reference reactant (Table III). The magnitude of the H-3 activities was sufficient to minimize the interference from C-14 in both the cane juice and the polymers (Table III, A and B). The ratios of the activities of the polymers to cane juice solids for C-14 and for H-3 (Table III, C) were used to calculate the relative occurrence of the principal amino-acids in the polymer using DL-alanine-3-H-3 as the reference reactant (Table III, D; E with the reference amino-acid at 1·00). The relative concentrations of these acids in the cane final molasses model polymers were calculated from the amounts of the respective amino-acids available in the cane juice solids[18] (Table IV, D) and the relative number of amino-acid residues in the polymers was obtained from these data (Table IV, E and F). The distribution of these residues in polymers generated from 93·9% of the measurable amino-acids in cane juice[18] was found to be 52–53 asparagine, 5 γ-aminobutyric acid, 2-3 proline, 2 aspartic acid, 2 glutamic acid, 2 alanine and 1 valine residues. These findings strongly suggest that asparagine is the principal amino-acid participating in the formation of the "browning" products of cane final molasses. Furthermore, the combined utilization of C-14 labelled amino-acids with a suitable reference reactant labelled with tritium at relatively high activity has been found to be a new and useful probe in the study of the "browning" polymers in cane final molasses.

Acknowledgment

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Summary

Utilizing carbon-14- and tritium-labelled amino-acids in the formation of model cane final molasses "browning" polymers from cane juice, asparagine was found to be the principal participating amino-acid. Polymer units containing 66 to 68 amino-acid residues were found to possess 52–53 asparagine, 5 γ-aminobutyric acid, 2–3 proline, 2 aspartic acid, 2 glutamic acid, 2 alanine and 1 valine residues.

Sugar cane research in South Africa

(Annual Report of the Experiment Station of the South African Sugar Association, 1967-68)

THE main experiment station of the South African Sugar Association is at Mount Edgecombe, near Durban, in Natal. It was established in 1925. The functions and activities of this station have steadily increased over the years and several substations serving cane areas with different climatic and edaphic conditions have been established. Laboratory research is carried out at the main station. A 200-acre station located near Chaka's Kraal some 25 miles north of Mount Edgecombe is used extensively for agronomic studies. At Mtunzini in Zululand, a 300-acre station is used for variety trials and as a propagation centre. A field station on a typical coastal sand is located at Cornubia, a few miles from the Experiment Station, and this too is widely used for variety studies. In 1966, 165 acres of land were leased at the Pongola Irrigation Settlement to provide a new station in an area where total irrigation is essential. The Experiment Station provides member growers with a free advisory service which is designed to help them with all problems related to cane production. Free fertilizer and irrigation advisory services are also available to all sections of the industry. An extensive reference library, dealing with all aspects of sugar cane production and appropriate related disciplines, is maintained at the Experiment Station. The library, and the various services it provides, is open to all members of the industry and to many other approved institutions and organizations.

Negotiations are reported to be in progress "which it is hoped will lead to the conclusion of an agreement between the South African Sugar Association and the Malawi Sugar Industry, on the provision of agricultural advisory and research services. A similar agreement already exists between the South African Sugar Association and the Swaziland Sugar Association. This development is a further step towards the achievement of close co-operation between the Experiment Station and all contiguous sugar producing countries. This, it is hoped, will lead to better control over the import of varieties and restriction of the spread of pests and disease, which will be to the mutual benefit of the industries concerned."

The activities of the Station cover a wide field and include the following: an active breeding programme and the production of new cane varieties, sugar cane agronomy and basic physiological and nutrition studies, soil studies, irrigation, agricultural engineering, weed problems, pests and diseases.

Cane varieties

Among South African cane growers the popularity of the variety N:Co 310, which has been and is so widely cultivated in other parts of the world, has continued to decline. Five seasons ago it was responsible for half the total production in South Africa, two seasons ago a third, and last season only a quarter. Despite this, in the Pongola district it still comprises more than 90% of the total crop. In contrast N:Co 376 continues to increase in importance. During the 1967–68 milling season it contributed over 40% of the total crop. Although N:Co 310 and N:Co 376 are the most widely used varieties, others are of great importance in certain localities. Thus N:Co 293 comprised half of the total tonnage crushed at the Dalton factory in the Midlands and N:Co 382 made up 42% of the cane crushed at the Illovo factory. N 50/211, the first locally bred cane to be released, achieved its highest proportion of throughput at the Melville factory but even there it formed only 12% of the total crop handled.

No new varieties were released during the season but the variety N 6 (previously known at N 54/64) was sent out for growth in pre-release plots. This variety has performed best in the mistbelt region. It flowers readily but not excessively and its sucrose content is a little lower than that of N:Co 376. So far its disease resistance appears to be satisfactory, although infection with gumming disease has been observed and a few stools have been found infected with smut disease.

Cane breeding

The results from the first full season's operation of the new plant breeding complex proved highly satisfactory. Conditions maintained within the glasshouse were such that an exceptionally high rate of fertility was attained in individual tassels. As a result, seed production reached an all-time high, being more than treble the highest output achieved previously. In 1968, however, the almost complete suppression of flowering, which has characterized this breeding season, emphasized the need for development of reliable methods of controlling the flowering of parent plants. The possibility of using a glasshouse for this purpose is being investigated. The glasshouse was used for sowing seed and raising seedlings, again with most satisfactory results. More than 160,000 seedlings were reared and potted-out within a month of seed sowing.

During the year 23 varieties were released from quarantine and planted at the Experiment Station; 22 varieties were introduced from other cane growing countries and planted in the quarantine greenhouse in Durban and a number of varieties despatched to other countries.

With regard to seedling production, the railway trolleys designed for the conveyance of marcotted "boents" (detached shoots) were used to carry seed trays. In this way the newly germinated seedlings could be moved into and out of the glasshouse whenever conditions were suitable. Analysis of the seed mixture used to raise these seedlings showed that nutrient supplies were adequate. Despite this, however, N-P-K in insoluble form applied twice weekly to the seed trays produced greatly enhanced

growth and apparently reduced the incidence and severity of "damping-off". All the seedlings were potted up within four weeks of commencement of seed showing.

Tests made with different media for covering cane seed were carried out. It was found that sieved peat moss proved to be better than sand, soil, bagasse, vermiculite or a mixture of vermiculite and compost in equal quantities. It was also found that when the aluminium cans containing the rooting medium were painted black instead of being left their normal colour, better rooting of cut stalks was achieved during the first week.

Basic sugar cane physiology

Having perfected the technique of rearing whole cane plants from free cell units of meristematic tissue, attention has been devoted to securing virus-free cultures. Morphogenesis or complete differentiation of tissues has been achieved with tissue cultures of various size, but the rate of such morphogenesis is progressively delayed as the size of the initial cell unit is reduced. From experiments with mosaic- and streak-infected cane it was concluded that culturing tissues regardless of the size of the original cell unit is unlikely to yield plants free from virus disease. Attempts to eliminate virus diseases by thermo- and chemo-therapeutic treatments of meristematic tissues were examined, and plants free from symptoms of streak disease were produced by these means. The apparent elimination of streak from meristematic cultures is a major step forward in attempts to secure virus-free stocks of cane. Similar studies are now to be carried out in an attempt to eliminate the mosaic virus.

Interesting results of cane root system studies are recorded in the report. These have been made possible by the root laboratory recently established at the Station where roots can be seen growing in natural soils and can be approached through specially designed windows. Three main aspects of the work are discussed. These are: (1) yield of an 18-month-old plant crop in relation to soil type, (2) the behaviour of the root systems at and after harvest and (3) the early growth of the first ratoon crop. Light is thrown on the much discussed question "Does the old root system support the ratoon crop?" Radioactive phosphorus ^{32}P was used in the investigation which confirmed the view that the old roots do, in fact, support the new crop. There is no doubt that the plants put down a new root system after ratooning but until this is adequately developed some of the support for the regenerating crop comes from the old roots. In other words the old roots have survival value, especially if drought occurs at or after harvest which may prevent new roots from developing.

Agronomy

A varied research programme is included under this general heading and includes agro-meteorology, fertilizer use, herbicides, husbandry and special projects.

Experiments on the placement of phosphates on ratoon cane are reported, most South African soils being deficient in phosphorus. Three different methods of applying phosphate to ratoons proved to be equally effective on a soil with high P-sorption properties. Whether superphosphate was broadcast or banded on bare ground or on trash, or buried below the soil surface, the response to phosphate was the same. It follows therefore that, provided distribution is satisfactory, the cheapest and quickest method of application can be used for top-dressing phosphatic fertilizer. In many instances this would be by means of a broadcast/spinner implement.

The effects of planting cane on a ridge or hill, rather than in a furrow, to assist with mechanical harvesting, were studied on the plant crop in 3 experiments. On a sandy clay at Pongola, 9-inch ridge planting was compared with 8-inch furrow planting at 6 different row spacings. Results led to the conclusion that, whilst yields between furrow and ridge planting were not materially different at the wider spacings, statistically significant suppression of yield occurred with ridge planting when row spacings were reduced to 3 ft 4 in or less. This was ascribed to a greater tendency for the cane to lodge when planted on a ridge at close row spacing. In general it would seem that yields are likely to be reduced rather than increased by planting on a ridge instead of in a furrow. Should ridge planting become necessary therefore, as an aid to mechanical harvesting, then the shallowest ridges which can be used are to be preferred.

Experiments on deep tillage or subsoiling, without excessive inversion of the soil profile, were also carried out. Yields from a succession of cane crops will be needed before full evaluation of the various treatments can be made.

Basic nutrition studies

Investigations are reported on soil type in relation to nitrogen fertilizing. Responses obtained in a large number of N fertilizer experiments conducted throughout the cane belt during the past 15 years have been examined and divided among the main soil groups. The results show that large responses from N applied to the cane plant are confined primarily to soils derived from ordinary Table Mountain Sandstone and from Dwyka tillite. Moderate responses are obtained on granite, recent sands and on Table Mountain Soils (mistbelt), while other groups show little or no response. With ratoon cane, however, substantial responses are obtained on a much wider range of soils. Recent results indicate that the indifferent response of plant cane to fertilizer on many soils is due to the fact that the crop is able to obtain much of its N from another source, namely the soil. Ratoon crops, on the other hand, are rarely able to obtain sufficient amounts from the soil to sustain maximum growth. In South Africa the relative ability of sugar belt soils to supply N varies widely. The rôle of the C/N ratio within the rhizosphere and

its importance are discussed as are the changes that take place in mineral and organic nitrogen.

In regard to trace elements, spectrochemical analyses for levels of aluminium, boron and iron were carried out on 190 third-leaf samples taken from cane grown on T.M.S. (Table Mountain Soil). These soils are noted for their prevalence in areas where, for no known reason, cane will not grow. Analyses were also made from leaf samples from other more normal cane soils. It was found that an inverse relationship existed between the Al content of the leaf and crop appearance at time of sampling. The mean Al content of samples from fields where growth was designated as poor, fair, good and very good were respectively 64, 51, 49, and 44 p.p.m.

Soil compaction studies

Results from soil compaction studies showed that compaction was responsible for a 10% reduction in yield when the soil was dry and over 13% reduction when the soil was wet. It was particularly interesting to note that the presence of a trash blanket did nothing to prevent the compacting effect of a tractor and loaded infield trailer. Tillage of the compacted soil had little effect upon the yields of the subsequent crop owing, perhaps, to the damage done by such cultivation to roots. A beneficial residual effect of the tillage operation was noted on the next ratoon crop. It was found that re-compaction after harvest of plots compacted previously when wet further decreased the yield of the succeeding crop. This effect was far less severe, however, than that obtained following the initial compaction.

Irrigation

It is pointed out that 6 crops have now been harvested from certain irrigation experiments where the water treatment was based on water duties. The results consistently show that maximum productivity —where water supplies are limited but there is no restriction on available land—can be realized by spreading the water over relatively large areas. For supplementary irrigation, water duties in excess of 200 acres per cusec may be recommended in Natal, and at Pongola the optimum may exceed 100 acres per cusec. Results showed that yield increased on average at the rate of 0·79 tons of cane and 0·12 tons of sucrose per acre per inch of effective water, over the range from 40 to 66 inches of water.

Agricultural engineering

One of the projects in the present research programme of the newly constituted agricultural engineering section is to endeavour to create a cane extraction unit able to operate on hillsides. This is not surprising, having regard to the hilly nature of much of the Natal cane belt. Other projects are to construct a stubble shaver suited to local conditions and to test different mechanized systems of cane production on properly conserved terrain.

A cane extraction unit, designed to winch 500 lb cane bundles up steep slopes, and then lift and load them on to a trailer has been produced but requires some modification.

Samples of the "La Zafra" cane stripper from the Argentine were tested. Before this hand tool can be used the cane has to be cut and laid on the ground. Although a high degree of cleanliness was obtained much effort was needed. Field tests showed that local labour disliked the tool, finding it uncomfortable to use. It is considered unlikely that it will be accepted by cane growers in South Africa.

Diseases and pests

Dry weather served to aggravate the effects of ratoon stunting disease, now considered to be very widely distributed. Widespread publicity has been given to the seriousness of this disease but it is considered there are still far too few heat-treatment plants to handle the amount of seed cane required to bring about any immediate major improvement in the position. Strenuous efforts have been made in extension programmes to disseminate information on methods of combating other serious diseases. This applies particularly to the northern areas, Pongola and eastern Transvaal, where smut and mosaic disease have recently made heavy tolls.

Other diseases which have attracted attention or been the subject of investigation were red stem rot and black stem rot. The former seasonally affects sugar cane in high altitude areas in the Natal midlands. Black stem rot, a fungus disease, was reported for the first time from the south coast of Natal.

Much of the time and attention of the entomological staff was concerned with Numicia (*Numicia viridis*). The increasing prevalence of the pest in the newly developed areas of the eastern Transvaal is cause for concern. It was found that one of the two major parasites of *Numicia* eggs was virtually absent from this area. Supplies of parasites and parasitized eggs were introduced from other areas. There is still no critical evidence to show that aerial application of insecticidal dusts against the pest is an economical proposition.

Experiments carried out in an insectary with the insect and cane plants showed conclusively that the fecundity of the insect improves with increasing rates of application of nitrogenous fertilizer to the cane plant.

About 13,000 soil samples were examined during the year to provide a picture of nematode populations. Field trials are reported showing the effects of different plants (weeds, grass and some crop plants) on nematode populations. Trials are reported on differences in susceptibility of cane varieties to nematodes. There were highly significant differences between some varieties. Work on the differential response to fumigation by different kinds of nematode is discussed.

F.N.H.

Sugar beet agriculture

Parasites of sugar cane stem borers in Nigeria. M. L. JERATH. *J. Econ. Ent.*, 1968, **61,** 435–436; through *Hort. Abs.*, 1968, **38,** 1109.—Parasitization of stem borers (*Sesamia, Eldana* and *Chilotraea*), notably by the tachinid *Descampsina sesamiae*, is discussed.

* * *

Control of sugar cane frog hoppers. D. W. FEWKES. *World Rev. Pest Control*, 1967, **6,** 21–31; through *J. Sci. Food Agric. Abs.*, 1968, **19,** ii–223.—These plant-sucking insects of the superfamily *Ceropoidea* (*Homoptera*) are important pests of several crops, including sugar cane. Distribution, ecology and damage are briefly reviewed. A general review of chemical methods of control is given and a summary of biological control methods is presented. It would appear that no one method or insecticide is entirely satisfactory. Eighty-six references are given to the literature.

* * *

Very good results from heat treatment of the cane variety Co 421 in controlling ratoon stunting disease. A. P. DA SILVA. *Brasil Açuc.*, 1968, **72,** 381–384. Results are given of eleven different tests which illustrated conclusively the good results to be obtained from this now well-known treatment.

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The truth concerning the early introduction of sugar cane to Brazil. A. DE SALLES. *Brasil Açuc.*, 1968, **72,** 408–410.—The writer presents his own views on this controversial subject, quoting a number of early Portuguese historical documents.

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Strengthening the varietal front in subtropical India. J. T. RAO, M. B. G. R. BATCHA, A. S. ETHIRAJAN, M. K. NAIR and T. N. KRISHNAMURTHY. *Indian Sugar*, 1968, **18,** 319–323.—Trials being carried out in the varied sub-tropical cane belt of India with 8 foreign varieties are reported in this paper. Co 975 has recorded the highest stability among the varieties studied, being at its best in the Motihari and Lucknow areas, B 37172 being next best, N:Co 310 ranking third and Co 1148 fourth.

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Innovations in cane handling. G. R. TIMMONS. *Sugar Bull.*, 1968, **46,** (3), 6–8.—Descriptions are given, with photographs, of a piece of new equipment designed to handle cane in bulk in the mill yard. It is the Hough Payloader. Preliminary indications are that it will handle 3 to 4 tons of bulk cane per minute. The grab can manipulate 4 to 5 tons of cut cane at a time.

Improvements in the Domininican Republic's sugar industry. ANON. *Sugar y Azúcar*, 1968, **63,** (11), 36–38.—One of the main areas of improvement has been field mechanization and harvesting. Better roads, new irrigation projects and better social conditions for the workers are other improvements under way.

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Bulk handling in Puerto Rico during the 1968 crop. R. RAMOS and H. P. MURATI. *Sugar y Azúcar*, 1968, **63,** (11), 41–42.—Faster unloading systems with new equipment recently installed at two mills are described. They involve considerable savings in labour and it is considered that their cost will have been worked off in 5 years.

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Importance of the pest "oruga variada" (*Laphygma frugiperda*) in cane cultivation in Tucumán. M. A. COSTILLA and H. MERCADO D. *La Ind. Azuc.*, 1968, **74,** 219–220.—The sugar cane pest is described and notes on its life history given. Other economic plants which it may attack are named. These include sorghum, maize, alfalfa or lucerne, and soybean. Methods of control using "Endrin", DDT and "Parathion" are discussed.

* * *

Control of cane flowering can increase sugar yields. I. A. BROWN and G. M. CHAMBERS. *Sugarland* (Philippines), 1968, **5,** (8), 20, 22, 30, 31, 43.—What is known of the main causes and the physiology of flowering in sugar cane is discussed. It is a phenomenon throughout the world that high yielding cane varieties are often heavy tasselling, making the need for cheap and reliable method of flowering control all the more desirable. Results of comprehensive experiments with "Diquat" are recorded.

* * *

Evaluation of germplasm in USDA sugar cane program —Louisiana. P. H. DUNCKELMAN and R. D. BREAUX. *Sugar J.*, 1968, **31,** (6), 14–16.—The importance of producing, if possible, new varieties of cane resistant to mosaic disease and varieties well suited for mechanical harvesting (e.g. erect and not brittle) has had its effect and a notable impact on the breeding programme. Details are given. Potential parent clones of the wild *Saccharum spontaneum* and *S. robustum* are being screened, as well as those of *S. officinarum.*

Experiments with mole drains. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1968, **15**, (3/4), 2–3. The advantages of mole drainage on heavy, poorly drained cane land is described. Under prevailing conditions it was considered superior to tile drainage. The torpedo-shaped steel mole was drawn through the soil by a powerful Caterpillar D6C tractor. Convincing aerial photographs of the mole-drained and adjoining undrained fields carrying cane are shown.

* * *

On stubble shaving. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1968, **15**, (3/4), 6–7.—The need for good stubble shaving is emphasized and the need to use sharp implements, immediately after harvest, is stressed. The effect is to induce the stool to produce good strong basal shoots early, instead of unsatisfactory shoots from the old stalk base.

* * *

Varietal composition of the 1967-68 crop. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1968, **15**, (3/4), 12–13.—A table illustrates the present varietal distribution in terms of area occupied by each variety. The rate of increase or decrease with each variety from 1960–61 is also shown. Old established varieties are now being rapidly replaced by new varieties bred in the Philippines.

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Pokkah boeng. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1968, **15**, (3/4), 14–15.—Recent high incidence of this disease affecting sugar cane caused by a fungus (*Fusarium moniliforma*), in some areas is recorded. Symptoms, easily recognised, are described and illustrated. The use of resistant varieties is regarded as the best or most practical method of approach.

* * *

New cactus weed danger in Natal. ANON. *S. African Sugar J.*, 1968, **52**, 969.—The plant (*Harrisia martinii*), a potential noxious weed which has been grown as a garden plant, has been found naturalized in another area (Muden) in Natal. It is known to have been grown as a pot plant or rockery plant in Zambia.

* * *

Relationship between rainfall and sugar cane production. H. S. PENG. *Taiwan Sugar*, 1968, **15**, (4), 20–22, (5), 16–22.—Results are given of a careful study of rainfall distribution in Taiwan and sugar cane production. Stalk elongation at different stages in its development in relation to soil moisture and rainfall is considered. The effects of rainfall are illustrated by means of graphs and tables.

* * *

Smut of sugar cane discovered at Hsichi quarantine nursery in Taiwan. L. S. LEU and Y. P. TSAI. *Taiwan Sugar*, 1968, **15**, (5), 23–24.—Sugar cane smut (*Ustilago scitaminea*) was discovered in June 1968, in the variety Phil 53-33, introduced from the Philippines in August 1967. All the material was destroyed. Sugar cane smut had not been recorded in Taiwan since 1930.

* * *

Crichton self-propelled cane harvester. L. G. VALLANCE. *Australian Sugar J.*, 1968, **60**, 379–383, 387. Eighteen of these self-propelled, medium capacity chopper harvesters were in operation during the 1968 season in Bundaberg and adjoining areas. All were visited and the owners or operators interviewed. The machine is favourably reported on and considered likely to give good service to grower-owners. Among its features is the ability to cut directly into the block and the possibility of at least two-stage air removal of extraneous matter.

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Pre-emergence control of weeds in sugar cane with "Ametrin", "Simazine" and 2,4-D. G. M. AZZI and J. FERNANDES. *Brasil Açuc.*, 1968, **72**, 462–467.—An account is given of field trials on two soils in São Paulo with these three herbicides using as control plots cane weeded in the customary fashion. Satisfactory weed control was obtained. There was a difference in performance on the clay and the sandy soil; on the clay soil "Simazine" was superior to the others.

* * *

Sugar industry in East Pakistan, its progress, problems and prospects. A. M. A. HAQUE. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, 23–30.—Since independence sugar production in East Pakistan has been more than quadrupled but much remains to be done. Problems that have to be faced are discussed. These include inadequate cane supply to the mills, low sugar content of cane, bad communications, poor field husbandry, no incentive to supply good clean cane to the mills and taxation policy.

* * *

Effect of different levels of nitrogen and potassium on the growth, yield and juice quality of sugar cane. M. S. ALI. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, 31–36.—Results are given of fertilizer experiments carried out at the East Pakistan Agricultural Institute Farm at Dacca, urea and muriate of potash being used. It was concluded that under prevailing conditions 120 lb N and 150 lb K per acre was the most profitable rate to apply.

* * *

Breeding of sugar cane varieties in East Pakistan. M. A. ELAHI and N. N. SARKAR. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, 37–48.—After independence sugar cane breeding in East Pakistan commenced in 1953–54 at the Central Sugarcane Research Station at Ishurdi, Pabna. So far 392 varieties have been assembled for possible use in breeding work. Details are given of the breeding technique and selection programme and brief descriptions of the varieties so far released. The major cause of poor yield is considered to be the fact that old and degenerated varieties are still used in most areas.

Instructions for sending samples of pests and diseases that attack sugar cane. ANON. *Bol. Azuc. Mex.*, 1968, (226), 28–30.—Details are given of the best methods of packing and sending insect and other pests attacking cane for identification. The need to supply all available local information in regard to the pest or disease is emphasized.

* * *

On the use of chemicals as weedicides in sugar cane fields. R. P. SINGH. *Indian Sugar.*, 1968, **18,** 377–378. Herbicide trials carried out at the Sugar Cane Research Station, Shahjahanpur, U.P., are reported. The weedkillers used included 2,4 D, "Crag herbicide", "Nata" (sodium salt of trichloracetic acid), "Dalapon", "Paraquat", "Simazine" and "Eptam".

* * *

Some effects of hurricane Betsy on cane yields in 1965. L. G. DAVIDSON and J. E. IRVINE. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 21–31.—The effects of the hurricane are graphically illustrated by means of photographs, a photograph taken 12 hours before the hurricane being used for comparison (at the Sugar Cane Field Station, Houma, Louisiana). Loss in cane yield was estimated at 12–28%, this loss being due partly to cane left in the field and partly to low stalk weights resulting from severely reduced growth rates following the storm.

* * *

A review and discussion of some recent changes in cane handling. J. N. FAIRBANKS. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 32–46.—This is a general appraisal of present day methods of harvesting, transporting and handling cane in Louisiana. Because of ever-increasing labour costs it is felt that changes in present methods are desirable. The conventional method of handling and hauling cane in slings is considered to be inefficient because of its high labour requirement. Handling and hauling full-length cane direct from field to factory in bulk-type dumping wagons (either chain-net or side-dump) is fully discussed.

* * *

Cane planter principles. M. M. MAYEUX. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 55–61.—The planting operation is the last obstacle to a completely mechanized sugar industry in Louisiana. With cane, planting rates are massive compared with other crops, with 2–4 tons of material per acre needed. The several factors concerned in mechanized or semi-mechanized planting are discussed. It is considered that a completely mechanized planter is within the realm of possibility. It may not be economical for use by the small grower but should be practical for the larger growers.

* * *

Fertilization of sugar cane under minimum cultivation. L. G. DAVIDSON. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 62–64.—Minimum cultivation may be defined as the fewest field operations necessary for a satisfactory profit. With minimum cultivation or no cultivation after fertilization it may be necessary to place fertilizer a little deeper than normal. Reasons for this are discussed, N, P and K being considered separately.

* * *

Minimum cultivation of sugar cane. R. J. MATHERNE. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 65–70. In Louisiana the number of cultivations that a sugar cane crop receives varies widely with different growers, depending partly on soil and weather conditions. It may vary from only one to as many as eight. Reference is made to two experiments having been started at Houma on minimum cultivation.

* * *

Pollen germination studies. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1963–64, 4.—The new technique using cellophane sheets for germination of pollen was found to work very satisfactorily. Detailed studies with varying concentrations of sugar and varying temperatures showed that the optimum sugar concentration needed for maximum germination increased with temperature. Phenomenal depression in germination was observed in atmospheres of high carbon dioxide tension. This partially explains the poor seed setting in air tight cages.

* * *

Cytogenetics of sugar cane. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1963–64, 11.—Cytological work with sugar cane included: determination of chromosome numbers of a large number of clones of *Saccharum officinarum* and *S. spontaneum*, crosses for cytological investigations, cytological investigations on the origin of *Saccharum* species, studies on the inheritance of characters and other projects.

* * *

Physiology of sugar cane. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1963–64, 17–23.—Projects reported on include studies on the physiology of flowering, morphological characters in relation to waterlogging, inter-relationship between flowering and growth as influenced by month of planting, day length, temperature, humidity and rainfall, and physiological studies on drought resistance in sugar cane.

* * *

Flowering behaviour of certain Co canes. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1964–65, 4.—The time lag between tassel emergence and spikelet opening, or opening of the individual florets, was observed in 56 Co canes in order to evaluate varietal differences and utilize the information for synchronizing flowering time in parent forms. Results pointed to the predominant influence of the environment in the expression of this character.

* * *

Field spread of sugar cane mosaic. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1964–65, 50. Thirty-two hybrid varieties were planted, using

disease-free seed material, in plots adjoining a field infected with mosaic. Rapid spread of the disease was observed in spite of low populations of aphids. No spread of mosaic in the US variety US 49-7 was observed.

* * *

Cane borers in India. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1964–65, 52.—Various lines of work on cane borers, notably on the internode borer (*Proceras indicus*) and the top borer (*Tryporiza nivella*), are reported. These included studies on possible resistance in sugar cane varieties, effect of cane growth on incidence, effect of nitrogen and dry matter in the spindle on borer incidence, and studies on the basis of host selection by borer moths.

* * *

Intergeneric hybridization. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1965–66, 3. Attempts at crossing sugar cane with species of *Bambusa* (bamboo), *Sorghum* and *Zea mays* (maize: tetraploid) revealed the fact that embryo culture techniques would be essential for any success. Ground work for the aseptic culture of the sugar cane embryo has made good progress.

* * *

Disease resistant genetic stocks. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1965–66, 3. Thirty clones were obtained by crossing US and Indian hybrid varieties with selected clones of the wild species of *Saccharum spontaneum*. Many of them combined resistance to two or more of the diseases red-rot, smut, mosaic and ratoon stunting disease. A few showed multiple resistance to all the diseases. These clones are included in a back-crossing programme for combining disease resistance and commercial acceptability.

* * *

Influence of waterlogging on the growth of cane and internode borer incidence. ANON. *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore), 1965–66, 75.—A trial with 14 varieties was carried out at the Palghat substation because of low shoot borer incidence there during the early stages of crop growth. Results showed that the generalization that all varieties record heavy borer attack under waterlogged conditions is not true.

* * *

An easy method of screening out red rot susceptible varieties in initial stages of multiplication. O. S. RANA and S. C. GUPTA. *Indian Sugar*, 1968, **18**, 447–452.—The seriousness of red rot disease (*Glomerella tucumanensis*) to sugar cane cultivation in northern India and the increased effort now being made to obtain resistant varieties are discussed. A new method of testing susceptibility is described. A culture of the fungus is sprayed over the nodal region with a small hand sprayer after careful removal of the leaves with the hands. Fresh leaf-scars are thus made open to fungal penetration.

Trial of some new insecticides for the control of sugar cane white fly in Uttar Pradesh. H. SINGH and A. HAQ. *Indian Sugar*, 1968, **18**, 457–459.—In areas where sugar cane is grown under waterlogged conditions with little nitrogenous manure or where ratoons are left uncared-for, white fly (*Aleurolobus barodensis* and *Neomaskellia bergii*) has become a serious pest. Field experiments to control the pest with insecticides (chlorinated hydrocarbons and phosphatic insecticides) against nymphs and puparia are reported. Good results were obtained.

* * *

Mechanization and sugar cane cultivation in Queensland and Taiwan. M. LAMUSSE and A. NOEL. *Rev. Agric. Sucr.* (Mauritius), 1968, **47**, 192–204.—The numerous operations employed in producing cane for the factory in the two countries are discussed, each country being dealt with separately. There is special emphasis on the degree of mechanization now practised in each country.

* * *

Sugar cane variety outfield experiments in Louisiana in 1967. H. P. FANGUY. *Sugar Bull.*, 1968, **47**, (4), 6–13.—A notable change was that all outfield experiments were cut by mechanical harvester and not by hand because of the expanded programme and the scarcity of labour. The variety CP 61-37—a high tonnage variety with a degree of resistance to mosaic—was released for commercial production. Other promising varieties, not yet released, are discussed.

* * *

Irrigation and drainage. F. E. MERCADO. *Sugarland* (Philippines), 1968, **5**, (9), 12–14, 45, 49.—The importance of the quality of irrigation water is discussed, as is frequency of irrigation. Field drainage is considered under three categories: open drains, closed drainage or tile drains, and mole drains. Suggestions are made for improved drainage.

* * *

Hand weeding or herbicides? ANON. *Sugarland* (Philippines), 1968, **5**, (9), 24–27, 49.—In the Philippines chemical weed killers have tended to go down in cost while the cost of hand labour for weeding constantly goes up. The use of herbicides may be expected to increase. A table showing cost per hectare for some commercial herbicides is given.

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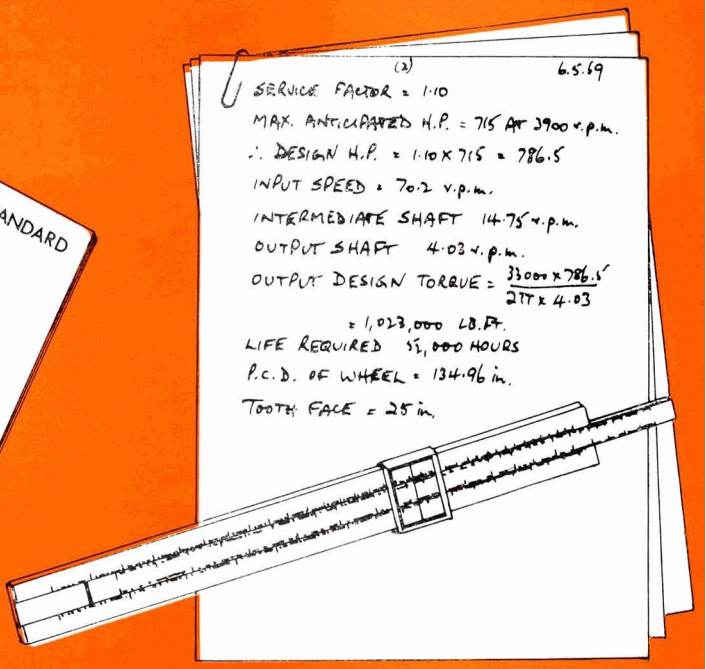
Vented bag for fertilizers. ANON. *Sugarland* (Philippines), 1968, **5**, (9), 29.—Improved packing of chemical fertilizers is obtained by use of a vent which allows air to escape from the sealed plastic bag in which fertilizers are packed, but resists re-entry of air and so moisture.

* * *

A new virulent strain of red rot pathogen in Uttar Pradesh. G. P. SINGH and O. S. RANA. *Indian Sugar*, 1968, **18**, 537–540.—What is regarded as a new strain of red rot disease of sugar cane (*Glomerella tucumanensis*) has been recorded on an important commercial



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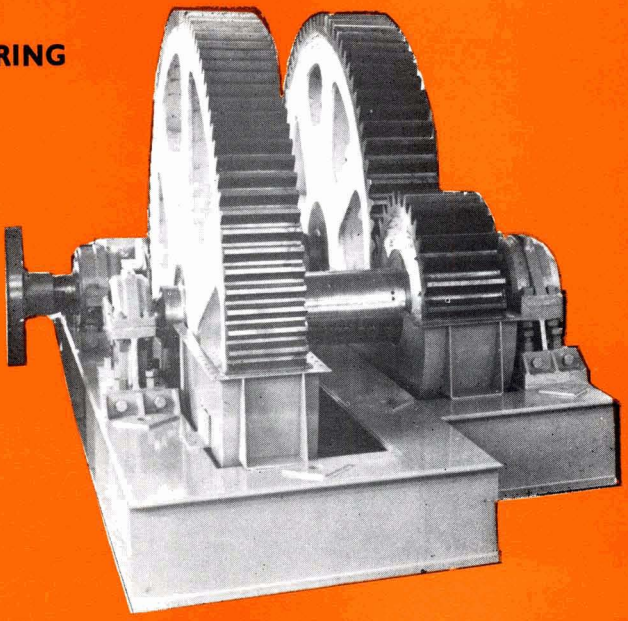

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variety of cane (B.O. 17) in Eastern Uttar Pradesh. It has been assigned a number (R.58) and its characteristics are described in this paper.

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Red stripe disease of sugar cane and its control in Uttar Pradesh. O. S. RANA and R. SHUKLA. *Indian Sugar*, 1968, **18**, 541–545.—Observations are recorded on the spread of this disease (caused by the bacterium *Xanthomonas rubrilineans*) in relation to weather conditions. Symptoms, varietal susceptibility and chemical control are discussed. Copper bactericides proved effective in controlling the disease.

* * *

Field drainage for sugar cane. F. Y. PANOL. *Sugar News*, 1968, **44**, 572–576.—The writer considers that drainage has been neglected by Philippine cane growers with more attention paid to irrigation and other agronomic practices. The great value of mole drainage in poorly drained cane fields, from recent experience, is pointed out. This has led to surprising increases in yield. Drainage problems for the cane grower in general are discussed.

* * *

Economics of nitrogen usage. ANON. *Producers' Rev.*, 1968, **58**, (11), 21.—Urea has been used as a nitrogenous fertilizer in the Australian sugar industry since 1956. Since that time there has been competition with aqueous ammonia. A recent fall in the price of urea has resulted in its greater use. As a given weight contains more than double the amount of nitrogen compared with sulphate of ammonia, growers are warned not to use the product wastefully.

* * *

Soil erosion control in sugar cane fields. ANON. *Victorias Milling Co. Exp. Sta. Bull.*, 1968, **15**, (5/6), 2–15.—In the Victorias milling district average rainfall is over 100 inches per annum and rainfall intensity can reach 2 inches per hour. It is considered that 85% of the area under cane is subject to erosion with the prevailing rolling topography. The many harmful effects of soil erosion are discussed as are the remedial measures open to the cane grower.

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How to prepare sugar cane setts to ensure good germination. N. VEGA O. and C. UZCÁTEGUI. *La Ind. Azuc.*, 1968, **74**, 281–282.—Hot water treatment of planting material, because of the possibility of ratoon stunting disease, is strongly recommended as is the use of mercurial fungicide preparations to counteract rot.

* * *

Weed control on sugar cane farms. L. G. WILLIAMS. *Australian Sugar J.*, 1968, **60**, 433.—The value of chemical weedkillers, especially for special purposes, is emphasized. For example the vine weeds are readily kept under control by the application of suitable forms of 2,4-D. Giant sensitive plant would become out-of-hand on many cane farms were it not that it can be kept down by regular spray schedules. Knowledge of circumstances that determine when a weed is most susceptible to a weedkiller can make all the difference between success and failure.

* * *

Post-emergence control of weeds in sugar cane with mixtures of 2-4-D and triazines. G. M. AZZI and J. FERNANDES. *Brasil Açuc.*, 1968, **72**, 533–538.—An account is given of herbicide trials on two different soils (cane variety CB 41:76). Mixtures of "Ametrine" with 2,4-D or "Simazine", or "Atrazine" were tested. All the herbicides gave good control of mono- and di-cotyledonous weeds.

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Morphological characters and the requirements of new cane varieties. O. LOPES. *Brasil Açuc.*, 1968, **72**, 549–551.—The characteristics of the main varieties cultivated in Brazil are discussed and presented in a table.

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Insect pests on two sugar cane estates in Pernambuco and Alagoas. H. DIAS DE S. *Brasil Açuc.*, 1968, **72**, 557–560.—The Brazilian "cigarrinha" pest (*Mahanarva indicata*) is discussed and recommendations made for its control. The possibility of biological control is also discussed. The control of the cane borer (*Diatraea*) by means of parasites, or biological control, is considered.

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Sugar economy in Cuba—ten years after the revolution. H. HIRSCHMÜLLER and H. J. DELAVIER. *Zeitsch. Zuckerind.*, 1969, **94**, 74–81.—Present conditions in the sugar industry and some recent changes are described. The 1965 plan for doubling sugar output by 1970 is discussed. It is thought the economic conditions for such a target may not be fulfilled. Extending the acreage, improving cultivation methods and the capacity of existing factories are envisaged.

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New variety of sugar cane evolved. ANON. *N.S.I. News* (National Sugar Inst., Kanpur, India), 1968, **4**, (1), 7.—The Sugarcane Breeding Institute, Coimbatore, has evolved a new variety of hybrid sugar cane (Co 6806) which is claimed to be the sweetest in the world. The sucrose content in the juice is claimed to be 20% at 10 months and 22% at 12 months. The reducing sugar content is very low—less than 0·2%. Fibre content is 15 to 16%.

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The relationship between rainfall and sugar cane production. V. Ways and means for reducing yield decrease in a poor crop year. H. S. PENG. *Taiwan Sugar*, 1968, **15**, (6), 27–31.—It is considered that in Taiwan there may be in the aggregate 7 crop years out of 12 when irrigation results in substantial increases in yield. Adequate drainage is also very important, especially with young cane. Other subjects discussed are soil filling and soil banking at the proper time.

Sugar beet agriculture

Sugar beet yields increased by phosphorus fertilization. R. L. SAILSBERY, F. J. HILLS and B. A. KRANTZ. *Calif. Agric.*, 1968, **22,** (1), 19; through *Field Crop Abs.*, 1968, **21,** 358.—In field trials P was applied before sowing at rates of 13–40 lb P/acre to soils containing 4·5–22 p.p.m. of P. In early growth there was a marked response of top growth to P on soils with 4·5–8·4 p.p.m. of P. The average increase in root yield (2·6 tons/acre) was statistically significant.

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Effect of depth of ploughing and subsoil tillage on yield of sugar beet. O. J. FURRER. *Schweiz. Landw. Forsch.*, 1967, **6,** (2), 201–212; through *Field Crop Abs.*, 1968, **21,** 357.—Ploughing was carried out to 3 depths—(1) 18 cm deep, (2) 18 cm deep plus 8 cm subsoiling and (3) 28 cm deep. Treatment (2) tended to increase yields of roots and sugar compared with (1). Treatment (3) had no effect on yield but reduced the proportion of fanged roots.

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A study of the introduction of sugar beet into the warmer regions of Japan. T. ARAFUNE and M. A. OSAKI. *Bull. Chugoku Agric. Expt. Sta.*, (Ser. A), 1966, (13), 145–167; through *Field Crop Abs.*, 1968, **21,** 357. Autumn sowing gave better yields than spring or summer sowing. Growth and development of roots in the autumn sown crop were retarded in winter. American varieties tolerated winter cold better than European varieties. Early developing varieties gave higher yields than later developers.

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Effects of sodium on sugar beets. T. YASUDA, M. KUSHIZAKI, H. NISHI, S. HOSHI and A. YOSHINO. *Res. Bull. Hokkaido Nat. Agric. Expt. Sta.*, 1968, (92), 45–53; through *Field Crop Abs.*, 1968, **21,** 359. In 44 trials in Hokkaido application of sodium increased root yields by an average of 3·7%. Highest yields were obtained with 60 kg Na/ha. Sodium chloride gave higher yields than sodium sulphate. Sodium had little effect on root sugar content but slightly decreased root purity.

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Studies on the decrease of yield of the sugar beet caused by continuous cropping. I. The decrease in yield of sugar beet caused by continuous cropping and its relation to the rate of damping off. Y. ISHIZUKA and K. YOKOTA. *J. Sci. Soil Manure* (Japan), 1967, **38,** 345–350; through *Field Crop Abs.*, 1968, **21,** 359. Damping-off disease, caused by *Aphanomyces*, occurred in soils in which sugar beet had been grown continuously. Incidence was reduced where crop rotation was followed.

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Preliminary evaluation of soil insecticides for sugar beet root maggot control. W. E. PEAY, C. E. STANGER and A. A. SWENSON. *J. Econ. Ent.*, 1968, **61,** (1), 19–21; through *Field Crop Abs.*, 1968, **21,** 359.—In field trials (Idaho) the herbicides "Bay 37289" and "Stauffer N-2790" applied in granular form before sowing, each at 2 lb/acre, in 6-cm bands at a depth of 1 in reduced the population of the maggot (*Tetanops mopaeformis*) by over 80% and increased root yield by 39% compared with untreated plots.

* * *

Results obtained from 3-year weed control experiments using different herbicides in sugar beet. K. WIESNER. *Albrecht Thaer-Arch.* (East Germany), 1968, **12,** (2), 173–186; through *Field Crop Abs.*, 1968, **21,** 358. Results are given of trials with 17 herbicides, mainly applied at sowing. Results varied from trial to trial but none of the herbicides controlled all annual weeds. Only 4 of the herbicides did not harm sugar beet to some extent.

* * *

Nitrate nitrogen in leaves and petioles of sugar beet in relation to yield of sugar and juice purity. P. J. LAST and P. B. H. TINKER. *J. Agric. Sci.* (Camb.), 1968, **71,** 383–392.—The concentration of nitrate in leaves and petioles was ascertained to test whether it would determine the need for top dressings of nitrogen in the field. Petiole nitrate concentration decreased sharply with time, from around 1000 p.p.m. in early June to 100 p.p.m. in early September. It was concluded that nitrate nitrogen cannot at present be recommended as an indicator for deciding how much fertilizer to use.

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Gibberellin and maleic hydrazide as growth regulators in sugar beets. K. SCHREIBER and A. C. FERGUSON. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14,** 574–577. It had previously been demonstrated that foliar application of gibberellic acid increased yield but decreased sugar content of beet, while maleic hydrazide increased sugar content but decreased yield. Experiments are recorded in which the two substances were used in combination. They had no effect on sugar yield. There is a possibility that frost may have affected results. Trials with 5 other growth-promoting substances are reported.

Association of chemical characters with *Cercospora* leaf spot resistance in sugar beets. G. W. MAAG *et al.* *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 605–614. Experiments are reported to determine whether certain chemical components found in leaf and root tissue of sugar beets are correlated with *Cercospora* leaf spot resistance. It was established that high concentrations of 3-hydroxytyramine in disease-free plants are associated with high *Cercospora* leaf spot resistance. This may have a bearing on breeding sugar beet resistant to leaf spot disease.

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Controlling soil crusting in sugar beet fields by applying concentrated sulphuric acid. R. C. JOHNSON and J. B. LAW. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 615–618.—Soil crusting is a serious problem on heavy calcareous soils, for after irrigation or rain tough crusts form which prevent sugar beet seedlings from emerging. In the experiments reported (in Utah) the acid was applied in a 1½–2 inch band over the planted row. A fine film formed which completely prevented the formation of crusts. It was easily broken and presented no problem to the emerging sugar beets.

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Damage produced by Beet Yellows and Beet Western Yellows under greenhouse and field conditions. C. W. BENNETT and J. S. MCFARLANE. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 619–636.—The results of further tests on the two yellowing viruses of sugar beet are given in this paper. Both occur as complexes of strains varying in virulence. This variation in virulence is discussed at length.

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Irrigation in Norfolk. N. B. DAVIS. *British Sugar Beet Rev.*, 1968, **37**, (1), 41–42, 47.—The experience of a Norfolk farmer growing 50 acres of sugar beet on a free draining medium loam soil and making use of irrigation is described, drought being his worst fear. The farmer maintains that with his particular soil his irrigation system is worth to him an average of 5·6 tons of beet per acre each year.

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"No hard work" trial in Essex: effect of seed type and spacing. ANON. *British Sugar Beet Rev.*, 1968, **37**, (1), 20–21.—Sugar beet demonstrations at Great Bardfield, Essex, are described. Photographs show plants in the row from multigerm rubbed and graded seed, pelleted polyploid seed and pelleted genetic monogerm seed, drilled to stand or with mechanical thinning and grown without hard work. The aphicidal effectiveness of "Menazon" incorporated in seed pellets was shown or explained.

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An attempt to produce sugar beet in the tropics. A. C. CHATTERJEE and A. V. PICHUMANI. *Proc. 1st Conv. S. Indian Sugar Cane & Sugar Tech. Assoc.*, 1968, 21–23.—Results of a small trial of sugar beet in a sugar factory farm at Pennadam, South Arcot, are given. The soil was well tilled and manured before sowing with the sugar beet variety Maribo Magna Poly. Fourteen irrigations were given. Estimated yield was 15 tons/acre, with average sugar content of 14%. The economics of cultivation could not be estimated.

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The problems facing the sugar industry in Rajasthan: a unique experiment. V. S. SUD. *Indian Sugar*, 1968, **18**, 125–128.—The poor state of the sugar industry in Rajasthan and reasons for it are discussed. Stress is placed on the need for more adequate irrigation. The unique experiment referred to is the trial cultication of sugar beet in the cool season, which is promising.

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Questions concerning choice of variety and fertilizing considered in relation to beet quality in modern beet growing. C. WINNER. *Zucker*, 1968, **21**, 521–530. Results of field trials are given involving comparison of different cultivation methods (manual and mechanical thinning and drilling to a final stand). These have shown that each cultural operation affecting stand density may influence not only yield but also the quality of the beet. Differences in sugar content in the trials may be due to differences in nutrient supply, mainly nitrogen.

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Past, present and future of chemical herbicides for sugar beet. C. ANTONELLI. *Ind. Sacc. Ital.*, 1968, **61**, 205–221.—Experimental work in this field in Italy began in 1957, 45 herbicides having been tested, only a few of which have been used in practice. Statistical data for Italy and other European countries are given. A critical examination is made of the use of "Pyramin" and "Venzar" under various environmental conditions. Future prospects, especially in regard to the mixing of certain herbicides, are discussed.

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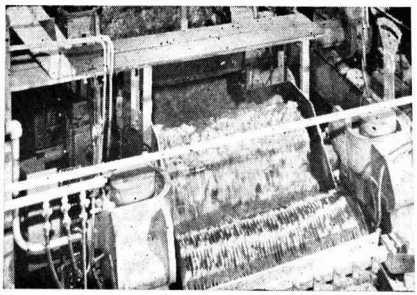
Effect of *Cercospora* leaf spot and dates of harvest on sugar beet varieties with or without "Manet" treatment. R. E. FINKNER and D. E. FARUS. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **14**, 643–663.—This destructive disease of sugar beet has been partly controlled in the United States by the use of resistant varieties. When conditions are especially favourable to the disease (high humidity and temperature) such varieties may be damaged. Under these conditions fungicides such as "Manet" may give additional protection. In the experiments described the object was periodically to follow the weight and chemical composition of the roots, crowns and leaves of a resistant, a moderately resistant and a susceptible beet variety under leaf spot and non-leaf spot conditions. Results obtained did not provide critical data to support or reject the hypothesis that leaf spot caused protein degradation. Spraying with "Manet" increased root yield.

Cane sugar manufacture



Operating history of the French bagasse screw press in Florida. J. DILLON. *Proc. Amer. Soc. Sugar Cane Tech.*, 1968, **15**, 67–79.—Details are given of the French Oil Mill Machinery Co. J-88 and K-70 bagasse screw presses and of their performances at certain sugar factories in Florida and at Ingenio San Cristóbal in Mexico. The results are compared with the performance of bagasse mills, showing the advantages of the presses. The costs of the presses and financial gain to be expected from their use are also discussed.

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Water quality in Louisiana streams receiving sugar factory wastes. R. A. LAFLEUR. *Proc. Amer. Soc. Sugar Cane Tech.*, 1968, **15**, 78–82.—See *I.S.J.*, 1969, **71**, 307.

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Egypt as cane sugar country. H. J. DELAVIER, G. BRUHNS and H. HIRSCHMÜLLER. *Zeitsch. Zuckerind.*, 1969, **94**, 210–214.—A survey is presented of cane agriculture and raw sugar manufacture and refining in Egypt, which has six factories producing about 350,000 tons of sugar a year, of which 40–50% together with imported raws is refined at Hawamdieh refinery hear Cairo.

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Combustion and chemical additives. D. E. WARNE. *S. African Sugar J.*, 1969, **53**, 166–170.—The use of chemical additives to control soot and slag deposits in boilers and low-temperature deposits in the economizer and/or air heater areas is discussed.

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Instrumentation for sugar mills and refineries. G. P. TREARCHIS. *Sugar J.*, 1969, **31**, (9), 9–13.—See *I.S.J.*, 1969, **71**, 340.

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The De Danske cane diffuser system. N. J. LOFT. *Sugar J.*, 1969, **31**, (9), 31–35.—Results of investigations on diffusion juice from sugar factories equipped with DDS cane diffusers show that since increase in juice temperature and pH is accompanied by increase in the extraction of pectin, gums and wax (decrease in the fat content in the juice with increasing pH is probably due to hydrolysis in alkaline solution), it is concluded that the diffusion temperature should be below 70°C, that the retention time in the diffuser should be as short as practical, and that the pH should be no higher than that of the natural cane juice. Data show the advantages of diffusion over milling.

Highlights of progress in the Florida sugar industry. ANON. *Sugar y Azúcar*, 1969, **64**, (3), 36–41.—A survey is presented of the Florida cane sugar factories with information on processes and equipment and results from the 1967/68 season.

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New raw sugar boiling system in Florida. R. E. DIAGO. *Sugar y Azúcar*, 1969, **64**, (3), 42–43.—In the 3-boiling system devised by the author, commercial raw sugar of 98·8 purity is obtained from the *A*-massecuite only, the *B*- and *C*-massecuites yielding sugar (of 96 and 89 purity, respectively). The *B*-sugar is used as seed magma for the *A*-strike, while the *C*-sugar is remelted and added to the syrup feed to the *A*-strike. A final molasses purity of 33 is obtained. In some respects the raw sugar exceeds the standards set by the American Sugar Co.

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Burning bagasse in step grate furnaces and the importance of the air:fuel ratio. M. V. RAO and R. RAMACHYARULU. *Indian Sugar*, 1969, **18**, 745–747. At the authors' sugar factory the efficiency of a Murry boiler was reduced by a high excess of air making its way through unburnt bagasse over the top gate bars in the modified step grate furnace. This was prevented by covering with an iron sheet and using an auxiliary furnace to pre-heat the bagasse, after which the CO_2 content in the flue gas rose sharply and a much higher temperature was obtained.

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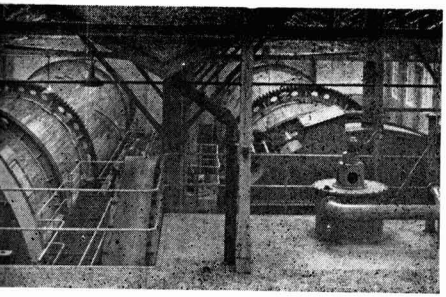
Clarification factor. S. C. GUPTA and K. SHANKAR. *Sharkara*, 1968, **10**, 50–53.—The relationship between non-sugars removal % and juice purity rise in clarification is discussed and various formulae for calculation of the clarification factor are examined. The values of the factor obtained with the formulae are compared with those given by the formula of VAN DER LINDE $\left[\frac{-10{,}000\ (P_{cj} - P_{mj})}{P_{cj}\ (100 - P_{mj})}\right.$, where P_{mj} and P_{cj} are, respectively, mixed and clarified juice purities]. Most of the values fall with rise in purity, in one case there is a rise in the value with increased purity, and only in the case of the Indian Sugar Technologists' Association formula is the factor almost constant, although the value is always higher than the constant value given by the VAN DER LINDE formula, which is recommended until a better formula is available.



Beet sugar manufacture

Campaign length, factory capacity and technico-economic factors of a projected concern. V. L. MAR'YANCHIK. *Sakhar. Prom.*, 1969, **43**, (1), 49–52. Calculations show that under Soviet conditions it is better, both economically and technically, to increase sugar factory capacity and minimize campaign length rather than increase the campaign while maintaining factory capacities at existing levels.

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Gaudfrin universal sliding plate pressure filter. P. DEVILLERS and M. ROCHE. *Sucr. Franç.*, 1969, **110**, 81–86.—A detailed description is given of this filter[1] and its performance at Epenancourt sugar factory in France is discussed. Despite certain modifications considered necessary to overcome faults discovered in operation, which are described, the filter is thought to be highly promising.

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Derivation and application of a formula for calculation of crystal yield from a massecuite of known composition. E. SVOBODA. *Listy Cukr.*, 1969, **85**, 12–18.—The formula for calculating crystal yield G_1 from massecuite takes the form

$$G_1 = \frac{Z_o - c_{Zo} W_o}{s_1 - (c_{Zo} + c_{No})(1 - s_1)}$$

where Z_o = sugar content of mother liquor, c_{Zo} and c_{No} = sugar and non-sugar concentration, respectively, in mother liquor water, W_o = mother liquor water content, and s_1 = required moisture content of sugar obtained. For calculation of the saturation coefficient of standard molasses, K_n, an equation is derived based on the work of SILIN and VAVRINECZ which assumes a standard molasses non-sugar content of 2·05%: $K_n = 0{\cdot}416\ c_N + 0{\cdot}574 + 0{\cdot}426\ e^{-2{\cdot}4 c_N}$ where c_N = non-sugar concentration in water and e is the base of the natural logarithm. A correction for temperature takes the form $K_n = 0{\cdot}003\ (t - 40)$, where t = temperature (°C). The equations are claimed to be valid where data are available on thick juice quality, initial massecuite and standard molasses.

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Steam expansion in modern sugar factories. V. SÁZAVSKÝ. *Listy Cukr.*, 1969, **85**, 18–19.—It is shown that because the measured heat losses are small, the true amount of injection water used in the reduction and saturation of live steam is 0·43 ± 0·16% lower than the theoretical value for steam immediately before reduction (1·07 ± 0·16% lower for steam leaving the boiler room). Steam losses amount to 2·09 kg/kWh with expansion in a turboset at an enthalpy of 667·9 cal/kg.

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Dynamic characteristics of sensing devices for temperature measurement. P. MOTEJL and V. VALTER. *Listy Cukr.*, 1969, **85**, 20–23.—The transient characteristics of various types of thermometer were determined in water, wash liquor and crystal sugar. In all cases the time constants increased in the three media mentioned as well as air and steam. The standard housings for temperature sensing elements have a considerable adverse effect on the dynamic characteristics and should be oil-filled.

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Sugar extraction from beet cossettes by liquid exchange and not by diffusion. W. RATHJE. *Sucr. Belge*, 1969, **88**, 141–144.—See *I.S.J.*, 1968, **70**, 373.

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Comparative tests on Giproniisakhprom and BMA clarifiers. V. A. ZAMBROVSKII and D. V. OZEROV. *Sakhar. Prom.*, 1969, **43**, (3), 29–32.—In tests with a specially-constructed combined clarifier, in which each of the four trays was of different design, the juice from a BMA tray had a higher turbidity (0·037 and 0·063 g $CaCO_3$/100 ml juice) than did juice from a Soviet Giproniisakhprom tray (0·028 and 0·042 g/100 ml) in which the juice enters through a hole in the central shaft and is discharged through a port at the side of the clarifier via two semi-annular tubes, each having three branches.

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Lining constructions, method of installation, bricklaying and repair methods in coke mixture-fired vertical lime kilns in the sugar industry. G. KRIST. *Zeitsch. Zuckerind.*, 1969, **94**, 82–84.—The author, a representative of Veitscher Magnesitwerke A.G., of Vienna, Austria, describes the advantages of special magnesite bricks for lime kilns and discusses the various aspects given in the title.

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Installing stainless tubes in an evaporator station. ANON. *Zeitsch. Zuckerind.*, 1969, **94**, 94.—Experience at an Austrian sugar factory with stainless steel longitudinal seam welded evaporator tubes has shown their advantages as regards freedom from corrosion, and the only damage encountered is attributed to mechanical effects. Since the tubes

[1] *I.S.J.*, 1968, **70**, 154.

have a longer life than normal steel tubes, the higher initial costs of the former are considered to be of lesser importance than originally thought.

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The calculation and control of multiple-effect evaporators. Theoretical studies. O. WIKLUND. *Socker Handl. II*, 1968, **22**, 1–22.—A system of mathematical equations is presented for calculation of multiple-effect evaporator parameters, including vacuum pan vapour consumption. Control of evaporator juice level is exemplified by a closed circuit system with feed-back and by an open circuit scheme. Calculation of marginal conditions in evaporation is demonstrated. The equations can be used for computer programming.

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Filter-press sweet waters — their composition and utilization. R. BRETSCHNEIDER and P. KADLEC. *Listy Cukr.*, 1969, **85**, 34–40.—Details are given of investigations into filter-press cake sweetening-off. It is recommended to limit sweetening-off to 7·5°Bx, which in the tests took 14 min compared with 20 min for complete sweetening-off, when the press mud contains only 0·8–1·0% sugar.

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Investigations of the oxygen content of juices from continuous diffusers and its significance for the growth of thermophilic micro-organisms. H. KLAUSHOFER and A. KOLBER. *Zucker*, 1969, **22**, 101–106, 132–136. The oxygen content of juice from two different tower diffusers (Buckau-Wolf and BMA) was determined and the possible existence of correlation between this and the bacterial counts tested. It was found that there is a critical range, in which the oxygen content is too high for growth of *Clostridium thermohydrosulfuricum* anaerobe and too low for growth of *Bacillus stearothermophilus* aerobe. An adverse effect of this oxygen level on the thin juice quality could not be found. It is considered that the results offer a better means of bacteriological control than does the conventional periodical disinfection.

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Selection of a complex mechanization scheme for (lime kiln) operation with limestone and solid fuel. S. P. VEREVKIN, L. A. RADMAN and V. A. CHUBUKIN. *Sakhar. Prom.*, 1969, **43**, (2), 38–41.—Details are given of a scheme for preparing, loading and discharging limestone and solid fuel with a vertical lime kiln.

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Modernization of a sloping twin-scroll diffuser. M. S. GABOVICH and D. G. GRIN'FELD. *Sakhar. Prom.*, 1969, **43**, (2), 29–34.—Troubles encountered in the USSR with Polish-built DDS diffusers and Soviet-built S-17 twin-scroll diffusers of similar design are divided into two groups: those caused by failure to maintain suitable operating conditions, and those attributable to design and structural defects. Details are given of the faults and their remedies.

Use of synthetic fabrics in juice filtration. R. A. SHIRING. *Sakhar. Prom.*, 1969, **43**, (2), 35–36.—The use of synthetic filter cloths on disc and vacuum filters at two Soviet sugar factories has given good results in the treatment of carbonatation juice and mud filtrate. Performance details are given.

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Column-bed decolorization of juice and sugar products by means of active carbon. S. ZAGRODZKI, H. ZAORSKA and S. M. ZAGRODZKI. *Sakhar. Prom.*, 1969, **43**, (2), 11–17.—See *I.S.J.*, 1968, **70**, 373.

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Preventing early tube wear in heat exchange equipment. G. G. KOLESNIK. *Sakhar. Prom.*, 1969, **43**, (2), 37. Means of preventing premature heating tube wear caused by hammer are described.

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Beet mass and sugar losses in the use of unloading-loading techniques. A. E. POPOV and I. I. NAGORNOVA. *Sakhar. Prom.*, 1969, **43**, (2), 45–48.—In Soviet tests with a disc and a toothed dirt separator, the former proved more efficient. For loading beets onto a road or rail truck, a grab was more efficient than a bulldozer.

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New detector for control of evaporator calandria venting. S. ZAGRODZKI and J. DOBRZYCKI. *Gaz. Cukr.*, 1969, **77**, 28–31.—See *I.S.J.*, 1969, **71**, 235–237.

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Slicing resistance, elasticity and quality of beet cossettes. K. VUKOV. *Zucker*, 1969, **22**, 160–166. Experiments in Hungary, in which the resistance to slicing and elasticity modulus of cossettes from various beet varieties were examined, showed that for a given set of values of these factors there is an optimum slicing technique whereby the thickness, compressibility and friction coefficient of the cossettes will give optimum sugar extraction in a given diffuser. Guide lines are given for slicing of beets according to their quality. The factors governing elasticity and slicing resistance are evaluated statistically.

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Preventive measures against sugar dust explosions. I. G. SCHNEIDER. *Zucker*, 1969, **22**, 166–171.—West German regulations concerning measures for the prevention of sugar dust explosions are explained.

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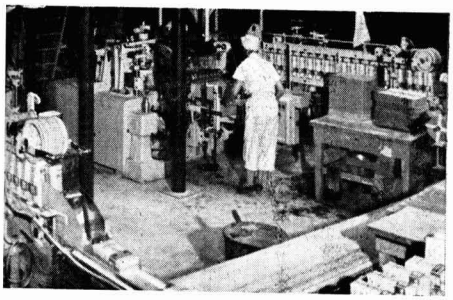
Heat transfer kinetics in cooling crystallizers. I. S. GULYI and N. A. SHEVANDIN. *Sakhar. Prom.*, 1969, **43**, (3), 14–20.—An empirical equation is derived for calculation of the heat transfer coefficient at any moment of time as a function of initial massecuite Brix and at constant speed of rotation of the crystallizer cooling surface. A formula is also given for calculating the time constant. This is valid for an initial molasses Brix of 80–90°. Worked examples of calculations are given.



Sugar refining

Ultrasonic sensor permits accurate, dependable level control of sticky liquids. O. C. SAMUEL. *Food Process. Market.*, 1967, **28**, (9), 30, 36; through *S.I.A.*, 1968, **30**, Abs. 68–203.—At Refined Syrups & Sugars Inc. refinery at Yonkers, N.Y., syrup levels in tanks and pipes are detected by ultrasonic probes which can be used with viscous liquids of variable temperature, pH, conductivity and capacitance. Ultrasonic vibrations pass from a transmitter to a receiver in the probe only when the ½-in gap between them is filled with liquid.

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The future of adsorbents in cane sugar refining. E. P. BARRETT. *Proc.* 1966 *Tech. Session Cane Sugar Refining Research*, 2–15.—In the author's view, the quantity of adsorbent used will decrease in relation to the quantity of raw sugar refined as the average daily melt increases. Bone char and "Synthad" will continue to be the major adsorbents used in cane sugar refining, while granular activated carbons will completely replace powdered active carbons except for use as a "polishing" adsorbent in liquid sugar production. Granular activated carbon will not replace bone char but its use as an auxiliary refining aid will increase. Choice in a new installation between the most efficient but capital-intensive bone char type of refinery and the less efficient but cheaper active carbon type will depend on the capital available.

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Control of granular carbon regeneration by the use of particle density. J. T. TRUEMPER. *Proc.* 1966 *Tech. Session Cane Sugar Refining Research*, 15–24.—Particle density is independent of particle size and shape distribution changes in a service activated carbon. This independence is advantageous when density is used as an analytical control method for the regeneration of carbons. Bulk density measurements may be seriously affected by the changes in particle shape and size and its use may cause the loss of the control point for regeneration. Subsequently unnecessary overburning can occur with excessive carbon losses. Further, measurement of particle density by mercury displacement is relatively simple, rapid, and may be used as an in-process regeneration control.

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Weight control at sugar refinery. ANON. *Food Manuf.*, 1968, **43**, (2), 60.—The total weight and flow rate of raw sugar entering Thames Refinery of Tate & Lyle Ltd. on 32-in wide steel band conveyors are measured by two Ashworth Ross band weighers, each handling up to 180 tons/hr at an error no greater than ½%. The syrup dosing valve is automatically controlled by the recorded weights, the time taken by the sugar to reach the dosing equipment being taken into account.

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Refined sugar conditioning and storage. A. M. HOWES. *Sugar y Azúcar*, 1968, **63**, (8), 26–27.—See *I.S.J.*, 1967, **69**, 247.

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Recent advances in the Japanese sugar refining industry. M. KAMODA and T. ANDO. *Sugar y Azúcar*, 1968, **63**, (9), 35–39.—Information is presented on four refineries constructed in Japan during recent years. Common features are bulk handling of raw sugar and products, outdoor installation of equipment and automatic operation. The decolorization processes used vary, but follow a common carbonatation process; they include treatment with a moving bed of granular carbon and bone char, standard bone char and ion exchange resin treatment, and a granular carbon and ion exchange resin process. Other equipment at the four refineries which are surveyed include that in the boiling houses, that for drying and finishing the refined sugar, and the automatic controls.

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Use of the slugging system with granular carbon in the Puerto Rican American Sugar Refinery. M. CRUZ V., F. J. SERRALÉS and J. E. MAYORAL. *Bol. Azuc. Mex.*, 1968, (222), 15–20.—The slugging system was adopted when the Puerto Rican American sugar refinery changed from powdered carbon to the use of granular carbon in 1964. Three cisterns, 10 ft in dia. × 30 ft. high, are used and slugs of 170 cu.ft. are removed from each every 24 hours, equivalent to a column height of 2 ft 3 in. An account is given of the arrangements for slug removal, washing and regeneration of the carbon. Colour removal averages 84–85%, and four white sugar strikes can be boiled from the liquor. Future modifications to be applied to the system are listed and briefly discussed.

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The carbonatation of re-melted raw cane sugar at Insular Sugar Refining Corporation. L. CIFRA. *Proc.* 14*th Conv. Philippines Sugar Tech.*, 1966, 93–97. A description is given of the raw sugar remelt continuous carbonatation scheme, the liquor from which is filtered and treated with active carbon. Despite some problems, answers to which are discussed, the scheme is considered of advantage as a preliminary stage in Philippine refineries.

Change in the properties of cane raw sugar during bulk storage. M. B. YARMOLINSKII. *Sakhar. Prom.*, 1968, **42**, (9), 12–16.—In average samples of cane raw sugar stored in bulk under cover for 2 months at an average temperature of 23·4°C and a relative humidity of 79%, the pol fell from 97·30 to 96·20°, the moisture content rose from 0·53 to 1·30%, the reducing matter content increased from 0·55 to 0·85% and the colour from 31·2 to 32·0°St. On the other hand, the sugar retained its free-flowing characteristic. It is recommended that raw sugar quality requirements should be adjusted to a pol of at least 97°, a moisture content no higher than 0·7%, a maximum reducing matter content of 0·5%, and at least 80% crystals measuring 0·75 mm.

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Fractional single-stage defeco-saturation in the processing of cane raw sugar. KH. I. MICHEV and I. F. BUGAENKO. *Sakhar. Prom.*, 1968, **42**, (9), 16–19. Tests were carried out on three variants of the BMA carbonatation process. In variant I all the milk-of-lime (3–4% CaO on weight of raw sugar) was added in vessel Ia, vessels Ib and Ic being used for gassing with CO_2 to pH 9·5 and 7·5, respectively. Defecation was omitted in variants II and III, 60% of the milk-of-lime being added to vessels Ia and 40% to Ib, simultaneous liming and gassing being used in both vessels. In variant II the pH in vessels Ia, Ib and Ic was 10·4, 8·6 and 7·2, respectively, while in variant III the corresponding values were 9·5, 8·7 and 7·3. Comparison of results showed III to be the most suitable variant and I the least effective, since in the former, reducing matter destruction was minimal and the lime salts content very much lower than in I. Remelt purity and colour in III were only slightly higher than in II, although the lime salts content was still less than half that in II.

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Fives Lille-Cail continuous crystallization. F. DAMBRINE, J. C. GIORGI and G. WINDAL. *Ind. Alim. Agric.*, 1968, **85**, 1005–1008.—Information is given on the Fives Lille-Cail continuous 7-cell horizontal vacuum pan[1] at Nassandres sugar refinery. Some details are given of the automatic controls. At a vacuum of 54 cm Hg, about 10 tons of massecuite is produced per hr at 74–75°C. This has been raised to 17 tons/hr in prolonged tests and a figure of 20 tons/hr is considered possible. At the nominal throughput, 150 kg of seed is introduced per hr. The resultant crystals are well formed with no fines; under these conditions the M.A. is 0·7 mm and the C.V. 32%. The massecuite is dropped at 91·5°Bx (a purity of at least 97), variation in the Brix being less than $\pm$ 0·5°. The crystal yield is 55–60 kg/100 kg massecuite.

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The Finnish sugar industry, particularly the new sugar refinery at Porkkala. G. HERNBERG. *Zucker*, 1968, **21**, 549–554.—A survey is presented of the Finnish sugar industry with details of the Porkkala refinery which stands on the coast about 30 km west of Helsinki. The refinery produces 600 tons of sugar per day, mainly from cane raw sugar; this output could be raised easily to 1000 tons/day. The sugar is delivered in bulk by ships for which quays have been especially built. The bulk warehouse holds 50,000 tons of sugar. Information is given on automatic controls and processes used in the refinery.

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Investigations of changes in beet raw sugar during bulk storage. H. G. SCHNEIDER. *Zucker*, 1968, **21**, 588–597.—Detailed investigations of the behaviour of raw sugar from various sugar factories stored at Elsdorf refinery in West Germany are reported. The factors used as criteria were: non-sugars content, pH, invert content, amino-N content, colour, water migration and refining properties. Each is considered in turn and the results expressed in the form of graphs and tabulated data. It was found that, under conditions of excessive temperature and sugar moisture, after a certain storage period (9–12 months) the Maillard reaction taking place in the sugar will increase its deterioration to the point at which it cannot be refined. Although other factors affect stored sugar besides moisture and temperature, no precise relationship could be found and the investigations are continuing. It is thought advisable to store sugar at a temperature of 25 $\pm$ 3°C, at a non-sugars:water ratio of at least 1·5 [or at water/(100-pol) $\leqslant$ 0·4]. Under these conditions, the sugar loss will be 0·1–0·2% after 8–12 months' storage.

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Reinforced plastic reduces metal contamination and cuts the costs of replacement and of equipment maintenance in a refinery. N. ROSENBERG. *Sucr. Belge*, 1968, **87**, 869–872.—The use of "Atlac 382" diphenol-A-fumarate reinforced polyester resin (produced by Atlas Chemical Industries Inc., Wilmington, Del., USA) for the construction of equipment at the liquid sugar plant of Refined Syrups and Sugars Inc. at Yonkers, N.Y., USA, is described. It has been used particularly for tanks, pipelines, vapour lines and sumps. Its advantages are discussed.

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Behaviour of non-sugars during affination of cane raw sugar. N. A. ARKHIPOVICH and B. A. KUTSENKO. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (4), 23–25.—Laboratory affination of Cuban raw sugar having an apparent purity of 98·3 showed that 60–67% of the non-sugars were discharged with the run-off; the greater part of the unseparated non-sugars (colloids, ash and N matter) were found within the affined sugar crystals, while reducing matter and gums made up the majority of non-sugars in the syrup film surrounding the crystals, i.e. 60% of the total affined sugar reducing matter and about 50% of the total gum content. The quality of the added syrup had considerable effect on the affined sugar quality.

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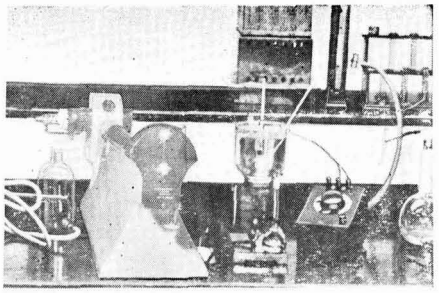
The use of reinforced plastics in the refinery. N. ROSENBERG. *Sucr. Franç.*, 1968, (12), 415–418.—See abstract on this page.

[1] *I.S.J.*, 1964, **66**, 73–76, 113–116.



Laboratory methods & Chemical reports

Molecules and crystals of sucrose. I. N. KAGANOV and A. A. SLAVYANSKII. *Sakhar. Prom.*, 1968, **42**, (12), 15–17.—The authors present and discuss the configuration of the sucrose molecule, its spacial model, schematic representation about the *a* axis and its location in the elementary nucleus (three projections on three planes). A geometric representation of the sucrose crystal nucleus is given as well as an electronogram of sucrose taken along the *b* axis.

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The amount of sugar that can be crystallized from sugar solutions during cooling. I. K. POPEREKA. *Sakhar. Prom.*, 1968, **42**, (12), 20–21.—The data of ZHUKOV and GRUT and results of tests in which saturated sugar solutions of 80, 70 and 60°C were cooled to 40°C have been used to construct curves showing the amount of crystallizable sugar, Brix, purity and sugar content of the initial and cooled solutions as well as the saturation coefficient. The curves are reproduced and their interpretations explained.

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Examination of methods of sucrose determination in sugar beets and sugar cane by the isotope dilution method. H. HIRSCHMÜLLER and R. KRÖCHER. *Zeitsch. Zuckerind.*, 1968, **93**, 475–482, 587–592, 649–655. Methods of determining the sucrose content of beet and cane are surveyed with 157 references to the literature. A number of them were compared with the isotope dilution method[1]. Differences between the ID method and the cold digestion method were within the limits of random error. On the other hand, the double extraction method of PARKER[2] (also officially adopted by ICUMSA) and the hot water digestion method of the Berlin Institut für Zuckerindustrie[3] showed systematic errors when compared with the ID method, the values given by hot water digestion being higher and those obtained by double extraction lower than the reference values. With both cold and hot digestion there was an increasing reduction in the D-levulose content with rise in temperature and basicity of the lead acetate solution; since the D-levulose is only partly, if at all, removed from the solution, its positive optical rotation will give too high a sucrose content. The lower values given by double extraction are attributed to elimination of the error due to marc volume, whereby the error compensation is displaced. The anthrone method is comparable to the ID method but the results are too scattered. In evaluation of methods for determining cane sucrose content, it is considered that insufficient attention is paid to the effect of fibre and hydrate water contents. The SPENCER & MEADE method[4] and the anthrone method were the only ones to give results comparable within experimental error to those of the ID method, all other techniques showing systematic errors.

* * *

A method for determining betaine in thin juice after removal of the cations. F. PERSCHAK and H. KLAUSHOFER. *Zucker*, 1969, **22**, 38–40.—The method of BLOOD & CRANFIELD[5] has been modified for determination of the betaine content in thin juice after treatment on a cation exchange resin. It consists in comparison of the amount of N/30 sodium thiosulphate used to titrate the test solution after precipitation of the betaine as betaine periodide with that used in a standard solution of known sucrose and betaine contents. Results compared favourably with values obtained using the method of CARRUTHERS *et al.*[6] and the method is recommended for factory control.

* * *

Cane factory research in India. ANON. *N.S.I. News* (National Sugar Institute, India), 1968, **4**, (1), 8–12. Computer processing of analytical data for cane final molasses showed the alkali:non-sugar ratio to have closest correlation with exhaustibility, followed in descending order by the reducing sugar:ash, ash:non-sugar, reducing sugar:non-sugar, (calcium + magnesium):non-sugar and calcium:non-sugar ratios. Regression equations have been derived for the relationship between molasses minimum true purity and each of these factors and combinations of the factors, and can be used to predict minimum attainable molasses purity and to compare molasses exhaustibility at different factories. A rapid flame photometric method of estimating sodium, potassium and calcium in cane molasses has been developed. Experiments on seeding rab used for khandsari manufacture are discussed. Probable causes of molasses spontaneous combustion have been investigated and are listed, and means of preventing it are enumerated.

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[1] HÖRNING & HIRSCHMÜLLER: *I.S.J.*, 1960, **62**, 107.
[2] *I.S.J.*, 1958, **60**, 102–105, 132–135, 159–161, 197–200.
[3] "Handbuch für die Betriebskontrolle der Zuckerfabriken" (Hannover, Germany). 1948, p. 7.
[4] "Cane sugar handbook" 9th Edn. (Wiley, New York). 1963, p. 509.
[5] BROWNE & ZERBAN: "Physical and chemical methods of sugar analysis", 3rd Edn. (John Wiley & Sons Inc., New York), 1955, pp. 1085–1086.
[6] *I.S.J.*, 1961, **63**, 26.

The "Saccharomat" I and II automatic sugar polarimeters. W. KERNCHEN. *Zeitsch. Zuckerind.*, 1969, **94**, 27–31.—The basic concept of saccharimetry is explained and the schemes of operation of the "Saccharomat I" and "Saccharomat II" automatic saccharimeters are described[1]. Illustrations are reproduced showing the electronic components of both instruments.

* * *

Identification and sucrose-decomposing capacity of bacterial strains cultured from raw juices. I. TÓTH-ZSIGA. *Zeitsch. Zuckerind.*, 1969, **94**, 32–34.—Of 106 pure cultures isolated from raw juice in a number of Hungarian sugar factories, 73 were mesophiles and 33 thermophiles; 70 were gram-positive, this group also appearing to predominate geographically. The identifications of the bacteria and their properties and sucrose-decomposing capacities are given.

* * *

Determination of sulphur dioxide traces in white sugar. M. GAWRYCH and A. BUTWILOWICZ. *Gaz. Cukr.*, 1969, **77**, 8–9.—Details are given of a colorimetric method based on that of CARRUTHERS *et al.*[2] but using an alkaline fuchsine solution instead of rosaniline, and KI solution for preparation of a standard curve (1 ml of 0·01N I_2 corresponds to 0·32 mg SO_2). SO_2 contents in Polish white sugar samples generally varied from 0 to 0·9 mg/kg, although isolated cases occurred where the content was up to 10·4 mg/kg.

* * *

Determination of the acid equivalents and anion mean equivalent weight in beet molasses. E. REINEFELD and W. GOSCH. *Zucker*, 1969, **22**, 66–73.—The ion exchange method of STARK[3] was used to determine the "total acid" in beet molasses (357–465 meq/100 g non-sugars, average of 411 meq/100 g non-sugars) and the mean equivalent weight of the anions (80·2 ± 20%). Pyrrolidone carboxylic acid was determined from the glutamic acid concentration by paper electrophoresis after acid hydrolysis of the anion fraction. A conversion factor for calculating the true salt content from the conductivity was found, although this was also subject to considerable fluctuation (1·2–1·7, average 1·4–1·5).

* * *

Boiling points of concentrated sugar solutions. V. I. TUZHILKIN and I. N. KAGANOV. *Sakhar. Prom.*, 1969, **43**, (1), 17–20.—An ebulliometer is described which was used to determine the boiling point elevation of pure sucrose solutions at pressures in the range 149·38–760 mm Hg and of molasses solutions, the test solutions being boiled in one ebulliometer and water in a reference one. Graphs are plotted relating b.p.e. to sugar concentration and sugar:water weight ratio for pure sucrose solutions and to Brix for molasses solutions. Graphs also show the b.p.e. caused by the molasses non-sugars per unit β (β = non-sugars:water weight ratio). A linear relationship was established between Brix and the ratio between b.p.e. due to non-sugars and β for impure solutions in the range 55–83°Bx.

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Effect of organic and inorganic substances on the formation of double salts of potassium calcium sulphate. H. ITO, B. AMARASENA, M. KAMODA and T. ANDO. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1968, **20**, 22–28.—The effects of various organic and inorganic compounds and substances on the recovery of K from molasses by formation of potassium calcium sulphate double salt are recorded in the form of graphs.

* * *

Oligosaccharides and polysaccharides produced by *Dematium pullulans* from sucrose. M. KOMOTO and H. TSUCHIDA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1968, **20**, 29–38.—Details are given of experiments in which *D. pullulans* was cultured on synthetic media of varying initial sucrose concentration. The oligosaccharides and polysaccharides formed in the media are described.

* * *

Chromatography of sugars in the solvent systems including dimethylsulphoxide or N,N′-dimethylformamide. T. OTAKE. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1968, **20**, 60–65.—Experiments are reported in which dimethylsulphoxide (DMSO)-ethyl acetate and N,N′-dimethylformamide (DMF)-ethyl acetate were used to separate mono- and oligosaccharides by thin-layer chromatography using silica gel, and DMF-ethyl acetate for column chromatography of sugars on silica gel.

* * *

Studies of some variable parameters of sugar crystallization. T. HUSSAIN. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 89–113.—Various aspects of pan boiling and crystallization are discussed in the light of work carried out by various authors (32 references).

* * *

Control of sucrose crystallization in sugar factories. III. Application of the new graphical method for determining the crystal content of massecuites to optimization of crystallization in sugar factories. S. ŠUŠIĆ, G. KUKIĆ and K. RACA. *Zeitsch. Zuckerind.*, 1969, **94**, 89–93.—The method previously described[4] is applied to optimization of crystallization where no water is added. The results obtainable are compared with actual results where a high degree of thickening and dilution is used, showing that the crystallizer capacity can be greatly increased: by 16% in stages 1 and 2 of crystallization, and by 20% in the 3rd stage. The sugar yield can, it is claimed, be raised by 16% (on beet weight) in stage 1 and by 0·15% in stage 3, while steam consumption for thickening low-grade

[1] HIRSCHMÜLLER: *I.S.J.*, 1963, **65**, 58.
[2] *Ibid.*, 1965, **67**, 364–368.
[3] *Ibid.*, 1961, **63**, 156.
[4] *Ibid.*, 1969, **71**, 310.

massecuite is up to 25% lower. All important parameters for optimization of crystallization can be found using the proposed method.

* * *

Working operations for making preparations from sugar beets. B. OLOFSSON. *Socker Handl.* II, 1968, **22**, (2), 31–46.—The best technique to adopt with microscope preparations from sugar beet, including stains and reagents, is discussed.

* * *

Effect of heat on sucrose solubility in impure solutions. A. MALÍNKOVÁ and V. VALTER. *Listy Cukr.*, 1969, **85**, 40–42.—The factors a, b and c in the equation $H = a + bt + ct^2$, where H = sucrose concentration in saturated solution (g sugar/g water), t = temperature (°C), and a, b and c are functions of purity, were calculated from GRUT's solubility data for purities of 70 and above at 40–80°C and from HRUBÍŠEK's data for purities of 80 and above at 60–80°C to give solubilities for 70–100 purity at 50–90°C, both at 5-unit intervals.

* * *

The relation of beet molasses composition to true purity. I. Composition. J. B. STARK and R. M. MCCREADY. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 61–72. **II. Statistical evaluation.** J. B. STARK, R. M. MCCREADY and A. E. GOODBAN. *ibid.*, 73–84.—Investigations with molasses samples from a number of US beet sugar factories showed that "straight house" molasses cannot be readily distinguished from Steffen molasses by chemical analysis except by the raffinose content, which in Steffen molasses averages twice the content in straight molasses from the same source. However, in many instances the raffinose content was greater than 1% on solids in the straight molasses and below 2·5% in the Steffen molasses, in which case comparison was not so easy. The greatest variation in any of the major constituents analysed was in the chloride content with an 8-fold variation compared with a 2-fold variation found for most constituents, betaine showing least scatter. A positive relationship was found between the chloride content and purity (1 part of chloride carried 6–7 parts of sugar into the molasses); positive correlation between purity and other variables such as ash, (K + Na) and anion contents being attributed to the chloride effect. A negative correlation between N-containing fractions and purity is probably due to a decrease in sucrose solubility caused by them. The approximate 1:1 ratio for sucrose: (K + Na) equivalents found by DEDEK is confirmed, although a new ratio of sucrose-anion is presented and claimed to be as reliable.

* * *

Crystal formation during continuous boiling of sugar massecuites. S. I. SIRENKO, S. I. GULYI, V. D. POPOV and I. G. BAZHAL. *Sakhar. Prom.*, 1969, **43**, (2), 24–29.—Formulae are presented for calculation of a materials balance in continuous boiling, the various factors involved being expressed in the form of a Sankey diagram. Four different boiling techniques were tested, in which the crystal generator worked as a cooler, as a flash evaporator after a concentrator, as an evaporator after a concentrator and working with at the same vacuum, and as an evaporator after a concentrator but working at a separate vacuum. It is concluded that nucleation must take place in a space removed from the other boiling stages and at a strictly determined quantitative ratio found from the heat transfer-crystallization relationship.

* * *

Quantitative spectrophotometric analysis of mixtures of lactose, sucrose, invert sugar, glucose and levulose. F. TATEO. *Ind. Alimentari*, 1969, **8**, (48), 71–76.—The method is one for determination of lactose in the presence of the other sugars and involves determination of total sugars by a spectrophotometric method involving reduction of picric to picramic acid, and a second determination after fermentation with yeast diastase, after inversion in the case of sucrose, which destroys the reducing sugars but leaves the lactose intact.

* * *

The technological quality of sugar beets as determined by the modified Silin method. G. RAĆIK. *Zeitsch. Zuckerind.*, 1969, **94**, 133–137.—The author has developed a laboratory method of carbonatation, evaporation and 3-stage boiling. The melassigenic coefficient is then determined [$k_M = p_{NM}/(100 - p_{NM})$, where p_{NM} is standard molasses purity given by $p_{NM} = p \pm (69 - p)(s - 83{\cdot}5)/(s - 72{\cdot}5)$, p being the purity of the 1:1 diluted molasses and s the polarimeter reading]. Experiments with different beet varieties over a number of years in Czechoslovakia have shown that the optimum maturity of beets, at which sucrose yield is greatest and molasses losses minimal, can be determined from k_M, thus enabling beet varieties to be compared and the best harvest time to be selected.

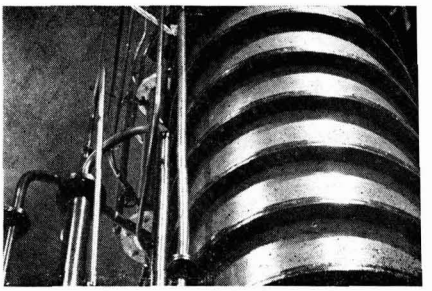
* * *

Separation of carbohydrates by thin-layer chromatography. S. M. PETROVIĆ and V. D. CANIĆ. *Glas. Khem. Drushtva*, 1969, **34**, (1), 151.—The separation of 13 sugars by one- and two-dimensional chromatography on cellulose and starch layers using 8 solvents is described. Good results were obtained on cellulose. Two-dimensional chromatography proved to be a satisfactory and widely applicable method in carbohydrate research.

* * *

Microflora in recovery house products from 2nd refined sugar raw syrup. E. K. POPOVA, G. N. MIKHATOVA and N. K. KVACHEVA. *Sakhar. Prom.*, 1969, **43**, (3), 22–25.—The bacterial counts in 2nd crop raw syrup and those in other products at each of the four recovery stages used at Krasnopresnensk refinery (USSR) were determined for mesophiles, heat-tolerant bacteria and thermophiles. The values are tabulated, showing the increase in the bacterial count of the 2nd crop raw syrup with reduction in its purity, particularly in tanks and screw conveyors.

By-products



Bulk storage of bagasse. D. R. BERNHARDT. *Proc. Amer. Soc. Sugar Cane Tech.*, 1968, **15**, 24–30.—See *I.S.J.*, 1969, **71**, 315.

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Nutritive value of filter cake and sugar cane tops for forage. J. A. LÓPEZ H. *Circ. Estac. Exp. Agríc. Tucumán*, 1967, **178**, 1–8; through *S.I.A.*, 1968, **30**, Abs. 68-157.—Investigations conducted on the digestibility by animals of protein contained in filter cake from cane sugar factories and in sugar cane tops are briefly discussed. In experiments conducted in northern Argentina with forages composed of different mixtures of dried filter cake, dried chopped cane tops, lucerne flour, oat meal, and molasses, it was found that digestibility of protein in filter cake and cane tops is low, approaching a level of 15% only. Cane tops contain less protein than filter cake but have better digestible protein. As to nutritive value, both filter cake and cane tops are comparable to low-quality hay.

* * *

Value of sugar in animal feeding. P. WAHL. *Sucr. Belge*, 1968, **87**, 465–478.—The low price obtainable for sugar has led to investigation of its use as animal fodder; the author discusses this use on the basis of comparison with other feedstuffs and on economic grounds.

* * *

Utilization of by-products of the alcohol industry and its future prospect. B. B. PAUL and D. K. R. CHOWDHURY. *Indian Sugar*, 1968, **17**, 763–766.—The possibility of use of distillery slops for production of methane by anaerobic fermentation, followed by recovery of potash from the fermented product, is discussed with an account of pilot plant trials and calculation of steam requirement, costs, etc.

* * *

Research on the development of the fermentation industry in Cuba. O. ALMAZÁN and V. GREGR. *CubaAzúcar*, 1967, (March/April), 18–28.—Research on fermentation of molasses is in two parts: work for solution of existing problems, and basic studies. Among the former are work to raise the fermentation efficiency of Cuban alcohol distilleries, the production of yeast from molasses and from distillery worts, and the utilization of by-products from distilleries, e.g. recovery of carbon dioxide, fusel oil and yeast and the manufacture of fertilizer from dunder. Basic work includes study on alcohol fermentation, with new types of yeast, and production of vitamins, ergosterol and nucleic acid, enzymes, amino-acids, biotin and fats by means of yeast fermentations, as well as production of organic acids, especially citric acid, dextran and vitamin B_{12} by other fermentations.

* * *

Different related aspects of yeast production in Cuba. ANON. *CubaAzúcar*, 1967, (May/June), 19–26.—The characteristics of *Torula* yeast produced both as a prime product and as a by-product from alcohol manufacture are tabulated; either is suitable for animal fodder which should ideally be a mixture. Manufacture of yeast in an alcohol distillery is briefly discussed and experience gained at the Ciro Redondo plant in Cuba described. Suitable raw materials for *Torula* manufacture include molasses, distillery worts, or a mixture of the two, hydrolysed bagacillo, cane trash or bagasse, high test molasses and residues from pulp manufacture. Opportunities for yeast manufacture in Cuba are surveyed and the investments and raw materials supplies necessary for various processes and production levels are discussed and tabulated.

* * *

Hog breeding station of T.S.C. ANON. *Taiwan Sugar*, 1968, **15**, (2), 33–34.—The operation, facilities and achievements or the Taiwan Sugar Corporation's hog breeding station are discussed; the hogs are able to utilize fodder from sugar by-products and provide meat as well as manure for application to cane fields.

* * *

Selective acylation of sucrose: isolation and structure of fatty acid partial esters. E. REINEFELD and S. KLAUDIANOS. *Zucker*, 1968, **21**, 330–338.—The main components of a mixture of fatty acid partial esters of sucrose were isolated and identified by preparative thin-layer chromatography. Details are given of the results, with R_f values for the esters and a scheme for separation of the main components of a mono-ester (sucrose laurate).

* * *

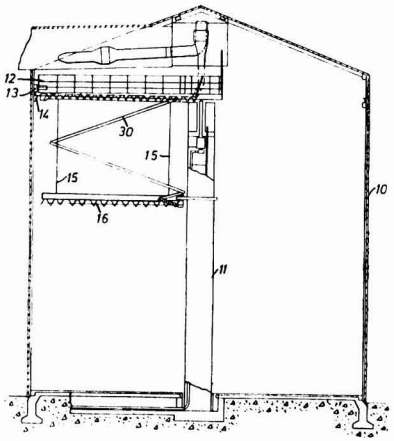
Vinasse: a problem in sugar factories. P. DE OLIVEIRA L. *Brasil Açuc.*, 1968, **71**, 391–396.—The large amount of vinasse which results from fermentation of molasses is indicated, as is the problem of its disposal. It cannot be discharged into rivers because of its high content of organic matters, etc., which kills the fish, but its high content of nutrients and easily handled form make it highly suitable as a fertilizer for the soil.

Patents

UNITED STATES

Silo unloader. C. M. WEIBULL, of Malmö, Sweden, *assr.* INGENIÖRSFIRMAN NILS WEIBULL A.B. **3,429,619.** 25th August 1967; 25th February 1969.

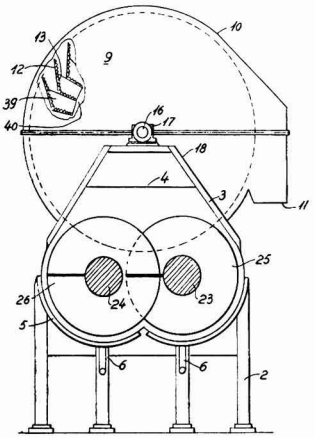
The silo 10 comprises a floor, wall and roof and has a central column which supports the inner end of the beam 12 which carried the silo filling mechanism and rotates about the column under the effect of driven wheels 13 supported on the beam 14 which runs around the top of the wall. Supported by cables 15 from the beam is a reclaiming screw conveyor 16 which delivers at the inner end into a connected housing from which another smaller screw conveyor



raises the stored material to a second housing from which another screw conveyor raises it to a further housing through a flap of flexible material, which acts as a non-return valve. The material passing through the flap enters a chamber to which a supply of compressed air is admitted and this air entrains the material, carrying it along a conduit placed on the articulated support 30 and up to the level of beam 12 after which it is carried out of the silo by suitable means. The compressed air supply is brought from an externally mounted compressor to the chamber by a duct which is also carried by support 30.

Cane diffuser. A. V. FAABORG-ANDERSEN and P. JENSEN, *assrs.* A/S DE DANSKE SUKKERFABRIKKER, of Copenhagen, Denmark. **3,433,598.** 4th November 1965; 18th March 1969.

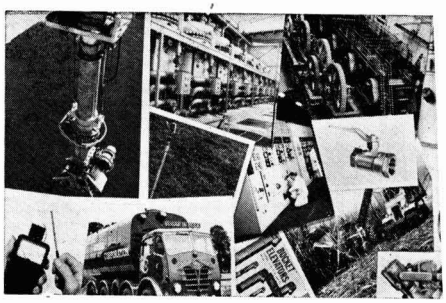
Exhausted bagasse from the twin-scroll cane diffuser is removed by apparatus in the form of a bucket wheel contained in the housing 10 having a discharge opening 11. The buckets consist of bucket plates 12 the outer edges of which are provided with teeth 13 which, during the passage of the bucket wheel through the bagasse which has been compressed by the twin scrolls, cause the bagasse to be loosened. The inner



edges of the bucket plates are welded to perforated plates some of which form the rear part of the buckets and the remainder form extensions of the bucket plates 12 each of which acts as a roof in the inner portion of the following bucket. This allows the drainage of excess liquid back into the trough as the wheel, rotating about the driven shaft 17 in bearings 16, lift the exhausted bagasse out of the trough and carry it round to the discharge opening 11.

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

Trade notices



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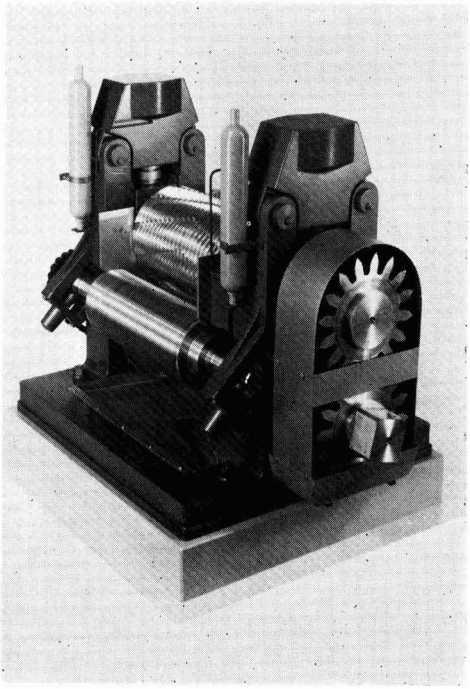
Bagasse dewatering mill. Stork-Werkspoor Sugar N.V., P.O. Box 147, Hengelo (OV.), Holland.

The illustration shows a model of a two-roller mill manufactured by Stork-Werkspoor for dewatering of bagasse from cane diffusion. The mill is advocated in preference to a 3-roller mill, over which it has the advantages of lower investment costs because of lower



weight and simpler construction, elimination of the trash plate, and simple, and hence cheaper, maintenance. It is recommended to use two 2-roller mills with different grooving. Two mills can be operated from one prime mover without any problem.

Plastic tanks. Prodorite Ltd., Eagle Works, Wednesbury, Staffs., England.

Through expansion of their Plastics Division factory, Prodorite Ltd. are now able to offer a wide range of standard-sized "Orglas" vertical (500–25,000 gal capacity) and horizontal (1000–10,000 gal capacity) cylindrical tanks. "Orglas" is a highly chemical-resistant plastic based on thermosetting resins heavily reinforced with glass fibres and is available in a number of grades including a food quality grade. The tanks can be used as storage or process vessels over a very wide range of chemical conditions. Smaller open-top rectangular tanks are also available in "Orglas".

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Bag filters. Stansted Filtration Ltd., 2a Lindsey Rd., Bishop's Stortford, Herts., England.

New bag filters for dust collection are announced by the makers. The filters comprise a circular tower in which the sleeves are arranged concentrically and hang down for about three-quarters of the tower height. The sleeves are cleaned continuously by blasts of fan-driven air, so that only 3–4% of the total filter area is off-stream for cleaning at any one time, each sleeve being cleaned every 10 seconds from an air manifold rotating at 6 r.p.m. The collected dust particles are constantly discharged by a rotating arm which sweeps the dust into a rotary discharge valve. Units are being used for dust collection at a bulk sugar reception unit, as well as for beet pulp dust collection.

Farrel expansion.—Farrel Company, a Division of USM Corporation, well known in the sugar industry as cane mill manufacturers, has announced the inauguration of a $2 million project to expand and improve the gear-making facilities at its plants in Ansonia and Derby, both in Connecticut, USA. A special gear division has been established within the Ansonia engineering department and will be responsible for the design of gearing and gear drives for all Ansonia product lines, the development of improved manufacturing methods, processes, special tooling and test procedures, and quality control and inspection of all gear elements and drives. Acoustic testing services are to be made available to the company's design engineers in view of the legal aspect of noise problems.

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Herbicide unit in Belgium.—Monsanto Europe S.A. have announced that a unit under construction at Lillo, near Antwerp, Belgium, was expected to be completed in late October and that a major manufacturing plant under construction at the same site is scheduled for completion in mid-1970. This will provide technical-grade raw materials to the new unit for formulation of Monsanto "Avadex" and "Avadex BW" herbicides, which are pre-emergence herbicides to control wild oats and black grass in, amongst other crops, sugar beet.

Ireland sugar imports and exports[1]

	1968	1967	1966
	—— (*long tons, tel quel*) ——		
Imports			
Barbados	6,100	22,462	22,701
British Honduras	—	4,724	7,474
France	5,288	—	—
Guyana	17,400	46,366	51,155
Jamaica	8,128	15,496	11,523
Trinidad	3,513	—	—
UK	—	—	6,312
Other Countries	8,091	940	96
	48,520	89,988	99,261
Exports			
UK	10,233	9,729	12,260
USA	4,504	4,482	4,500
	14,737	14,211	16,760

The late G. Y. Ewart.—George Y. EWART, one of the world's foremost authorities on sugar cane crop and water management, was killed in an air crash near Manila on the 13th September. Born in China, he graduated from Cornell University with a master's degree in agricultural engineering and entered the sugar industry more than 20 years ago as an irrigation and drainage engineer at Kekaha Sugar Co. in Hawaii. Five years later he became concurrently Director of Agricultural Control and Research, two years later becoming Manager of the Land Dept. and Chief Civil Engineer of Oahu Sugar Co. In 1959 he became Director of Agriculture and Hydrology of Amfac Inc., serving as consultant to its six sugar plantations, while in 1966 he joined American Factors Associates as Vice-President in charge of agriculture and related field engineering activities. He was on a business journey at the time of his death. He was best known for his work in developing crop management techniques in respect of fertilization, ripening and harvesting schedule control, and especially of irrigation water management and drainage of swampy and salt areas.

* * *

Mauritius sugar factory closure[2].—It was decided to close down Bénarès sugar factory with effect from the 1969 crop. An application to do so received Government permission and the factories remaining number 22. The closure is a step towards rationalization of the sugar industry and the neighbouring factories Britannia, Savannah and Union St. Aubin, which had been working below their milling capacity, will be able to crush the cane formerly sent to Bénarès and thereby increase their own efficiency.

* * *

New Philippine cane varieties[3].—Two new cane varieties have been bred by the University of the Philippines College of Agriculture at Los Baños. One, designated CAC 57-11, has been produced by crossing N:Co 330 with the College 39 variety, and the second, designated CAC 57-60, was produced by crossing H 37-1933 with N:Co 310. The new varieties are being planted on a commercial scale and yield 90–120 tons per hectare compared with the 60–70 tons/ha of older varieties. CAC 57-11 is early-maturing and has not been found seriously susceptible to pest infestation although it is moderately susceptible to smut and yellow leaf spot. CAC 57-60 is drought-tolerant and is moderately susceptible to leaf scorch.

* * *

Iran sugar production[4].—According to official data, the total beet slice in Iran during the 1968/69 campaign was 3,239,160 metric tons, produced from an area of 148,200 ha. Average sugar content was 16·83% and 352,962 tons of granulated sugar was produced as well as 84,244 tons of loaf sugar.

Brevities

New Indian sugar factories[5].—The Indian Minister of State for Food and Agriculture has disclosed that five new sugar factories—one each in Bihar and Mysore and three in Maharashtra—were expected to start crushing operations from the 1969/70 season. In the first half of 1969 the Indian Government issued 25 letters of intent for the establishment of new sugar factories, of which 21 proposals were for cooperative factories.

* * *

Hawaii sugar factory plans[6].—A new $27 million sugar factory for Oahu is planned by C. Brewer & Co. Ltd., to replace four plants on Mauna Kea and Pepeekeo. It will crush 6000 tons of cane per day and will produce 135,000 tons of raw sugar per year.

* * *

Hungary sugar industry expansion plans[7].—In order to process the beets delivered, the eleven sugar factories in Hungary have been forced to extend their campaigns to 130–150 days. The losses caused by this long campaign are in future to be avoided by extension of the processing capacities of the factories.

* * *

Sugar extraction possibility from sorghum[8].—According to the US Dept. of Agriculture sweet sorghum could become a new supplementary source of sugar because of the recent discovery of a practical method of removing starch from sorghum juice. The juice is first made alkaline with lime-water and a small amount of an acrylamide polymer or other agent added to cause the starch granules to form large clumps which can be separated after settling, when the remaining juice can be processed much the same as cane juice.

* * *

Sugar factory project for Panama[9].—The Instituto de Fomento Económico is sponsoring a project to instal a sugar factory in the Province of Veraguas. It is envisaged that the plant will be owned 51% by private investors and 49% by cane farmers. It will have a processing capacity of 3500 tons of sugar cane per day.

* * *

Jamaica sugar crop, 1969[10].—Final production of 1969 crop sugar aggregated 360,199·5 tons, or 95,583·5 tons less than was manufactured from the 1968 crop. The sugar yield was equivalent to 10·87 tons of cane per ton of 96° sugar. Output of 1969 crop molasses to the end of August 1969 amounted to 163,068 tons. Shipment of molasses between September 1968 and August 1969 totalled 108,867 tons.

* * *

Philippines-Taiwan sugar cooperation[11].—The Philippine Sugar Institute has signed an agreement with the Taiwan Sugar Corporation concerned with close cooperation in the development of the sugar economies of both countries. The agreement provides, among other items, for the exchange of cane varieties which are resistant against diseases and drought.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1969, (914), 66.
[2] *Mauritus Chamber of Agriculture Ann. Rpt.*, 1968–69, 14–15.
[3] *Sugar News*, 1969, **45**, 213.
[4] *Zeitsch. Zuckerind.*, 1969, **94**, 574.
[5] *Indian Sugar*, 1969, **19**, 322.
[6] *Zeitsch. Zuckerind.*, 1969, **94**, 407.
[7] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (26), 4.
[8] *ISRF Bull.*, 1969, **1**, (1), 3.
[9] *Bank of London & S. America Review*, 1969, **3**, 587.
[10] *Willett & Gray*, 1969, **93**, 358.
[11] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (27), 5.

Brevities

The late Pamela Scarr.—The death of Dr. M. PAMELA SCARR occurred on the 22nd October following a road accident. Dr. SCARR, who was 52, had been the principal microbiologist at the Tate & Lyle Research Centre for many years and had achieved a world reputation as an authority on the micro-organisms associated with the sugar industry.

* * *

Rumania sugar expansion plans[1].—Sugar production in Rumania is to be increased to 580,000–610,000 tons, white value (645,000–678,000 tons, raw value) by 1975. In the 1968/69 campaign sugar production was 415,000 tons, raw value

* * *

Ceylon sugar expansion[2].—In Uda Walave, Ceylon, it is planned to plant 18,000 acres (about 7300 hectares) to sugar cane and to erect factories for sugar and by-products manufacture. Firms interested in the project will be required to make technical-economic investigations and to provide technical assistance, and should seek further information from the Chairman of the Tender Board, Ministry of Land, Irrigation and Power, P.O. Box 500, Colombo.

* * *

Bagasse board in Mauritius[3].—A new company, The Universal Board Co. Ltd., has been formed to utilize bagasse for the manufacture of panels and tiles. The company's factory, which will be situated in the north of the island, is expected to start production in July 1971. It is hoped that the output will reach about 3000 tons of panels annually. The share olders of the company include eight sugar estates and others of the island's important firms are also participating.

* * *

Beet pulp drying plants for Turkey[4].—It is planned to instal beet pulp drying plants in Alpullu and Amasya sugar factories this year and in the Susurluk, Adapazari, Burdur, Malatya and Eskisehir factories in 1970. In order to save foreign currency, however, the plants are to be produced in Turkey by the machinery manufacturing division set up by Turkiye Seker Fabrikalari A/S. in Etimesgut, Ankara.

* * *

British Honduras 1968/69 sugar crop[5].—Total sugar production of Belize Sugar Industries Ltd. for the year 1968/69 amounted to 52,138 tons, slightly less than the previous year's total. After providing for local consumption, 20,500 tons have been shipped to the UK as part of the negotiated price quota under the Commonwealth Sugar Agreement, 13,800 tons has gone to Canada and over 14 000 tons was shipped to the US under the US quota.

* * *

New Czechoslovakian sugar factory[6].—A new sugar factory built in Pola d was put into operation at Hrochuv Tynec near Pardubice at the start of the current campaign. It has a daily processing capacity of 4000 metric tons of beets.

* * *

USSR beet crop reduction forecast.—Although it is reported that about 80% of the beet crop has been lifted in the Ukraine and: he Russian Federal Republic, there have been transport difficulties and it has been suggested, according to C. Czarnikow Ltd.[7], that technical difficulties will make it impossible to process a large proportion of the roots grown in the Ukraine (which is the principal beet growing republic). A severe drought in the Krasnodar region is expected to reduce the Soviet beet crop[8] and Western agricultural experts in Moscow estimate a decline of 10%.

Canada sugar imports[9]

	1968	1967
	(metric tons, raw value)	
Raw sugar		
Australia	144,798	157,127
Barbados	—	26,602
British Honduras	19,206	16,690
Colombia	—	6,500
Cuba	47,440	69,936
Fiji	56,648	76,630
Guyana	62,657	88,929
India	11,802	59,925
Jamaica	64,258	45,237
Mauritius	126,575	49,808
Mexico	—	4,572
El Salvador	5,334	—
South Africa	292,644	270,616
Trinidad	28,385	17,168
TOTAL RAW SUGAR	859,747	889,740
Refined sugar		
Germany, East	69	—
Germany, West	1	—
Holland	146	121
UK	3,115	3,037
US	85	16
TOTAL REFINED SUGAR	3,416	3,174
TOTAL IMPORTS	863,163	892,914

Polish sugar situation[10].—In the 1969/70 campaign a total of 76 sugar factories are working, their total capacity having been increased by 5% compared with last campaign as a result of modernization and expansion. In 1968, according to official figures, exports totalled 483,000 tons of white sugar and 163,000 tons of raw sugar; principal customers were the UK with 133,000 tons of white sugar and 38,000 tons of raws, France with 26,000 tons of whites and 28,000 tons of raw sugar, Jugoslavia with 90,000 tons of whites and Morocco with 83,000 tons, West Germany with about 23,000 tons, Norway with 30,000 tons, Greece with 20,000 tons, and Spain with 11,000 tons of white sugar. New export markets included the UAR with over 30,000 tons, Pakistan with 30,000 tons and East Germany with about 17,000 tons. The Polish sugar machinery export organization CEKOP has supplied a total of 35 sugar factories since 1954, including 15 in the USSR, 6 in Iran, 3 in Mainland China, 2 each in Czechoslovakia and Spain, and 1 each in Ceylon, Greece, Ghana, Indonesia, Morocco, Pakistan, and North Vietnam.

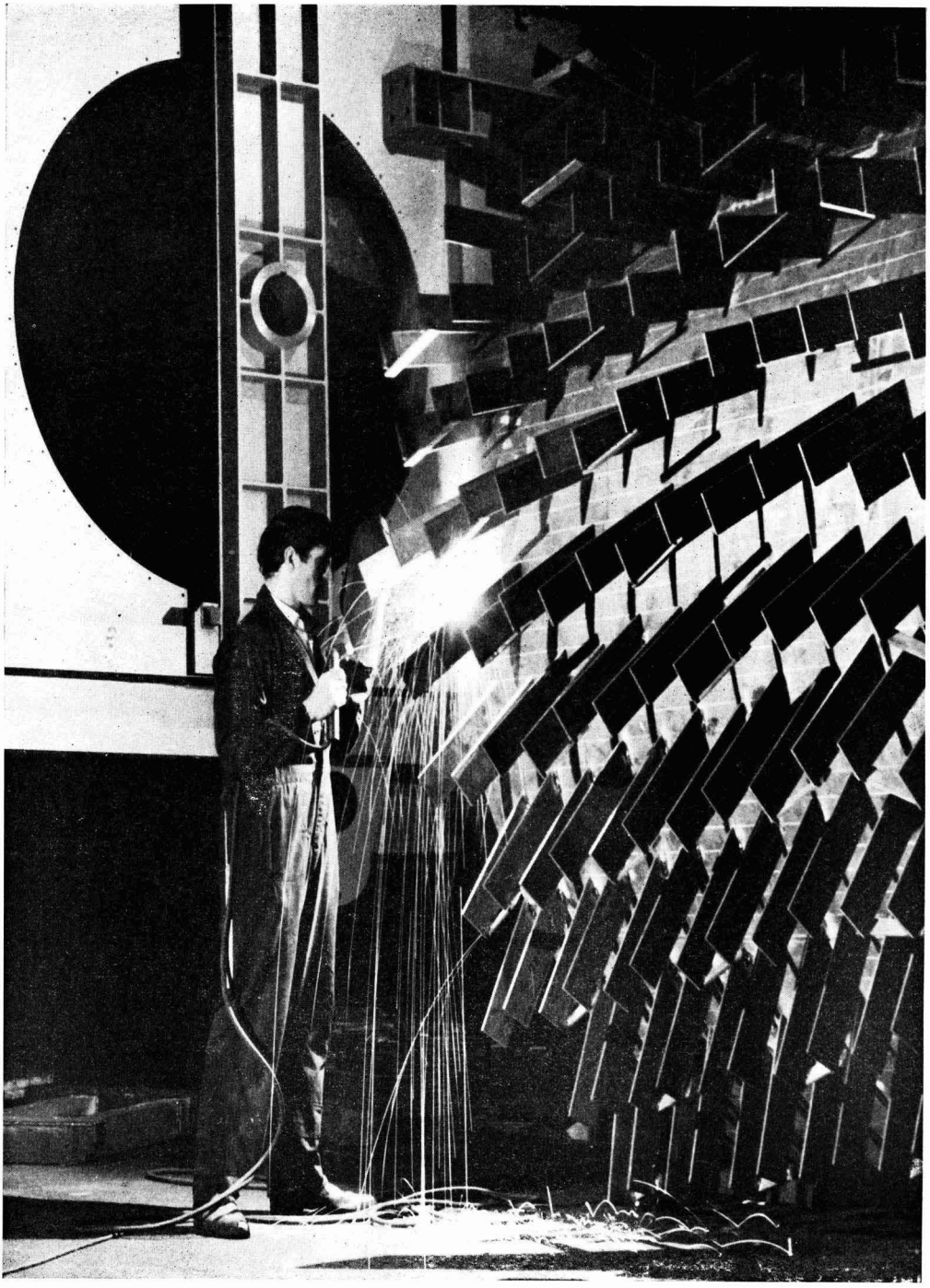
* * *

Mexico sugar exports, 1968[11].—Exports of sugar from Mexico totalled 676,321 metric tons, raw value, in 1968 compared with 571,583 tons in 1967 and 513,148 tons in 1966. Principal outlet was the US which took 574,981 tons, while 62,014 tons went to Chile, 29,015 tons went to Japan and 10,311 tons to South Korea.

* * *

Sugar beet as animal fodder in Poland[12].—Owing to a shortage of feeding stuffs, part of this year's sugar beet crop is to be diverted for use as cattle feed. As a consequence sugar production will probably be lower than previously estimated.

[1] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (27), 6.
[2] *Zeitsch. Zuckerind.*, 1969, **94**, 526.
[3] *Barclays Overseas Review*, October 1969, p. 22.
[4] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (26), 6.
[5] *Tate & Lyle Times International*, October 1969, p. 18.
[6] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (28), 5.
[7] *Sugar Review*, 1969, (942), 187.
[8] *Public Ledger*, 8th November 1969.
[9] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (12), viii.
[10] *Zeitsch. Zuckerind.*, 1969, **94**, 574.
[11] *Lamborn*, 1969, **47**, 168.
[12] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (29), 5.



[*Photo by courtesy of Fletcher & Stewart Ltd.*]

Cane diffuser under construction

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ERRATA AND CORRIGENDA

Page 52.	Line 24 of column 2.	Read "VLASÁK" for "VALASÁK".
Page 61.	Line 21 of column 1.	Read "C. R. STEELE" for C. F. STEELE".
Page 145.	Line 32 of column 1.	Read "C. WINNER" for "G. WINNER".
Page 174.	Line 6 of column 2.	Read "BONNET" for "BONNETT".
Page 176.	Line 10 of column 2.	Read "ULLIVARRI" for "ULLIVARI".
Page 208.	Line 24 of column 2.	Read "MURRY" for "MURRAY".
Page 240.	Line 11 of column 1.	Read "S. D." for F. D.".
Page 244.	Line 43 of column 1.	Read "PIOTROWSKI" for "PITROWSKI".
Page 305.	Line 22 of column 1.	Read "types" for "sypes".
Page 313.	Line 28 of column 2.	Read "TUZHILKIN" for "TUZHILIN".

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SOME REMARKS ON ITS USE

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

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

(Abs.) indicates *Abstract*; (Brev.), *Brevity*; (N.B.), *New Books*; (Corr.), *Correspondence*; (F.N.H.), *Dr. Howes*, our Agricultural Editor; (N.C.), *Note and Comment*; (Pat.), *Patent*; (Stat.), *Statistics*; (T.N.), *Trade Notice.*

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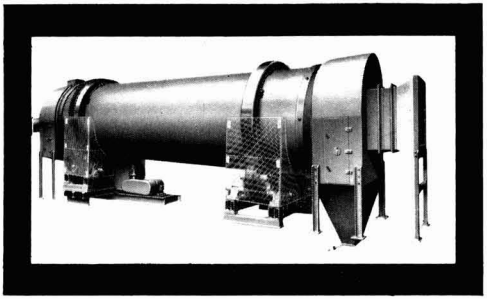

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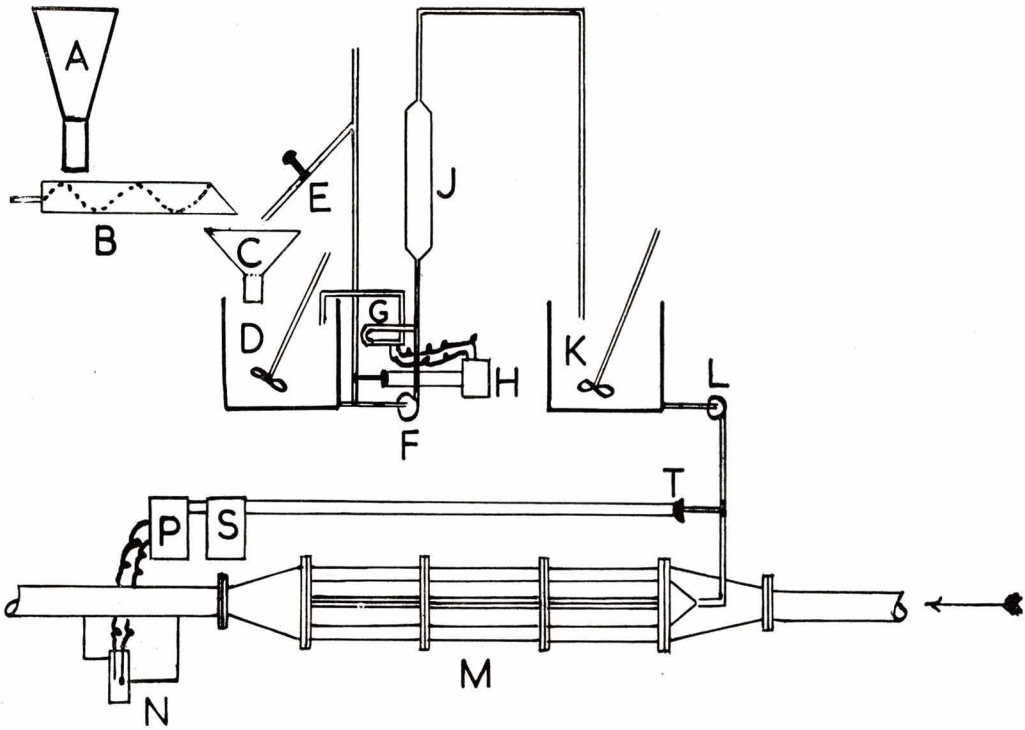

AUTOMATIC LIMING CONTROL

KEY TO SCHEMATIC DRAWING LAYOUT

A—Hydrated Lime Hopper

B—Screw Conveyor

C—Sieve-bottom Receiver Hopper.

D—Heavy Milk-of-Lime Tank with Stirrer.

E—Hand Operated Valve on Water Line.

F—Centrifugal Pump for Heavy Milk-of-Lime to Density Meter & Controls.

G—Density Meter, Continuous and Automatic.

H—Recorder/Controller for Continuous Density Control.

I—Stand-pipe for ensuring that Meter is always full.

K—"Correct" Milk-of-Lime Tank, with Stirrer.

L—Centrifugal Pump for "Correct" Milk-of-Lime to Process.

M—Mixer Unit.* (U.K. Patent 891,713; other patents pending).

N—Flow-through Electrode System for pH Control.

P—pH Transmitter.

S—Recorder/Controller for pH Control of Liming.

T—Automatic Valve for Controlled Addition of "Correct" Milk-of-Lime to Mixer unit.

* See *I.S.J.*, 1958, **60**, 213

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