THE International Sugar Journal

JUNE 1969

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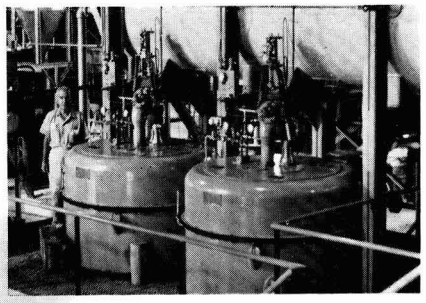

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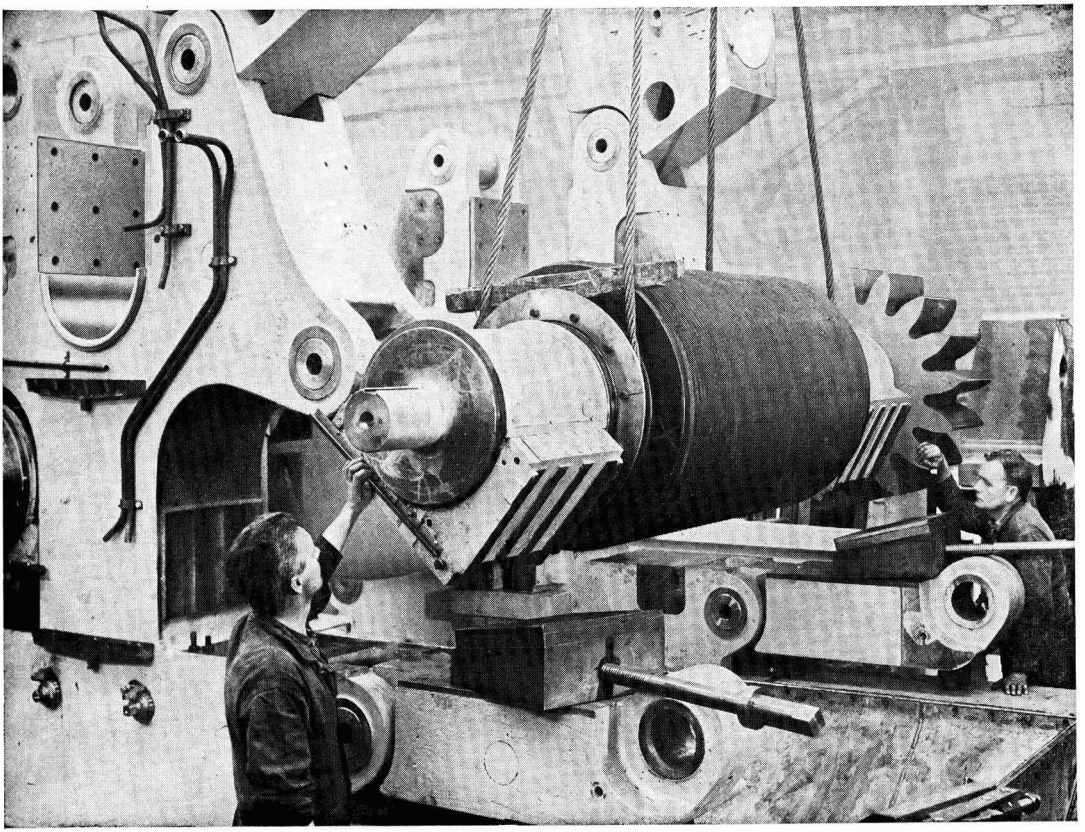

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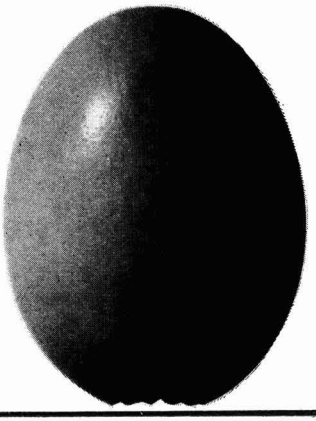

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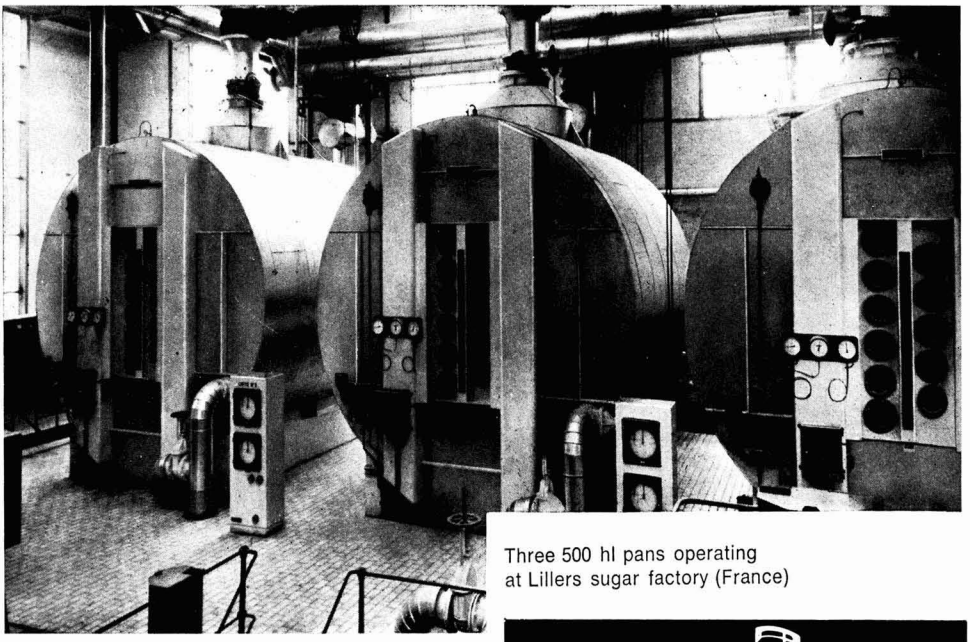

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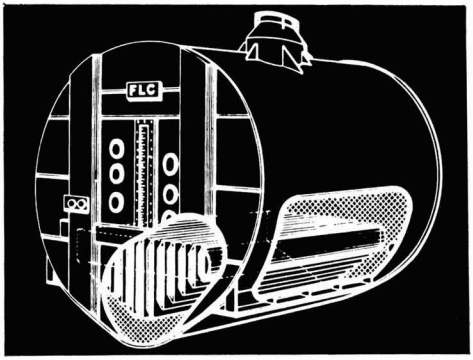

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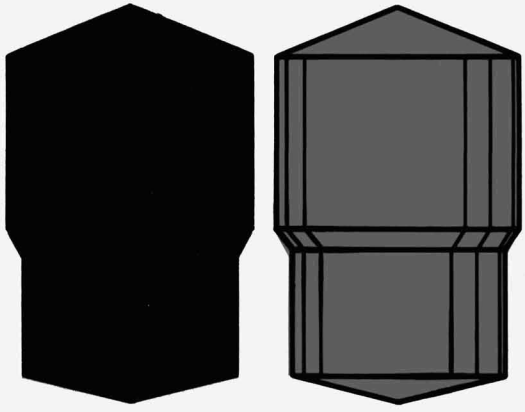

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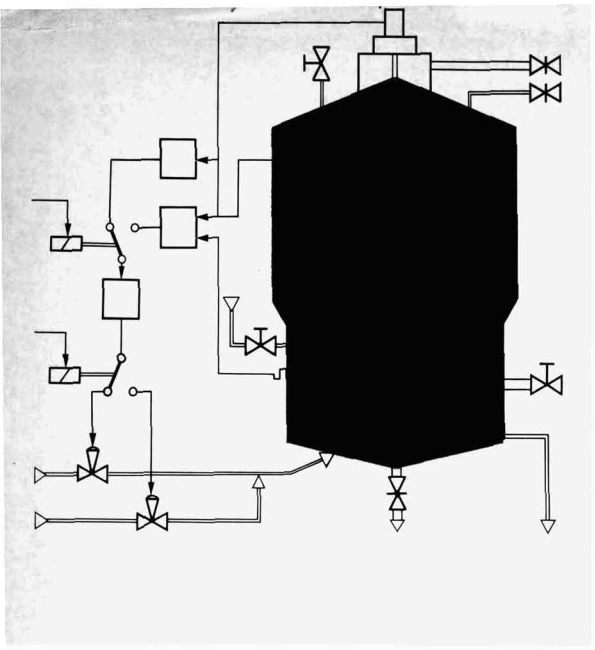

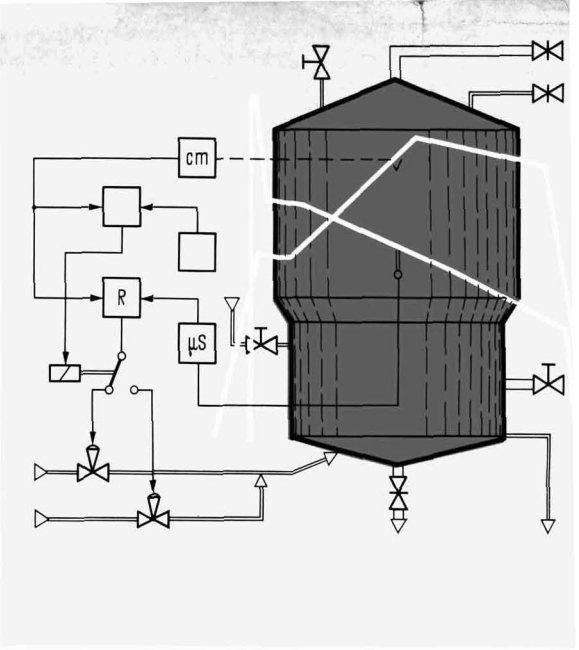

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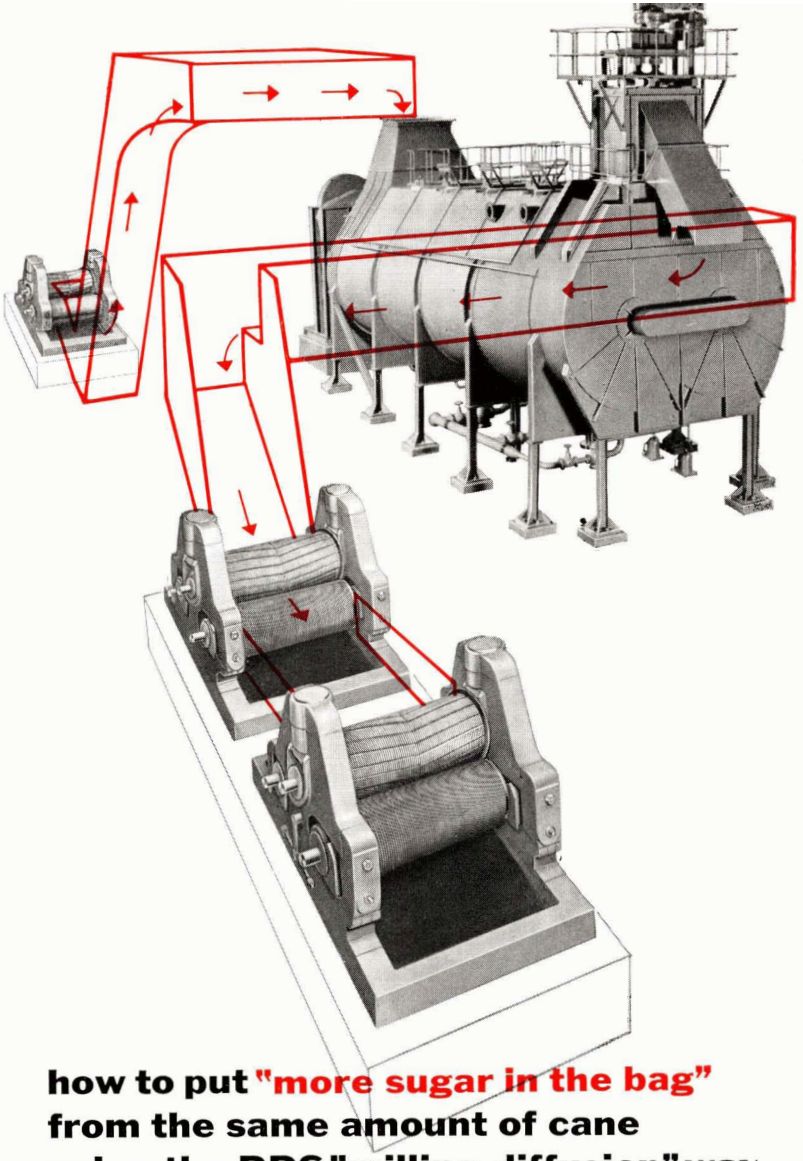

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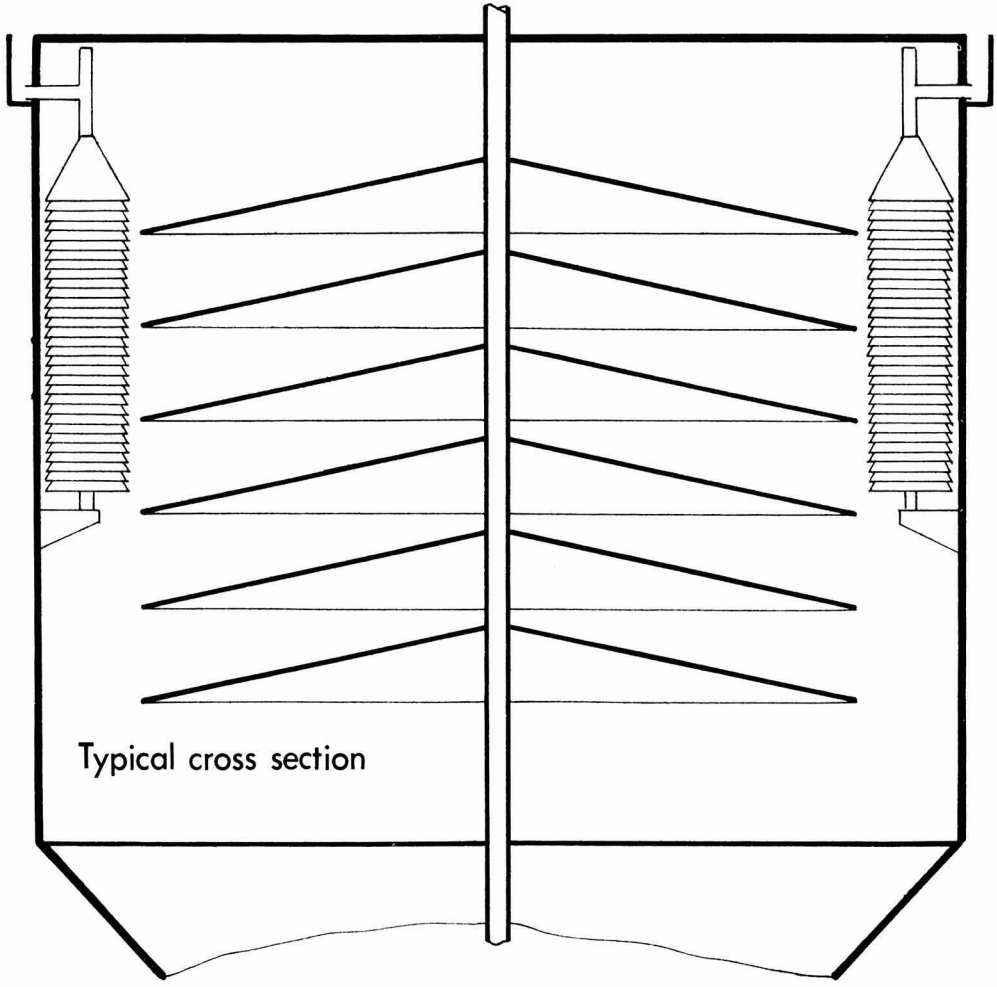

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SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

"Couleur" dans la fabrication de sucre brut. B. M. MUNDAY, I. G. BURGESS, R. V. AMES et C. W. DAVIS. *p.* 163–167

On discute des recherches à deux sucreries australiennes, dans lesquelles on a examiné les effets de procédés individuels sur la couleur de sucre brut (exprimeé sous la forme de l'atténuation à 420 nm après la filtration à travers de filtres Millipore de 0,3μ). En général, les changements de l'atténuation par toute la sucrerie dans les deux cas examinés étaient variables et dependaient surtout des conditions de procédé pendant la cristallisation et la clarification et aussi des qualités technologiques de la canne.

* * *

Recherches sur la canne à sucre en Hawaï. *p.* 167–169

Dans cette condensation du rapport annuel (1967) de la Station Expérimentale de l'Hawaiian Sugar Planters' Association on décrit le travail sur la cultivation de la canne, la mécanisation, des insectes et animaux nuisibles et des maladies de la canne, comme aussi la physiologie et biochemie basique de la canne à sucre.

* * *

Fabrication de sucre de betteraves dans l'Inde. V. S. SUD. *p.* 170–172

On rapporte la production expérimentale réussie de sucre blanc de betteraves à la compagnie Ganganagar Sugar Mills Ltd. dans l'Inde. Une sucrerie de betteraves en miniature a été construite, dans laquelle on a installé les équipements pour tous procédés du lavage de betteraves jusqu'à l'évaporation. La diffusion DDS employée avait une capacité de 25 tonnes de betteraves par jour.

* * *

International Sugar Research Foundation Inc. *p.* 172

L'histoire, les buts et l'activités de la Foundation sont résumés.

"Farbe" in Rohzuckererzeugung. B. M. MUNDAY, I. G. BURGESS, R. V. AMES und C. W. DAVIS. *S.* 163–167

Die Verfasser besprechen Erforschungen in zwei australischen Zuckerfabriken, wo die Wirkungen von einigen Verfahren auf Rohzuckerfarbe (als Attenuation bei 420 nm nach Filtration durch 0,3μ Millipore-Filter ausgedrückt) untersucht wurden. In den meisten Fällen waren Attenuationsänderungen durch die Fabriken veränderlich; sie hingen von Verfahrensverhältnissen während der Kristallisation und Saftreinigung wie auch von den technologischen Qualitäten des Zuckerrohrs ab.

* * *

Zuckerrohr-Forschungsarbeit in Hawaii. *S.* 167–169

Dies ist eine Zusammenfassung des Jahresberichts 1967 der Versuch-Station der Hawaiian Sugar Planters' Association, und betrachtet Rohranbau, Mechanisierung, Schädlinge und Krankheiten, auch basische Zuckerrohr-Physiologie und -Biochemie.

* * *

Erzeugung von Zucker aus Rüben in Indien. V. S. SUD. *S.* 170–172

Man berichtet über die erfolgreiche experimentelle Erzeugung von Weisszucker aus Rüben von der Firma Ganganagar Sugar Mills Ltd. in Indien. Eine Kleinrübenzuckerfabrik, mit Einrichtungen für die Verfahren von Rübenwaschung bis zur Verdampfung ausgerüstet, wurde gebaut. Ein DDS-Diffusionsapparat mit eine tägliche Verarbeitungsfähigkeit von 25 Tonnen Rüben wurde angewendet.

* * *

International Sugar Research Foundation Inc. *S.* 172

Ein Kurzbericht über die Geschichte, Absichten und Aktivitäten der Foundation wird gegeben.

"Color" en el elaboración de azúcar crudo. B. M. MUNDAY, I. G. BURGESS, R. V. AMES y C. W. DAVIS. *Pág.* 163–167

Se discuten investigaciones a dos azucareras en Australia en que se examinan los efectos de individuales procesos sobre color de azúcar crudo (exprimido como atenuación a 420 nm después de filtración a través de filtros tipo Millipore de 0.3μ). En general, cambios en atenuación estaban variables y gobernados principalmente por las condiciones de los procesos de cristalización y clarificación y por las calidades de la caña.

* * *

Investigaciones sobre caña de azúcar en Hawaii. *Pág.* 167–169

Es un sumario de la Memoria Anual de 1967 del estación experimental de la Hawaiian Sugar Planters' Association, y trata del cultivo de caña, mecanización, plagas y enfermidades, y la fisiología y bioquímica basica de la caña.

* * *

Elaboración de azúcar de remolacha en la India. V. S. SUD. *Pág.* 170–172

Se presentan detalles de la producción experimental con éxito de azúcar blanco de remolacha a la Ganganagar Sugar Mills Ltd. en la India. Una fábrica miniatura de azúcar de remolacha se construió, incluyendo planta para los procesos de lavadura de la remolacha al evaporación. El difusor marca DDS tenía una capacidad diaria de 25 toneladas métricas de remolacha.

* * *

International Sugar Research Foundation Inc. *Pág.* 172

Se resumen la historia, los objetos y las actividades de la Fundación.

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXXI JUNE 1969 No. 846

Notes & Comments

Weather conditions and the European sugar beet crop.

It appears that beet sowing has been hampered by unfavourable weather conditions in many European countries. Accounts in the Soviet press refer to late arrival of spring—in some cases almost a month late—and the difficulties of sowing beet in ground still covered with snow. Although a brief spell of very warm, sunny weather at the beginning of April allowed farmers in the northern part of West Germany to make a belated start with sowing after heavy snowfalls in March had hindered their work, the good weather only lasted a week, after which there was a return to cool, rainy conditions.

Only in the south and west of Europe has the weather been suitable for beet sowing, so that good progress has been made in France and Italy. On the other hand, Poland and Czechoslovakia have suffered from poor weather as has south-eastern Europe. Consequently, most European countries will have a shorter beet growing period than usual and whether there will be a good harvest will depend on climatic conditions during the next few months.

* * *

International Sugar Organization.

The Executive Committee of the International Sugar Organization, which met in London in April, decided not to increase export quotas at that time. This decision was not altogether unexpected, since the Committee was due to reconvene at the end of May and it was anticipated that, by that time, a number of shortfalls would have been made known and the statistical position would be clearer. The Committee decided, however, that it should meet immediately to review the situation should the I.S.A. price reach or exceed 3·75 cents per lb on the first day and at least 11 other days of the 17-day average.

As is now known this did not occur; indeed, the London Daily Price which climbed to £39·25 per ton c.i.f.f.o. declined to and became stable at £37·50. In this connexion, E. D. & F. Man made some interesting comments[1]: "It is again difficult to forecast the future path of the market, because sentiment continues to be the dominant factor and this is always very difficult to assess. Although the Executive Committee of the I.S.O. decided not to recommend any alterations to the quota, they will meet again and study the matter further if the I.S.A. prevailing price reaches 3·75. To many minds this tended to create a ceiling of 3·75, with the fear of further sugar becoming available. The fluctuations of the past month (April) had little to do with physical sugar and prices have been dominated by the terminal market . . . Purely from the sugar angle it looks to us as though sellers are sufficiently scarce and cautious that any strong buying interest would cause values to rise, until quotas are restored by the I.S.O. Council at the end of May or by the prescribed method of the Agreement as written. We see little prospect of a collapse in prices".

* * *

World market supply situation.

The Statistical Committee of the International Sugar Organization provided the figures on which was based the decision of the Executive Committee not to restore the 10% quota cuts, and it will have received new data for the meeting at the end of May since member producers are obliged to report by the 15th May if they are not going to be able to use their entitlements. Mexico is reported[2] to have been the first country to declare officially that it was not able to use its 96,000-metric ton world market quota this year owing to increased domestic consumption and the need to fill the US quota, and several other countries are said to have indicated that they will not be able to use all or part of their entitlements.

C. Czarnikow Ltd. reviewed the position earlier[3] and commented that, in their view, a tight statistical position prevails when quotas are at 90% of basic export tonnages.

"In preparing our figures we have an advantage in that we may estimate shortfalls in areas where the Council might find it impolitic to do so. Accordingly, we shall be surprised if the findings of the Statistical Committee indicated quite so tight a statistical situation as do our own figures.

---

[1] *General Remarks on the Sugar Situation*, 1969, (215).
[2] *Public Ledger*, 26th April 1969.
[3] *Sugar Review*, 1969, (914), 65.

"It is remarkable, this year, how many countries seem likely to have poorer crops than usual. The two largest producers of sugar in the world are the USSR and Cuba and in each of these countries current indications are not optimistic. The situation in Cuba has been frequently mentioned in the past and needs no retelling at this stage. It does seem a pity, however, that the market should find it necessary to do without any sort of guidance as to likely output from this important producer.

"Weather conditions in the Soviet Union during the past winter have been particularly severe . . . Valuable growing time has already been lost and an average crop would seem to be the very best that could be expected.

"For some time it has been clear that the Peruvian crop this year will be disappointing. A News Agency has this week quoted a Sugar Workers' Union official as saying that the crop will be 25% down on last season's output which amounted to 750,000 tons. Our own information is that, although the outlook is far from healthy, it is not quite so pessimistic as that. Nevertheless, it seems clear that Peru will have no sugar available for the world market this year; furthermore a shortfall on the US quota would also appear indicated which, in turn, would presumably make it necessary for the deficit to be made up by other suppliers to the United States market.

"The Puerto Rican crop also appears likely to be the poorest for many years. Consequently, despite the shortfall declarations which have already been made, totalling 500,000 short tons, further deficits can be expected and here again other countries will receive corresponding quota additions." (On 1st May a 200,000-ton deficit was announced by the US Dept. of Agriculture, bringing the total deficit to 700,000 tons.)

* * *

UK Sugar Board report, 1968.

In the 11th Annual Report of the UK Sugar Board it was announced that during 1968 the Board's cumulative deficit was reduced from £4·7 million to £1·7 million. The deficit on trading amounted to £53·7 million on 1,700,000 tons of Commonwealth and Irish sugar and the Board also paid £28·5 million to the British Sugar Corporation, making a total outgoing of £82·2 million. Net receipts of surcharge collected in the year amounted to £85·2 million, while the expenses of the Board and H.M. Customs and Excise (who collect the surcharge for them) were offset by dividends received on the Board's shares in the British Sugar Corporation and by a credit on interest account.

The basic domestic ex-refinery price of granulated sugar was kept fairly stable for the first nine months of the year at about £71 10s a ton but went up in the last three months to raise the average for the year to £72 10s. The average retail price of granulated sugar in the UK remained very steady, however, no significant increase appearing until December.

US sugar quota, 1969.

On the 14th March the US Department of Agriculture announced an increase of 100,000 short tons, raw value, in the total sugar supply quota for 1969 while at the same time declaring a deficit of 300,000 tons in the Puerto Rico quota and another of 15,000 tons in that of the Virgin Islands. On the 10th April came a further increase of 100,000 tons in the quota, bringing it to 10,800,000 tons, while an additional deficit of 200,000 tons was declared in the Puerto Rican quota, to be reallocated among Western Hemisphere countries. In addition, the Hawaiian quota was reduced from 1,200,000 tons to 1,190,673, the 9327 tons cut being also reallocated. The Philippines would normally have received the largest share of deficit reallocations and increases but has only sufficient sugar to meet the basic quota based on the original 10,600,000 tons total, and has therefore not been able to accept any quota increase.

On the 1st May the Department declared yet another shortfall in the Puerto Rican quota. Of the 200,000 tons which were redistributed, Mexico, Brazil and the Dominican Republic were awarded the largest shares and the balance went to other Western Hemisphere producers except Peru, where drought conditions are limiting production.

Details of the changes appear elsewhere in this issue.

* * *

EEC sugar production forecast[1].

Sugar production in the European Common market this year is expected to total 6,900,000 metric tons, and surpluses are expected to exceed 1,200,000 tons, according to a statement from the EEC Executive Commission in Brussels.

Surplus stocks during the 1968-69 season stood at 1,200,000 metric tons but most had already been used up and the remainder would be accounted for in the present season. But the production of 6,900,000 tons this year would exceed human consumption by about 1,000,000 tons and part of the consumption would be covered by imports. The resultant surplus would be used for exports, animal feeding and by the chemical industry.

Brevities

UK sugar surcharge.—In view of the continuing rise in the world price of raw sugar on the London Market, the U.K. Minister of Agriculture, Fisheries and Food has reduced the surcharge from 2d per lb (18s 8d per cwt) to 1¾d per lb (16s 4d per cwt) from the 25th April 1969.

* * *

Philippines sugar shortage.—The Philippines Sugar Institute has reported that, not only will it not be able to fill its 1969 US quota[2] because of crop damage by typhoons, but that the government is contemplating importing roughly 20,000 tons of refined sugar from Japan and/or other areas to cover a local shortage caused by heavy shipments to fill the 1968 US quota[3].

[1] *Public Ledger*, 12th April 1969.
[2] *I.S.J.*, 1969, **71**, 95.
[3] *Sugar y Azúcar*, 1969, **64**, (2), 32.

"Colour" in raw sugar manufacture

By B. M. MUNDAY, I. G. BURGESS, R. V. AMES and C. W. DAVIS.
(The Colonial Sugar Refining Co. Ltd., Sydney, New South Wales, Australia)
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Introduction

RAW sugar "colour" is an important criterion of refining quality. As part of an investigation into the origins and natures of the "colorants" in raw sugar, attenuation levels have been measured throughout the major stages of raw sugar manufacture.

This work commenced with general surveys of attenuation levels at two Australian mills during the 1965 crushing season. These surveys provided a broad picture of attenuation levels in the manufacturing process, and revealed those stages of manufacture where major changes occurred. Each of these stages was then examined in greater detail.

Both mills used the same manufacturing technique: crushing of cane, simple lime defecation, evaporation, crystallization in vacuum pans using a three-massecuite formula, and single purging of massecuites. The *C*-sugar is mixed with syrup and used as the foundation of *A*- and *B*-massecuites.

Measurement of Colour

A photometric method, based on the method published by BEALE[1], was used to measure the attenuation of a wide range of mill process materials. The sample was diluted to a suitable concentration with distilled water. The pH was then measured, and adjusted to 7·00 $\pm$0·01 by addition of dilute sodium hydroxide or hydrochloric acid.

The solution was filtered through a 0·3 micron "Millipore" filter membrane, and the optical density of the filtrate measured at a wavelength of 420 nm in a 1 cm cuvette, using a Bausch and Lomb "Spectronic 20" colorimeter. Distilled water was used as a blank.

The result was converted to an attenuation index, a^*_{420}, defined[2] by:—

$$a^*_{420} = \frac{\text{optical density at 420 nm}}{b \times c}$$, where b = cell depth in centimetres (equals 1·00 in this work) and c = concentration of soluble solids in the solution (g/ml).

The soluble solids concentration, c, in the filtered solution was measured using a precision dipping refractometer.

The use of a 1 cm cuvette meant that very dilute solutions, in the range 1° to 5°Bx, had to be used to obtain optical density readings that could be accurately measured.

The attenuation index thus obtained is assumed[3] to represent the sum of two effects, absorption and scattering, represented by an absorption index, a_s, and a scattering index S:

$$a^*_{420} = a_s + S$$

We have followed the sugar industry practice of describing the combined effects of absorption and scattering as "colour". The amount of light scattered by particles in suspension and macro-molecules in solution is dependent on several factors, among them the refractive index, and hence concentration of the solution. As shown by CARPENTER and DEITZ[2], the relationship between scattering and solution concentration is non-linear, and the scattering *index* is therefore dependent on concentration. The absorption of light by the colorants, however, is presumed to follow the BEER-LAMBERT Law, that is to say, optical density caused by absorption is proportional to concentration. It follows that the absorbancy index is taken to be independent of concentration.

In the present work it was found that filtration of sample solutions of syrup through a 0·3 micron Millipore filter apparently reduced the scattering contribution to attenuation to such an extent that the attenuation index was independent of concentration (Fig. 1).

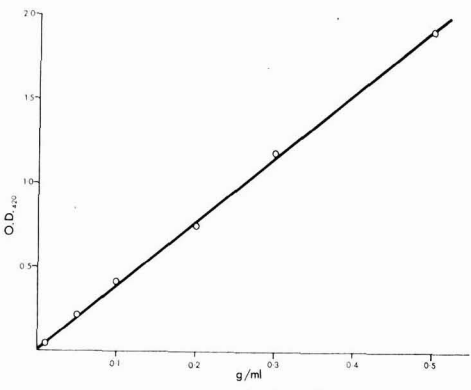

Fig. 1. Test of validity of Beer's Law for raw sugar colour attenuation, by plotting optical density at 420 nm (corrected for cell size) against solids concentration (g/ml). *Sample:* Mill 1 syrup, filtered through 0·3μ Millipore filter and pH adjusted to 7·0.

It was assumed therefore that the light scattering component in these measurements was relatively small and although the results are quoted as attenuation indices, they may be considered in the context of this work as approximating to absorption indices only. We are aware that this assumption is of obviously questionable validity. However, the results obtained support the foregoing assumption which may be valid

[1] *Proc. 22nd Meeting Sugar Ind. Tech.*, 1963, 34–53.
[2] CARPENTER and DIETZ: *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 236.
[3] REIGER and CARPENTER: *J. Research* (National Bureau Standards), 1959, **63A**, 205.

in the context of the experimental technique used. For example, the instrument used for attenuation measurements is a relatively unsophisticated one. In this paper the terms "substances contributing to attenuation" may be more technically correct than the term "colorant" even though the latter is compatible with the experimental results.

EXPERIMENTAL

"Colour" Surveys

Several surveys of attenuation levels were conducted at each of the two mills. For each survey, representative samples of material from the main process streams were collected and attenuation measurements made. Results for two of these general surveys are given in Table I.

Table I. Survey of attenuation levels in mill process materials

Sample	*Attenuation, a^*_{420} Mill 1*	*Mill 2*
First expressed juice	6·7	7·7
Mixed juice	11·8	13·6
Clarified juice	17·1	—
Syrup	17·8	9·6
Magma	30·8	35·0
A-massecuite	22·5	16·0
A-molasses	53·5	41·0
B-massecuite	41·7	28·0
B-molasses	69·6	51·0
C-massecuite	—	55·0
C-molasses	161	112
Raw sugar	1·10	1·93

The progressive increase in the attenuation of samples from mixed juice to *C*-molasses (final molasses) did not necessarily indicate that "colorants" were being formed in the manufacturing process. It did, however, reflect the distribution of "colorants" among the various materials. This distribution is similar to that found for many other impurities in the process stream.

An indication of actual formation or removal of "colorants" was obtained by attempting to balance the total attenuation in mixed juice with that in the final products, raw sugar and molasses. This was done by multiplying the attenuation index for a given material by the total estimated weight of soluble solids in that material for the week of the survey.

The results, expressed in arbitrary units, with the total attenuation in mixed juice equal to 100 for each mill, are shown in Table II.

Table II. Attenuation balance

Material	*Total Attenuation Arbitrary Units Mill 1*	*Mill 2*
Mixed juice	100	100
Clarified juice	140	(70)
Syrup	146	70
Raw sugar	6	12
C-molasses	280	88

It is clear from these results that major changes in attenuation occurred during clarification (lime defecation at both mills) and crystallization. (In this context "crystallization" is to be taken as including all operations subsequent to syrup production.) A slight increase was found during the evaporation of clarified juice to syrup at Mill 1.

The percentage changes in attenuation for the clarification, evaporation and crystallization processes are summarized in Table III. The net attenuation change from mixed juice to final products, relative to mixed juice attenuation, is also given below.

Table III. % Attenuation changes

Process	*% Attenuation Change Mill 1*	*Mill 2*
Clarification	+40%	—30%
Evaporation	+ 4%	No results
Crystallization	+96%	+43%
Net change from mixed juice to products (relative to mixed juice colour)	+190%	0%

Each process was then investigated in greater detail.

Clarification

Further surveys each of one week duration were conducted at each mill. The results of these surveys relating to attenuation in mixed juice and clarified juice are shown in Table IV.

Table IV. Clarification—Attenuation changes

Mill	*Test*	*Attenuation, a^*_{420} Mixed juice*	*Clarified juice*	*% Colour change*
1	1	12·2	15·8	+30%
1	2	11·8	17·1	+45%
2	3	13·6	9·6	—29%
2	4	14·8	11·3	—24%
2	5	14·6	10·2	—30%
2	6	14·0	10·7	—24%
2	7	17·4	12·5	—28%

At the times of these surveys, the quality of clarified juice was noticeably higher at Mill 2 than at Mill 1. The method of liming was also different at the two mills, Mill 1 using warm liming and Mill 2 using cold liming. Another difference is that Mill 1 has a significantly lower total annual rainfall than Mill 2.

Table V. Effect of temperature of liming on attenuation of clarified juice (laboratory-scale tests)

Test No.	*Liming method (H = Hot, 212°F) (C = Cold, approx. 140°F)*	*Attenuation, a^*_{420} Mixed Juice*	*Clarified Juice*
1	C	10·8	9·7
	H	10·8	11·3
2	C	12·1	9·0
	H	12·1	9·0
3	C	12·7	10·3
	H	12·7	11·8
4	C	13·0	10·7
	H	13·0	12·9
5	C	11·9	12·0
	H	11·9	13·3
6	C	12·7	12·8
	H	12·7	13·8
7	C	10·5	10·3
	H	10·5	10·3
8	C	15·9	14·3
	H	15·9	14·9
9	C	13·8	13·8
	H	13·8	13·3

NOTE.—In the foregoing comparisons the pH at 20°C of each pair of juices agreed to within 0·3 units.

Laboratory-scale trials were then conducted, using the C.S.R. Clarification Test Procedure[4] to compare (paired comparisons) the techniques of cold (about 140°F) and hot (212°F) liming. The results of nine paired-comparison trials are given in Table V.

The attenuation of juice clarified by cold liming was significantly lower than that of juice clarified by hot liming. The magnitude of the differences was, however, small. It was also noticeable that, although the magnitude of the change in attenuation from mixed juice to clarified juice varied considerably, the largest changes were generally obtained in those cases in which clarified juice had a relatively low turbidity* and residual total phosphate level.

Effect of Phosphate

One important known factor in juice clarification is the phosphate content of mixed juice. This was investigated in further laboratory clarification tests, the results of which are given in Table VI. In some trials a flocculating agent, "Separan AP–30", was also added.

Table VI. Effect of mixed juice phosphate on attenuation of clarified juice (laboratory-scale trials)

	Mixed juice			Clarified Juice	
Test No.	*Attenuation* a^*_{420}	*Phosphate as p.p.m. P*	*Phosphate added as p.p.m. P*	*Attenuation* a^*_{420}	*pH at 20°C*
1	18·3	not measured	0	14·0	6·7
			0	13·3	7·4
			0	13·3	7·6
			20	13·6	7·2
			200+"AP-30"	11·7	7·2
2	13·2	not measured	0	13·3	7·8
			0+"AP-30"	13·2	7·4
			20	12·8	7·4
			20+"AP-30"	12·9	7·5
			40	11·7	7·5
			60	12·0	7·6
			80+"AP-30"	11·7	7·4
			100+"AP-30"	12·1	7·6
3	16·7	110	0	13·7	6·7
			20	13·4	6·9
			60	12·9	6·3
			100	12·5	6·8
			200	11·9	7·0
4	—	80	0	13·3	7·2
			50	11·6	7·4
			100	10·6	7·6
			200	10·7	8·0
5	13·9	100	0	11·0	7·2
			100	9·6	7·3

Interpretation of these results is difficult because of the measured differences in clarified juice pH. The aim in these tests was to maintain a clarified juice pH in the range 7·2 to 7·4. This was not achieved in all cases. However, a general trend is apparent in the results. The more phosphate added, the more efficient was the clarification (as measured by turbidity and residual phosphate levels) and the lower was the attenuation of the clarified juice. This trend is, of course, well known to sugar technologists.

Weekend storage of juice in clarifiers

It has been a practice at the C.S.R. Company's Australian mills to retain limed juice in clarifiers over a weekend shutdown. Excessive lime addition, for example by liming to a pH greater than 8·0 (at 20°C), can result in considerable "colour" formation. This is shown by the results given in Table VII.

Table VII. Darkening of stored limed juice

Trial No.	*Storage time (hours)*	*Initial pH*	*Final pH*	*% Colour increase*
1	45	8·8	7·2	32%
2	24	8·4	6·7	59%
3	36	8·2	6·7	49%
4	31	9·6	6·0	57%
5	16	8·9	6·1	105%

The very large colour increases shown in Table VII could be expected to have a significant effect on sugar colour when crushing is resumed.

Evaporation

Survey results indicated that only a small "colour" increase occurred during the evaporation of clarified juice to syrup. Two additional trials carried out at Mill 1 confirmed this. We were surprised by this result as we had thought it likely that this unit process was contributing to "colour" formation.

In each trial, corresponding samples of clarified juice and syrup were taken over a period of four hours. Results of attenuation measurements are summarized in Table VIII.

Table VIII. Change in attenuation levels

Test No.	*Clarified juice attenuation,* a^*_{420}	*Syrup attenuation,* a^*_{420}	*Increase*
1	13·5	13·8	2%
2	15·4	15·7	2%

Crystallization

The general "colour" surveys had indicated that major colour formation occurred during crystalliza-

[4] BURGESS *et al.*: *Proc. 11th Congr. I.S.S.C.T.*, 1962, 920–928.

* Turbidity is defined as the (optical density × 100) of a clarified juice measured at 975 nm wavelength.

tion. It was then necessary to determine at what point in the crystallization operations these increases took place.

The attenuation increases during crystallization found at the two mills were 96% and 43% respectively. One clue to this marked difference in behaviour was provided by the amount of *C*-molasses made at the two mills, i.e. 21% on syrup and 10% on syrup ; the lower cane purity at Mill 1 was responsible for these differences.

It thus appeared that the boiling and subsequent treatment of *C*-massecuite may have been largely responsible for the "colour" increase during crystallization.

Further information was obtained by calculating the expected attenuation of the *A*, *B* and *C*-massecuites from the known attenuations and proportions of magma (mixture of *C*-sugar and syrup used as foundation for *A*- and *B*-massecuites), syrup and molasses which they contained. This was done for the survey results, and also for several massecuite boilings. The results of these calculations are shown in Table IX.

Table IX. Calculated and observed massecuite attenuation

Mill	*Massecuite*	*Observed attenuation,* a^*_{420}	*Calculated attenuation,* a^*_{420}
1	A	22·1	22·8
1	A	22·6	19·4
1	A	24·3	22·2
1	A	21·2	20·5
2	A	16·1	16·2
2	A	16·5	16·7
2	A	18·8	19·6
2	A	14·7	18·2
2	A	16·6	15·6
2	A	12·2	13·1
2	A	13·8	14·9
2	B	27·6	26·6
2	B	28·4	26·7
2	B	21·7	23·6
2	B	22·1	21·4
2	B	21·4	23·2
2	C	65	54
2	C	64	54
2	C	63	57
2	C	62	57
2	C	59	54
2	C	60	49
2	C	55	51

There was no evidence of a significant amount of "colour" formation during the boiling of *A*- or *B*-massecuites. If "colorants" were formed, then the amounts produced were within the errors of this method of measurement. Results for *C*-massecuite boilings *did* indicate increases in attenuation of about 10% to 20%. These increases were not sufficiently large to account for the 43% or 96% attenuation increases indicated in the survey.

In all the work described above, massecuite had been sampled at the time of dropping from the vacuum pans. The possibility of "colour" formation during *C*-massecuite exhaustion in the crystallizers was therefore explored.

Daily composite samples of *C*-massecuite were taken over a period of four weeks at Mill 2. Each *C*-massecuite was sampled as it was dropped from the pan, and, after passage through the crystallizers, whilst it was being centrifugalled. The results are shown diagrammatically in Fig. 2. The time delay between dropping and centrifugalling is also given.

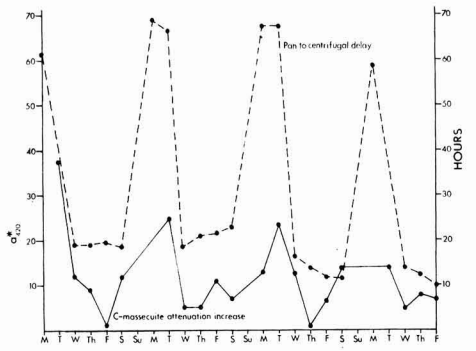

Fig. 2. Daily variation in *C*-massecuite attenuation increase and pan to centrifugal delay.

With the exception of results for one day, there is a clear similarity in the variations of massecuite attenuation and delay between dropping and centrifugalling. The major effect is that of weekend storage of *C*-massecuite, which produced attenuation increases greater than 30%. The average attenuation increases in the pan, the crystallizers, and the overall increase for the four-week period are given in Table X.

Table X. Average attenuation increases in *C*-massecuite processing for a four-week period

Samples	*Attenuation,* a^*_{420}	*Increase*
B-molasses	54·5	
C-massecuite as dropped.....	61·1	12% (Boiling)
C-massecuite as centrifugalled ..	71·4	17% (Crystallizers)

Overall increase from *B*-molasses, 30%.

The *B*-molasses attenuation quoted may be regarded as the calculated massecuite attenuation, since no other molasses comprised the massecuite.

At an investigation conducted at Mill 1, attenuation increases of similar magnitude were observed to occur in the crystallizers. In these latter trials the delay between dropping and centrifugalling averaged 19·5 hours. The average of results from ten trials were:—

C-massecuite attenuation ex pan	59·4
C-massecuite attenuation at centrifugals ..	70·6
% increase	19%

Relationship Between *C*-Massecuite Darkening and Raw Sugar Crystal Colour

At both mills, *A*- and *B*-massecuites were made from a foundation of *C*-sugar magma. The "colour" of the *C*-sugar crystal might therefore be expected to influence the "colour" of the washed, syrup-free raw sugar crystal grown from it. The method for determining raw sugar crystal "colour"-attenuation was based on that developed for use in the Hawaiian sugar

industry[5]. The daily variation in magma crystal attenuation for a four-week period at Mill 2 is shown in Fig. 3.

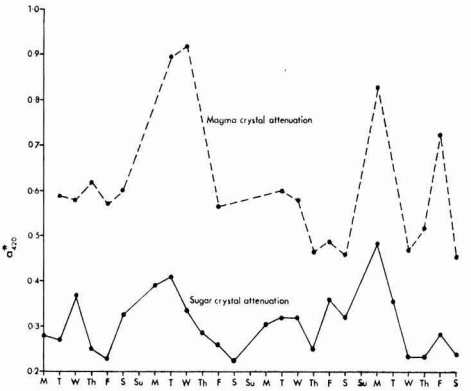

Fig. 3. Daily variation in sugar and magma crystal attenuation.

It can be seen that the variation in magma crystal attenuation is largely mirrored in the raw sugar crystal attenuation.

It should also be noted that the magnitude of magma crystal attenuation was about twice that of the raw sugar crystal attenuation. Assuming that the seed crystal volume is one quarter of the total raw sugar crystal volume, it can be shown that half the attenuation in the raw sugar crystal is contributed by the magma seed.

Summary

Semi-quantitative surveys of levels of "colour" (i.e. attenuation at 420 nm after filtration through 0·3 micron Millipore filters) were made at two Australian mills in the 1965 season. Both mills used crushing, simple lime defecation of juices, crystallization in vacuum pans using a three-massecuite formula, and single purging of massecuites. *C*-sugar was used as the foundation for *A*- and *B*-massecuites.

The increases in the quantities of "colorants" or substances contributing to attenuation were found to occur for the most part in the crystallization processes and to some extent in clarification. Only relatively small increases in attenuation were found to occur during the evaporation of clarified juice to syrup. This was unexpected.

No significant change in attenuation was detected in the boiling of high grade massecuites. Increases of 10–20% were found to occur during the boiling of *C*- or final massecuite. A further attenuation increase occurred during exhaustion of *C*-massecuite in crystallizers and relatively large increases (up to 50%) were found to occur in *C*-massecuite held over a two-day shut-down.

When clarification was good, i.e. low clarified juice optical density and low total phosphate content, a net decrease in attenuation from mixed to clarified juice of approximately 40% was observed.

The opposite effect of a net increase of attenuation of approximately 30% was found when clarification was relatively poor.

The attenuation of washed, syrup-free raw sugar was found to be influenced to a significant extent by the attenuation of the *C*-sugar crystals used for foundation for high-grade massecuites.

In general, changes in attenuation through two raw sugar mills in Australia were found to be variable and determined mainly by processing conditions in the crystallization and clarification unit processes and also, of course, by the processing qualities of the cane.

Acknowledgment

The authors wish to thank the Management of the Colonial Sugar Refining Co. Ltd. for their permission to present this paper.

[5] "Official Methods of the Hawaiian Sugar Technologists for Control of Cane Sugar Factories" (H.S.T., Honolulu) 1955, p.75.

Sugar cane research in Hawaii

(Annual Report, 1967, Experiment Station, Hawaiian Sugar Planters' Association)

THIS report covers a 15-month period—1st October 1966 to 31st December 1967, owing to a change in the Station's reporting year. This change has been effected so that the reporting year coincides with the Station's fiscal year, future reports to be by the calendar year. In his introductory remarks the Director points out that the Research Station has been working towards more "understanding research", the kind that tells "why" and "how" and not just "what", and towards more interdepartmental and interdisciplinary research. It is pointed out that, as might be expected, this approach not only gives a stronger base on which to answer immediate practical questions, but it sometimes leads to new and improved methods and—most important—it frequently reveals unsuspected relationships and helps to clarify certain problems previously seen only dimly, if at all.

Examples of the results of this approach are to be found in connexion with varieties, physiology of the

cane plant, biochemistry and sugar technology. Cooperative work with other research organizations was broadened during the year. A new programme was initiated with the Taiwan Sugar Experiment Station for the testing of the Hawaiian cane varieties against diseases found in Taiwan. The knowledge gained could be of great value should certain diseases in Taiwan become established in Hawaii. Another cooperative project was with the University of Hawaii in research on the sugar cane borer and its control. It is considered such cooperative arrangements provide an effective means of supplementing, extending and reinforcing the Station's own programmes. They cannot substitute for, nor should they result in, any diminution of the Station's efforts. To be able to participate in such cooperative programmes, and to make them successful the Station must maintain its own strong capabilities.

Cultivation

Many different lines of research are included under the broad heading of cultural practices, such as fertilizing, weed control, control of tasseling, transplanting, spacing and the use of gibberellic acid in the field for increasing yield. It is pointed out that the heavy isotope of nitrogen (^{15}N) has been used for the past several years in a series of tests to assess the efficiency of uptake of applied nitrogen by sugar cane and to investigate the fate of the nitrogen not used by the plant crop. The results of these tests, performed throughout the state at localities varying markedly in soil type and climate, have shown efficiency of uptake to range from 21% to 43%, with an early single application being the most efficient method in all cases. Fertilizer not taken up by the plant crop has been found to remain in the soil, primarily in bound form as organic nitrogen complexes. In all these tests, the amount of nitrogen lost through leaching was relatively small.

Further tests in shallow alkaline soils were carried out, it being believed that nitrogen in the ammonium form on alkaline soils can be subject to heavy loss. Tests confirmed this, loss being highest in full sun. It is considered that a single early application of nitrogen in such soils is not desirable.

Experiments in the response of sugar cane to applied magnesium in different Hawaiian soils are described. Field experiments with magnesium sulphate at two plantations showed gains of approximately 0·5 ton pol/acre with the application of 100 lb Mg/acre; when the added magnesium was 200 lb/acre, however, there was a decline in pol, indicating a possible overapplication of magnesium. Other evidence of magnesium response was noted in experiments where magnesium sulphate was added to low magnesium soils. Further experiments are planned in order to characterize the conditions necessary for magnesium application to bring about increased yields of sugar cane.

Somewhat similar work was carried out in the application of sulphur to low-sulphur soils. Sulphur is a vital constituent of certain amino acids and proteins and is important in the process of cell division and plant growth. Field experiments with sulphur showed that with high sulphur soil there was no response to treatment but with low sulphur soils (approx. 30 lb S/acre) there were gains of about 2 tons pol/acre with sulphur applications. Both elemental sulphur and sulphate were effective in increasing yields.

The rôle of silicon in sugar cane nutrition has been the subject of special study during the year. In general it was found that the lower the soil silicon the greater was the response to applied silicate, as is to be expected. In a laboratory study it was found that amounts of extractable soil silicon increased with increasing temperature. This may be related to the observation that intensity of leaf freckling in a field crop is influenced by seasonal changes. The diminished freckling during the warm summer months may be due in part to greater availability of silicon and greater activity of the roots during this period.

The weed control programme during the year was concerned with quantitative evaluation of pre-emergence herbicides, evaluation of pre-emergence herbicides on small seeded plots, selecting pre-emergence herbicides for specific grasses, post-emergence control of problem species, evaluation of surfactants used with post-emergence herbicides and the effect of herbicides on young sugar cane.

Tests were carried out to explore the feasibility of the use of pre-germinated sugar cane for replanting in a ratoon field. Similar gaps were planted for comparison with conventional sets. At 22 months the optimum spaced transplanted area showed substantial gain over current standard practice. Much of the advantage was lost by extending the growth period to 24 months.

Mechanization

Reference is made to the development and evaluation of a new commercial cut-transport-transload harvester. This machine, in contrast to the cut-load type, accumulates a 3 to 4 ton load of cut-up cane and transfers it either to the road transport unit or to a field buggy which in turn transfers it to the road transport unit. The harvester will be operated on a regular production basis on plantations to provide data on: (a) production rates under various field operating conditions and methods of handling, (b) operating, repair and maintenance costs, (c) percentage of availability, and (d) percentage of area suitable for harvester operation. The harvester is constructed on a Caterpillar D6 tractor with auxiliary engine.

Construction of an experimental, single-line, mechanical transplanter for plant replant operations is near completion. It is designed to furrow, remove the plant package, place the plant at proper spacing, water the plant, and cover the furrow—all in an automatic sequence upon demand by the machine operator.

Pests and diseases

Experimental work on borer control with insecticides is described. In addition to bolstering the biological control programme to meet the increasing borer problem, an investigation was started to find out whether insecticides can be used to decrease the borer populations. This new approach is being evaluated in extensive tests with five different insecticides. These compounds have been used commercially for the control of the moth borer (*Diatraea saccharalis*) common in Florida and Louisiana. The borer in Hawaii is a weevil (*Rhabdoscelus obscurus*) and will not necessarily respond similarly to the same insecticides. Results indicated that the insecticide treatment in old cane did not have any effect on the established borer population. Results are reported of successful experiments in raising the borer in the laboratory using artificial or quasi-artificial media and specially designed cages to maintain humidity.

With regard to rat damage it is pointed out that rats show remarkable ability to detect the foreign odours or tastes imparted to food products by the addition of toxic substances. The bait shyness thus produced limits the effectiveness of poisoned baits, especially where rats have other natural food sources. If an odour disliked by rats could be disseminated in their habitat areas it might be possible to force them out of the cane fields and prevent injury to the crop. No success was obtained in tests with naphthalene or *para*-dichlorbenzene. The use of other possible repellants with slower evaporation rates is being considered. With regard to conventional rat poisons it is pointed out that no bait material yet tested is fully acceptable to rodents in or near sugar cane fields but oats is the best carrier known at the present time.

In recent years some of the newer commercial varieties of cane in Hawaii have proved highly susceptible to chlorotic streak disease. In applying hot water treatment of planting material to control the disease it has been found that the optimum water temperature may differ with different varieties. As a general practice it is recommended that the temperature be maintained at 52°C for 20 minutes or that the time be extended to 30 minutes if the temperature is 50°C to 51°C.

Ratoon stunting disease is known to attack most commercial varieties grown in Hawaii but a few show resistance or tolerance to the disease. These are listed. Some have been used in breeding work in attempts to breed more resistant varieties. It is of interest to note that many seedlings proved to be symptomless carriers of the disease.

Basic sugar cane physiology and biochemistry

Screening tests of about a dozen new chemicals as possible ripeners for cane are described. Eleven compounds showed a ripening effect on cane, the most active compounds being *iso*chlorotetracycline, Du Pont's DA-5 and tetrachlorodiphenylsulphone. In field tests chemicals were applied with a boomspray to simulate aerial application. It is thought that best tesults might be obtained by using combinations of active compounds in a single spray.

Work in connexion with the enzyme approach to the nitrogen problem is discussed. It is pointed out that in order for plants to utilize nitrate it must first be reduced to nitrite. The enzyme catalyzing this reduction is dependent on the presence of nitrate and is rapidly destroyed in its absence. The chemical nature of the enzyme inhibitors is being studied. Root extracts showed almost no nitrate reductase activity under a variety of conditions, but the enzyme was present and active in intact root tissue. By means of a very sensitive analysis it was confirmed that nitrate does reach the upper parts of the sugar cane plant, a point which has been debatable for some time. Studies showed that, provided the plants were exposed to light, addition of nitrate to potted plants which had remained unfertilized for about three months was followed by induction of nitrate in leaves within 5 hours, with optimum activity after 3·5 hours.

Other studies on enzymes that affect sugar cane growth and development were concerned with polyphenol oxidases, a group of enzymes generally associated with "browning" of plant tissues. In freshly cut stalk tissue of sugar cane near the apex, "browning" becomes progressively less intense during the change from the vegetative to the reproductive stage—suggesting a decrease in the activity of one or more of the enzymes in this group. Amino acid fluctuation and factors affecting it are discussed.

A study of the amino acid arginine and its rôle in sugar cane metabolism is dealt with. Previous work on the subject was extended by using a new synthetic medium. Results favoured the conclusion that the cell is dependent on extracellular arginine, possibly because of limited capacity of the cane plant to synthesize this amino acid. This bolstering supply of extracellular arginine may be controlled by other amino acids such as lysine—possibly during the transport across the cell membrane.

Observations on the effect of crop age on photosynthesis are recorded.

The effects of "Dalapon" on growth and on the morphological appearance of tissue cultures from three Hawaiian varieties are discussed. Two varieties reacted differently from the third. As differentiation remains one of biology's greatest unsolved problems it is hoped that this manipulative tool—exposing cultures to "Dalapon" and thereby increasing (or at least hastening) their ability to differentiate—will serve as an excellent starting place for studies on differentiation.

F.N.H.

US beet area increase[1].—US beet growers are planning a beet area of 1,649,000 acres (667,327 ha) compared with 1,482,000 acres (599,745 ha) in 1968. This would be an increase of about 11% and, based on average beet yield, would produce some 27 million short tons of beets or 7% more than in 1968.

[1] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (8), 8.

Manufacture of sugar from beet in India

By V. S. SUD, Chief Executive Officer
The Ganganagar Sugar Mills Ltd., Sri Ganganar, (Rajasthan), India

Introduction

An ambitious experiment on the manufacture of sugar from sugar beet was undertaken by the Ganganagar Sugar Mills Ltd., Sri Ganganagar, Rajasthan, India in 1968, in collaboration with the National Sugar Institute, Kanpur. The Institute had supplied to this mill a small DDS beet diffusion plant, with a capacity of 25 metric tons per day, along with a slicer, a washer and several other units. The management of the mill undertook to fabricate the remaining units in their workshop and erected a miniature sugar factory from the beet washer to the quadruple effect evaporator, with a view to having a balanced plant for the experiment, which is reviewed in two parts, namely (A) Cultivation of beet in the Sri Ganganagar area; and (B) Working of the sugar beet diffusion plant at Sri Ganganagar.

Sugar Beet Cultivation in the Sri Ganganagar Area

It had been observed by the Management of the Ganganagar Sugar Mills Ltd. that in the Sri Ganganagar District, from which they drew their supplies of sugar cane, the traditional cane crop was gradually losing its popularity with the local growers owing to the following reasons:

(i) sugar cane is a year-round crop and occupies the field for 12–13 months thereby allowing only one crop in the field annually,

(ii) the crop requires more waterings than any other crop, the normal waterings necessary being 17 to 20, as against 5 to 8 waterings required by other crops,

(iii) cane is vulnerable to all kinds of diseases and pests right from its germination to its maturity, and

(iv) the cost of cultivation of cane is higher than alternative crops, but the returns from its sale during the last five years were far below the expectations of the growers.

In view of these adverse circumstances, the cultivators in Sri Ganganagar District had, of late, developed a tendency to neglect the sugar cane crop and to show greater inclination towards other competitive cash crops such as high yielding varieties of Mexican wheat, hybrid millet, hybrid maize and American cotton. This presented a very serious problem to the mill management because the continuance of such a tendency on the part of the cultivators would have imperilled the very existence of the mill. After a detailed study of the situation, it was felt that sugar beet could be the answer to this problem. Accordingly the management launched this experiment in the hope that sugar beet would take its proper place in the agricultural pattern in Sri Ganganagar and the plains of northern India, side by side with sugar cane. Fortunately, the experiment has been successful beyond our expectations.

Climate

Sugar beet requires a fairly cool climate and is resistant to frost. Good rainfall at regular intervals or alternatively regular irrigation during the sowing period accompanied by bright sunshine greatly helps its growth and yield. In the Sri Gananagar area nights are fairly cool during the winter season and there is bright sunshine during the daytime, as was evident from the statistics collected by us. From the data below it may be observed that climatic conditions in Sri Ganganagar, though not the same as in Europe, are sufficiently suited to the requirements of this plant so that the crop can be successfully cultivated in this area.

	Temperature			*Relative*	
Month	*Max.*	*Min.*	*Rainfall*	*Humidity*	*Climate*
Oct. '67	38·8°C	9·0°C	Nil	57	Moderate
Nov. '67	32·4°C	6·0°C	15·1 mm	72	Moderate
Dec. '67	23·6°C	1·4°C	47·2 mm	90	Cool
Jan. '68	22·0°C	1·8°C	6·5 mm	92	Cool
Feb. '68	27·0°C	1·0°C	12·7 mm	96	Cool
Mar. '68	34·0°C	4·0°C	29·0 mm	85	Moderate

Soil

Loamy or clay loamy soils in India with a slight alkalinity are suited to sugar beet. This crop requires a well-prepared and levelled seed-bed having sufficient moisture. It has been our observation that deep ploughing greatly helps in development of sugar beet roots as it is a deep-rooted crop. This crop requires much more moisture in the soil during its germination period than the seeds of other winter crops in India.

Seed

Sugar beet seed is not readily available in India and was imported by us from Denmark, West and East Germany and Japan. A quantity of imported seed was also supplied to us by the Indian Institute of Sugarcane Research, Lucknow. A small quantity of indigenous seed was also procured by us from the Government Seed Farm, Kalpa (Himachal Pradesh). We had arranged the cultivation of sugar beet of the following varieties:—

(i) Maribo Magna Poly;
(ii) Ramonskaya;
(iii) Maribo Resista;
(iv) Monakal;
(v) Di-Monakal.

Our observations during the experiment have been that all the varieties cultivated in this area have given satisfactory results. From this experimental cultivation, it is not possible to judge as to which variety is best suited to the local conditions and this can be done when extensive cultivation operations are carried out in future years.

Sowing

Trials of the several beet varieties were carried out at Sri Ganganagar to find out the most suitable time for sowing and proved that the best period in this area is from 7th to 27th October. The beet was sown on ridges and flats, and experience showed that the crop grown on ridges gives better yield and better germination.

Manure

It was observed that good results were obtained by using about 10 cart loads of farmyard manure per acre as basal dressing, followed by 100 kg/acre of superphosphate and 80 kg/acre of calcium ammonium nitrate or ammonium sulphate as top dressing.

Diseases and pests

During the experiment in general the crop was healthy but in some stray cases leaf spots, fungus and rotting of roots were observed and there were symptoms of boron deficiency. We requisitioned the services of Dr. Kishan Singh, a specialist from the Indian Institute of Sugarcane Research, Lucknow, who inspected the crop and after discussions with our technical officers worked out chemical control methods to check these diseases.

Irrigation

In the Sri Ganganagar area, rainfall during the winter season is scanty. The crop had therefore to be irrigated by perennial canal water supply, which facilities are available in this area. Our experience shows that the crop requires between 7 and 10 waterings at regular intervals to meet its moisture requirements. Since this crop is sensitive to drought, regular waterings are necessary especially during the early stages of the growth of the plant.

We had selected 35 progressive cultivators mostly in the area round about the factory gate for the experimental cultivation. The cultivation was done in an area of about 60 acres. We maintained statistics of the agricultural data of the crop of each cultivator. The highest yield obtained came to 30 tons per acre while the average yield was 13 tons per acre.

The cultivators found the green tops to be a good fodder for cattle including the milch cattle. The waste pulp after the diffusion process was dried and fed experimentally to cattle.

As this was the first year of experimental cultivation in this area the results achieved do not depict a true picture of the extent of the success of the crop in this area. There is a general belief among the local cultivators that with the experience gained this year the results will be much more encouraging from the next year. Judging from the results achieved from this experiment, we are fully convinced that sugar beet has a great future not only in Sri Ganganagar District alone but also in other parts of the northern Indian plains. The local cultivators have greatly welcomed this new crop and are very keen and enthusiastic about its extensive cultivation from the next year. The seed of the crop can also be produced in hilly tracts like Kashmir, Simla Hills and the Tarai area of Uttar Pradesh, where climatic conditions are suitable for seed cultivation.

WORKING OF THE DIFFUSION PLANT AT SRI GANGANAGAR

The sugarbeet season started at Sri Ganganagar on the 8th April 1968, the formal inauguration being performed by the Chief Minister of Rajasthan State on the 12th April. The diffusion operations concluded on 16th May 1968 with a duration of 40 days, the total working hours during which actual operations were carried out being 738⅓. During this period 6,489·35 quintals of sugar beet were diffused. The clarification process used was double carbonatation followed by single sulphitation.

Working results

The results achieved show that the beet juice is richer in sugar content than the cane juice. The average purity of beet juice was 82·33 as compared to the mixed cane juice purity of 78·65 during the season 1967–68. The sugar content in beet averaged 14·77% against 11·54% in cane during the season 1967–68. Since the beet sugar manufacturing process is entirely different from that of cane sugar, in the beginning the workmen had difficulty in handling the juices and there were losses, but with passage of time they gained sufficient experience and the working gradually improved, so much so that, towards the close of the season, the recovery had improved to 11·5%. A summarized statement showing the salient features of the Final Manufacturing Report is given in the table below:—

Date of start	8th April 1968
Date of finish	16th May 1968
Duration of season	40 days
Working hours	738 hr 20 min
Beet sliced	6,489·35 quintals
Total sugar bagged	604 quintals
White sugar	521 quintals
Brown sugar	83 quintals
Final molasses sent out	337·29 quintals
Average recovery of sugar % beet	9·10
Average production of final molasses % beet	5·41
Filter cake % beet	6·63
Pulp % beet	5·41
Analytical Results:	
Sugar % beet	14·77
Sugar % raw juice	11·00
Brix of „ „	13·47°
Purity „ „ „	82·33
Sugar % clarified juice	8·42
Brix of „ „	9·63°
Purity „ „ „	87·44
Sugar % final molasses	49·14
Brix of „ „	88·01°
Purity „ „ „	55·83
Sugar % pulp	1·49
Water % pulp	87·79
Sugar % filter cake	1·89

Sugar recovery

The actual figure of sugar recovery achieved—9·10%—does not depict a true picture as the losses on the small experimental diffusion plant were naturally on the high side, and can be avoided when we erect a commercial-size diffusion plant. The white sugar produced was of finest quality and was rated as equivalent to imported refined sugar by Dr. S. C. GUPTA, Director of the National Sugar Institute, Kanpur (India).

We manufacture sugar from cane by the double sulphitation process but for beet sugar the double carbonatation process is necessary, and we used CO_2 gas produced in the distillery attached to the mill. CO_2 gas was recovered from the fermentation wash tanks of the distillery and was transferred to the sugar factory through a pipe line.

Production of final molasses was 351·05 quintals and its purity was 55·82. This is far higher than cane molasses, the purity of which is 31·26%. Beet molasses is very valuable as it is utilized in this country for manufacture of Vitamin B complex, lactic acid, citric acid and other fermentation products. At present beet molasses is being imported into the country for use by the pharmaceutical industry; with the development of beet cultivation and installation of a commercial-sized diffusion plant, ample quantities of molasses should be available for use by the pharmaceutical industry in India and the necessity for importing the molasses should be completely eliminated, thus saving foreign exchange.

Conclusion

The experiment at Sri Ganganagar has proved successful. White sugar has been produced from sugar beet for the first time in the history of India. The sugar industry watched our progress with keen interest and a number of sugar factories deputed their technical personnel to observe the working of the diffusion plant in this factory. A new chapter in the history of the sugar industry in India has been ushered in and it is earnestly hoped that it shall be the harbinger of a new era of growth of the beet sugar industry. Encouraged by the experiment, we are making arrangements for the extensive cultivation of sugar beet and to purchase a commercial size sugar cane-cum-sugar beet diffusion plant, which is expected to go into production in the 1970–71 season.

Achnowledgments

We are greatly indebted to the National Sugar Institute, Kanpur and the Indian Institute of Sugar Cane Research, Lucknow, for the valuable help and assistance rendered by them in this experiment.

International Sugar Research Foundation Inc.

A NEW brochure has been published by the International Sugar Research Foundation Inc. under the title "What's at Stake in Sugar Research?". It presents an account of the Foundation and its background and the work on which it has been and is currently engaged.

ISRF was brought into being on 1st July 1968 as the successor to Sugar Research Foundation Inc. which during the previous 25 years had sponsored nearly 280 research projects at educational institutions and commercial laboratories in the USA, Canada, the UK and the British West Indies, spending more than $5,000,000 on the work. Formation of the new Foundation recognized the more international nature of the SRF with the accession of members from Australia, Belgium, Ireland, Mexico and South Africa as well as those from Canada, the UK and the USA.

The Foundation thus has in existence facilities for aiding research into new markets for sugar, checking to see if there are health reasons for restricting the use of sugar, and finding methods to outflank sugar's competitors. Response to the urgency of the threat of significant displacement of sugar by synthetic sweeteners in 1964 led to research which produced growing evidence that cyclamates are not safe for all people under all conditions of use. Such evidence has led to the abandonment of cyclamates by some industrial consumers and examination by food authorities in a number of countries as to the desirability of restrictions on their use.

Nutrition and public health are basic themes in the ISRF programme, and current research studies include work on the effects of diet on athletic performance in which preliminary findings indicate improvement when the diet contains generous amounts of sugar and cereals. Studies are also being carried out on alleged possible relationships between dietary sugar and heart disease, while other research includes work on dental caries, sugar in human metabolism, etc. Scores of non-food uses of sugar have been investigated, ranging from animal feeds to plastics. Sugar ester surfactants exhibit superior qualities as detergents and also as emulsifiers and dispersing agents in foods, being tasteless, odourless and non-toxic as well as completely bio-degradable. Some work has also been done on the utilization of molasses, bagasse and beet pulp in the fields of animal feeding, paper-making and manufacture of plastic moulding compounds.

The remaining area of research is in food technology where the use of extra sugar in canned fruits has been found preferable by consumers for whom the fruit flavour is improved. It has been found also that sugar may be used in commercially-prepared foods in place of glucose syrups, the amount of which must be limited to avoid interior flavours and unwanted variations in texture and colour.

The new brochure gives details of the Board of Directors of the Foundation for 1968–69, as well as information on the careers of Dr. PHILIP ROSS, President and Secretary, and Dr. JOHN L. HICKSON, Vice-President and Director of Research, and a list of Member Companies and Associations.

Sugar cane agriculture

Variety yield trials used to measure rate of mosaic spread in sugar cane. H. P. FANGUY and R. L. TIPPETT. *Sugar y Azúcar*, 1968, **63**, (5), 56–57.—It is pointed out how the advent of the strain H of the mosaic virus and the susceptibility of the variety N:Co 310 caused much concern in Louisiana. An account is given of mosaic counts in connexion with yield and variety trials in different locations. It is explained how these trials may be an important source of mosaic spread data for both experimental and commercial varieties in Louisiana.

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Sugar cane pests and their control (in Mexico). A. SOLONA. *Bol. Azuc. Mex.*, 1968, (218), 30–34. The main insect pests of sugar cane in Mexico are briefly described and methods of combating them with modern insecticides outlined.

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"Crash program" sugar cane breeding progress. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1967, **14**, (13 & 14), 2–4.—The new cane breeding programme initiated by the Victorias Milling Co. in the Philippines is described. It was started as a result of a visit and advice from a well known sugar cane breeding expert from the United States.

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Urea *vs.* ammonium sulphate as a source of nitrogen. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1967, **14**, (13 & 14), 8–9.—The relative merits of the two fertilizers for cane are discussed. It is pointed out that ammonium sulphate may increase the acidity of the soil and lime may be needed to counteract this. One ton (20 bags) of urea will fertilize the same area as 2¼ tons (45 bags) of ammonium sulphate.

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Efficacy of "Endrin" granules in controlling black bug of sugar cane. A. N. KALRA and D. K. BANERJI. *Indian Sugar*, 1968, **17**, 749.—The black bug or lygaeid bug (*Macropes excavatus*) is a serious pest in Haryana and western Uttar Pradesh. "Endrin" emulsion spray has been used to control it but there are drawbacks to this with peasant cultivators. "Endrin" granules were found to be just as efficient and cheaper to apply, although more costly to purchase.

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The occurrence of new beetle pests damaging the sugar cane crop in Uttar Pradesh. S. S. KHANNA, K. M. GUPTA, B. SINGH and K. N. RAM. *Indian Sugar*, 1968, **17**, 751–752.—During the years 1961–64 four beetle pests of rather localized distribution were found damaging sugar cane. They were *Holotrichia consanguinea*, *Holotrichia serrata*, *Pentodon bengalense* and *Heteronychus robustus*. Remarks on the biology and control of each are given. Results of screening tests with various soil insecticides are presented in a table.

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The Parkinson cane weeder and stubble shaver. I. J. V. STEWART. *Cane Growers' Quarterly Bull.*, 1968, **31**, 112–113.—This versatile, low-cost machine, invented (patented) by a Queensland cane grower, is described with photographs. It has been in service for the last two years. It is tractor-drawn and a spinning wheel with tines rotates at right angles to the direction of the tractor. By replacing the weeder tines with L-shaped blades it is converted to a stubble shaver, an operation requiring half an hour.

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Earth pearl trials at Bundaberg. J. F. USHER. *Cane Growers' Quarterly Bull.*, 1968, **31**, 114–116.—Margarodids, or earth pearls as they are called, were first recorded as minor pests of sugar cane in Queensland in 1932. There are four species. Field and pot trials to gain more knowledge about one of the species and its effects on the ratooning ability of cane are described. It is considered that an economical method for commercial control of earth pearls has yet to be found.

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A comparison of some irrigated varieties on the Southern Sugar Experiment Station (Bundaberg, Queensland). R. B. MOLLER. *Cane Growers' Quarterly Bull.*, 1968, **31**, 118–120.—Field trials with 5 varieties emphasized the superiority of N:Co 310 under the prevailing conditions. Q 68 appeared to be a worthwhile alternative for late harvest fields while Q 71 may be worthy of consideration for very early harvest fields.

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A new stool remover. J. F. USHER. *Cane Growers' Quarterly Bull.*, 1968, **31**, 122–124.—The destruction of old stools at plough-out has long been a problem, especially in wet soils, when there is a tendency for "transplanting" to occur. A new implement, produced in Queensland, which is able to chop the old stubble into small pieces and deposit them on the surface of the soil, is described. The machine, fixed at the rear of a tractor, resembles a rotary hoe except that the blades rotate at right angles to the row. They cut at four different levels. This stool remover has functioned well on all types of soil.

Windburn in H 48-3166. L. K. IZATT. *Cane Growers' Quarterly Bull.*, 1968, **31**, 124.—The characteristics of windburn or leaf burn in young cane are described, the variety H 48-3166 being very prone to it under certain conditions. Notes are given on how to distinguish it from leaf scald, which is a serious disease.

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Soldier fly control by "Dieldrin" in third ratoons. B. E. HITCHCOCK. *Cane Growers' Quarterly Bull.*, 1968, **31**, 131.—Experiments are reported in controlling soldier fly in second and third year ratoons in the Walkerston area of Queensland. It was found that reasonable control could be obtained with "Dieldrin" at 6 lb/acre. A higher rate, 8 lb/acre, gave slightly better control but the difference was not significant.

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Sclerophthora **disease at Mackay.** C. G. STORY. *Cane Growers' Quarterly Bull.*, 1968, **31**, 134–135.—This sugar cane disease, which also attacks various well known grasses and is usually confined to low-lying or waterlogged areas, is described. Following the heavy rainfall of 1947 two outbreaks were reported in Queensland.

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Breeding, botany, genetics and cytogenetics of sugar cane. ANON. *Salient Research Achievements*, 1967, (Sugar Cane Breeding Institute, Coimbatore), 1967, 1–5.—Information is given on 5 promising new sugar cane varieties bred in India, and on improved breeding methods, mutation breeding, inheritance studies, introgressive hybridization and intraspecific incompatibility in *Saccharum officinarum*. The incompatibility has been noticed to be due to shortness of the pollen tube of *Saccharum officinarum* and its failure to travel the style and reach the ovule. Preliminary studies during the year on amputation of the style and dusting pollen on the stump and increasing the length of the pollen tube by gibberellic acid and boric acid has indicated encouraging results. Seedlings have been obtained through these methods, which had not previously been achieved.

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Earth filling: an essential operation in cane culture for safeguarding tonnage at harvest in Taiwan. C. S. LOH. *Taiwan Sugar*, 1968, **15**, (2), 21–25.—Reasons for the practice of "earth filling" in Taiwan, i.e. placing earth in the centre of a developing stool, are given. Taiwan is noted for high winds and some varieties lodge easily. The writer considers the operation could be performed mechanically by tractor with suitable implements or attachments, resulting in a great saving in man-hours.

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Johnson grass mosaic in sugar cane fields in Louisiana. I. L. FORBES and M. GIAMALVA. *Sugar Bull.*, 1968, **46**, (15), 8–10.—Results are given of recent inoculation experiments. In inoculations of Johnson grass seedlings with sugar cane mosaic virus less than 1% of the plants developed mosaic symptoms. More work needs to be done to ascertain whether Johnson grass mosaic and sugar cane mosaic are reciprocally transmitted.

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Sugar cane problems on saline soils. J. A. BONNETT. *Sugar y Azúcar*, 1968, **63**, (6), 21–23, 40.—The undesirable effects of high salinity in sugar cane soils are discussed, notably its adverse effect on germination and growth, yields and quality of juice, saline juices creating problems in the sugar manufacturing process by increasing scale in evaporator tubes and pans and generally reducing efficiency of equipment. The danger of inadequate handling of drainage and irrigation waters is discussed. The writer discusses experience gained recently in Puerto Rico and the Dominican Republic under various soil and climatic conditions and makes recommendations under 10 headings.

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The effect of tasselling on yield. R. ARANETA. *Sugarland* (Philippines), 1968, **4**, (12); 5, (1 & 2), 20–22. This is a discussion on the effect of tasselling or flowering on sucrose content and growth of cane. The various factors that lead to flowering are discussed. It is pointed out that the degree by which tasselling reduces crop yield depends upon: (1) age of crop, (2) the percentage of flowering and (3) the time at which the crop is harvested.

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The most important pests of sugar cane in the Philippines and their control. J. D. RECUENCO. *Sugarland* (Philippines), 1968, **4**, (12), **5**, (1 & 2), 42–45, 61. The pests are briefly described under four headings: (1) insect pests attacking underground parts (termites, white grubs), (2) pests attacking stalk (pink mealy bug, stem-boring caterpillars, (3) insect pests attacking the leaves (woolly aphis, locusts) and (4) pests other than insects (rats, nematodes).

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Considerations on the use of dual systems in irrigation. J. C. TEJADA and O. F. TELLO. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 11–15.—The use of aluminium or plastic piping for irrigation of sugar cane under the special conditions prevailing in Peru is discussed.

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Irrigation with canals of minimum fall. M. ECHEANDIA N. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 16–19.—Irrigation practised on the San Jacinto estate with plant (not ratoon) cane on sandy soil where the slope is minimal is described.

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Urea. H. T. FUCHS. *Anal. VII Conv. Peruana Técn. Azuc.*, 1963, 33–38.—The use of urea as a nitrogenous fertilizer for sugar cane under the climatic conditions prevailing in Peru is discussed and results of numerous trials are given.

Selectivity of Hawaiian sugar cane varieties to urea and sulphate of ammonia. L. G. NOVOA S. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 39–42. Three varieties were compared, viz. Ch. 32 (H 32-8560), Ch. 37 (H 37-1933) and "Azul", over two crops. "Azul" was superior to the other varieties when urea was used as the N fertilizer, but was inferior to Ch.37 when sulphate of ammonia was used. The fall in yield from plant crop to 1st ratoon was smaller with "Azul" than with Ch.32 or Ch.37 (13% *vs.* 19·1% and 18·1%, respectively). Comparison of the yields with different amounts of N showed that 850 kg/parcela (132·75 sq.m.) gave a 12% greater yield than did 500 kg/parcela.

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Results obtained with various fertilizers in the commercial cultivation of sugar cane. G. LARREA S. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 43–47.—Results are given of extensive nitrogen fertilizer experiments carried out in the period 1956–1963. Sulphate of ammonia, nitrate of ammonia, urea and guano were used with three cane varieties (Ch.37, Ch.32 and "Azul"). Under prevailing conditions, single applications proved superior to split applications.

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Sugar cane varieties cultivated on the Casa Grande estate (Peru). P. P. D. LIU. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 53–58.—Comparisons are made between the main commercial cane varieties cultivated in Peru, and information is given on their origin and dates of introduction to Peru. The varieties concerned are: (1) POJ 2878, introduced from Java in 1928 and the principal variety cultivated at Casa Grande from 1945 to 1957; (2) Ch.32 (H 32-8560) and Ch.37 (H 37-1933), introduced from Hawaii in 1932 and 1937, respectively; and (3) P 12.745 ("Azul"), the most important local commercial variety.

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New varieties of sugar cane (in Peru). General observations. C. J. ULLAURI. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 59–63.—Information is given on the behaviour of some half-dozen new varieties of sugar cane at Paramonga. Various factors are considered separately, e.g. growth rate, yield, tendency to lodge, ratooning, susceptibility to borer infestation, etc.

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Varieties of sugar cane for commercial planting in Peru. P. TERESHTCHENKO. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 64–70.—Four important commercial cane varieties in Peru are discussed at some length: "Azul", Ch.32, Ch.37 and POJ 2878. The greatly increased cultivation of "Azul" during the previous 15 years is emphasized, especially in new areas and as a substitute for POJ 2878 which is declining in popularity. Reference is made to the hybridization work initiated in Peru to produce new varieties better suited to Peruvian conditions.

Observations on diseases affecting new cane varieties introduced (to Peru) from Hawaii. V. R. REVILLA M. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 93–101.—Information is given on the distribution and degree of severity of various cane diseases in Peru such as mosaic, *Sclerospora* and pokkah boeng.

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Transport of cane on the Pomalca estate. A. DE LA PIEDRA L. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 111–118.—Details are given of the handling of cane on this estate and its transport to the factory, the total amount of cane transported being in the neighbourhood of 380,000 tons per annum.

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The implementation of an intensive system of herbicide application to sugar cane. S. UGAZ O. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 127–138.—To be able to arrange an efficient method of application of herbicides on a sugar estate is of primary importance today, hand labour for weeding being now at a premium everywhere. Some methods employed at the Paramonga Experiment Station and elsewhere are described. The use of tractors with side tanks attached and tank trailers capable of carrying and applying large quantities of herbicide over extensive area is described.

* * *

Experience with pre-emergence and post-emergence herbicides on three sugar estates (in Peru). C. BECERRA, R. CORNEJO and G. PASTOR. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 139–146. The development of efficient methods of herbicidal weed control, with an eye to costs, on three different sugar cane estates in Peru—Tumán, Pucalá and Anexos—is described.

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Evaluation of the desiccant "Gramoxone". J. C. P. CHEN and P. P. D. LIU. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 147–152.—The results of four applications of "Gramoxone" applied by air during May, June, August and December are discussed.

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Experiments with "Gramoxone" as a foliar desiccant wi'h sugar cane on the Paramonga Estate. M. MONTERO S. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 153–163.—The effect on cane of one, two and three applications of "Gramoxone" on mature cane crops is discussed. It was considered that results were not such as to justify large-scale commercial usage.

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Factors affecting herbicide usage in sugar cane with special reference to soil applied herbicides. E. ROCHECOUSTE. *Proc. 14th Conv. Philippines Sugar Tech.*, 1966, 10–14.—This is a general discussion on the use of herbicides with sugar cane. The various factors that may influence the efficiency of herbicides or

chemical weedkillers are dealt with in turn such as land preparation and soil type, rainfall, sunlight and temperature and soil micro-organisms. Other matters discussed are weeds and their growth habits, crop tolerance and varietal response.

* * *

What makes for poor or good germination of the cane seedpiece? T. R. ESCOBER. *Proc. 14th Conv. Philippines Sugar Tech.*, 1966, 15–23.—Advice is given to the sugar cane planter on the correct selection, treatment and planting of sugar cane setts. The various factors that need careful consideration are dealt with in turn. If these are properly attended to, the planter will reap the benefit of faster, more vigorous and uniform germination and appreciable saving in replant costs. The author illustrates his points with suitable photographs.

* * *

Weed flora of Philsugin La Granja Experiment Station. F. T. AALA. *Proc. 14th Conv. Philippines Sugar Tech.*, 1966, 109–119.—The results of a survey of the weed flora of sugar cane fields at the La Granja Experiment Station made from January to July, 1965, are summarized. The total number of species recorded was 106, of which 24 were grasses. A list of the weeds is given with the family, common names and degree of prevalence. Three main categories are considered to be: weeds found in young cane, weeds found in more developed cane and weeds found on the boundaries of fields and along roadsides. Small sketches (49) of some of the weeds are included.

* * *

Variety tests in east Visayas. R. ARANETA, A. ALBA, F. CARBALLO and E. GEOLINGO. *Proc. 14th Conv. Philippines Sugar Tech.*, 1966, 120–124.—An account is given of two-year sugar cane variety trials (plant and ratoon) in several districts of east Visayas. Some foreign and Philippine varieties showed promise. Among a group of 7 varieties, MPR 275 proved to be the most promising. Next was Phil. 55-324. In Bogo-Medellin Phil. 53-33 and Phil. 54-60 proved superior to H 37-1933, the standard variety in yield performance. The immediate propagation of these varieties is recommended for these districts.

* * *

Sugar cane breeding at the La Granja Experiment Station. F. T. AALA. *Proc. 14th Conv. Philippines Sugar Tech.*, 1966, 143–145.—A summary of achievements since sugar cane breeding commenced 13 years ago is given. Of the 3,024,786 seedlings produced, 10 varieties have been released for large scale planting. Two of these are popularly known as Phil. 53-33 and Phil. 54-60. At present there are 147 foreign and 59 local varieties maintained at the Station.

* * *

Test of some weedicides in sugar cane fields. L. G. REYES. *Proc. 14th Conv. Philippines Sugar Tech.*, 1966, 146–158.—Results are given of trials carried out at La Granja Sugar Cane Experiment Station with 8 herbicides, the object being to test their comparative efficiency, their effect on the sugar cane plant and to ascertain the most profitable application to employ. Pre-emergence application did not affect germination of setts. Six of the herbicides tested did not control certain weeds which are enumerated. "Gramoxone" caused severe burning of the leaves of cane and is not recommended. Other herbicides tested were: "Gesaprim", "Telvar", "Fernoxone", 2,4-D ester, "Fernimine" and "Sesone".

* * *

New varieties of sugar cane improve factory output. R. F. DE ULLIVARI and D. M. MORIN. *Rev. Agron. Noroeste Argentino*, 1966, **5**, (1–2), 5–21.—This is a detailed discussion of the performance and yields of some of the newer varieties of sugar cane in cultivation in Argentina.

* * *

Insecticidal treatment of seed cane prior to planting. J. A. MARIOTTI. *Rev. Agron. Noroeste Argentino*, 1966, **5**, (1–2), 93–112.—The damage that may be done to seed cane by certain insects inhabiting the soil in many cane growing countries is discussed, the trouble with termites in India being mentioned. Results of preliminary trials with various insecticides for the control of harmful soil insects in Argentina are discussed. Insecticides used included "Lindane", "Endrin", "Heptachlor" and "Dieldrin".

* * *

Effect of hot air treatment (8 hours at 58°C) on germination of sugar cane. E. CERRIZUELA and J. A. MARIOTTI. *Rev. Agron. Noroeste Argentino*, 1966, **5**, (1–2), 113–122.—Five widely grown varieties were used in the trials, the treatment being that commonly applied for prevention of ratoon stunting disease in place of hot water treatment. No appreciable harmful effect was noted.

* * *

The influence of various herbicides on cane germination (individual shoots): preliminary trials. E. CERRIZUELA and J. A. MARIOTTI. *Rev. Agron. Noroeste Argentino*, 1966, **5**, (1–2), 123–132.—Planting setts (variety N:Co 310) were immersed momentarily in various herbicides prior to planting, the concentration being that recommended by the makers. The herbicides used were: "Fenac", "Dalapon", "Simazine", "Karmex", T.C.A., "Triazol-amine" and 2,4-D. "Simazine" and "Karmex", far from having an ill effect, actually hastened germination. The others had no effect except that "Triazol-amine" suppressed green pigment and caused the shoots to appear in a chlorotic state.

* * *

Fungicidal treatment of seed cane prior to planting. J. A. MARIOTTI. *Rev. Agron. Noroeste Argentino*, 1966, **5**, (1–2), 133–149.—Seed cane from 3 varieties was treated at different seasons with various fungicides to prevent bud rot in the soil and improve germination. The organo-mercuric fungicides proved to be superior to copper and other non-mercuric types, and appeared actually to stimulate germination, good results being obtained with "Clerit 6", "Agrosan", "Agallol" and BSM 11. A lengthy bibliography is included.

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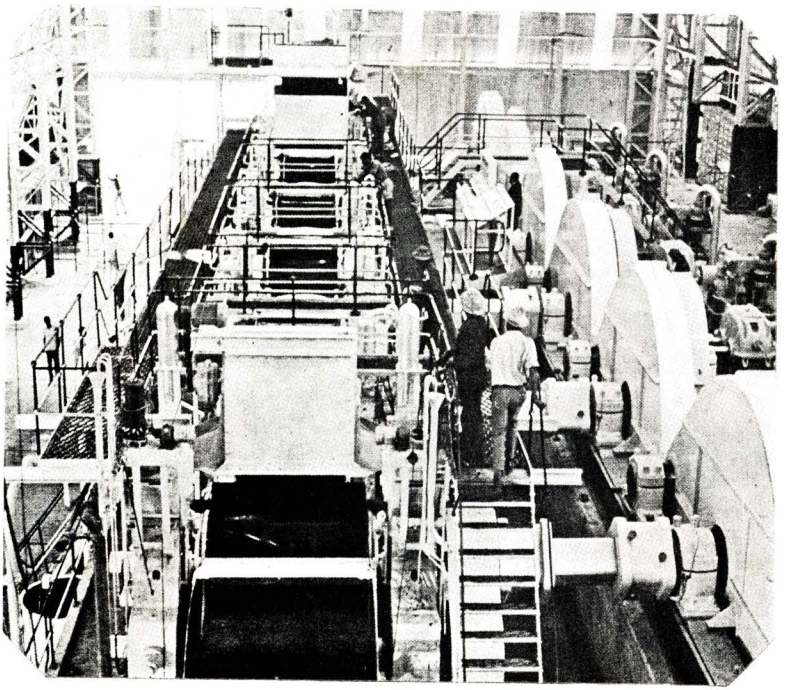

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Sugar beet agriculture

Sugar beet after grass. N. A. WYKE. *British Sugar Beet Rev.*, 1968, **36**, 116.—As a result of the 1967/68 UK foot-and-mouth epidemic some farmers planted sugar beet after grass. Advice on treatment of such land is given. One of the problems, matted turf, can be overcome by rotary cultivation before ploughing or burying with a good skim on the plough. Lime requirements of the soil should be checked as the crop is susceptible to acidity.

* * *

Planting to stand. R. G. DUNNICLIFF. *British Sugar Beet Rev.*, 1968, **36**, 120, 127.—Sugar beet planting is discussed and the various factors that may affect germination pointed out. Suggestions are made in regard to ground spacing with multi-germ varieties, pelleted polyploid varieties and pelleted genetic monogerm varieties.

* * *

Results of sugar beet variety trials carried out in Belgium from 1963 to 1967. N. ROUSSEL and R. VAN STALLEN. *Publ. Bimest. Inst. Belge pour l'Amél. Betterave*, 1967, **5**, 137–170.—Thirty varieties were tested in trials in 3 different areas. Results are shown in detail in 14 tables. In addition to yield and sugar content information is given on other factors such as fibrosity, height of crown above the soil and ability to cover quickly the inter-row space at the beginning of growth.

* * *

The effects of triphenyl stannic acetate on the powdery mildew of sugar beets. H. C. WELTZIEN. *Zucker*, 1968, **21**, 241–246.—Sugar beet plants were artificially infected with powdery mildew (*Erysiphe betae*) and then treated with triphenylstannic acetate or "Brestan". It showed a significant fungicidal effect but there was no noticeable difference between it and one of the copper fungicides.

* * *

Performance of sugar beet hybrids at different harvest dates. R. J. HECKER, M. G. PAYNE and E. E. REMMENGA. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 455–464.—A three-year study is described, carried out in Colorado to find the response of single-cross sugar beet hybrids to time of harvest. Results indicated the possibility of breeding sugar beet hybrids which would have as high a percentage apparent purity, when harvested a month earlier, as do commercial open-pollinated varieties harvested a month later. The obvious advantage to grower and factory, of starting harvest earlier, is discussed.

Mass selection for the improvement of *Cercospora* resistance and sugar content in the Northern Ohio Sugar Company areas. R. K. OLDEMEYER and R. C. ZIELKE. *J. Amer. Soc. Sugar Beet Tech.*, 1969, **14**, 465–469.—Sugar beet in the Great Lakes region, which has warm humid summer weather, is very liable to be attacked by leaf spot disease (*Cercospora beticola*). This report discusses the results from mass selection for leaf spot resistance in 6 monogerm open-pollinated varieties at Old Fort, Ohio. Significant gains were made in leaf spot resistance by mass selection.

* * *

Yellow wilt of sugar beet. C. W. BENNETT, F. J. HILLS, K. EHRENFELD, J. VALENDZUELA and C. KLEIN. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 480–510. This disease, described as potentially the world's most destructive sugar beet disease, is due to a virus, transmission being by a leafhopper (*Paratanus exitiosis*). It is troublesome in Argentina and Chile, but could be serious in any areas of the world where beet is grown under low rainfall conditions. An account is given of a detailed study of the disease and its vector.

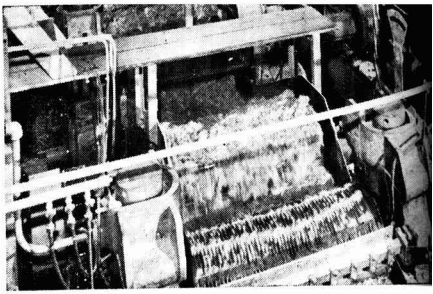
* * *

Breeding for combined resistance to leaf spot and curly top in sugar beet. J. O. GASKILL, C. L. SCHNEIDER, A. M. MURPHY and G. E. COE. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 518–537.—The growing need for sugar beet resistant to both diseases is discussed. Results of this study showed that the backcross method is a useful tool for combining leaf spot and curly top resistance and that the sugar beet variety US201 is suitable for use in such a programme as the nonrecurrent parent and the source of leaf spot resistance.

* * *

Germination and emergence of sugar beets. A. E. ERICKSON and L. S. ROBERTSON. *Sugar Beet J.*, 1968, **31**, (3), 6–7.—The requirements of the sugar beet seed for germination are discussed and the need for adequate soil moisture and oxygen emphasized. The harmful effects of "crusting" of the soil surface, that can take place with many sugar beet soils, is pointed out. It may completely prevent the emergence of the young beet seedling. A stable soil structure, that "resists" crusting, is perhaps most easily and cheaply obtained by the wise use of organic matter.

Cane sugar manufacture



Magnesium oxide in the raw sugar house. J. R. RADWAY. *J.A.S.T.J.*, 1966, **27,** 48–58.—The use of MgO instead of lime reduces overall costs by increasing the capacity of juice heaters, clarifiers, mud filters and evaporators. These advantages arise from the higher neutralizing power of MgO per unit weight and the higher solubility of most Mg salts compared with the corresponding Ca salts. An exception to the latter is of advantage; Ca forms a soluble saccharate while Mg does not. The apparent reaction of MgO is slower than that of lime and adequate residence time must be allowed before measuring pH for control of clarification. Juice clarity has been claimed to be poorer when using MgO but clarity is not a criterion of non-sugars removal and sugar from two Hawaiian factories using 100% MgO has earned a premium for high quality. Possible reasons for poor results using MgO reported by WOTHERSPOON[1] are suggested.

* * *

Comparison of evaporator cleaning techniques. F. H. CONNOLLEY. *J.A.S.T.J.*, 1966, **27,** 59–61.—The results of a survey showed that cleaning procedures in 13 Jamaican sugar factories were fairly standard, most using a 20–60°Bx $NaOH/Na_2CO_3$ solution which covered the top tube plate and was kept at the boil under atmospheric pressure by means of 3–4 p.s.i. steam in the calandria. In two cases the solution was sprayed from above and recirculated to a storage tank from which it was pumped to the sprays. Treatment continued for 2–4 hours after which the vessels were rinsed with water and cleaned with power-driven rotary brushes. Traces of alkali were removed with boiling water and by boiling with 1% HCl containing an inhibitor for 1–1½ hours.

* * *

Sulphi-carbonatation process. H. T. TAN and M. MOCHTAR. *Madjalah Perusahaan Gula*, 1966, **2,** 77—86, 102, 87–89; through *S.I.A.*, 1968, **30,** Abs. 68–110. With the purpose of reducing limestone and coke consumption in sugar factories using the carbonatation process, experiments on a laboratory as well as a factory scale were conducted in Java. Results showed that by the use of the sulphi-carbonatation process limestone consumption could be reduced from 30 to 20 tons per 1000 tons of cane, and coke consumption from 2·98 to 1·84 tons per 1000 tons of cane, as compared with the normal carbonatation process. Sulphur consumption, however, increased from 15·45 kg to 22·1 kg per 1000 tons of cane. Sugar produced did not differ greatly from that obtained with the normal carbonatation process.

Studies on the storage of raw sugar as affected by packing materials. S. HASE, Y. FUKUMOTO, N. TAKATUKI and S. SUZUKI. *Nihon Shokuhin Kogyo Gakkaishi*, 1966, **13,** (5), 186–194; through *S.I.A.*, 1968, **30,** Abs. 68–113.—Raw sugar samples were packed in 5-ply paper bags (30 kg content) or jute bags (90 kg content) and stored in warehouses in Japan from June to October. The paper bags were piled 20 bags high and the jute bags 15 bags high. In the warehouse the temperature of the lower space near the floor was always 2–5°C lower than the higher space, whereas the relative humidity was always 10% higher, i.e. always >70%. Raw sugar in the lower bags was therefore susceptible to deterioration. In a good warehouse, sugar in jute bags showed less deterioration than sugar in paper bags, but in an unfavourable warehouse sugar in both jute bags and paper bags showed nearly the same extent of deterioration.

* * *

Mill settings or adjustments. L. FANDIÑO L. *Bol. Azuc. Mex.*, 1968, (216), 25–35; (217), 25–30; (218), 25–29.—Factors influencing mill settings are discussed; these include: quantity of cane to be milled, percentage of fibre in cane, quantitative composition of bagasse leaving each mill, mill velocity, material of construction of the rollers and trashplate, juice drainage, feeders at the entrance of the mill, amount of maceration water and method of application, mechanical condition of the mill and bad distribution of bagacillo. Three methods of calculation of settings are indicated, the first based on average diameters of the rollers, the second on exterior diameters, and the third on the moisture:fibre ratio of the feed to each mill.

* * *

Evaluation of heaters. A. VALDÉS D. *CubaAzúcar*, 1967, (March/April), 2–10.—Studies and tests were made of two different juice heater designs to be found in Cuban sugar factories, viz. the Honolulu design with a horizontal, multi-pass, single body of cylindrical cross-section, and the Webre horizontal multi-pass heater having several bodies. For technical and economic reasons the latter is preferred.

* * *

Cuban sugar factories—Camilo Cienfuegos. ANON. *CubaAzúcar*, 1967, (March/April), 12–16.—Brief information is given on this sugar factory—formerly Central Hershey—and its cane supplying area, with

[1] *J.A.S.T.J.*, 1965, **26,** 65–69; *I.S.J.*, 1968, **70,** 116.

a note on the principal factory equipment and comparative figures of cane and sugar yield per hectare and cane variety distributions in 1961 and 1967 as well as graphs of cane milled, boiling house losses and losses in bagasse each year from 1951 to 1967.

* * *

Juice purification with magnesium oxide. E. CARDET C. *CubaAzúcar*, 1967, (May/June), 34–38.—Preliminary studies are reported; it was found best to use 3–4% MgO on Brix, added as a powder to juice coming straight from the mills and allowed a contact time of 12 minutes while heating to 90–100°C and agitating for 4 minutes before rapid filtration. Factors affecting filtrability of the juice included the vacuum applied and the cloth used; nylon permitted residual turbidity but cotton cloths eliminated this. Various means of neutralizing the alkaline filtrate were tested—with CO_2, SO_2, HCl, H_2SO_4 and H_3PO_4—and the disadvantages led to examination of the possibility of using cation exchange resins on the H^+ cycle, to be regenerated with H_2SO_4 when exhausted. Examination of the juice showed the extent of removal of the various non-sugars by the technique; it varied from 12·57 to 92·50% and produced a purity rise from 85·25 to 86·73. Benefits accruing in the rest of the sugar manufacturing process are listed and additional costs briefly examined.

* * *

Fires in bulk sugar stores. A. R. KING. *Proc. 1966 Tech. Session Cane Sugar Refining Research*, 24–35. Fires in bulk stores may be of three kinds which are classified and described with their characteristics and behaviour. Factors influencing ease of ignition and type of fire have been studied, including sugar purity, industrial fall-out and dust, wind and fire-induced draughts, and the slope of the exposed face of sugar. Guidelines for the extinction of fires are provided.

* * *

Results of investigation of Oliver filtrate clarification. C. S. CHENG and W. C. CHENG. *Taiwan Sugar*, 1968, **15**, (1), 8–18.—Processes were investigated for clarification of Oliver filtrate; six were not effective but four showed promise for further study. Of the latter, hot liming to pH 9·9–10·6 at 100°C gave a comparatively slow rate of clarification and high residual CaO content and pH, but gave a juice of lower turbidity. Clarification by bringing to pH 8·2–8·4 at 100°C with Na_2CO_3 solution and liming to pH 10·2 gave a CaO content comparable to clarified juice from the defecation process and the filtrate could be sent to the evaporator either direct or after gassing with CO_2 to reduce the pH. The De Haan process, involving addition of 4% 20°Bé milk-of-lime at 50–55°C with simultaneous gassing to maintain a pH of 10·5–11·0, followed by further gassing to pH 8·2–8·6 and then heating to 80°C, gave good clarification rate, mud volume, purity difference and CaO content, but the filtrate turbidity is poor and causes difficulty in clarification; addition of 3 p.p.m. of "Separan AP-30" improved juice quality but it becomes of great importance not to go below pH 8·2. Adoption of these processes at different times during the crop is advocated, the choice of process depending on the ease or difficulty of main clarification.

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Kaohsiung district sugar factory. ANON. *Taiwan Sugar*, 1968, **15**, (2), 30–31.—The modernization programme of this sugar factory is described with especial reference to the automatic controls installed.

* * *

Nanchow sugar factory. ANON. *Taiwan Sugar*, 1968, **15**, (2), 32.—A brief account is given of the post-war expansion and improvement of the sugar factory equipment, particularly the Silver ring diffuser installed for the 1968 season.

* * *

Purging high-grade massecuites with a continuous centrifugal. J. C. P. CHEN. *Sugarland* (Philippines), 1968, **4**, (12), **5**, (1/2), 18–19.—Use of continuous centrifugals for *A*- and *B*-massecuite has been unsuccessful at Hacienda Casa Grande in Peru because of crystal damage which reduced its refining quality because of difficulties in affination (such damage is not important with low-grade strikes). Parallel tests run in Puerto Rico on *B*-massecuite curing in a Western States batch machine and a Silver 104 continuous centrifugal are reported; extra crystal damage in the continuous machine was slight but there were more lumps which would require screening out of the sugar. Performance of the Silver machine with *B*-massecuite is considered promising.

* * *

Audubon sugar factory studies—'67. J. J. SEIP. *Sugar J.*, 1968, **30**, (12), 13–15.—A facet of industrial training at the Audubon sugar school is assignment of student projects involving a study of industrial problems in a plant-scale laboratory environment. Such projects investigated during 1967 are briefly described; they include: bulk bagasse handling, topping for cane sampling, the use of the Millipore filter to evaluate clarification efficiency, optimum final molasses exhaustion, vacuum pan instrumentation for pan seeding, clarification experiments to minimize evaporator scaling, and the application of a laboratory-scale evaporator to evaluate scaling, frothing of molasses in handling and storage, and water pollution.

* * *

Facing the quality standard for raw sugar. G. ALEMÁN. *Sugar J.*, 1968, **30**, (12), 16–19.—It is emphasized that adherence to the minimum standards for raw sugar set by refiners will not only aid the refiner to produce a better product for competition with artificial sweeteners, but will usually be obtainable without harming recovery of sugar from cane. The criteria are: ash, colour, filtrability, safety factor and size and uniformity of grain, and it is considered that the required standards can be met by following good practice in the raw sugar factory in accordance with

recommendations made over many years by sugar technologists. Such recommendations are briefly summarized for the various stages in raw sugar production.

* * *

Instruments need clean air. A. A. TROY. *Sugar J.*, 1968, **30,** (12), 22–24.—The importance of a clean air supply for proper operation and service life of pneumatic control instruments is emphasized, with information on removal of contaminants such as dirt, water and oil, and indications given on a preventive maintenance programme.

* * *

Rapid cooling of *A*-massecuites between centrifugal charges. G. F. FUNDORA. *Sugar J.*, 1968, **30,** (12), 26–28.—It is calculated that if the temperature of an *A*-strike could be reduced from 150°F to 126°F by a rapid-cooling crystallizer, the crystal weight would increase from 0·382 to 0·415 mg in a period of 3·85 min so that it is possible for this to take place when the centrifugals operate on a 4-min cycle. It is acknowledged that there would be considerable research needed to design a compact cooling crystallizer with such a heat transfer area that this rate of cooling could be achieved.

* * *

In Ecuador a large sugar factory built by a French company has started operations. ANON. *Sucr. Franç.*, 1968, (6/7), 195–198.—An illustrated account is given of the AZTRA factory/refinery built by Soc. Fives Lille-Cail for Azucarera Tropical S.A. in the Guayaquil region of Ecuador. It has a nominal capacity of 7000 t.c.d. which may be extended to 8500 t.c.d.

* * *

Importance of instrumental methods of control of sugar factories realized. R. B. L. MATHUR. *Indian Sugar*, 1968, **17,** 867–870.—Instrument control of sugar factory operation in India is desirable in order to detect and then correct losses, to improve efficiency of working to keep production high and costs low, and to avoid the consequences of mistakes by factory workers. Types of equipment used in factory control are briefly reviewed.

* * *

Calculations in massecuite systems. J. VERDÍN B. *Bol. Azuc. Mex.*, 1968, (219), 30–35.—Sample calculations are made of quantities involved in a three-boiling system, given basic data such as syrup and molasses purities of various grades.

* * *

Studies on the keeping quality of Indian plantation white sugars. IV. Suggestions for improvement of the keeping quality of carbonatation sugars. N. A. RAMAIAH and B. I. NEMADE. *Sharkara*, 1967, **9,** 82–99.—Two proposals made are: (i) elimination of carbonate in the syrup by sulphitation to pH 5·0, and (ii) replacement of 2nd carbonatation by neutralization of the filtered 1st carbonatation juice with triple superphosphate solution. Factory trials showed that both methods reduced the development of colour in the white sugars produced.

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Ecuador's Aztra sugar factory and refinery. ANON. *Sugar y Azúcar*, 1968, **63,** (7), 29–31.—See abstract on this page.

* * *

The Silver cone press. H. B. MOSER. *Sugar y Azúcar*, 1968, **63,** (7), 35–37.—Details are presented of the development, design and performance of the Silver cone press for bagasse[1], which is now standard equipment for use with the Silver ring diffuser. The unit installed at Central Cumanacoa in Venezuela has cones of 72-in diameter and when operated during a week in the 1967 season had a throughput of 60–65 tons of bagasse per hour, reducing the moisture content to 47·44%. With higher hydraulic pressure, the moisture content was reduced to the lower 40's, but optimum pressure had yet to be established. The total horsepower requirement was about 4¼ h.p./ton (*sic*).

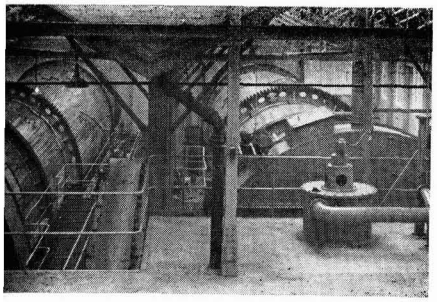
* * *

Increase in syrup density—Experience of the past season. C. PERK. *S. African Sugar J.*, 1968, **52,** 531–533.—Examination of the records from the 1953/54 to the 1967/68 seasons shows that syrup Brix is not a function of the clarification process used (defecation or sulphitation) but more of the individual factory. In order to reduce the bill for supplementary fuel, syrup Brix should be at least 65° instead of the current approximately 60°Bx, and it is considered that this target can be reached even with juice of 12·5°Bx by attention to proper evaporator condition, design and operation. Important factors affecting these are discussed.

* * *

Design of pH control stations for hot liming in cane juice processing. F. LE GUEN. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1967, 123–128.—A design is illustrated and described in which 2°Bé milk-of-lime is added to juice entering a pipe-line mixer unit from the effluent of which a sample is withdrawn, passed through a cooler unit to bring its temperature to 80°C (to avoid pH measurement fluctuations as a result of flash bubbles between the electrodes) and so to the pH electrodes. The latter produce a signal for the pH controller which then adjusts the pneumatic control valve on the lime pipe to maintain the required pH. As an alternative to cooling, a pH electrode withstanding a higher temperature may be used, provided the juice is allowed to flash to atmosphere before pH measurement. Factors in the design and operation of a pH control system are described and liming in a flash tank discussed with an illustration of the pH chart obtained by control under such conditions.

[1] *See also I.S.J.*, 1968, **70,** 220.



Beet sugar manufacture

Scheme for feeding formalin into a rotary diffuser. B. V. VASETSKII and A. I. KUZNETSOV. *Sakhar. Prom.*, 1968, **42**, (6), 39–40.—A scheme for dosing formalin is described with the aid of a diagram.

* * *

Reduction in beet quality as a result of withering. B. I. KRASNOKUTSKII and A. G. SHCHERBINA. *Sakhar. Prom.*, 1968, **42**, (6), 47–49.—Investigations showed that the extent of withering in mechanically-harvested beet was about the same as in manually-harvested beet. The need for a standard is emphasized, whereby beet showing a moisture loss exceeding 10% should be considered as sub-standard.

* * *

Tests on storage of beet with varying trash content. A. E. POPOV. *Sakhar. Prom.*, 1968, **42**, (6), 49–53. While a trash content of less than 1% by weight did not have any noticeable effect on the stored beet, a trash content of 4% or above had considerable adverse effects. It is thought that a maximum permissible trash content of 1% should be set as standard requirement once Soviet harvesters have been improved.

* * *

Production of diffusion juice from sugar beet by a batch and a continuous process, and the difference in juice quality. B. ROGINA, I. BROZOVIĆ, I. MILOSTIĆ and V. JOVIĆ. *Kemija u Industriji*, 1967, **16**, 281–285, 295; through *S.I.A.*, 1968, **30**, Abs. 68–273.—A comparison was made at Crvenka sugar factory, Yugoslavia, where a diffusion battery and a BMA tower diffuser were both operated on beets of a similar quality. Average results over 15 days showed that the purity of the battery juice was 0·56 units higher than that of the tower juice. The juice draft in the battery was 10% on beet less than in the tower. However, sugar losses in pulp and water were twice as high in the battery as in the tower. The tower was also cheaper to operate.

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Influence of polyelectrolyte on the sedimentation and filtration rate of (1st) carbonatation juice. J. JOVANOVIĆ and D. ŠURIJA. *Kemija u Industriji*, 1967, **16**, 289–295; through *S.I.A.*, 1968, **30**, Abs. 68–276. "Praestol FZN" (an anionic copolymer) was added as a 0·1% solution at levels of 0·5–1·5 p.p.m. to muddy beet juice of 0·06–0·09% CaO alkalinity. Values of sedimentation rate, F_k and mud volume were measured. The influence of temperature in the range 60–90°C on sedimentation and mud volume was also determined: the values decreased with temperature in the presence of "Praestol", and increased in its absence. The effects of "Praestol" on F_k and sedimentation were most favourable at 0·06% CaO alkalinity, corresponding to a decrease of 2 F_k units and increase of >100% in sedimentation rate. 0·5 p.p.m. was generally sufficient. "Praestol" did not influence the mud volume at low alkalinity, but tended to increase it at higher alkalinities. Mixing had an unfavourable effect on F_k, and it is recommended to add the polyelectrolyte during a short mixing period and then rapidly eliminate turbulence.

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Application of the Quentin process at Hohenau sugar factory. F. PERSCHAK. *Zucker*, 1968, **21**, 364–371. Details are given of the 3-column ion exchange plant at Hohenau in which syrup of about 76 purity is treated with "Imac C16P" resin which replaces the alkali ions with Mg^+ ions. Over a period of 47 days (465 cycles) the molasses purity was reduced from 59·14 to 54·276 on average, corresponding to an extra recovery of about 800 tons of sugar. The costs of the plant, which is additional to a demineralization unit for 60% of the factory thin juice, are discussed.

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Tests on thick juice storage in Czechoslovakia. K. Čížˇ and J. BERGER. *Listy Cukr.*, 1968, **84**, 124–131. Unfiltered thick juice was stored for one year in storage tanks under a surface layer of mineral oil. At 20–30°C there was almost no change in the pol (about 63) and pH (8·8), the ash content rose slightly to 2·95%, the reducing matter content rose from 0·089% to 0·341%/100°Bx, while the colour content increased from 46°St to 66·6°St/100°Bx. At 30–40°C in a nitrogen atmosphere, juice of about 61 pol in two tanks underwent more obvious changes, the reducing sugar content rising from 0·090% to 0·571% and 1·551%/100°Bx, the pH falling to 7·3, and the colour content increasing from 55·2°St to 128°St/100°Bx and from 53·4°St to 125·8°St/100°Bx. No difficulties were experienced in boiling the stored juice.

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Sugar factory waste water. F. SCHNEIDER and H. P. HOFFMANN-WALBECK. *Zucker*, 1968, **21**, 396–402. Sugar factory effluent treatment is discussed against the background of industrial and domestic drinking water requirements in West Germany. Methods available for effluent purification are described.

While activated sludge treatment of waste water previously stored in tanks gives good results, in tests on activated sludge treatment of fresh effluent excessive development of slime-forming bacteria inhibited settling of the activated sludge in the final settling tanks.

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Juice purification processes. V. PREY, J. BARTSCH, W. BRAUNSTEINER, G. PETERSHOFER, H. POLLERES, B. SHAMIRIAN, E. STEINECK and H. TEICHMANN. *Zeitsch. Zuckerind.*, 1968, **93**, 343–351.—Various aspects of juice purification are considered from the standpoint of the creation of other impurities when raw juice is limed. A phosphatation scheme was tested, but $CaCO_3$ was found to have better adsorptive properties than calcium phosphate. At 20–40°C carbonatation was found to give greater colloid removal. Hot and cold liming, as they affected particle size distribution, were compared. Ion exchange treatment of thick juice was slightly better than thin juice treatment; better decolorization was obtained in counter-current than in co-current treatment. Ion exchange resins do not adsorb browning products generally, but preferentially remove the larger components. Reaction products formed from amino acids and methylglyoxal lowered the rate of sucrose crystallization. An identical concentration of sodium acetate did not affect the rate. Thin juice sulphitation was shown not to destroy any colouring matter already present.

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Sugar in Chile. H. HIRSCHMÜLLER and H. J. DELAVIER. *Zeitsch. Zuckerind.*, 1968, **93**, 352–357.—Information is given on the Chile beet sugar industry with details of the four sugar factories.

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Spontaneous ignition through decomposition of molasses stored in open ditches. M. MUTLUAY. *Seker*, 1968, **17**, (68), 1–4.—An account is given of frothing decomposition of molasses at Eskisehir sugar factory. The molasses, of 56·2 purity and 56·2°Bx on average at storage, ended as a thick layer of carbon with a watery layer above.

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The use of chlorine as a disinfectant for sugar beet. H. GELEN. *Seker*, 1968, **17**, (68), 5–7.—The use and technique for disinfection of beet wash water with liquid chlorine are discussed, together with properties, handling and hazards of this material and first-aid measures to be taken in case of accidents.

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Use of hydrocyclones in the sugar industry. N. TAYGUN. *Seker*, 1968, **17**, (68), 8–17.—A review.

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Slaking of lime. P. GÜRAY. *Seker*, 1968, **17**, (68), 18–22.—When lime is slaked with a sugar-containing juice, destruction of sugar occurs as a result of the heat evolved and coloured compounds are formed; it is better to slake with water and adjust the milk-of-lime density with sweet water obtained by washing filter cake. Regular liming requires lime of constant quality; that at Ankara sugar factory was found to be highly variable. The reactivity of milk-of-lime in juice depends on the dispersion of $Ca(OH)_2$ particles; this can be measured in terms of a settling test.

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Increase in juice colour content during evaporation at Khmel'nitskii sugar factory. M. N. SHPINETSKAYA. *Sakhar. Prom.*, 1968, **42**, (7), 10–12.—Excessive colour formation during evaporation was chiefly caused by processing of sub-standard beet with concomitant high quantities of reducing matter which was subsequently decomposed during evaporation. To avoid excessive decomposition of reducing matter, sulphitation of 2nd carbonatation juice should be carried out at pH 7·8–8·5.

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Calculation of the life of (sugar) factory equipment. N. A. SOLOGUB. *Sakhar. Prom.*, 1968, **42**, (7), 13–16. Calculations made by RYBALKIN[1] of the life of sugar factory equipment are considered inaccurate since they are based on random data and incorrect application of formulae.

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Use of beet pieces and tails at sugar factories in the Northern Caucasus. M. S. SABANSKII and A. I. KATANA. *Sakhar. Prom.*, 1968, **42**, (7), 21–23. Treatment of beet pieces and tails before adding them to the whole beets at or after the beet washer is discussed and reference made to some experimental work. The cost of the extra equipment required is justified on the grounds of the extra sugar obtainable and because of the greater quantity of beet fragments to be expected with increased mechanization of operations involving beet.

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Causes of increased fuel consumption of Kuban' sugar factories. I. F. ZELIKMAN, V. A. KOLESNIKOV and YU. G. GONCHAROV. *Sakhar. Prom.*, 1968, **42**, (7), 23–27.—Reasons are given for high fuel consumption at Kuban' sugar factories, including low syrup and remelt liquor concentration in the pans as a result of inefficient evaporator performance and insufficient heating of 1st carbonatation juice. Possible remedies are listed.

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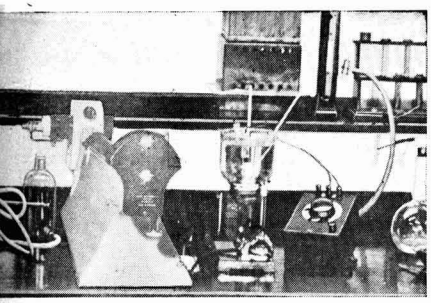
Defects in the operation of the (juice) purification station at Dolinskii sugar factory. B. I. KATS, D. E. SHEINERMAN and N. B. VLASENKO. *Sakhar. Prom.*, 1968, **42**, (7), 27–28.—Despite the addition of 3·0–3·3% lime on weight of beet, 1st carbonatation juice from sub-standard beet had a high colour content. This is attributed to the much lower adsorptive capacity of the mud particles in the BMA multi-carbonatation system used than in conventional carbonatation. It is thought that simultaneous liming and gassing (defeco-saturation) in more than one stage might provide the answer.

[1] *I.S.J.*, 1966, **68**, 88.



Laboratory methods & Chemical reports

Infra-red spectra of sucrose caramelization products. A. R. SAPRONOV, E. F. KOZYREVA and K. N. DUNAEVA. *Sakhar. Prom.*, 1968, **42,** (5), 9–11.—Infra-red spectra obtained for caramelen and sucrose are interpreted. Sucrose caramelization products were found to be of cyclic structure, although the possibility of substances having an open keto-enol form is not ruled out. The colour of sucrose caramelization products is attributed to carbonyl and carboxyl chromomorphous groups. The form and intensities of the caramelen spectrum were the same as for caramelin and caramelan.

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Photometric ferricyanide method of determining reducing matter in molasses. L. B. TUET and I. F. BUGAENKO. *Sakhar. Prom.*, 1968, **42,** (5), 32–35.—The method involves clarifying 2–10 g of molasses, depending on reducing matter content, with 3–5 ml of lead acetate solution (250 g/litre), stirring and filtering after standing 2–3 minutes; 100 ml of the filtrate is transferred to a 110-ml measuring flask and 2–3 ml of Na_2CO_3 solution (100 g/litre) added. After making up to volume, the solution is filtered, to 5–8 ml of the filtrate is added 20 ml of ferricyanide (10 g/litre) and 10 ml of 1·25N NaOH, and the solution made up to 40 ml and boiled for 1 minute, cooled and the colour measured photometrically at 400 nm. Although results obtained by this and the Müller method were in good agreement, the ferricyanide method was more reliable in parallel tests, apart from being cheaper and more rapid.

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Chemico-analytical work in the effluent purification laboratory at Dondyushansk sugar factory. L. A. SAVVIN. *Sakhar. Prom.*, 1968, **42,** (5), 36–38.—Details are given of methods used in effluent analysis and particularly to determine the amount of oxygen dissolved and the sulphate ion content, and to detect nutrients (nitrates) in waters in which chlorella is being cultivated. A method is described for treatment of distillery effluent.

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Polarographic determination of colloids in sugar beet juice. J. ŠTUDNICKÝ and A. DANDÁR. *Chemické Zvesti*, 1967, **21,** (1/2), 81–86; through *Anal. Abs.*, 1968, **16,** Abs. 2933.—A standard solution is prepared by dissolving 0·2 g of gelatin, apple pectin or egg albumin in twice-distilled water at 40°C and diluting with water to 100 ml. A 5-ml aliquot is further diluted to 100 ml (equivalent to 0·1 mg of colloid per ml). An increasing volume of this solution is added to 15 ml of 0·001N KCl solution and the wave recorded of the oxygen maximum in 10 ml of the liquid (for comparison with that of the juice).

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Thermal stability of buffer sugar solutions. L. I. TREBIN and K. D. ZHURA. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (2), 71–72.—To determine the effect of alkalinity on the thermal stability of sugar solutions, 65% sugar solutions to which a 2% potassium monophosphate-sodium diphosphate mixture was added, were heated for varying times at constant temperatures in the range 80–120°C and constant pH (7·05–8·52). The mean hourly quantity of sucrose decomposed varied from 0·004% of the initial sucrose at 80°C to 0·14% at 120°C, both at pH 7·57. Increase in heating temperature from 80 to 90°C caused at least a three-fold increase in sucrose decomposition. Minimum decomposition at any of the temperatures investigated occurred at pH 7·5–8·0 which may be considered the optimum for massecuite boiling.

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Electrochemical measurements of oxygen in technical sugar solutions at high temperatures. F. TÖDT and M. MONAZAHIAN. *Zeitsch. Zuckerind.*, 1968, **93,** 225–232, 252.—The literature on evaporator corrosion studies is surveyed and apparatus described for measuring oxygen dissolved in sugar solutions. Extrapolated curves drawn from experimental data for oxygen in sucrose and sodium phosphate + sodium chloride solutions demonstrate the linearity of the temperature-oxygen relationship with increasing temperature up to 109°C (110°C) in solutions saturated with air, oxygen and nitrogen. The corrosion of new and used boiling tube sections was determined from measurement of the iron content in low-oxygen, air- and oxygen-saturated sucrose solutions. The findings indicate the considerable increase in corrosion when the solution is saturated with oxygen.

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Polarography in the sugar industry. II. Evaluation of the refining process by means of polarographic determination of chloride in intermediate products. J. BURIÁNEK. *Zeitsch. Zuckerind.*, 1968, **93,** 232–237. During refining, chlorides are not affected, so that their quantity in intermediate and final products in the refinery may be assumed constant; since they do not enter the sucrose crystal, it may be assumed that they are all to be found in the mother-liquor. The concentration of NaCl in a product to which it is added can be determined polarographically and from the original sucrose-chloride ratio information can

be obtained on the sucrose content in the product. Other possible applications of polarographic determination of chloride in refinery products are discussed and the polarographic technique used is described.

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Design and operation of a laboratory vacuum pan. E. PIAT and A. BÉRENGER. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1967, 135–138.—An illustrated account is given of a laboratory vacuum pan having a maximum capacity of 10 litres, provided with a three-bank steam manifold, a central downtake with a Webre-type impeller located inside it, and a "Cuitometer" resistance measurement electrode fitting. Strikes boiled by different operators were reproducible in respect of purity drop and sugar filtrability and indicate that the pan may be used to study causes of poor filtrability in raw sugars.

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The exhaustibility of Mauritius final molasses. E. C. VIGNES, M. RANDABEL and M. ABEL. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1967, 140–144. Studies were made to relate refractometric Brix of Mauritius molasses with solids determined by drying, and also to calculate an exhaustibility formula applicable to local molasses. Two formulae for the first relationship were obtained, one of them correcting for invert sugar and ash content, and both are to be tested by further analyses of final molasses. Statistical analysis of 1966 molasses data produced two exhaustibility formulae, the first being of the DOUWES DEKKER type, giving corrections for reducing sugars % non-sugars and sulphated ash % non-sugars. For easy application, a second formula was calculated statistically in which the correction factor was applied to the reducing sugars:ash ratio (Expected True Purity = 43·4 — 2 R.S./Ash). Results from both formulae agree well and since the second is simpler it is recommended for factory use.

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Influence of beet quality and method of juice purification on the content in molasses of volatile acids determined by gas chromatography. S. ZAGRODZKI and A. KURKOWSKA. *Roczniki Technol. Chem. Zywn.*, 1967, **13,** 41–50; through *S.I.A.*, 1968, **30**, Abs. 68–191.—Volatile acids (formic, acetic and butyric) were separated from beet molasses from two Polish factories by means of a strongly basic anion exchange resin in the HCO_3^- form after exchanging cations for H^+ ions. The acids were eluted with NaOH, and extracted with dichloracetic acid in acetone. The extract was analysed by gas liquid chromatography on polyethylene glycol adipate, using an argon ionization detector and a graphic recorder. Typical contents in meq/100g dry solids were: formic acid, 13·3–13·7; acetic, 7·2–9·7; butyric, 1·1–1·7. The factory having a DDS diffuser was characterized by slightly higher (by 35–52%) contents of acetic and butyric acids than the other factory which had a diffusion battery. The differences are ascribed to microbiological action. Frost action on beets led to increases of 54–200% in all volatile acids. The determination of butyric acid content by this technique is an effective method of estimating the fermentability of molasses. The results show that the butyric acid contents are not necessarily correlated with total volatile fatty acids: the highest values of the former were recorded from the continuous diffuser factory, and of the latter, from the battery factory, both during the frosts of early 1963.

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Determination of potassium in sugar factory products by the tetraphenylboron method. Determination of potassium in final molasses. M. KOMOTO and S. SUNAGAWA. *Hyogo Noka Diagaki Kenkyu Hokoku, Noegi-kagaku Hen*, 1965, **7,** (1), 17–2; through *S.I.A.*, 1968, **30,** Abs. 68–196.—The tetraphenylboron method[1] was applied to the analysis of molasses. Each of the test samples was prepared according to one of the following procedures: (1) ignition to ash and dissolution of the ash in water, (2) ignition to ash, removal of SiO_2 from the ash and dissolution of the ash in water, (3) direct dilution with water, (4) dilution with water and decolorization of the diluted solution by activated carbon, or (5) dilution with water and isolation of a K-rich fraction from the diluted solution by ion exchange resin. With respect to the estimated K values, there was no significant difference between the above procedures for the preparation of test sample solutions. The third procedure is recommended.

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Estimation of starch in sugar and sugar house products by the formamide method—a critical examination. S. BOSE, K. C. GUPTA and S. MUKHERJEE. *Indian Sugar*, 1968, **17,** 739–742.—The BALCH technique for starch analysis in sugar, as modified by Tate & Lyle Ltd., involves its precipitation with acid aqueous alcohol, collection on kieselguhr after 2 hr, washing free of sugar and re-solution with calcium chloride solution before filtration and determination with iodine. A new method is proposed in which 10 g of raw sugar is dissolved in 10 ml of water in a 50 ml centrifuge tube, and 24 ml 70% ethanol added with a few drops of saturated KCl solution. After centrifuging at 2500 r.p.m. for 15 min, the supernatant is decanted and the residue extracted with 5 ml 50% formamide for 50 min in a boiling water bath. After dilution to 25 ml and mixing, the solution is centrifuged at 2500 r.p.m. for 10 min and a 5-ml aliquot of the supernatant diluted with water, mixed with 1 ml iodine solution, made up to 25 ml and the blue colour measured at 660 nm, the starch content being obtained from a standard curve. Both methods were examined using a solution of A.R. sucrose containing varying amounts of a starch solution. Recovery varied from 86–110% for the BALCH method in the range 0·012–0·084% to 40% for 0·006% starch content, and from 92–99% for the formamide method in the range 0·12–0·084% to 67% for a starch content of 0·006%.

[1] "A.O.A.C. Official Methods of Analysis", 1960, 19–20.

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Two-dimensional thin-layer chromatography of sorbitol and mannitol in the presence of fructose, glucose and sucrose. –. MATTIONI and –. VALENTINIS. *Industrie Alimentari*, 1968, **7**, (5), 65–70.—The technique used is development on a thin layer (0·2 mm) of silica gel G applied to the plate in the form of a paste in 0·1M boric acid solution and dried. The developing solvents are: (i) 50:30:20 dioxane:methanol:water and (ii) 60:40 methanol:water, and the indicators used are (I) a solution of 0·1 g sodium metaperiodate in water, and (II) a solution of 2·8 g benzidine in 80 ml 96% ethanol to which is added 70 ml water, 30 ml acetone, 1·5 ml 0·1N HCl and a 0·2% methanolic solution of sodium fluoresceinate, the last in the proportion of 0·5 ml per 100 ml of benzidine solution. The polyols are well separated from the three sugars and may be determined in samples without any pre-treatment, with a sensitivity of 0·20% w/w.

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Determination of sugar solution polarization. W. SCHIEBEL. *Zucker*, 1968, **21**, 308–311.—Since even with most precise preparation of a sugar solution the polarization value will be accurate only to within ± 0·1% (± 0·15% with raw sugar), difficulties arise in checking whether a consumption sugar satisfies the EEC minimum requirement of 99·7°S. Sources of error discussed by the author include: volume contraction; meniscus distortion; the effect of turbidity, particularly caused by solid talc; the effect of lead acetate clarification, which at 1·0% organic non-sugars content gives a 0·1°S higher value than when lead acetate is not used. A minimum quantity of lead acetate is necessary, although an excess has no greater effect. Since the polarimeter tube should be checked for optical activity before being filled, only tubes having a feed tube should be used.

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The significance of the polysaccharide-producing bacteria belonging to the genus *Bacillus* in sugar refining. R. D. SKOLE, H. NEWMAN and J. L. BARNWELL. *Proc. 1966 Tech. Session Cane Sugar Refining Research*, 35–45.—The population of *Bacillus* spp. able to synthesize polysaccharides in a range of raw sugars was low, and only two species, *B. subtilis* and *B. cereus*, essentially levan producers, were isolated. The ecological limits established by taxonomic studies of these organisms showed that refinery materials in process, particularly those of less than 25°Bx, maintained between 28°C and 40°C over a period, afford an environment for growth of *Bacillus* polysaccharide producers.

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A filtration test to predict refinery performance. T. N. PEARSON and J. J. AMENTO. *Proc. 1966 Tech. Session Cane Sugar Refining Research*, 45–53.—Tests using a Millipore filter on laboratory washed raw sugar and refinery sugar liquor showed excellent correlation with refinery Sweetland press throughputs. Tests on "slow" and "fast" washed sugars with calibrated membranes showed at least 95% assurance that the Millipore test is reproducible within 5% of the average filtrability.

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A filtrability test based on plugging value. M. K. FAVIELL and W. W. BLANKENBACH. *Proc. 1966 Tech. Session Cane Sugar Refining Research*, 53–62.—In work on filtrability of viscose solutions, the "complete blocking law" of HERMANS & BREEDEE[1] has been found to be valid; this is based on the assumption that the filter consists of a large number of parallel similar capillaries which are each blocked by one particle, which leads to a linear relationship, under conditions of constant pressure, between V/T and V, where V is the cumulative volume and T is time. With raw sugars, the quantity of solution which would pass before all the capillaries were blocked or plugged —the "plugging value"—would be characteristic of the sugar and could be determined by plotting the weight of sugar (V × °Bx), divided by T, against W and extending the line obtained to W/T = 0. The value of W at this point, divided by the filter area, is the "plugging value". A suitable apparatus was built and values were found to be changed by about 1% by a 10% variation from the normal 1·0 g of filter aid precoat, by about 0·075% over a temperature range of 20–80°C, and an increase from about 85 to 180 g/sq.in. with increase in vacuum from 5 to 20 in Hg, which should therefore be standardized for comparative testing. The test has been used for comparison of raw sugars of different sources and also for evaluation of various filter aids.

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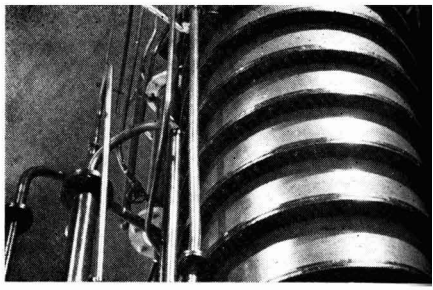
Fractionation of sugar colorants with molecular sieves. N. H. SMITH. *Proc. 1966 Tech. Session Cane Sugar Refining Research*, 84–102.—The colorants in raw sugar and molasses may be fractionated by gel filtration using "Sephadex" into three parts totalling about 0·25–0·3% on raw sugar or about 30% of the non-sugars. The first major fraction is of high M.W. (about 50,000), insensitive to pH change, shows a relatively low ratio of u.v. to visible absorption, and is probably melanoidin. The second fraction, having a M.W. near that of sucrose, is also pH insensitive but shows a higher ratio of u.v. to visible absorption; it is probably derived from reactions of the third major fraction. This is retarded by "Sephadex" but is probably of low M.W. and is sensitive to pH change. It is relatively easy to adsorb on bone char, and on heating under alkaline conditions becomes less pH sensitive and forms two different substances, the elution volume of one of which corresponds to a component in alkali-degraded fructose. This third fraction is probably derived by alkaline decomposition of the simple sugars. The application of "Sephadex" molecular sieves allows determination of the proportions of these fractions which may be related to refining quality. Molasses provides a concentrated source of the colorants which when fractionated appear representative of those present in the raw sugar.

[1] *J. Soc. Chem. Ind.*, 1936, **55**, 1T–4T.

By-products



First tests of the constituents of crude cane wax at Casa Grande. F. LEMBCKE. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 314–320.—Preliminary tests on crude wax obtained from filter cake have been made to relate the resin, oil and pure wax contents to the varieties of cane. While it is considered that the cake should contain not less than 4% of crude wax, this cannot be considered definitive because of the variations which arise because of climate changes, etc.

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Molasses and micro-organisms. N. TAYGUN. *Seker*, 1966, **16**, (61), 16–20.—Molasses characteristics required for fermentation to produce alcohol, citric acid, butanol and acetone are discussed, as are the effects of molasses components on the fermentation process.

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Utilizing molasses in yeast production. Y. SARAY. *Seker*, 1966, **16**, (61), 26–31.—An account is given of the production of bakers' yeast, *Cerevisiae saccharomyces*, by cultivation on beet molasses, as well as its recovery, processing for sale, and storage.

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Chipboard from bagasse for the building and furniture industries. A new bagasse plant in Réunion. H. HESCH. *Zeitsch. Zuckerind.*, 1968, **93**, 114–120.—See *I.S.J.*, 1968, **70**, 90.

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Intensive beef production from sugar cane. T. R. PRESTON, M. B. WILLIS and A. ELIAS. *Rev. Cubana Ciencia Agríc.*, 1967, **1**, 33–53.—Zebu bulls were fed *ad lib* on rations containing a mixture of ground sorghum, maize and bagasse to which molasses, water and urea (0%, 3%, 6% or 9%, by weight) were added. Animals fed on urea gained weight significantly faster than those given only molasses in the supplement, but there were no differences among the urea levels, although 3% is recommended if a maximum molasses intake is the aim. Only in abnormal cases was any urea or molasses toxicity observed. Invert molasses without urea gave lower weight gains than did normal molasses, although more of the invert molasses was consumed, possibly because of its lower mineral content.

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Bagasse as a raw material for furfural. H. R. DUFFEY. *Paper presented to the 13th Congr. ISSCT*, 1968. Furfural manufacture from bagasse is discussed, particularly with regard to production economics and marketing. Numerous raw materials are available for furfural production and the use of bagasse is not necessarily desirable nor economical.

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By-products of sugar cane. W. H. CLAYTON. *Paper presented to the 13th Congr. ISSCT*, 1968.—The use of bagasse as a raw material for a number of products, particularly pulp and paper, is discussed with reference to the operations conducted by W. R. Grace & Co. in Peru. Steps in bagasse treatment are described.

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Limiting factors in the manufacture of pulp and paper from bagasse in the Philippines. M. F. GLORIA. *Paper presented to the 13th Congr. ISSCT*, 1968. Although bagasse is considered a suitable raw material for pulp and paper production, reasons are given why no bagasse pulp projects have been started recently in the Philippines.

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Amino acid composition of various yeasts prepared from cane molasses. K. C. SU, M. C. HSIE and H. C. LEE. *Paper presented to the 13th Congr. ISSCT*, 1968. Results are given of studies on variations in the amino acid composition and protein yield of various yeasts grown on the same molasses medium and of the same culture grown under different conditions.

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Some economic factors involved in the utilization of bagasse for the manufacture of pulp and paper. J. ATCHISON. *Paper presented to the 13th Congr. ISSCT*, 1968.—The use and availability of bagasse for pulp and paper manufacture, the economics of bagasse purchase, collection, storage and preservation, and of depithing and preparation for pulping are discussed. Guidance is given on bagasse pulping processes and on determining the costs of bagasse as raw material. The potential of bagasse pulp on the world market is considered.

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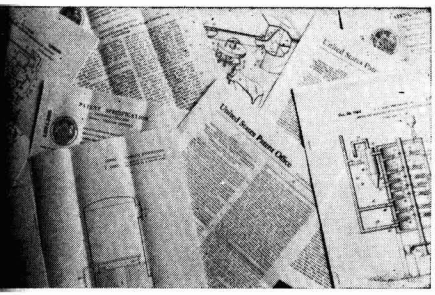
Effect of oxygen absorption velocity on the growth of *Torulopsis utilis* in shaking culture. Y. T. LIU. *Paper presented to the 13th Congr. ISSCT*, 1968.—The effect of the oxygen absorption velocity K_d, expressed as g.mol. O_2/ml/min/atm, on the growth rate, sugar utilization rate and protein synthesis was studied in the case of *T. utilis* NRRL-Y-900 cultured in a rotary shaker. Results are expressed in tabular and graph form.



Patents

UNITED KINGDOM

Cane harvester. CRICHTON INDUSTRIES PTY. LTD., of Brisbane, Australia. **1,137,160.** 21st November 1966; 18th December 1968.

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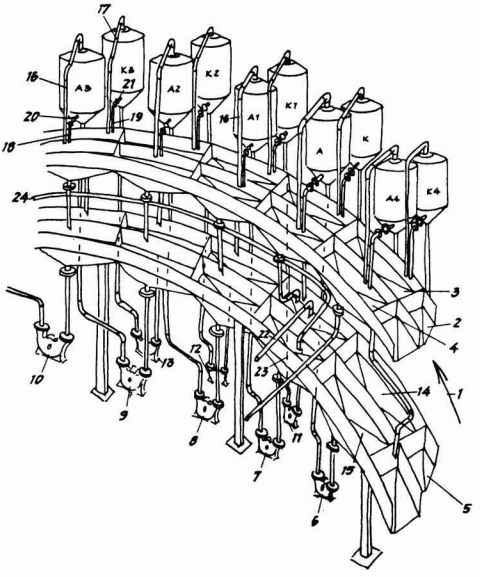
(Ion exchange) Treatment of sugar solutions. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **1,139,692.** 13th January 1966; 8th January 1969.

The diagram shows a partial view of a circular arrangement of chambers for the anion and cation exchangers of a sugar desalting plant with partitioned stationary and movable channels 5 and 2 for the simultaneous supply of the liquids to the system and for progressively and cyclically changing the nature of the liquid supplied to the stationary resin beds within the system. The sugar juice is introduced



through line 22 which is gradually advanced at predetermined time intervals together with channel 2. The line 22 discharges the juice above and into the compartment of channel 5 which supplies pump 11; this pump feeds the juice through line 23 upwardly to cation exchange chamber K1. The juice passes through outlet 17 into corresponding compartment 3 of channel 2, from the outlet of which it flows into the compartment 14 of channel 5 supplying pump 12 and thence to chamber K2. The sequence is repeated until the juice reaches the overflow of the last cation exchanger chamber when it flows into the corresponding compartment 4 of channel 2 and from this into line 24 which returns it to the compartment 15 of channel 5 feeding pump 7.

This sends it up to the anion exchanger chamber A1, and a similar sequence passes it through all the anion exchange chambers before it is discharged to a collecting tank. During this sequence, the previous chambers K and A are drained through their outlet pipes 18, 19 into the appropriate compartments of channel 2, which are the same compartments filled with fresh juice by line 22 and de-cationized juice through line 24. Resins in the previous chambers K4, A4 are treated with water to rinse their sugar content while the next pair of compartments are again drained. Subsequent pairs of chambers are for regenerant treatment, and following this are drainage, rinsing and further drainage stages. The resin chambers then become the last stages of the juice deionization treatment. The use and regeneration of resins on a sequential basis in this manner ensures optimum utilization of the resins and their regenerants, with minimum water usage.

* * *

Inhibition of encrustation (by sugar crystals) on the internal surfaces of continuous vacuum pans. SOC. FIVES LILLE-CAIL, of Paris 8e, France. (A) **1,140,948.** 17th May 1966; 22nd January 1969. (B) **1,141,639.** 21st July 1967; 29th January 1969.

(A) The pan is in the form of a cylinder 10 with a heating element in the form of longitudinal vertical plates 14 and divided into compartments by vertical transverse partitions 12, the compartments being interconnected by apertures 16 in the bottom of each partition, passage of crystals from one compartment to the next being aided by a worm conveyor 18. Unsaturated syrup is admitted to each of the compartments in order to maintain the saturation at a required level to feed the crystals, and this is achieved by feeding through pipes 20 along the lateral and transverse walls. Liquid from the first compartment 14, which contains no crystals, can be withdrawn

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).

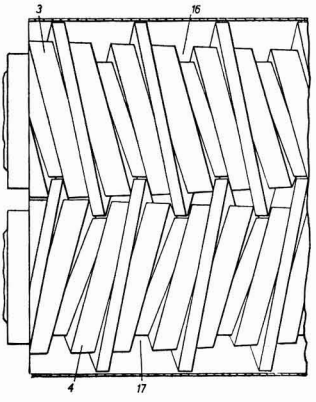
and mixed with the undersaturated liquid entering at A, whereby the walls of the compartment are continuously irrigated, but in the case of the subsequent compartments, the amount of undersaturated liquid required to achieve a proper saturation is insufficient to irrigate the walls continuously and the irrigation must be intermittent.

(B) The flow of undersaturated liquid to each compartment is governed by a valve in each line which responds to a supersaturation controller, and passes to the irrigation pipes by way of a rotary distributor valve. Each irrigation pipe is divided into six sections and the rotary valve directs the total flow to each section in turn, the time for and the length of each section being such as to ensure uniform and adequate washing of each successive area of the walls.

* * *

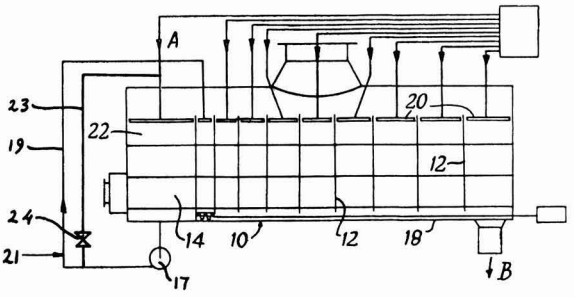
Screw presses (for beet pulp). STORD BARTZ INDUSTRI A/S, of Bergen, Norway. **1,140,237.** 28th June 1967; 15th January 1969.

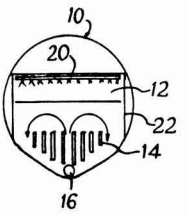
In continuous screw presses there is a tendency for the pressed material to cling to and rotate with the screw; to avoid this a double screw press with threads engaging reduces the gap for rotation to the extent that the material cannot pass through it and is thereby forced along the press. With some materials, however,



a certain degree of sliding still occurs, in spite of the small clearances, and to prevent this the spindles of the screws 3,4 are provided with helical grooves 16, 17 so that the crowns of the flanges forming the screws can enter them and the gap reduced so that at the end of the spindles they are so close together that no passage of pressed pulp is possible.

Cane diffusion. SOC. FIVES LILLE-CAIL, of Paris 8e, France. **1,143,640.** 21st July 1966; 26th February 1969.—On emerging from a diffuser, spent bagasse is

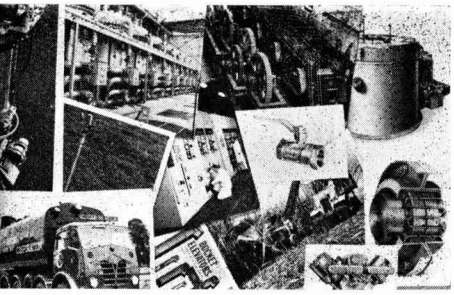




conveyed to a press where its moisture content is expelled. The recovered sweet-water is purified by liming and settling and thereafter concentrated in an evaporator, e.g. of the descending type, fed with vapour bled from the factory multiple-effect evaporator. The concentrated sweet-water is then returned to the diffuser at a suitable point where its sugar content is lower than the concentration in the cane. Since its volume is less than it would be if returned unconcentrated, this permits a greater amount of pure water to be applied to the tail end of the diffuser, thereby achieving a higher extraction without increasing the draught.

* * *

Purification of sugar juices. GEBR. RÖCHLING EISENHANDELSGESELLSCHAFT, of Köln-Deutz, and GEBR. HERRMANN APPARATEBAU, of Köln, Germany. **1,144,241.** 15th February 1966; 5th March 1969. Raw juice is treated with at least 1% (calculated as solids) on juice Brix of an extract obtained from umbelliferous plants, chiefly *Levisticum officinale* (borage or mountain hemlock), which acts as a defecating agent. After flocculation the juice is filtered to remove the flocculated impurities and (after mild evaporation to double its concentration) is fed to a polyamidic filter (a vessel containing suitable powdered polyamide synthetic material, e.g. "Perlon" or nylon, which has a large surface area and a strong affinity for OH groups) which separates a fraction of the remaining phenolic and nitrogen-containing impurities. The filtrate is passed through a reaction column filled with a catalyst in the form of a metal (e.g. Fe or Al) oxide or hydroxide carried by a silica or aluminium gel, so that impurities which cannot be filtered out are transformed into substances which may be removed by filtration and ion exchange. During this reaction chamber treatment the juice is treated by a counter-current of air mixed with ozone (to sterilize the juice) in order to stimulate and accelerate the transformation. The resultant juice is subjected to another polyamidic filtration and then to partial or total removal of salts by ion exchange or electrodialysis, and finally passed through an ion exchange charged with ferric ions.



Trade notices

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

Mobile cranes for cane handling. Jones Cranes Ltd., Letchworth, Herts., England.

Issue No. 57 of the Jones Newsletter contains some information on the use of Jones mobile cranes in cane fields. It is mentioned that at one estate alone in the West Indies 25 Jones cranes handle the cane, while Mauritius makes wide use of the Jones 4- and 6-ton capacity cranes, one 6-ton crane handling 1500 t.c.d. to keep eight 7-ton vehicles fully occupied when working at an average distance of 1 mile from the sugar factory. Central and South American countries also use Jones cranes, as well as the Philippines and East Africa. Details are given of a cane "bridle" which will hold up to 6000 lb of cane, a clock scale at the end of the holding rope automatically weighing the bundle. Crossover slings are passed around the cane which is bundled into a balanced load when lifting starts and is automatically released by running out the closing rope. To provide all-the-year-round employment for the crane, a special jib head and sheaves are used to operate double-rope grabbing equipment automatically. By this means, bagasse and other cane waste can be handled; the crane can even be used for sludge clearance. For use in East Africa these Jones 65 cranes have a travel speed of 7·5 m.p.h. with the engine governed at 1800 r.p.m. for high-altitude operation. The cranes are fitted with 30-ft channel jibs, the heads being modified for use with the hydraulic grabs.

* * *

Continuous *C*-sugar centrifugal. Thomas Broadbent & Sons Ltd., Central Ironworks, Huddersfield, Yorks.

The Broadbent "SP Horizontal" Type SP/36/25 centrifugal is a new horizontal continuous machine for *C*-sugar which has been thoroughly tested over 12 months under arduous working conditions in selected sugar refineries and factories in the UK and other countries. It is driven through V-belts by a 25 h.p., 1500 or 1800 r.p.m., totally enclosed, fan-cooled squirrel-cage motor and is fitted with a 36-inch diameter conical basket provided with stainless steel wire backing supporting a new type of improved nickel-clad copper perforated screen with perforations 0·0635 mm wide giving 12½% open area. Performance data for this machine and a 1500 r.p.m. batch centrifugal with a 48-inch diameter basket are compared in a special pamphlet, showing higher sugar purities and generally lower molasses purities and Brix at a much greater massecuite throughput and a lower massecuite reheat temperature. Apart from its exceptionally low power requirements, the "SP Horizontal" machine is simple, rugged, easy to service, requires less headroom, and is cheaper to buy and install than conventional centrifugals.

* * *

Laboratory flocculator. Paterson Candy International Ltd., 21 The Mall, Ealing, London W.5, England.

The new laboratory flocculator announced allows four separate flocculation tests to be carried out simultaneously. The unit consists of a stove-enamelled framework which carries four 2 × ⅝-in paddles driven by individual variable-speed motors, any required speed being selected by turning a knob on a graduated scale, covering the range 10–160 r.p.m., at the side of each motor. The paddles are mounted on vertical stainless steel shafts and dip into test beakers standing on the glass base illuminated from below by a discharge lamp fitted with a reflector. Switches and a signal light are mounted on the panel carrying the motors and speed selector knobs.

* * *

Synthetic flocculants for the sugar industry. Allied Colloids Manufacturing Co. Ltd., Low Moor, Bradford, Yorks., England.

A range of synthetic flocculants for use in clarification and filtration is announced. Based on polyacrylamide, the "Magnafloc LT" range includes five grades—three anionic, one cationic and one non-ionic.

* * *

"K" level switch. Actuated Controls Ltd., Bower Ashton, Bristol 3, England.

Sugar is one of the products for which "KH" heavy-duty bunker level switches are suitable. They are robust, dust- and weather-proof, have a high sensitivity with a consistent repeat accuracy, and can be used in pressurized systems with micro adjustment of the level setting without removal. A diaphragm forms the gasket between hopper flange and mounting surface and, should the diaphragm be punctured, a stainless steel backing plate seats on the sealing ring to prevent ingress of stored material.

Tilted plate separator. Constructors John Brown Ltd., CJB House, Eastbourne Terrace, London W.2, England.

The Tilted Plate gravity separator operates by passing an effluent or process stream through a pack of inclined corrugated plates so that laminar flow is achieved without side effects from turbulence or short-circuiting, thereby providing ideal conditions for gravity separation of materials such as oil, fats and solid matter. Housed in a specially designed vessel, installations (which may be single- or multi-pack) can be provided to suit effluent flow rates.

* * *

Repeater for liquid level or density measurement. Foxboro-Yoxall Ltd., Redhill, Surrey, England.

The Model 17R Foxboro repeater transmits a signal equal to process pressure and is ideally suited to level or density measurement in closed vessels operating at pressures up to 100 p.s.i.g. (7 kg/sq.cm.). The pressure is repeated to a differential pressure transmitter, or the repeater can be used alone as a level-measuring device in open vessels. It is rugged, light in weight and is designed for direct flange mounting in any position, all wetted parts being of stainless steel.

* * *

PUBLICATIONS RECEIVED

"MODEL 40" PROCESS ANALYSER. Anacon Inc., 62 Union St., Ashland, Mass., 01721 USA.

A 4-page brochure gives information on a new process refractometer which continuously monitors and controls liquid or semi-liquid process streams. The "Model 40" is suitable for opaque, coloured or turbid liquids and has its optical analysing unit mounted on a Weir-type Saunders valve body.

* * *

ION EXCHANGE, GEL FILTRATION AND ADSORPTION. Bio-Rad Laboratories, Richmond, Calif., U.S.A.; V. A. Howe & Co. Ltd., 46 Pembridge Rd., London W.11, England.

A 56-page indexed price list "S" gives not only details of prices, but also full technical details of ion exchange resins (including "AG" analytical grade resins and "Dowex" commercial grade resins), resins and reagents for amino acid analysis (including peptide resins), ion exchange crystals (inorganic exchangers), ion exchange and non-ionic celluloses, ion exchange gels, materials for gel filtration, including "Bio-Gel P" spherical polyacrylamide gels, "Bio-Glas" and "Bio-Beads", and adsorbents for column and thin-layer chromatography. Price List BG-6 gives prices and data for "Bio-Gel A" spherical agarose for gel filtration.

* * *

ANTIFOAMS FOR FERMENTATIONS. Hodag Chemical Corp., 7247 North Central Park, Skokie, Ill., 60076 USA.

A new brochure is available which gives helpful information on selection, applications and use of Hodag anti-foaming agents for fermentation processes including glutamic and citric acid and alcohol production.

* * *

ELECTRONIC WEIGHERS. Girling Ltd., Industrial Products Group, Grange Works, Cwmbran, Mon. NP4 3XU, England.

Literature is available from this firm giving information on its electronic weighing systems, which use electrical transducers to obviate the need for pivots or moving parts. Both weighbridges and batch weighers are described.

DDS CANE DIFFUSERS. A/S De danske Sukkerfabrikker, Langebrogade 5, DK-1001 Copenhagen K, Denmark.

A well-produced booklet has been published which describes and illustrates the DDS cane milling-diffusion system, including process stages, actual performance data from a number of DDS units, and principal dimensions for Types I-VI, which have a daily capacity ranging from 700 to 9000 t.c.d.

* * *

BULK HANDLING. Dowty Meco Ltd., Meco Works, Worcester, England.

An illustrated 64-page booklet shows the numerous applications of Meco conveying and handling equipment. While none of the information refers specifically to the sugar industry, a complete Meco bulk handling system has been installed at the Kidderminster beet sugar factory of the British Sugar Corporation Ltd.

* * *

POWER TRANSMISSION EQUIPMENT. A. Friedr. Flender & Co., 4290 Bocholt, Postf. 139, Germany; Flender (U.K.) Ltd., Treefield Industrial Estate, Gildersome, Morley, Leeds, Yorks., England.

Amongst the latest publications on Flender power transmission equipment are the latest revision of brochure W 32 on "FMB-Variators" for stepless speed adjustment with power ratings up to 60 h.p. and speed ratios up to 1:6 and 1:100 (the latter with output through planetary gears), brochure M 4201 on "N-Eupex" flexible couplings, and W 21/22 on "Redurex" gear units, including unit-construction, helical, bevel and bevel-helical types.

* * *

Spirit still for Jamaica.—Blairs Ltd. have received a contract from Tate & Lyle Ltd. for a rectifying column still to be installed in Jamaica as an extension to the existing distillery equipped by Blairs at Monymusk. It is designed to provide a super-neutral gin-type spirit from basic rum spirit.

* * *

Dryers for Portuguese East Africa.—Newell Dunford Engineering Ltd. have received an order from The Mirrlees Watson Co. Ltd. for two rotary dryers to be installed in a cane sugar factory to be built at Dondo in Portuguese East Africa. The dryers will be a "Dunelt" rotary cascading dryer for raw sugar and a "Rotary Louvre" dryer for refined sugar.

* * *

Refinery measurement and control system.—Automatic Control Engineering Ltd., of Crayford, Kent, England, have received a contract via Tate & Lyle Technical Services Ltd. for the major part of a measurement and control system valued at about £29,000 to be installed at the Lisbon sugar refinery of Sociedade Industrial do Ultramar.

* * *

Tecomatex '69.—This is the name given to an exhibition organized by The Tills Engineering Co. Ltd. at the Tate & Lyle Ltd. Transport Depot in Wandsworth, South London, during 14th–16th May 1969. Tills Engineering Co. Ltd., a subsidiary of Tate & Lyle Ltd., has accumulated a great deal of experience in the handling of bulk sugar, and the exhibition is designed to demonstrate its equipment which is equally suitable for other particulate solids. Cooperating with the company were manufacturers of components in the Tills systems, including W. C. Holmes & Co. Ltd., makers of vacuum pumps and blowers for pneumatic conveying systems, Goring Kerr Ltd., makers of level controls and metal detectors, Midland Industrial Designers Ltd., makers of solids flow control equipment, Samuel Hill Ltd., filter cloth specialists, Elliott Bros. (London) Ltd., makers of electrical weighing equipment, Clyde Wharf Ltd., container repair specialists, M2 Systems and Controls Ltd., makers of electrical weighing equipment, and Tate & Lyle Refineries Ltd. and Tate & Lyle Transport Ltd.

C. W. Murray Award

Fletcher and Stewart Ltd. announce changes regarding the C. W. Murray Award of which they are sponsors.

The value of the Award has been increased, as from 1970, from £250 to £400 and competitors are reminded they may choose for their paper any subject connected with beet or cane sugar technology.

The other changes affects the Panel. Mr. W. B. BOAST, Technical Director of the British Sugar Corporation until he relinquished that position on 30th September 1968, has served as a member of the Panel since its inception in 1967, but now wishes to retire. Mr. N. M. ADAMS, his successor as Technical Director, has kindly agreed to serve on the Panel in his place.

Details regarding the preparation and submission of papers for the 1970 Award can be obtained from: Fletcher and Stewart Limited, Bucklersbury House, 83 Cannon Street, London, E.C.4, England, and those wishing to contribute should write to that address.

Japan sugar imports[1]

	1968	1967	1966
	(*metric tons*)		
Australia	501,422	597,219	582,567
Brazil	—	12,915	—
China	—	—	8,297
Colombia	50,479	22,554	—
Cuba	564,995	506,070	361,012
Fiji	11,468	41,436	—
Indonesia	—	7	39,246
Mexico	28,326	—	—
Philippines	—	—	1
Portuguese East Africa	49	—	—
Réunion	10,456	12,416	—
Ryukyu Islands	231,652	204,534	219,647
South Africa	486,987	339,814	166,935
Taiwan	167,340	79,113	359,433
Thailand	—	—	974
USA	149	81	201
Total	2,053,323	1,816,159	1,738,313

French beet area, 1969.—In their first estimate of beet areas in Europe, F. O. Licht K.G. set the figure for France at 400,000 hectares[2]. Licht now reports that it has now become evident that the area will probably not reach 400,000 ha because a part will be utilized for cultivation of beets for alcohol production. It may therefore be assumed, says Licht[3], that this year's beet area for sugar production will be similar to that of the previous year—about 365,000 hectares.

* * *

Australian sugar crop, 1968.—The 1968 crushing season came to an end on 12th December, with a total of 18,400,987 tons of cane crushed, comprising 17,403,174 tons processed by the 31 Queensland mills and 997,813 tons crushed by the mills in New South Wales[4]. The 1968 total was some 1,640,000 tons higher than the previous record set in 1967, and yielded a total of 2,724,788 tons 94 n.t. sugar, of which 2,604,222 was produced in Queensland and 120,566 tons in New South Wales, the sugar output also being over 370,000 tons higher than the previous record[5].

Brevities

UK sugar crop, 1968/69[6]. —The 1968/69 sugar crop yielded a total of 7,005,895 tons, representing an average yield per acre of 15·81 tons. This compares with 6,775,391 tons and 15·50 tons per acre in the preceding season. It was only the second occasion in the UK when deliveries exceeded 7 million tons. Average root weight was fractionally better than 1967/68 at 698 g compared with 694 g, but average sugar content was 15·31% compared with 15·81% last campaign, so that sugar per root fell from 110 to 107 g. The provisional figure for sugar production is 896,000 tons, compared with 873,000 tons in 1967/68, and is the third highest figure so far attained.

* * *

Sugar Industry Technologists Inc. 1969 Meeting.—The programme of the 1969 meeting of S.I.T., held during the 28th–29th April, included the following papers: Evaluation of 300° wedge wire screens, by H. M. WALLENSTEIN; Pilot plant studies concerning Sweetland press filtration of washed raw sugar liquor, by S. B. POLLACK; Eductors for pre-coat of presses, by D. SULITEANU; Sugar quality and economics in pan boiling technique, by A. M. HOWES, D. W. FRANCIS, G. N. ALLAN and D. E. WARNE; Comparison of two semi-automatic white sugar vacuum pan systems, by P. H. PETRI; Thoughts on sugar boiling, by F. M. CHAPMAN; Interim report on some analytical results from contract raw sugar control tests, by W. W. BINKLEY; Activated carbon systems and economics, by G. F. SPINK; Some trials with Pittsburgh Carbon Type CAL in a refinery with carbonatation, by A. M. MOULT; Refinery wastes and pollution control, by G. S. BAUMERT; Treatment and disposal of industrial wastes, by R. SHAPIRO; and Auxiliary decolorants and de-ashing techniques, by H. G. GERSTNER.

* * *

Singapore sugar imports, 1968[7].—Imports of sugar by Singapore in 1968 totalled 227,391 metric tons, tel quel, the major suppliers being Australia with 71,512 tons, China 61,174 tons, Taiwan 35,913 tons and Czechoslovakia 24,914 tons. In 1967 imports totalled 169,342 tons of which China supplied 92,576 tons, Australia 35,683 tons, Taiwan 17,400 tons and Fiji 11,666 tons.

* * *

Lebanon sugar imports imitation[8].—New regulations limit the total quantity of raw sugar which may be imported by the three local refineries to 30,000 tons which may, however, be increased to 40,000 tons subject to certain conditions. Issue of import licences will be conditional on the importer buying a quantity of locally manufactured sugar equivalent to a quarter of the amount he wishes to import during 1969. For future years the proportion is to be decided by the Government.

* * *

Puerto Rico sugar factory closure[9].—The board of directors of Central Soller in Puerto Rico have announced that the factory will not operate in the 1969 season. Its cane supply will be transferred for crushing to Central Riollano, which is owned by the same interests. The closure has been forced by the drastic reduction in the area devoted to cane.

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[1] *Willett & Gray*, 1969, **93**, 100.
[2] *International Sugar Rpt.*, 1969, **101**, (9), 1; *I.S.J.*, 1969, **71**, 160.
[3] *ibid.*, (11), 4.
[4] *Australian Sugar J.*, 1968, **60**, 469.
[5] *ibid.*, 1969, **60**, 527.
[6] *British Sugar Beet Rev.*, 1969, **37**, 122.
[7] C. Czarnikow Ltd., *Sugar Review*, 1969, (913), 62.
[8] *Board of Trade J.*, 1969, **196**, 1054.
[9] *Sugar y Azúcar*, 1968, **63**, (12), 28.

US sugar quota, 1969

	Initial quotas	*Increases/Adjustments* 14*th March*	10*th April*	1*st May*	*Adjusted quotas*
		(*short tons, raw value*)			
Domestic beet	3,120,333	47,667	47,667	—	3,215,667
Mainland cane	1,134,667	17,333	17,333	—	1,169,333
Hawaii	1,200,000	—	—9,327	—	1,190,673
Puerto Rico	1,140,000	—300,000	—200,000	—200,000	440,000
Virgin Islands	15,000	—15,000	—	—	—
Philippines	1,126,020	—	—	—	1,126,020
Argentina	54,636	8,080	5,590	5,467	73,773
Australia	189,745	1,260	1,932	—	192,937
Bahamas	10,000	—	—	—	10,000
Bolivia	5,287	782	540	529	7,138
Brazil	444,138	65,683	45,440	44,439	599,700
British Honduras	11,630	1,632	1,098	1,149	15,509
British West Indies	159,639	22,406	15,097	15,778	212,920
Colombia	46,999	6,951	4,808	4,702	63,460
Costa Rica	52,286	7,731	5,352	5,232	70,601
Dominican Republic	444,138	65,683	45,440	44,439	599,700
Ecuador	64,624	9,556	6,613	6,466	87,259
Fiji	41,638	277	424	—	42,339
French West Indies	50,218	7,049	4,748	4,963	66,978
Guatemala	44,062	6,516	4,508	4,409	59,495
Haiti	24,674	3,649	2,524	2,469	33,316
Honduras	5,287	782	540	529	7,138
India	75,898	504	773	—	77,175
Ireland	5,351	—	—	—	5,351
Malagasy	8,960	58	93	—	9,111
Mauritius	17,394	115	177	—	17,686
Mexico	454,126	67,161	46,460	45,438	613,185
Nicaragua	52,286	7,731	5,352	5,232	70,601
Panama	32,899	4,866	3,367	3,292	44,424
Peru	354,253	52,391	36,242	—	442,886
Salvador	32,312	4,779	3,307	3,233	43,631
South Africa	55,869	371	568	—	56,808
Swaziland	6,852	46	69	—	6,967
Taiwan	79,060	525	805	—	80,390
Thailand	17,394	115	177	—	17,686
Venezuela	22,325	3,301	2,283	2,234	30,143
Total	10,600,000	100,000	100,000	—	10,800,000

Brevities

Jamaica sugar factory closure possibility[1].—The local Managing Director of the West Indies Sugar Co. Ltd., in a letter to the Jamaica Cane Farmers' Association, has said that, if prevailing conditions in the sugar industry do not change, one of the company's two major estates, at Monymusk, may be closed down. There was a loss of £301,000 on last year's operations at Monymusk which was responsible for a loss of £124,000 on the combined operations of both estates[2].

* * *

Sudan sugar factory proposal[3].—Negotiations are under way to finance the establishment of a third sugar factory in the Sudan, with an annual capacity of 60,000 metric tons of sugar. The cost of the installation is not to exceed $30,000,000. Estimated output of the existing two factories at Guneid and Khashm-el-Girba in the 1968/69 season is 90,000 tons.

* * *

Fiji record sugar crop[4].—Fiji produced a record sugar crop in the 1968 season, and the estimated output of 380,000 tons of sugar exceeded the previous record by about 70,000 tons or 23%. In contrast to the exceptional sequence of droughts which severely affected Fiji's crops in 1965, 1966 and 1967, growing conditions in 1968 were more normal and resulted in the record crop. Useful rains during May-September were beneficial to the 1968 crop and also provided favourable conditions for establishing the 1969 crop.

New Honduras sugar factory[5].—A new $7,500,000 sugar mill, located near San Pedro Sula, recently went into operation. Some 95% of the machinery for the mill, which has a capacity of 3000 short tons of cane per day and will produce 27,000 tons of sugar per crop, was purchased in the USA.

* * *

Canada 1968/69 beet sugar campaign[6].—In the 1968/69 campaign the total of beet delivered amounted to 929,100 long tons, as against 965,252 tons delivered in 1967/68. The crop was harvested from an area of 81,753 acres, somewhat less than the 83,305 acres harvested the previous year, while the yield per acre was lower at 11·4 compared with 11·6 tons. Sugar extraction was higher at 13·05% against 12·7%, so that outturn was almost the same at 122,528 tons in 1968/69 compared with 122,572 tons in 1967/68.

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[1] *The Times*, 11th April 1969.
[2] See *I.S.J.*, 1969, **71**, 130.
[3] *Sugar y Azúcar*, 1968, **63**, (12), 29.
[4] *Australian Sugar J.*, 1969, **60**, 559.
[5] *Sugar y Azúcar*, 1968, **63**, (12), 9.
[6] C. Czarnikow Ltd., *Sugar Review*, 1969, (909), 46.

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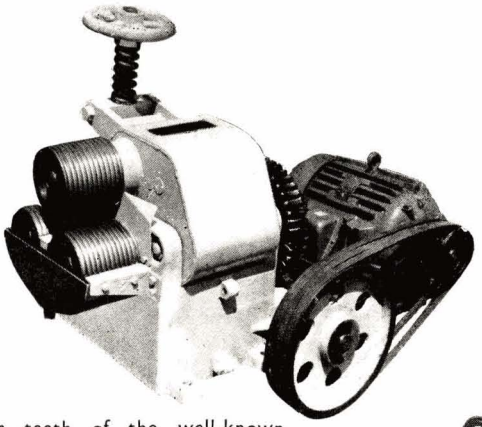
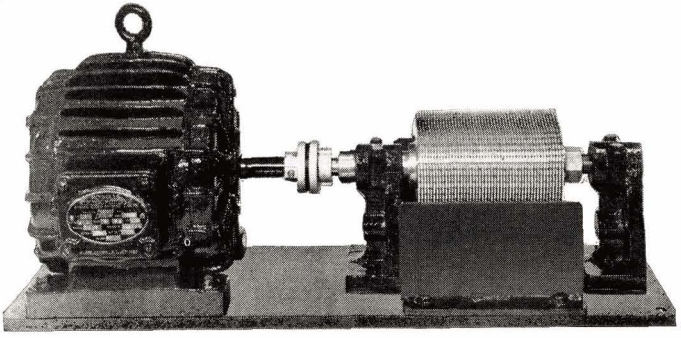
Suma Products

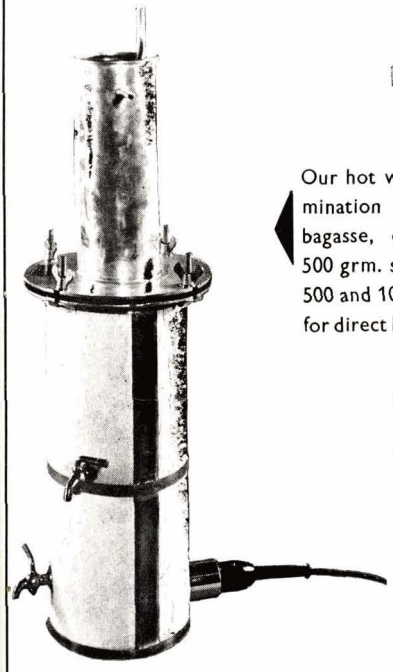
CANE AND BAGASSE ANALYSIS



Our **ROLEX** laboratory three-roller mill is provided with 5 in. × 5 in. rollers of Meehanite cast iron, while the spur gears and casting which carries the adjustable top roller are of steel. This top roller is fitted with a compression spring while scrapers are provided for both bottom rollers. Oilite bearings are fitted, and the juice tray and scrapers are removable for cleaning. The illustration shows a **ROLEX** mill belt-driven by a 3 h.p. electric motor.

The teeth of the well-known **CUTEX** laboratory cane shredder are cut from a solid piece of steel and are driven inside their housing by an electric motor mounted on the same bed-plate and connected by a flexible coupling. For the illustration the coupling and shredder housings have been removed.





Our hot water digester for determination of the sucrose lost in bagasse, electrically heated, for 500 grm. samples. Other types for 500 and 1000 grm. samples include for direct heating or steam heating.

Our high-speed mixer for analysis of fibre in bagasse has knives of improved design with two speeds of 7000 and 14,000 r.p.m. and a special feeder-type lid to prevent spillage. Its metal goblet is of 2000 ml. capacity. It is provided with a motor designed to take only single-phase A.C.

The Sugar Manufacturers' Supply Co. Ltd.

196-204 BERMONDSEY STREET, LONDON, S.E.1, ENGLAND

Telephone: HOP 5422 *Cables:* "Sumasuco, London S.E.1"

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