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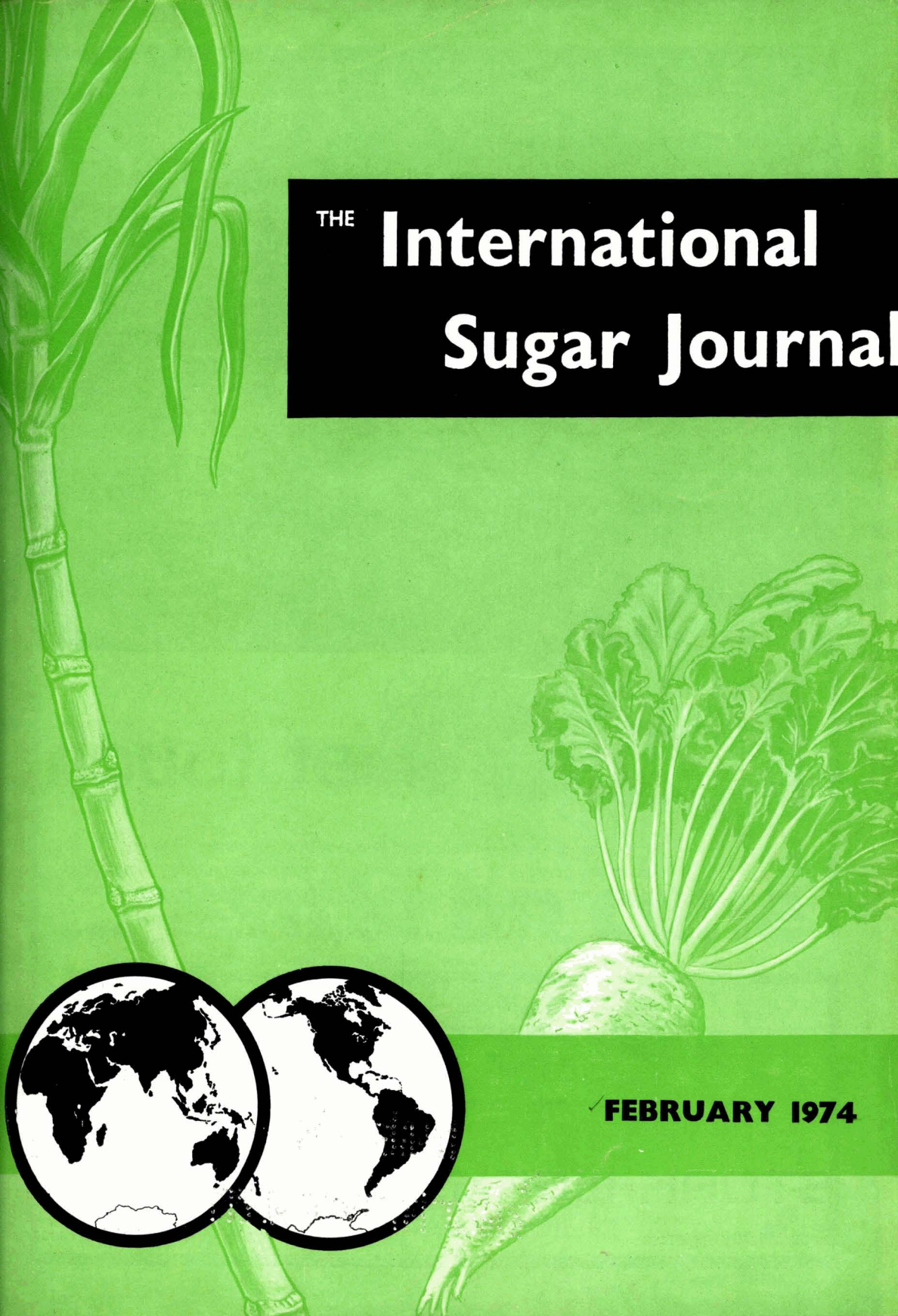

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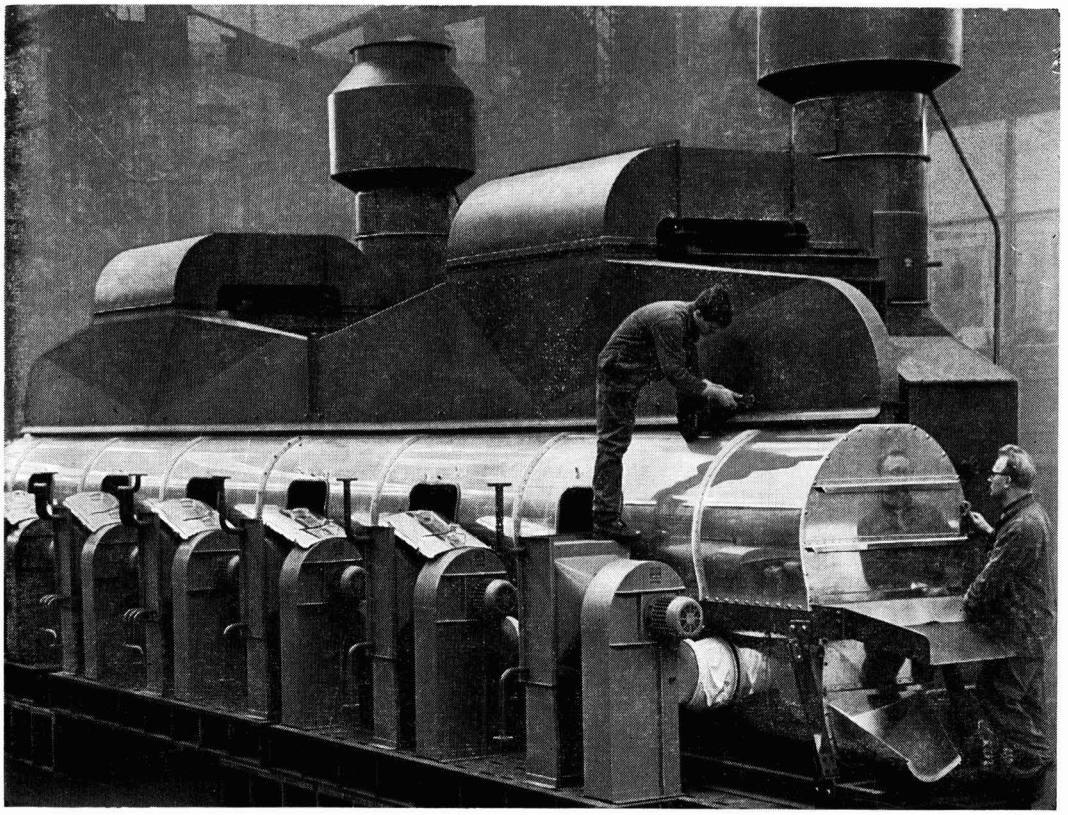

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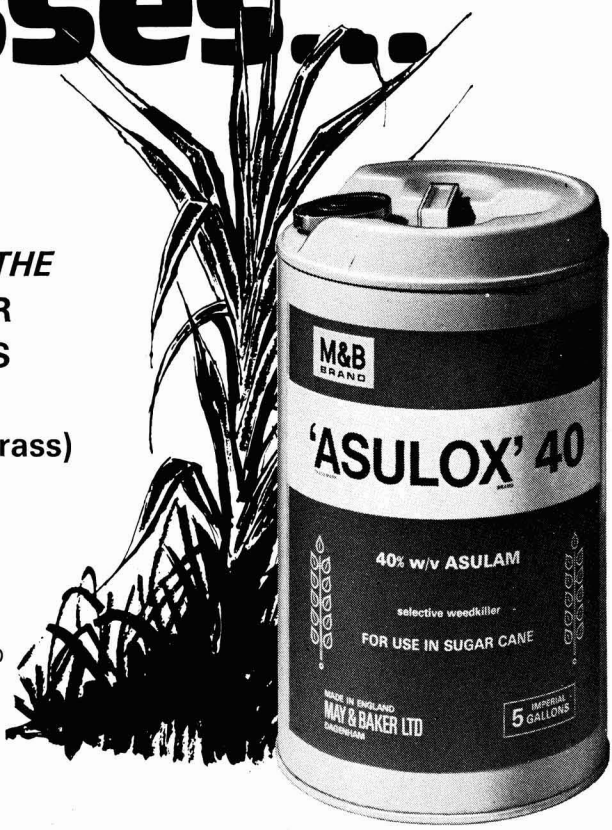

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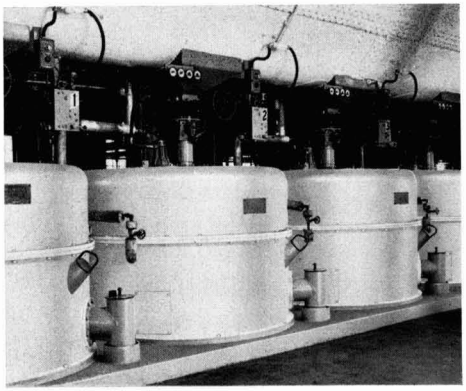

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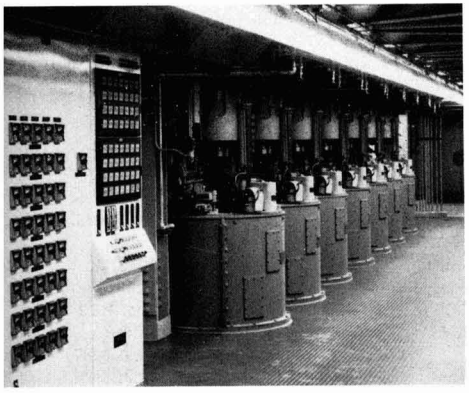

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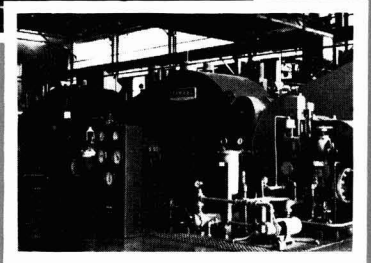

Aerial view of Gulf & Western's Okeelanta sugar factory and installation picture of Farrel drives in operation at the Central Romana factory.

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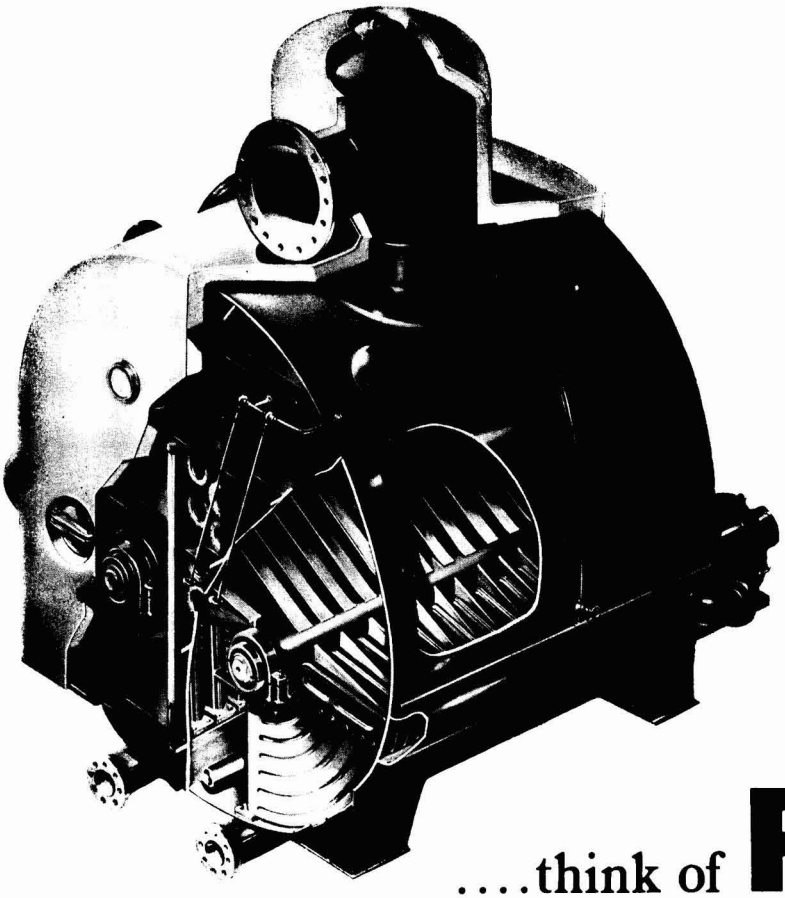

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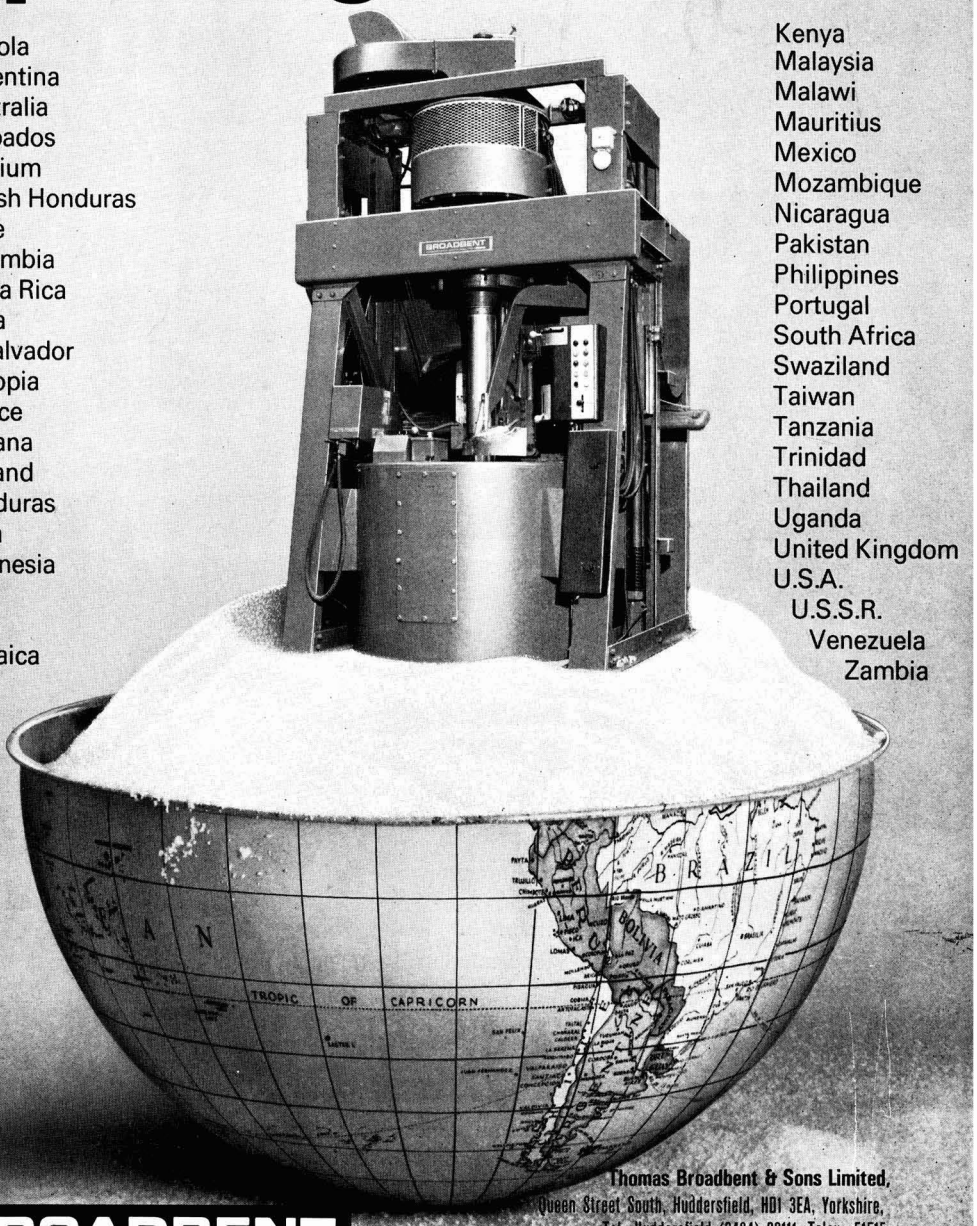

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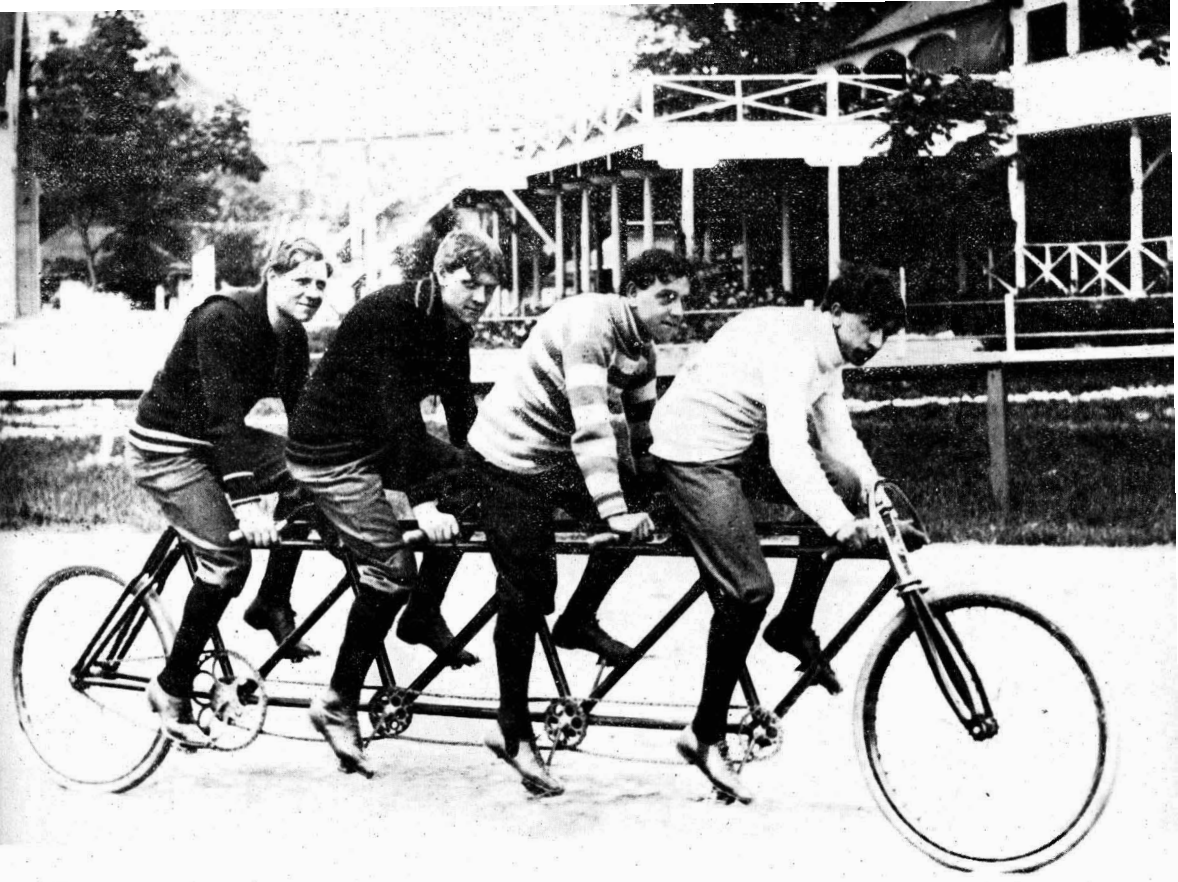

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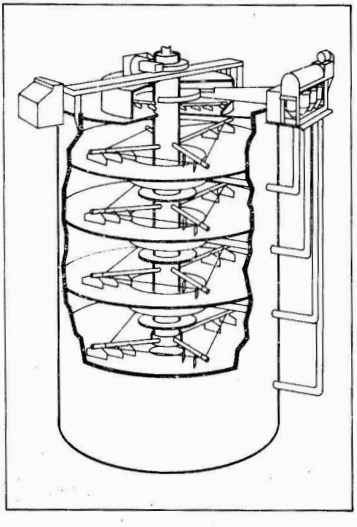

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February, 1974

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Nucléation continue du saccharose. Partie II. A. D. RANDOLPH et S. A. ZIEBOLD. *p.* 35–38

On décrit le cristalliseur expérimental et équipement auxiliaire employés dans les essais de nucléation et on donne des détails des essais comprenant solutions de sucre de 68° ou 75° Brix en plus de dissolvant. Les conditions expérimentales associées avec les tests individuels sont résumées dans un tableau. On a examiné cinq variables indépendantes, à savoir la température dans le cristallisoir, le temps de séjour, la concentration de solution entrée, l'effet d'agents tensio-actifs et l'influence du type de dissolvant. On a employé un compteur Coulter pour déterminer le nombre de cristaux obtenus.

* * *

La floraison de la canne à sucre en Egypte. G. ARCENEAUX. *p.* 38–39

On fait allusion à recherches d'induction de floraison de la canne à sucre effectuées en 1962, dans lesquelles on a trouvé que difficultés regardant la floraison de la canne sous les conditions sur champ en Egypte sont un résultat d'humidité d'air basse et d'une déficience en eau du sol. L'auteur considère que le facteur essential dans l'induction de floraison dans les essais de RAO (*I.S.J.*, 1973, **75**, 241–244) était le changement de condition en ce qui concerne l'humidité à l'intérieur des plantes de canne occasionné par inondation périodique.

* * *

La chimie physique de phosphatation et carbonatation. Partie I. M. C. BENNETT. *p.* 40–44

On décrit des expériences dans lesquelles on a traité des solutions de sucre par quatre méthodes pour réduire la couleur et des impuretés: filtration à travers craie et kieselguhr, carbonatation et phosphatation. On donne des résultats sous forme tabulaire et graphique et tente du distinguer entre enlèvement d'impuretés physique et chimique. On montre que le kieselguhr est plus effectif que craie au regard d'enlèvement du précipité d'alcool total, de l'amidon et des protéines et, à un diamètre de pore réduit, donne des résultats a peu près ceux de phosphatation à l'exception de couleur.

Kontinuierliche Bildung von Saccharosekristallen. Teil II. A. D. RANDOLPH und S. A. ZIEBOLD. *S.* 35–38

Der Versuchskristallisator und die zusätzliche Apparatur zur Durchführung der Keimbildungsversuche werden beschrieben. Die Autoren geben Einzelheiten über diese Untersuchungsreihe an, in deren Rahmen fünfzehn Versuche an Zuckerlösungen mit 68 und 75% Trockensubstanz unter Zusatz eines Lösungsmittels durchgeführt werden. Die bei den einzelnen Versuchen eingehaltenen Bedingungen sind in einer Tabelle zusammengestellt. Es wurden fünf voneinander unabhängige Parameter untersucht, nämlich die Temperatur im Kristallisator, die Verweilzeit, die Konzentration der zugeführten Zuckerlösungen, die Wirkung einer oberflächenaktiven Substanz sowie der Einfluss der Art des Lösungsmittels. Zur Ermittlung der Zahl der erhaltenen Kristalle wurde ein Coulter-Zählgerät verwendet.

* * *

Das Blühen von Zuckerrohrpflanzen in Aegypten. G. ARCENEAUX. *S.* 38–39

Der Verfasser bezieht sich auf Untersuchungen über die Möglichkeit, Zuckerrohrpflanzen zum Blühen zu bringen, die 1962 durchgeführt wurden und zeigten, dass Schwierigkeiten mit der Blüte von Zuckerrohrpflanzen unter den Anbaubedingungen in Aegypten auf die niedrige Luftfeuchtigkeit und den Wassermangel im Boden zurückzuführen sind. Für den wesentlichsten Faktor für die Herbeiführung der Blüte bei den Versuchen von RAO (*I.S.J.*, 1973, **75**, 241–244) hält der Verfasser die Aenderung des Wasserhaushalts der Zuckerrohrpflanze durch periodische Ueberflutung.

* * *

Physikalische Chemie der Phosphatation und der Carbonatation. Teil I. M. C. BENNETT. *S.* 40–44

Es werden Versuche beschrieben, bei denen Zuckerlösungen zur Verringerung der Farbe und zur Entfernung von Verunreinigungen nach vier Methoden behandelt wurden: Filtration über Kreide, Filtration über Kieselgur, Carbonatation und Phosphatation. Die Ergebnisse sind in Form von Tabellen und Diagrammen wiedergegeben. Ferner wurde der Versuch gemacht, zwischen einer physikalischen und einer chemischen Entfernung der Verunreinigungen zu unterschieden. Der Verfasser zeigt, dass hinsichtlich der Entfernung der gesamten alkoholischen Fällung, sowie Stärke und Protein, Kieselgur wirkungsvoller ist als Kreide und bei verringertem Porendurchmesser Resultate erzielt, die denen bei der Phosphatation nahekommen. Dies gilt jedoch nicht für die Farbe.

Nucleación continua de sacarosa. Parte II. A. D. RANDOLPH y S. A. ZIEBOLD. *Pág.* 35–38

Se describen el cristalizador experimental y equipo auxiliar que se han usado en los ensayos de nucleación y se presentan detalles de los experimentos que incluyen quince corridas usando soluciones de azúcar de 68° o 75° Brix con disolvente añadido. Las condiciones experimentales asociado con las corridas individuales se resumen en forma tabular. Se han investigado cinco variables independientes, es decir, temperatura en el cristalizador, tiempo de residencia, concentración del suministro de azúcar, efecto de agente tensio-activo, y la influencia del tipo de disolvente. Un contador tipo Coulter se ha usado para determinar el número de cristales que se han obtenido.

* * *

Floración de caña de azúcar en el Egipto. G. ARCENEAUX. *Pág.* 38–39

Se hace referencia a investigaciones sobre la inducción de floración de caña hecho en 1962, en que ese ha descubrido que las dificultades en floración de caña en condiciones del campo en el Egipto provienen de baja humedad del aire y deficiencia en agua del suelo. El autor considera que el factor decisivo en la inducción de floración en los experimentos de RAO (*I.S.J.*, 1973, **75**, 241–244) es el cambio del estado interno de humedad en las plantas de caña que proviene de inundación periódica.

* * *

Quimica fisical de fosfatación y carbonatación. Parte I. M. C. BENNETT. *Pág.* 40–44

Se describen experimentos en que se tratan soluciones de azúcar por cuatro m[illegible] para reducir su color y impurezas. Estos tratamientos incluyen: filtración a través de creta y a través de kieselguhr, carbonatación y fosfatación. Se presentan las resultas en forma tabular y gráfica y el autor ensaye distinguir entre eliminación física y química de impurezas. Se demuestra que kieselguhr es más efectivo que creta en eliminación de material totalmente precipitable con alcohol, de almidón y de proteína, y, a diametro reducido de poros, da resultas que se acercan a ellas de fosfatación sino que en el caso de color.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXVI FEBRUARY 1974 No. 902

Notes & Comments

World sugar balance, 1972/73[1]

F. O. Licht K.G. have recently published their fourth estimate of the world sugar balance for the crop years September 1972/August 1973 and the previous two years, as given below.

	1972/73	1971/72	1970/71
	(*metric tons, raw value*)		
Initial stocks	17,131,000	19,039,000	21,362,000
Production	77,539,000	73,852,000	72,771,000
Imports	24,357,000	24,482,000	23,503,000
	119,027,000	117,373,000	117,636,000
Exports	24,708,000	24,066,000	24,037,000
Consumption	78,768,000	76,176,000	74,560,000
Final stocks	15,551,000	17,131,000	19,039,000
Production increase..	3,687,000	1,081,000	
„ „ %	4·99	1·49	
Consumption increase	2,592,000	1,616,000	
„ „ %	3·40	2·17	

The new figures represent an increase in estimated consumption for 1972/73 compared with the previous balance, but while the production increase is greater it is still not enough to match consumption so that the final stock figure is reduced again to the low level of 15½ million tons or less than 20% of annual consumption.

* * *

World raw sugar price

Since the note in our last issue there has been an astonishing rise in sugar prices on the world market. The London Daily price rose through almost all of December, occasionally steady for one or two days, but leaping by £10 on the 13th December from £124 to £134 per ton, and eventually reaching an all-time peak of £152 on the 27th. This level was maintained for a day but subsequent drops have brought the price to "only" £144 at the time of writing. Thus the range of prices during December—£49.50—is almost double the difference between the highest and lowest prices of the previous eleven months! No single incident or factor can be indicated as the cause of the tremendous jump, which seems to be the natural result of a lack of offerings by producers of raw sugar to the world market, continuous demand on the part of importing countries in order to meet their requirements and to build up some stocks against future tightness, and a lack of resistance to the high prices engendered by this supply-and-demand situation, as well as pressure by the US to obtain early deliveries against 1974 quotas.

E. D. & F. Man, commenting on this at the end of December, write that, while end-buyers are continuing to pay up, "there is no reason why prices should not go higher still. First-hand sellers on the whole are not pressing, although small quantities emerge from time to time. It would seem that sellers are content to make sugar available very slowly. We have rechecked and still believe in our total statistical outlook for the next eight months and, with world consumption of the year ending August 1974 at or just under 81 million tons, we see, on paper, a surplus in excess of 1,000,000 tons. In due course (and this might take time) we believe that statistics will cause prices to fall considerably; immediately, however, it looks as though higher prices are perfectly possible, but further ahead we see lower prices as inevitable".

* * *

World sugar production estimates

F. O. Licht K.G. recently published their second estimate of world sugar production[2] and these are reproduced elsewhere in this issue. Three months have elapsed since the first estimate and in this time not only have more accurate figures become available for the 1972/73 season but changes have occurred in the crop prospects of many countries.

Beet development in the EEC has been unsatisfactory and the estimate for the nine member countries is 310,000 tons lower than forecast earlier, while for Western Europe as a whole the estimate is 343,000 tons lower. Poorer crops are expected for Czechoslovakia and Poland but an increase in the Rumanian estimate and, especially, a 200,000-ton increase in the forecast for the USSR has raised the East Europe total by a net 45,000 tons. Changes in beet crop

[1] *International Sugar Rpt.*, 1973, **105**, (32), 1.
[2] *ibid.*, (34), 1–4.

estimates outside Europe bring a net reduction of 46,000 tons so that the total beet sugar production estimate for 1973/74 is brought to 32,657,511 tons, or about 4% higher than the revised figure for 1972/73.

The period covers the crop year up to August 1974 and most of the cane sugar crops are in progress or had yet to start at the time of the new estimate. Consequently relatively few and smaller changes have been noted, the total net change being an increase of 70,000 tons to 48,939,807 tons. Revised and more up-to-date figures for 1972/73 cane sugar production have reduced the earlier total to 45,944,259 tons so that the 1973/74 estimate represents an increase of 3,000,000 tons or some 6½% in the year. The total of world sugar production at 81,597,318 tons is thus 4,258,207 tons higher than 1972/73, i.e. higher by 5½%.

* * *

Mauritius Chamber of Agriculture report, 1972/73

The 1972 crop had a very good start with good rainfall and above-average temperatures. Growth was good and the harvest totalled 6,314,762 metric tons, an increase of 20% over the poor crop of 1971. However, the high rainfall during the ripening period resulted in a low sugar content, extraction reaching only 10·87% sugar on cane, the lowest post-war figure apart from 1960. Nevertheless, cane yield was so high (33·2 tons/arpent compared with 27·8 tons/arpent in 1971) that sugar yield was a record 3·61 tons/arpent against 3·28 in 1971. (One arpent = 1·043 acres.) Final sugar outturn was 686,366 metric tons, tel quel, a record.

Mauritius fulfilled her Commonwealth Sugar Agreement Negotiated Price Quota of 380,000 long tons (386,080 metric tons) at the negotiated price of £57 per long ton, benefiting from the special payment for less developed exporters. This is related inversely to the world sugar price and amounted to £7 per long ton (the minimum) in 1972. The 1972 US quota was over-shipped—27,940 metric tons against 26,083 tons—and the excess was deducted from the 1973 quota. Exports to other destinations and free market sugar for the UK totalled 199,867 metric tons.

The 1973 crop had a good start but because of the extension of the 1972 crop canes cut late had less opportunity for full ratoon growth. Nevertheless lack of cyclones has given cane fields in good condition and the initial estimate was of a production near the 1972 crop.

* * *

US sugar supply quotas, 1974

With the US domestic price level virtually unaffected by the last increase in the 1973 sugar quota (which owing to the lateness in the year could not be completely filled in any case), the US Department of Agriculture took action as the price rose 5 points above the new upper limit of the December price corridor. The 1974 Supply Quota was raised by 200,000 tons to 12 million short tons, raw value, details of which appear below. The Mainland Cane quota (Louisiana plus Florida) was raised by its due share of 34,667 tons while that for Texas cane was unchanged, as were the Domestic Beet quota, that for Hawaii and for Puerto Rico. The remaining individual quotas were adjusted in accordance with the provisions of the Sugar Act.

	Initial quotas	*Increases*	*Quotas in effect*
	(*short tons, raw value*)		
Domestic Beet	3,300,000	0	3,300,000
Mainland Cane ..	1,643,000	34,667	1,677,667
Texas Cane	100,000	0	100,000
Hawaii	1,110,000	0	1,110,000
Puerto Rico	155,000	0	155,000
Philippines	1,526,445	28,913	1,555,358
Argentina	90,860	3,180	94,040
Australia	209,048	3,577	212,625
Belize	40,382	1,414	41,796
Bolivia	7,719	271	7,990
Brazil	655,611	22,953	678,564
Colombia	80,764	2,827	83,591
Costa Rica	81,952	2,869	84,821
Dominican Republic	760,127	26,614	786,741
Ecuador.....	96,798	3,388	100,186
Fiji	45,808	784	46,592
Guatemala	70,075	2,453	72,528
Haiti	36,818	1,290	38,108
Honduras	14,253	498	14,751
India	83,701	1,433	85,134
Ireland	5,351	0	5,351
Malagasy Republic	12,493	214	12,707
Malawi	15,408	263	15,671
Mauritius	30,816	528	31,344
Mexico	672,239	23,536	695,775
Nicaragua	76,605	2,682	79,287
Panama	76,605	2,682	79,287
Paraguay	7,719	271	7,990
Peru	433,020	16,426	449,446
Salvador	51,070	1,789	52,859
South Africa	59,132	1,012	60,144
Swaziland	30,816	528	31,344
Taiwan	87,034	1,490	88,524
Thailand	19,156	327	19,483
Venezuela	60,983	2,557	63,540
West Indies	53,192	8,564	61,756
	11,800,000	200,000	12,000,000

In spite of this action the US domestic price has continued to rise to well over the upper limit of the price corridor and the Department is faced with the problem of deciding whether or not to raise the Overall Quota further. A decision will be affected by the December index of farm prices on which basis a new price corridor was due to be established in early January. However, the increase in annual quotas does not make sugar immediately available, especially from supplying countries of Latin America which have been experiencing production difficulties. The US authorities have been pressing suppliers to deliver promptly against their quotas and this has contributed to scarcity of sugar supplies to the world market although not relieving appreciably the tight situation on the US market. As a consequence there has been talk of eliminating quota limitations altogether in 1974.

Continuous sucrose nucleation

Observations of secondary particle breeding in sucrose/water/organic systems as related to a continuous sugar pan

By ALAN D. RANDOLPH and STEVEN A. ZIEBOLD

(Chemical Engineering Department, University of Arizona, Tucson, Arizona, 85721 USA)

PART II

EXPERIMENTAL

Apparatus

The MSMPR crystallizer used in this research work was constructed from a 10-litre capacity polyethylene tank with a combination draft tube/baffle/cooling system. The baffle system extended about three-quarters of the overall height of the crystallizer and cooling or heating fluid circulated through the hollow draft tube to effect temperature control.

An impeller-agitator was used to mix the crystal magma. A 3-bladed impeller approximately 3 inches in diameter was used and was seated through the baffle system into a centred mounting. The speed of the agitator was maintained at 1100 r.p.m. during all runs.

An Eastern Industries U-17 ($\frac{1}{4}$-h.p., 1725 r.p.m.) circulation pump was mounted directly on the side of the crystallizer and circulated magma through $\frac{1}{2}$-inch "Tygon" plastic tubing. This circulation line led to a "T" which returned to the crystallizer or to the drain.

NOMENCLATURE

B°	nucleation rate, number per cm³ per min.
CV	coefficient of variation; standard deviation divided by mean, based on mass-weighted particle size.
G	linear crystal growth rate, microns/min.
i	exponent of growth rate in nucleation kinetics expression
j	exponent of solids concentration in nucleation kinetics expression
k_n	coefficient in nucleation kinetics expression
k_v	crystal volume shape factor, (volume)(length)$^{-3}$
L	crystal size, microns
M_t	solids concentration, g.cm^{-3}
$n(L)$	population distribution function, number per cm³-micron
n°	nucleus population density, B°/G, number per cm³-micron
S	coefficient of supersaturation, C/C$_s$
T	temperature, °K
ρ	crystal density, g.cm^{-3}
τ	crystallizer retention time, V/Q, hr.

The level of the crystallizer was maintained at 8 litres by the use of a Matheson "Lab-Stat" capacitance-sensing controller which activated a slurry control valve on the drain side of the circulation line.

Sucrose solution (68° or 75°Brix) and the solvent (either "Vanzol A-1" or 50:50 methanol/*iso*-propanol) were fed to the crystallizer using a micro-bellows pump. Delivery rates through the bellows pump ranged from 18 to 70 cm³.min^{-1}.

Both polyethylene feed storage tanks were of 11 gallons capacity. A steam coil was mounted inside the sucrose tank to regulate feed temperature. Feed sucrose syrup was continuously mixed to minimize formation of crystals on the liquid surface. Feed syrup temperature was maintained at around 170°F; there may have been some inversion occurring at this temperature.

A schematic flow diagram of the crystallizer system is shown in Fig. 1. The apparatus is described in detail by ZIEBOLD[15].

Coulter Counter

Particle distributions were obtained with a sixteen-channel particle size distribution analyser, the Coulter Model "T" Particle Counter. This counter is capable of analysing a particulate sample within twenty seconds. Particles, suspended in electrolyte, are sized and counted by passing them through a specific path of current flow. A tube, containing an aperture of known dimensions, is immersed in a conductive electrolytic solution which contains the sample to be counted. As particles pass through the aperture and displace electrolyte, resistance in the path of current flow changes which in turn changes the current. The magnitude of the change is directly proportional to the volumetric size of the particle. The number of current pulses within a specific sample is proportional to the number of particles within the suspension.

The Coulter Counter was calibrated with 19·5μ spherical ragweed pollen.

Sampling and particle counts

After the crystallizer was assumed to be at steady state (usually 7–8 retention times), a 5 cm³ sample was pipetted directly from the crystallizer. The sample was filtered on No. 30 Whatman filter paper.

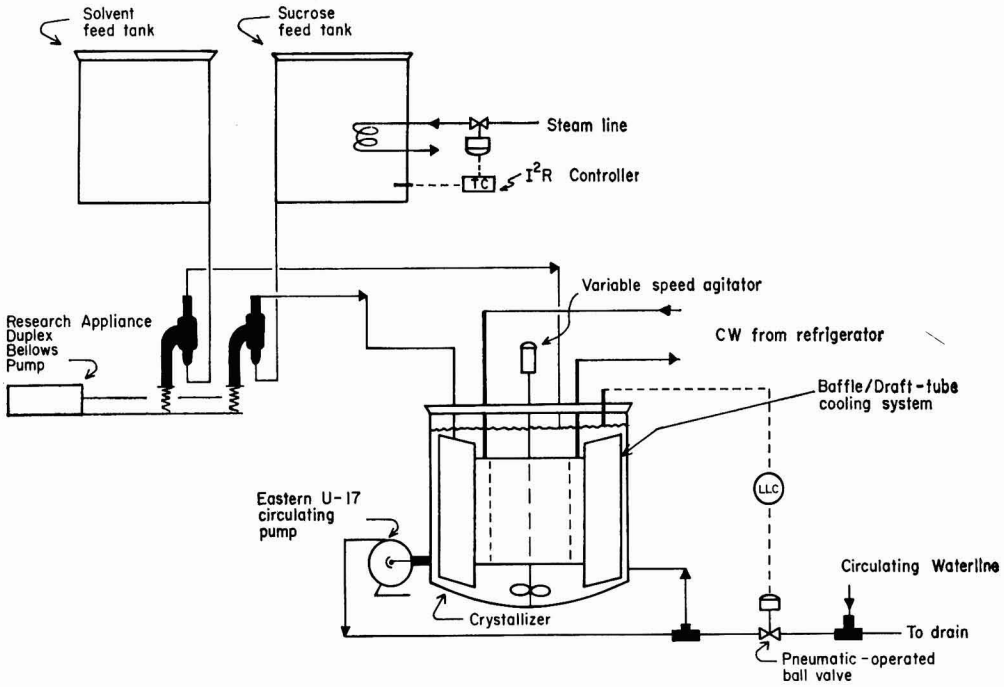

Fig. 1. Schematic flow diagram of crystallizer system

The filtered sample was then suspended in ammonium thiocyanate-containing electrolytic *iso*-propanol solution* with a total dilution factor of 2000 to minimize the number concentration of large particles.

* The electrolytic solution used for counting was a 4% by weight filtered solution of ammonium thiocyanate in absolute *iso*-propanol.

Good suspension was obtained with the aid of a sonic bath. The conductive *iso*-propanol solution was pre-saturated with sucrose to minimize possible dissolving of seed crystals.

"Background noise" counts on the Coulter Counter were taken and subtracted from raw crystal counts in each size channel. Four counts were taken of each sample and averaged.

Table I. Summary of experimental conditions

Run No.	*Solvent (MeOH = methanol; IPA =* iso-*propanol)*	*Solvent to water (mass ratio)*	*Holding time, τ (hr)*	*Crystallizer temperature, °C*	*Surfactants: (MH = Methylamine HCl; FC = "Fluorocarbon FC 96")*	*Sucrose feed concentration, °Brix*	*pH of sucrose solution*
1-A	Ethanol	2/1	1·0	27 ± 2°	None	68 ± 1°	6
1-B	"Vanzol A-1"	2/1	3·0	27 ± 2°	FC — 100 p.p.m.	75 ± 1°	6
2-B	"Vanzol A-1"	2/1	3·0	27 ± 2°	MH — 100 p.p.m.	68 ± 1°	6
3-B	50:50 MeOH/IPA	2/1	1·0	27 ± 2°	None	75 ± 1°	6
4-B	50:50 MeOH/IPA	2/1	3·0	5 ± 2°	FC — 100 p.p.m.	68 ± 1°	6
5-B	50:50 MeOH/IPA	2/1	1·0	27 ± 2°	FC — 100 p.p.m. MH — 100 p.p.m.	68 ± 1°	6
6-B	"Vanzol A-1"	2/1	1·0	13 ± 2°	FC — 100 p.m. MH — 100 p.p.m.	74 ± 1°	6
7-B	50:50 MeOH/IPA	2/1	3·0	5 ± 2°	MH — 100 p.p.m.	75 ± 1°	6
8-B	"Vanzol A-1"	2/1	1·0	8 ± 2°	None	68 ± 1°	6
1-C	50:50 MeOH/IPA	2/1	1·0	27 ± 2°	None	75 ± 1°	6
2-C	50:50 MeOH/IPA	2/1	1·0	27 ± 2°	FC — 100 p.p.m. MH — 100 p.p.m.	68 ± 1°	6
3-C	"Vanzol A-1"	2/1	1·0	10 ± 2°	None	68 ± 1°	6
1-D	"Vanzol A-1"	2·5/1	1·0	11 ± 2°	MH — 100 p.p.m. FC — 100 p.p.m.	74 ± 1°	10
2-D	50:50 MeOH/IPA	3/1	2·0	6 ± 2°	None	75 ± 1°	6
3-D	"Vanzol A-1"	2/1	2·5	7 ± 2°	None	75 ± 1°	6

Experimental runs

A total of fifteen runs were conducted. Run 1-A, the first successful preliminary run, was used to compare with previous results[14]. Runs 1-B to 8-B were designed to study the effects of five independent system variables. The results from the three C-series runs were used as an alternative method of finding the standard error used in a statistical t-test. Runs 1-D to 3-D were additional runs to check the optimized variables from the B-series experiments.

Table I gives a summary of experimental conditions associated with the individual runs.

Run 1-A was conducted using an ethanol/sugar/water system. However, the rest of the runs were executed using either "Vanzol A-1" or 50:50 (volume) *iso*-propanol/methanol mixture as the salting-out agent.

In runs 1-B to 8-B, five independent variables at high and low level values were studied to estimate their effects on the continuous nucleation and growth rate kinetics of the sucrose system. These variables along with their high and low level values are shown in Table II.

Table II. Independent variables studied in *B*-experiments

Independent variable	*Symbol*	*High Level* (+)	*Low Level* (—)
1. Crystallizer temperature	T	27°C	5°C
2. Residence time	τ	3·0 hr	1·0 hr
3. Sucrose feed concentration	Cj	75·0%	68·0%
4. Surfactants	(*a*) Methylamine HCl	100 p.p.m.	None
	(*b*) "Fluorocarbon FC-96"	100 p.p.m.	None
5. Solvent Type	—	50:50 methanol/ *iso*-propanol	"Vanzol A-1"

Runs 1-C, 2-C, and 3-C are duplications of runs 3-B, 5-B and 8-B. These three sets of duplicate runs

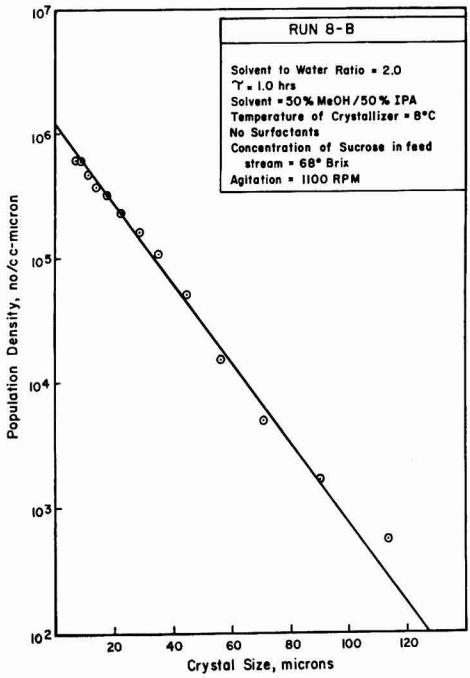

Fig. 2

were used to calculate a "pooled" standard error of the B-series runs in order to obtain a more accurate estimate of the main effects of the independent variables with three degrees of freedom.

Run 1-D was carried out using a high solvent-to-water ratio ($R = 3{\cdot}0$) and a pH of 10. In run 2-D, the conditions were similar to that of run 6-B; however, the solvent-to-water ratio was 2·5.

Finally in run 3-D, optimized variables were chosen to verify the effects on the system kinetics.

Table III. Summary of experimental results

Run No.	*Residence time*	*Solvent: water ratio*	*Nuclei density*	*Characteristic size* ($G\tau$)	*Crystal growth rate*	*Nucleation rate*	*Yield by filtration*	*Yield by Coulter Counter*
1-A	1·0	2·0	$6{\cdot}40 \times 10^5$	14·3	0·238	$1{\cdot}52 \times 10^5$	—	0·134
1-B	3·0	2·0	$1{\cdot}26 \times 10^6$	13·8	0·0767	$9{\cdot}56 \times 10^4$	0·380	0·226
2-B	3·0	2·0	$5{\cdot}85 \times 10^5$	15·3	0·085	$4{\cdot}97 \times 10^4$	0·242	0·161
3-B	1·0	2·0	$8{\cdot}76 \times 10^5$	16·1	0·269	$2{\cdot}36 \times 10^5$	0·408	0·293
4-B	3·0	2·0	$1{\cdot}25 \times 10^6$	15·0	0·0835	$1{\cdot}04 \times 10^5$	0·304	0·315
5-B	1·0	2·0	$8{\cdot}18 \times 10^5$	14·7	0·246	$2{\cdot}02 \times 10^5$	0·251	0·192
6-B	1·0	2·0	$5{\cdot}45 \times 10^5$	18·1	0·301	$1{\cdot}64 \times 10^5$	0·331	0·291
7-B	3·0	2·0	$4{\cdot}83 \times 10^6$	10·9	0·0608	$2{\cdot}94 \times 10^5$	0·423	0·347
8-B	1·0	2·0	$1{\cdot}22 \times 10^6$	13·6	0·226	$2{\cdot}76 \times 10^5$	0·205	0·206
1-C	1·0	2·0	$7{\cdot}40 \times 10^5$	16·5	0·276	$2{\cdot}04 \times 10^5$	0·437	0·270
2-C	1·0	2·0	$3{\cdot}30 \times 10^5$	18·6	0·310	$1{\cdot}03 \times 10^5$	0·204	0·266
3-C	1·0	2·0	$7{\cdot}70 \times 10^5$	10·5	0·175	$1{\cdot}35 \times 10^5$	0·193	0·047
1-D	1·0	3·0	$1{\cdot}30 \times 10^6$	—	—	—	0·414	—
2-D	2·0	2·5	$1{\cdot}30 \times 10^6$	13·9	0·231	$3{\cdot}0 \times 10^5$	0·326	0·238
3-D	2·5	2·0	$3{\cdot}60 \times 10^6$	11·9	0·0795	$2{\cdot}86 \times 10^5$	0·368	0·364

A representative population density plot is shown in Fig. 2. Values of n°, B°, G and $G\tau$ were obtained from such plots. The calculated yield via the Coulter Counter *versus* experimental yield by filtration is shown in Table III. One can see that the majority of filtered yields were higher than the calculated yields. This was probably due to error in the sampling procedure or to some dissolving of the fine crystals in the IPA suspending medium.

Table III is a summary of experimental results from all runs. Data from this table were used in subsequent statistical analyses and kinetics correlations.

(to be continued)

Flowering of sugar cane in Egypt

By GEORGE ARCENEAUX,
(Director, International Research Service)

DURING the spring of 1962 a study was made by ARCENEAUX and KASSEM seeking information on factors responsible for difficulties encountered in attempting to induce sugar cane to arrow in Egypt. Investigations included extensive field observations in cane-growing areas of the country together with a study of climatic records and geographic locations in relation to factors known to be associated with flower induction.

Our essential conclusions published in 1963[1] were as follows:

(1) Low air humidity and the relatively low soil moisture maintained under the customary irrigation régime in Egypt combine to produce internal moisture stresses inhibiting flower induction in sugar cane plants.

(2) Temperatures during the period within the time when natural photo-conditions are conducive to flower-induction were found to be, in many cases, too high for optimum results.

(3) Locations such as Alexandria, above 31°N latitude, do not present a situation that is highly satisfactory for natural induction. The reason for this is not the absence of diurnal dark-light periods within the inductive range but rather the reduced number of natural exposures during a season. As distance from the Equator increases the actual number of diurnal photoperiod cycles within an effective range for flower induction becomes fewer and fewer. At the extremity in latitude where flower induction occurs, only the most free-blooming varieties will be induced to arrow.

RAO *et al.* have recently reported results of an experiment in which flowering was obtained with N:Co 310 and other varieties near Alexandria[2]. Actually this phenomenon is not unique nor even highly unusual in Egypt. Our article previously cited[1] included pictures taken near Armant on 25th March 1962, which showed heavy arrowing in N:Co 310 along fringes of fields bordering the Nile. This observation supports our conclusion that physiological stress due to low air humidity and deficiency in soil moisture is a major deterrent to arrowing of sugar cane under usual field conditions in Egypt. It was also considered probable that the tempering effect of the evaporation of nearby water brought ambient air temperatures to a range more favourable for flower induction.

From what we know of the situation in Egypt, it may be assumed that the change in internal moisture status of affected plants caused by periodic flooding in RAO's experiments was the essential factor involved in the effect on flower induction. Similar results were reported by ROHRIG *et al.*[3] and by YUSSUF[4] from intensive irrigation by flooding at frequencies ranging from daily to every three days.

The reported arrowing obtained near Alexandria is considered typical of what may be expected under conditions of natural induction at the latitude in a reasonably favourable environment. A limited range in forms that will flower must be expected. The extremely long blooming period of five months was probably due to cases of marginal induction with emergence delayed under the influence of sub-optimal temperatures. Spring induction may also be involved.

Disadvantages in attempting to conduct a comprehensive breeding programme under such conditions are obvious. This is not to condemn or even discourage a continuation of sugar cane breeding at Alexandria. Some useful combinations will no doubt be found possible among forms that will bloom there, but above all an activity such as this in the neighbourhood of a major university will afford an

[1] *Sugar Journal*, 1963, **25**, (9), 10–18, 33–36.
[2] *I.S.J.*, 1973, **75**, 241–244.
[3] *Proc. 10th Congr. ISSCT*, 1959, 794–801.
[4] *I.S.J.*, 1958, **60**, 219–221.

opportunity for students to get first-hand experience in the breeding of this important crop.

But we find nothing in results published, so far, that conflicts with our published diagnosis of the situation affecting the arrowing of sugar cane in Egypt, or to suggest a modification of our recommendations for development of a comprehensive programme of sugar cane breeding. Extending, as Egypt does, over a span of more than 7° of latitude it would be a mistake to concentrate the principal effort at the northern extremity where photo-period effect under natural conditions is at a minimum for induction of flowering in sugar cane. I must therefore emphatically repeat our recommendation of ten years ago that a site for major activities in sugar cane breeding should be sought near the *southern* extremity of the country.

The map of Egypt shows a peninsula approximately three miles wide extending southward from the approximate latitude 23° 40′ N into the newly formed Lake Nasser for a distance of approximately ten miles. A site near the southern extremity of this peninsula providing maximum exposure to effects of the nearby water would, in my opinion, be an excellent place for a sugar cane breeding station. The tempering effect of the water should place air temperatures within a relatively satisfactory range. In terms of Egyptian conditions, air humidity should be comparatively high. By resorting to frequent irrigation, and if necessary, some misting, it should be found possible, at that latitude, to induce blooming in a wide range of parental forms with flower emergence confined to the normal period of eight to nine weeks, thus providing essential conditions for a highly satisfactory breeding programme.

Correspondence

To the Editor,
The International Sugar Journal.

Dear Sir,

THE POTENTIAL OF A SCREW PRESS TANDEM[1]

I would appreciate the opportunity of replying to Dr. DOUWES DEKKER's notes[2] on my above paper. To make my position quite clear in regard to his first comment: I do not accept the concept of Brix-free water associated with fibre in cane and bagasse. It is true that all water cannot be expelled by mechanical means and, in my opinion, this is due entirely to the nature of the material. The statement that "the fact that fibre in cane and bagasse contains about 25% Brix-free water" is therefore not acceptable to me since this proposition has not been established as fact, in my opinion.

As regards the comment (2) concerning a lower juice:solids ratio, it is perfectly true that no data are available for the press, simply because no-one has tried it. It is thus impossible to prove or disprove superiority to a mill on this ground; however, better mixing is certainly obtained with the press. As to comment (3), the screw press is capable of giving lower moisture figures than a mill, as data from screw press operators have shown. However, factories employ systems of operation based on economic considerations rather than mechanical efficiency. It cannot be denied that increased throughput at the expense of extraction is the order of the day. Consequently, actual press figures should be compared with actual and not potential mill data; Dr. DOUWES DEKKER's last sentence does not carry the same weight as would otherwise obtain.

The calculations under comment (4) are in order where the two bases are compared; even with provision for the Brix-free water concept, an efficiency of the order of 80% results, which is considerably higher than that obtained in a normal milling tandem. Why Dr. DOUWES DEKKER, in his calculations, chooses to suppose that "had, for example, the actual concentration of the press juice been 3·50°Bx", however, is not clear; the Brix of the press juice given in the example from analytical data was 4·83 and no other, so I do not see why something that was not the case should be assumed.

In conclusion (b) of this comment, the point is raised whether one might expect identical mixing efficiencies for a second screw press in a tandem and more particularly for the first, working on prepared cane. Again, there are no factual data on this point simply because no effort has been made to collect such information in these early days of press usage in the cane sugar industry. This is unfortunate but, in view of the fact that screw conveyors are used between mill and screw press, where water is added, there appears to be little doubt that the mixing efficiencies will be of a consistently high order.

Though the presence of unopened cells in the bagasse and the further possibility of the presence of air bubbles will assuredly affect mixing efficiencies, as mentioned in comment (5), it does not necessarily follow that, owing to an increase in the number of ruptured cells as milling proceeds, the mixing efficiency will increase. This will depend entirely on whether the added water can penetrate to these ruptured cells and is not prevented from diluting the contents by the air bubbles. Surely some analytical evidence must be available on this point.

The question of mixing raised in comment (6) has been discussed above. However, Dr. DOUWES DEKKER is apparently thinking in terms of milling

[1] *I.S.J.*, 1973, **75**, 371–375.
[2] *ibid.*, 1974, **76**, 12–13.

operations; there is no question of further absorption of liquid with freshly prepared cane and the use of imbibition at this juncture is merely to act as a washing fluid for the richer juice contained in the cane and so to obtain a higher extraction at this point. The screw press, unlike a mill, will readily accept much larger quantities of water in the feed without causing loss by excessive squirting and possibly excessive slip as with a mill. If one thinks in terms of milling and tries to employ the same reasoning to a totally different type of equipment, the answer invariably is distorted.

As Dr. DOUWES DEKKER notes in comment (7), it is perfectly true that factual information on the use of a press tandem is not available. My paper was intended to try to make prospective factory owners pause to think as to which method of extraction he will employ. Its factual information was derived from the observed operation of screw presses and the analytical data have been obtained from private sources and refer to a single factory. The operation of this particular press shows a Brix extraction of 37·25%; will the last mill of a 4 or 5-mill tandem give a figure of this magnitude—will it give a figure even half this value?

In my estimation, sufficient information is available from screw press operation at the lower end of the extraction process where, under normal conditions of milling, extraction falls away very rapidly. By introducing a screw press at the discharge end of an existing milling tandem, extraction levels have been considerably improved. Is this not sufficient reason to assume that higher extractions could be obtained at the easier end of the tandem? I am of the opinion that the evidence is sufficiently strong to warrant serious consideration.

As to Dr. DOUWES DEKKER's last paragraph, it appears that he has not appreciated what I wished to convey in the article. The installation of a fourth press together with a by-pass device could be envisaged as a comparatively easy and prudent means of retaining the high extraction of a three-press tandem in the event of one press breaking down. It was never intended to convey the impression that the press was unreliable any more than one would suggest that mills do not suffer breakdowns. The only difference is that, if one mill breaks down the whole tandem stops—a mischance which can be avoided with a press tandem.

Yours faithfully,

S. G. SMART.

Physical chemistry of phosphatation and carbonatation

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Paper presented to the 1972 Technical Session on Cane Sugar Refining Research New Orleans, La., USA

INTRODUCTION

LIQUOR defecation is essentially a pretreatment for the decolorization stage of sugar refining and the choice of defecation process should ideally be matched with the requirement of the decolorization adsorbent.

In general, the use of a porous granular adsorbent for liquor decolorization should impose a mechanical limitation on the particle size of impurities which escape defecation. There should be no restriction of liquor flow through the adsorbent bed caused by blockage of inter-granular spaces. The particle diameter here would probably be in excess of 10 nm.

With any adsorbent, including powdered vegetable carbon and ion exchange decolorizing resins, there should be no restriction of molecular diffusion within the adsorbent particle caused by pore blockage. Knowledge of the pore structure in the adsorbent particle might, therefore, allow some specification of a standard for the defecation treatment but, unfortunately, only limited data are available. In bone char, for example, it has been calculated[1] that most of the available surface lies in pores of 0·02 μm diameter, but this would set a quite unattainable limit for any simple defecation process. Electron micrographs of char particles show the main channels within each granule to be around 0·2 μm in diameter and this seems to be a much more realistic limit for impurity particle size.

The chemical requirements of the adsorbent are even more obscure and in many cases must be overridden by other considerations. For example, the pH

[1] BARRETT, JOYNER and HALENDA: *Ind. Eng. Chem.*, 1952, **44**, 1827.

The Tongaat 5 Shredder

Introduced.....

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3. **DESIGNED** by SUGAR Factory operators.
4. **ROBUSTNESS** of Construction and simplicity of design.
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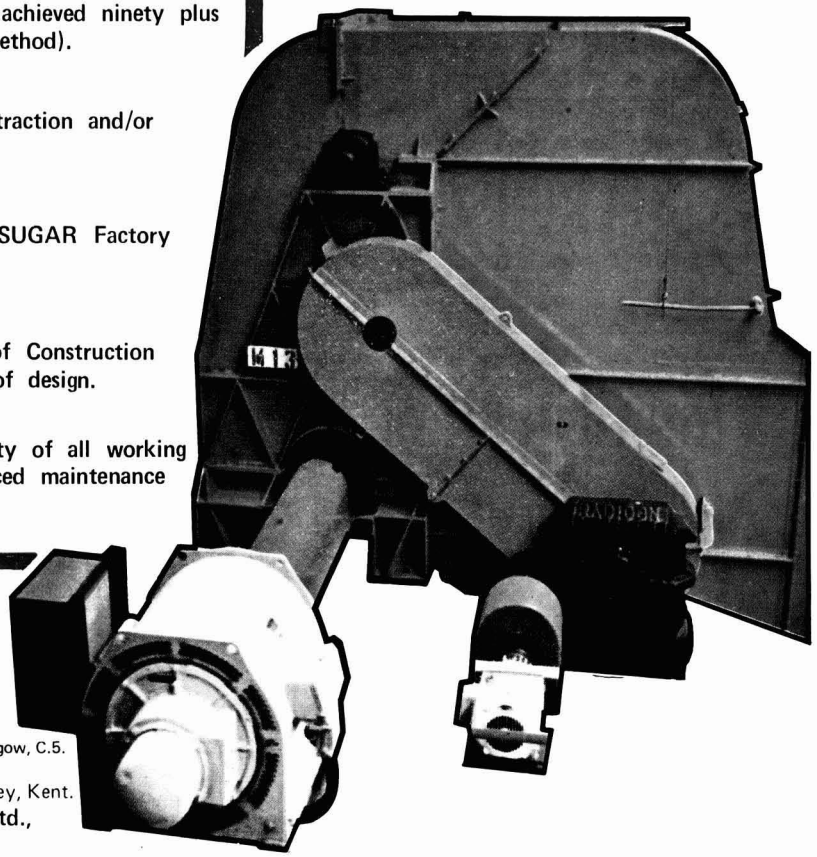

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at which activated carbon surfaces generally show the greatest adsorptive capacity for anionic adsorbate lies well below the minimum value which might be tolerated on the basis of invert formation. Only in the case of bone char and ion exchange decolorizing resin has there been any indication of adsorbent sensitivity to the chemical composition of the liquor. In both cases, the sensitivity arises through the relation between electrical properties of the adsorbent surface and the ionic composition of the liquor[2,3].

In seeking to define the purpose of a liquor defecation process, it must be concluded that there are few known criteria which can usefully be applied in the assessment of defecated liquor quality. Some attention has, therefore, been given in this paper to the measurable functions of the three most commonly employed defecation treatments: filtration through kieselguhr, phosphatation and carbonatation. The size limitations mentioned above focus attention sharply on the filtration aspects of each process and an attempt has been made to distinguish between mechanical and chemical removal of impurity.

Experimental

Membrane Filters

Most work was carried out using Millipore membranes of pore size ranging from $8 \pm 1{\cdot}4$ μm down to 50 ± 3 nm in eleven steps. For the smallest pore diameters, Membranfiltergesellschaft ultra-filters of 5–10 and < 5 nm pore size were used. Liquors were filtered at 50°Bx under pressures ranging from 0 to 60 p.s.i.g.

Liquor Appearance

Liquor colours were measured in 1-cm cells using the "Talameter" sugar colorimeter; 50–60°Bx liquors were adjusted to pH 7·5 and attenuation measured at 420 nm. Results are expressed as the attenuation index a^*_{420} at a solids concentration of 1 g.cm^{-3}.

Turbidity was measured in 1-cm cells using a Unicam SP 600 spectrophotometer; 50–60°Bx liquors were buffered at pH 3·5 by addition of a little glacial acetic acid (5 drops/10 ml liquor), so that traces of inorganic precipitate (e.g. calcium carbonate or calcium phosphate) could not interfere with the measurement. The attenuation was measured at 900 nm wavelength and results are expressed as the attenuation index a^*_{900} calculated at a solids concentration of 1 g.cm^{-3}. The a^*_{900} value was taken to give an indication of turbidity, optical clarity to the naked eye being found at $a^*_{900} = 0$.

Constituent Analysis

As an indication of the total content of colloidal material, together with its associated inorganic components, the concentration of material precipitated in 75% ethanol at pH 3·5 (acetic acid buffer) was determined. The precipitate was separated in a centrifuge, washed with 75% ethanol and absolute alcohol, and finally dried under vacuum over P_2O_5. The weight of precipitate is recorded as the total alcohol precipitate (TAP mg/100 g solids). It is believed that this material will include all impurities in the original liquor which are either present as, or capable of entering, the colloidal state.

Starch was determined by a modification of Alexander's method[4] and protein by the micro-Kjeldahl technique on the weighed total alcohol precipitate. Results are expressed as mg/100 g solids. Silica was determined by Alexander's molybdenum blue method[5], and expressed in the same units.

Total anions and cations were determined using the ion exchange resins IRA 401 and IRC 120 respectively, chloride ions being determined using an EEL chloride meter and hydrogen ions by titration with NaOH. Results are expressed in μeq/g solids.

Sulphate was determined turbidimetrically as $BaSO_4$ and phosphate by the molybdenum blue method using 1,2,4-amino-naphthol sulphonic acid as the reducing agent. ($Ca^{++} + Mg^{++}$) was determined by EDTA titration. Carbonatation and phosphatation techniques are described more appropriately in the relevant sections below.

Much of the experimental work reported here was carried out by Mrs. F. J. Gardiner. The carbonatation experiments were carried out by S. D. Gardiner.

Defecation by Filtration

It is widely appreciated that laboratory filtration tests are often empirical in nature and that the results of filtrate analysis are highly dependent on the way in which the filtration is carried out. The most serious complications arise through:

(1) progressive blinding of the filter medium which has the effect of progressively reducing the porosity of the medium;

(2) the difference between laboratory tests in which the liquor is passed through a fixed bed of filter medium and the industrial practice in which fresh filter aid is added continuously to the filter supply liquor.

Accepting the limitations of the particular technique adopted, it is reasonable to assume, however, that the known porosity of a clean filter medium sets an upper limit to the particle size of impurities which may pass through it. Provided no attempt is made to give significance to small changes, the results can at least be used as a basis for comparison against other defecation treatments.

Successive membrane filtration

In this series, two types of liquor were used, Liquor A being of high colour and turbidity while Liquor B was of low colour and turbidity. A sample of each of the two washed raw liquors at 50°Bx was passed at room temperature through a set of mem-

[2] *Tech. Rpt. Bone Char Research Project*, 1962, (69), 4.
[3] Abram and Bennett: Unpublished Tate & Lyle Research Reports.
[4] *Proc. 28th Ann Congr. South African Sugar Tech. Assoc.*, 1954, 100–104.
[5] *Proc. 31st Ann. Congr. S. African Sugar Tech. Assoc.*, 1957, 68–75.

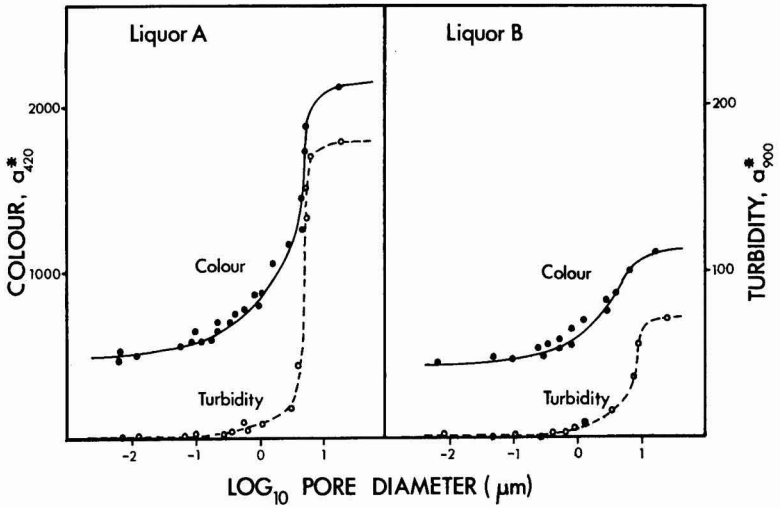

Fig. 1. Colour and turbidity after membrane filtration of liquors A and B

brane filters of decreasing porosity, the filtrate from one filtration being passed through the next lower porosity membrane. Care was taken to ensure that filtrate was only collected during the period of effectively constant flow of filtrate. With the membranes of lowest porosity, the filtration sometimes took over 20 hr.

Samples of filtrate were withdrawn at each stage for colour and turbidity determination and the results are shown as function of membrane pore diameter in Fig. 1.

Both liquors show a similar pattern as follows:

(1) Turbidity decreases to zero in the range 1–10μm.

(2) Over the range 0·1–10μm, colour is extremely sensitive to the filter porosity. This highlights the inherent dangers in quoting a washed raw liquor colour without reference to details of the sample preparation.

(3) Colour tends to a plateau value over the range 0·01–1μm. This presumably indicates the range of filter porosity which should be used for washed raw liquor colour determinations. Practical considerations require that the filtration should take only a few minutes and a satisfactory compromise may be reached using filters of pore diameter around 0·5 μm.

Filtration through filter cakes

In this series, a more complete analysis was made of filtrates through filter cakes of kieselguhr and a coarse precipitated chalk. The first runnings of filtrate were discarded to minimize the possible effects of adsorption of impurity by the filter cake. The kieselguhr chosen was Dicalite "Speedflow" with an apparent pore leakage diameter of 0·5 μm, a grade commonly used for the polish filtration of phosphatation-clarified liquors. The kieselguhr was deposited as a cake comprising 50 mg.cm^{-2} of filter surface on two Whatman No. 42 papers. The volume of filtrate collected was equivalent to a filter aid use of 0·25% on solids.

The coarse precipitated chalk was Waterworks Chalk Grade 311, which gives liquor filtrability characteristics similar to those of normal liquor carbonatation precipitates. It was deposited as a cake comprising 300 mg.cm^{-2} of filter surface on two Whatman No. 42 papers. The volume of filtrate collected was equivalent to a carbonatation level of 1·0% CaO on solids. Filtrate analyses are given in Table I and, for Liquor B, the two filter cake results are compared with those for the filtrate through a Millipore membrane of pore diameter 0·22 μm.

The results are as expected and show the coarse chalk to be of considerably higher leakage porosity than the kieselguhr. Reference to Fig. 1 shows that the colour passing through the chalk cake was equivalent to that passing through a membrane of pore diameter in the range 3–5μm, while the colour passing through the kieselguhr cake was equivalent to that passing a membrane of pore diameter in the range 1–2μm. The removal of "colloidal" impurity from the two liquor types is in accordance with this difference, the kieselguhr giving better defecation than the chalk with respect to TAP, starch and protein. A further improvement in defecation is achieved when the effective pore diameter is decreased to 0·22μm by using a membrane filter and it will be shown later that, with the exception of colour, the analysis now approaches that yielded on phosphatation.

The ion balance results reveal the extraordinarily low quantity of ash constituents associated with the suspended or colloidal organic impurity.

Table I. Defecation by filtration through chalk and kieselguhr

	Liquor A			*Liquor B*			
Constituent	*Original*	*Chalk*	*Kieselguhr*	*Original*	*Chalk*	*Kieselguhr*	*Membrane*
Colour (a^*_{420})	2170	1420	964	1120	722	660	600
Turbidity (a^*_{900} at pH 3·5)	179	51	12	70	6	5	1
TAP (mg/100g)	200	185	146	151	81	71	67
Starch (,,)	38	31	21	4	4	3	1
Protein (,,)	11	7	5	7	4	3	3
Total anions (μeq/g)	19·4	18·4	18·2	16·6	16·4	16·4	15·9
SO_4^{--} ,,	8·6	8·2	8·7	7·8	7·7	7·8	7·8
PO_4^{---} ,,	2·5	1·2	1·2	0·8	0·5	0·5	0
Cl^- ,,	1·9	1·8	1·8	1·6	1·8	1·6	1·7
$Ca^{++} + Mg^{++}$,,	14·2	13·4	12·0	9·8	10·8	9·3	9·3
$Na^+ + K^+$,,	5·2	5·0	6·2	6·8	5·6	7·1	6·6

Chalk: Waterworks Grade 311 at 1·0% on solids
Kieselguhr: Dicalite "Speedflow" at 0·25% on solids
Membrane: Millipore 0·22 μm

Defecation by Chemical Methods

Carbonatation

The sensitivity of impurity removal to filter pore size suggested that, in order to study the chemical effects of carbonatation, it would be necessary to adjust each carbonatated liquor to the same filtrability by the addition of inert filter aid. Data for one particular liquor, Liquor C, were already available in the laboratory concerning the relative quantities of carbonatation precipitate and Waterworks 311 Chalk required to give constant filtrability, and it was convenient to make up these mixtures for filtrate analysis. Liquor carbonatation was carried out by the standard constant condition laboratory procedure, details of which have been published elsewhere[6]. It has been shown that this technique yields a carbonatation precipitate very similar to that which is achieved in standard refinery carbonatation practice, and the specific filtration resistance, $\bar{r}$, lies between 10^9 and 10^{11} cm.g^{-1}. The constant conditions were pH 8·0, 75°C, 65°Bx and 1 hr retention time. Waterworks 311 Chalk filter aid was added after carbonatation. The lime addition was varied over the range 0–1·6% CaO on solids and the changes in filtrate analysis with CaO% are shown in Fig. 2.

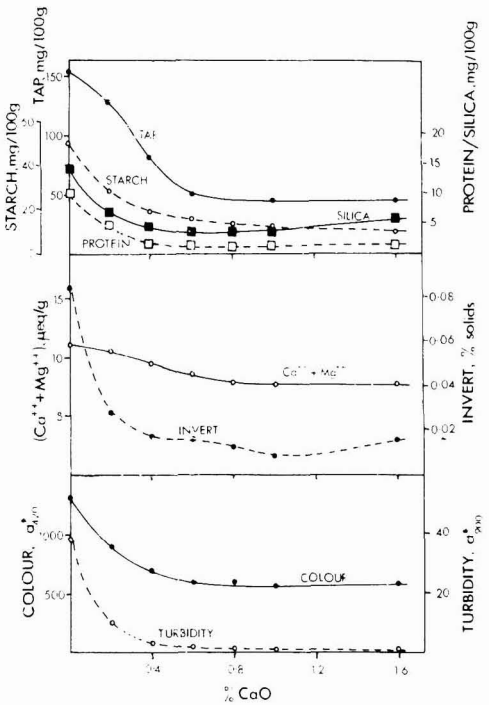

Fig. 2. Defecation by carbonatation of liquor C

It is seen that the curves for organic impurities have roughly the same form and that most of the defecation is achieved over the range 0–0·5% CaO. Without the addition of Waterworks Chalk 311 Filter Aid, optimum filtrability is found in Liquor C at 1·2% CaO and it is clear that most of the additional lime required to reach optimum filtrability serves only to grow large precipitated $CaCO_3$ conglomerates.

In order to examine further the effect of calcium carbonate precipitation, the above experiment was repeated using a carbonatation technique which produces the smallest precipitated $CaCO_3$ particle size and, hence, yields the lowest filtrabilities.

The method is the simple batch carbonatation system, whereby the CO_2 is bubbled through a beaker containing pre-limed liquor at the required level of % CaO on solids.The method has been described and the reasons for the difference in characteristics of the chalk precipitate have been discussed in detail elsewhere[7]. The nominal conditions for the precipitation reaction were the same as before, that is, final pH 8·0, temperature 75°C, 65°Bx and 1 hr total saturation time. The specific filtration resistance of carbonatation precipitates produced in this way can be 100 times

[6] Bennett and Gardiner: *I.S.J.*, 1968, **70**, 135–137, 173–175.
[7] *idem ibid.*, 1967, **69**, 198–202.

greater than that of the normal carbonatation process and large quantities of filter aid (Waterworks 311 Chalk) are necessary to separate any filtrate.

Batch carbonatations of Liquor C were carried out over the range 0–1·2% CaO on solids and the filtrates analysed as before. Impurity concentration curves were found to be very similar to those shown in Fig. 2 for the normal carbonatation procedure and in Table II below (last column) are listed the analyses for 0·5% CaO. The results are compared with those obtained by the normal carbonatation procedure at the same lime level (taken from Fig. 2) and analyses are also given for simple filtration of the original liquor through a filter cake of Waterworks 311 Chalk added at the level of 0·5% CaO on solids in the absence of any further carbonatation using lime and CO_2.

Table II. Defecation of liquor C by $CaCO_3$ systems

Constituent	*Original*	*Filtration through inert chalk*	*Carbonatation at 0·5% CaO*	
			Continuous	*Batch*
Colour (a^*_{420})	2480	1270	640	620
Turbidity (a^*_{900})	312	37	1	1
TAP (mg/100g)	280	156	48	42
Starch ,,	78	51	14	10
Protein ,,	18	11	2·8	3·1
SiO_2 ,,	15	11	6	6
$Ca^{++} + Mg^{++}$ (μeq/g)	12·4	11·0	8·6	9·0
SO_4^{--} (μeq/g)	8·2	8·1	1·5	1·5

The results in Table II allow a direct comparison of physical and chemical methods of defecation based on calcium carbonate. The chemical methods are outstanding and it is seen that there are relatively small differences between the two types of precipitation reaction.

The specific filtration resistance ($\bar{r}$) of the batch carbonatation precipitate is of the order of 100 times greater than that of the constant-condition carbonatation precipitate and, hence, according to the KOZENY-CARMEN equation, the specific surface might be expected to be 10 times greater. This is an important consideration, since it leads to the conclusion that the extent of defecation in carbonatation is not particularly sensitive to the surface area of precipitated $CaCO_3$. Thus it is unlikely that a simple adsorptive process can be involved, but rather that the defecation effect concerns the incorporation of impurity within a growing crystal of $CaCO_3$ by chemical co-precipitation.

In support of this view, crystallographic examination of carbonatation precipitate particles reveals extensive distortion of the normal calcite form and the X-ray diffraction pattern is displaced from that found with pure calcite. Furthermore, experiments to follow the desorption of a particular impurity, for

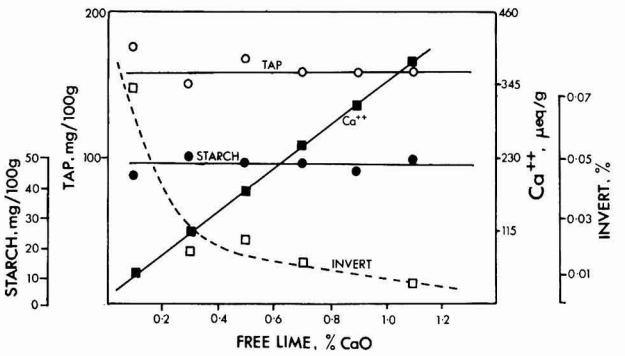

Fig. 3. The effect of lime on liquor C

example SO_4^{--}, show that the total quantity of impurity present within the carbonatation precipitate is only released when the solid phase has been completely dissolved in dilute acid.

In order to examine the possibility that some precipitation of impurity occurs merely on addition of lime, the above experiments were repeated without saturation by CO_2. Samples of Liquor C were limed over the range 0–1·2% CaO, heated for 1 hour at 75°C and then filtered with an addition of Waterworks 311 Chalk.

The filtrate analyses in Fig. 3 provide no evidence for the precipitation of impurity by lime and, therefore, support the view that chemical inclusion of impurity within the growing calcium carbonate crystal is the essential mechanism of defecation by carbonatation.

The destruction of invert seen in Figs. 2 and 3 is a well known feature of the carbonatation process and is a direct consequence of prolonged contact between liquor and lime at high temperature. The rate of destruction of invert is, of course, quite sensitive to temperature and time of contact.

(to be continued)

New sugar loading facilities in Mozambique[1].—New loading facilities are to be erected at the port of Beira, in Portuguese East Africa. They will be used for sugar exports by the three sugar producing companies of the area, Sena Sugar Estates Ltd., Açucareira de Moçambique S.A.R.L. and Companhia do Buzi S.A.R.L., which together produce about 270,000 tons per year. By 1978 it is intended to increase this quantity to 630,000 tons and, when the new factory at Dingue-Dingue is in operation, a further 200,000 tons can be expected.

* * *

New Iran sugar project.—The Government of Iran has commissioned the Iranian Agronomics Co. Ltd. to establish a sugar cane plantation, a sugar factory and refinery. The project, which will require an investment of 100 million dollars, should be completed in five years. The Iranian Agronomics Co. Ltd. is a subsidiary of Hawaiian Agronomics Co., the consultancy organization of C. Brewer & Co. Ltd.

[1] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (31), 7.
[2] *Zucker*, 1973, **26**, 636.

Sugar cane agriculture

Poisoned rat baits up sugar yield. ANON. *Sugar News* (Philippines), 1972, **48,** 501, 488.—Use of poisoned baits reduced damage by more than 50%, i.e. from 30–50 damaged stalks per hectare to 13–27, with a consequent increase in sugar recovery of 6·2 piculs (868 lb) per hectare.

* * *

From field to factory—a look at Cuba. ANON. *Sugar y Azúcar*, 1972, **67,** (12), 25.—A hindrance to success in cane field operation in Cuba has been the lack of skilled field technicians, and steps taken to improve the situation are described as is the expansion of mechanical harvesting in Cuba.

* * *

Mechanical harvesting—the new challenge. G. S. BARTLETT. *The Condenser*, January 1973, 16–17. Mechanization is going to be needed in South Africa and the benefit will be gained of experience in other countries where it has been adopted for many years. However, the steep and broken terrain in Natal and Zululand present great problems since field layout and conservation structures, the transport road system, trash blanketing, etc. present great difficulties. These are analysed, and it is noted that studies to overcome them are under way on a 60-acre pilot scheme operated by the Tongaat Group.

* * *

Field layout. ANON. *The Condenser*, January 1973, 18–21.—Illustrations show application of new techniques designed to make fields more amenable to mechanization; these include precise grading, establishment of new drainage lines and roads, etc.

* * *

Fresh cane—fresh profits. G. CARTER. *The Condenser*, January 1973, 22–23.—Progress in improving cane transport scheduling to ensure minimum delay between cutting and milling is reported. From about 78 hours in 1971 there has been a reduction to 61 hours in 1972 and the target is 51 hours. Reduction to an overall delay of less than 24 hours is desirable but could only be achieved by adoption of a completely different cane handling system.

* * *

Comparative study of four cane varieties in three harvesting cycles. M. DE ARMAS and F. REYES. *ATAC*, 1972, **31,** (5/6), 46–50.—The cane varieties were grown and harvested at 12, 16–18 and 24 months, respectively, yielding 4, 3 and 2 harvests in the same overall time. The crop data obtained—cane yield per hectare, sugar % cane and sugar yield per hectare—were recorded for the four varieties using a fifth as the control, and are given in tables. It was found that the 12-month cycle gave the best results both in terms of cane and sugar per hectare.

* * *

Combating "cigarrhinas". P. GUAGLIUMI. *Brasil Açuc.*, 1972, **80,** 606–614.—A report is presented on the author's work during April–October 1972 on control of the froghopper *Mahanarva posticata* Stal. The use of the entomogenous fungus *Metarrhizium anisopliae* has passed from the experimental to practical application and is giving positive results in large areas of cane. Control is now on two bases: application of the fungus above, and use of the egg parasite *Acmopolynema hervali.*

* * *

Field drainage and farm design. A. I. LINEDALE. *Cane Growers' Quarterly Bull.*, 1973, **36,** 76–78.—The application of different types of drainage system for different topographies is explained and examples illustrated.

* * *

The BSES system of farm management accounting. R. J. HAMPSON. *Cane Growers' Quarterly Bull.*, 1973, **36,** 79–85.—The BSES (Bureau of Sugar Experiment Stations) system of accounting has been developed to provide a practical farm management accounts system for the Queensland sugar industry. A computer processes records kept by the grower and produces from them a series of management reports providing performance and financial information. The system is explained and documentation illustrated.

* * *

Q 90 changes the Mulgrave variety picture. E. F. COPLEY. *Cane Growers' Quarterly Bull.*, 1973, **36,** 86–88.—This new variety is rapidly becoming popular in the Gordonvale district and since its introduction in 1970 reached about 30% of the crop harvested in 1972. It appears to have high sugar content throughout the whole crushing season but is inclined to lodge. It is capable of producing more than 50 tons of cane per acre, with excellent ratoons on poorer soils. It is susceptible to damage by funnel rats and also to mosaic, red rot and ratoon stunting disease, and is moderately susceptible to top rot.

* * *

From seed cane to approved variety—the work of many. E. A. PEMBROKE. *Cane Growers' Quarterly Bull.*, 1973, **36,** 93–94.—A period of 12 years elapses

between cross-pollination of two varieties at the cane breeding station at Meringa and the release of a resultant new variety to growers in a mill area. The interval is necessary for assessment and re-assessment, disease testing and examination on various soil types and in different climatic conditions. This provides a great deal of information on the variety before it is released, and even afterwards there may be resistance to its adoption as a result of particular characteristics; however, growers are not reluctant to change their techniques to suit a new cane.

* * *

Animal pests of the Herbert River district. J. G. POWELL. *Cane Growers' Quarterly Bull.*, 1973, **36,** 95–96.—The principal animal pests in this area are ground rats (*Rattus conatus*) and climbing rats (*Melomys litterolis*), wild pigs, wallabies and the striped phalanger or possum (*Dactylopsila picta*). The last two are officially protected, but control measures for the others are discussed.

* * *

The rise and fall of Burdekin water levels. C. A. REHBEIN. *Cane Growers' Quarterly Bull.*, 1973, **36,** 97–99.—Underground water was discovered in the region over 50 years ago and is used for cane irrigation purposes as it is less costly than surface water from the Burdekin River. Water levels at the Experiment Station borehole have been recorded since 1964 and changes have been noted and related to climatic phenomena.

* * *

Do you get uneven fertilizer distribution? L. G. W. TILLEY. *Cane Growers' Quarterly Bull.*, 1973, **36,** 99.—A photograph illustrates the uneven cane growth which can develop where fertilizer is deposited in heaps along the row instead of uniformly. A method of modifying the distributor to overcome the fault is indicated.

* * *

Changes in Fiji disease control measures for Bundaberg. B. T. EGAN. *Cane Growers' Quarterly Bull.*, 1973, **36,** 100–101.—Measures to be adopted are described. (See also *I.S.J.*, 1974, **76,** 18.)

* * *

Successful stabilization of an eroded gully. J. WRIGHT. *Cane Growers' Quarterly Bull.*, 1973, **36,** 101.—Vegetation around a 6–8 ft deep gully on a cane farm was cut and heaped into it together with an acre of drought-stricken cane. The vegetation held position and trapped soil carried down by run-off water which drained down the gully. All cane tops have subsequently been used for filling; from the start of the stabilization programme in 1969 the gully is now almost filled.

* * *

Minor ailments of cane in the Herbert River district. J. A. CURRIE. *Cane Growers' Quarterly Bull.*, 1973, **36,** 102–103.—In addition to the major diseases of the area (leaf scald and ratoon stunting disease), there is some incidence of pokkah boeng and banded chlorosis. Some cane damage occurs as a result of susceptibility to weed control herbicides.

* * *

Keep those headlands clean. J. F. REIMERS. *Cane Growers' Quarterly Bull.*, 1973, **36,** 104.—Grass growing on headlands, necessary for the turning of mechanical equipment, may act as host for diseases affecting cane and for pests. In addition the grass itself may be a nuisance because of the spreading of seed to the cane field, requiring expensive eradication, and also as a fire risk in dry weather.

* * *

Wind can be expensive. P. R. DOWNS. *Cane Growers' Quarterly Bull.*, 1973, **36,** 105–106.—Wind erosion of soil is discussed and methods to prevent it are listed.

* * *

Cane ripener tested extensively. ANON. *Australian Sugar J.*, 1972, **64,** 432.—A glyphosine ripener for cane, marketed by Monsanto Company under the name "Polaris", has undergone 3 years of testing by the HSPA and is to be distributed in limited quantities to Hawaiian plantations. Experimental trials are to continue in Florida, Louisiana, Puerto Rico and other Caribbean and South American sugar-producing areas.

* * *

"Multilift" cane transporter. L. G. VALLANCE. *Australian Sugar J.*, 1972, **64,** 433–437.—Photographs show a "Multilift" unit in operation. Made by Freighter Industries Ltd., the equipment is used for loading filled 20-ton cane containers from a gravelled dump site onto the unit's trailer section. The containers are deposited by tipping and lifting the end of the container when the trailer withdraws from below it.

* * *

Auxiliary infield transport at Broadwater. L. G. VALLANCE. *Australian Sugar J.*, 1972, **64,** 438–440. A "Bombadier" muskeg carrier has been adapted for use by a cane farmer for operation in very wet conditions where it shows exceptionally good flotation and can be used to transport bins for cane cut by a half-track Toft "Robot" harvester.

* * *

Diseases of sugar cane. ANON. *Producers' Rev.*, 1972, **62,** (12), 13–15.—Two diseases affecting cane in Australia are discussed, namely red stripe or top rot (two manifestations of the same bacterial disease) and a fungal disease, yellow spot.

* * *

New cane varieties in New South Wales. ANON. *Producers' Rev.*, 1972, **62,** (12), 21.—Three new varieties in the State are Hera (or MQ 52-38), a seedling from Macknade cane breeding station, B 52405, a variety bred in Barbados, and H 49-104, a Hawaiian variety introduced in the 1950's. Although raised 20 or more years ago, they have not been used commercially until the need arose to find cane more resistant to Fiji disease than the standard varieties.

Occurrence of thrips on sugar cane in epidemic form in U.P. N. L. SINGH, B. N. PANDEY, R. DAYAL and S. R. SINGH. *Sugar News* (India), 1972, **4,** (8), 7–8. Thrips have been reported from other areas of India but the U.P. had been free of them until a heavy incidence was reported from Bareilly district in August/September 1972. A description of the pest and the damage it causes are given and drought considered to be the factor responsible for its spread from paddy crops. Up to 80% infestation was observed in the cane fields; however, the onset of heavy rain cleared it and no chemical control measures needed to be developed.

* * *

Relative maturity of sugar cane varieties grown in Louisiana. B. L. LEGENDRE. *Sugar Bull.*, 1972, **51,** (3) 6–9, 12.—Analyses of juice from different cane varieties were made during the harvesting season and the data tabulated. The relative changes indicate the state of maturity at different times and permit classification of the varieties into early, mid-season and late maturing groups.

* * *

Higher sugar cane yields through higher populations. R. J. MATHERNE. *Sugar Bull.*, 1972, **51,** (5), 8–14. Experiments over six crops with higher seed cane rates showed that competition between plants in the same row reduced stalk population to the same level as obtained with the normal planting rate and thus did not increase cane yield. Using two drills increased population and maintained it at the higher level, but the yield increase was insignificant. By decreasing row width from the standard 6 ft, however, there were consistent large yield increases with 3- and 3½-ft rows, e.g. 50·65 and 44·16 tons/acre compared with 32·47 tons/acre with a 6-ft row. Use of such narrow rows should be considered as a means of raising cane yields in Louisiana.

* * *

Residue builds cane soils. D. KLEINPETER. *Sugar Bull.*, 1972, **51,** (6), 6.—The use of cover crops such as soybeans and the ploughing-in of cane tops and leaves is becoming more widely appreciated in parts of Louisiana as a means of soil conservation.

* * *

Ecological relationships of *Pythium* species in the rhizosphere of sugar cane and possible significance in yield decline. C. ADAIR. *Hawaiian Planters' Record,* 1972, **58,** (17), 213–240.—Studies were made on the soil microflora in two localities and the root damage suffered by two cane varieties, H 37-1933 and H 50-7209. The higher population of *P. graminicola* and the greater damage from root rot of H 37-1933 in one soil than the other indicate that the fungus is the cause of poor growth of the variety. In the second soil the relative populations of *Pythium* species and antagonists were different, and growth of H 37-1933 was normal as occurred when the first soil was treated with "Dexon", a specifically pythiaceous fungicide. The H 50-7209 cane did not suffer the same amount of damage and this might be due to a different effect on the soil micro-flora or to a component in the *P. graminicola* to which the H 37-1933 is peculiarly sensitive.

* * *

Age of harvest—a historical review. K. K. MAY and F. H. MIDDLETON. *Hawaiian Planters' Record,* 1972, **58,** (18), 241–263.—Studies extending from 1910 to 1972 to determine the optimum age of harvest for sugar cane in Hawaii are surveyed. It is concluded that there is no fixed or even general time at which all cane can be harvested; the optimum varies widely even in the same area or field and can be from 12 to over 36 months, depending e.g. on latitude and climate. The harvesting date for individual areas can be set on the basis of historical studies or on sampling and analysis to determine ripeness and profitability; where peak income is given during a limited period, the time of harvesting is indicated by these periods, while other canes and areas will have much flatter net income curves where harvest data can be varied for convenience without a significant change in income.

* * *

Volume balance analysis to determine water infiltration and efficiency in Hawaiian sugar cane furrows. C. M. VAZIRI and I. P. WU. *Hawaiian Planters' Record,* 1972, **58,** (20), 283–292.—A mathematical model has been developed to show the infiltration pattern after irrigation and a balance analysis made by determining water flow at the inlet, outlet and several intermediate sections of a cane furrow. From this and data collected in many previous studies, the values can be provided for parameters in the mathematical model which allows determination of the most efficient irrigation scheduling.

* * *

Chopper cane harvester on view at Malelane. ANON. *S. African Sugar J.*, 1973, **57,** 61–65.—An illustrated account is given of a demonstration of its harvesting ability by the importers of a Toft CH364 "Robot" Mark II harvester in cane fields at Transvaalse Suikerkorporasie Bpk., Malelane.

* * *

Grassy shoot disease of sugar cane. IV. Association of mycoplasma-like bodies. M. K. CORBETT, S. R. MISRA and K. SINGH. *Plant Science*, 1971, **3,** 80–82. Tetracycline hydrochloride at 250 ppm used for immersion of 2-bud setts, under negative pressure, was found to suppress symptoms of grassy shoot disease. This function of an antibiotic indicates that the cause of the disease is not a virus, as had been suggested, and electron micrography has shown the presence in the phloem cells of mycoplasma-like bodies which may be associated with the disease.

* * *

Problems of sugar recovery and higher production in Maharashtra. S. B. KUTE. *Sugar News* (India), 1973, **4,** (9), 4–6.—Recommended measures to check the

fall in sugar recovery in Maharashtra are discussed under cane varieties, cultivation, fertilization, protection against disease and pests, etc.

* * *

Soils of the sugar industry. ANON. *Bull. Expt. Sta. S. African Sugar Assoc.*, 1973, (19), 41 pp.—After a brief guide on how to identify soils, a number of maps are reproduced showing the soil systems of the South African and Swaziland cane areas. A key is given to the soils, after which follows a series of illustrated descriptions of soil forms, with their identifications, physical and chemical properties, extent of risk of nematode occurrence in them, soil system and series, parent material, salinity, erosion and wetness hazards, texture, depth to rock, whether lime is present or not, etc. Descriptions are then given of the soil systems followed by an alphabetically arranged index/glossary.

* * *

Cane variety programme for Lower Rio Grande Valley. W. R. COWLEY and K. A. SUND. *Sugar J.*, 1973, **35,** (9), 25–27.—The varieties being grown for processing in the new Texas sugar factory are given as: N:Co 310 (covering 30% of the cane area), CP 52-68 (24%), CP 61-37 (14%), L 62-96 (12%), CP 44-101 (10%), L 60-25 (6%) and CP 55-30 (3%). Average juice analyses and sugar yields are tabulated for each. Information is given on planting methods being adopted in the area, and warning is given on various specific problems facing cane growers.

* * *

Field operations planned for Rio Grande sugar industry. J. NELSON. *Sugar J.*, 1973, **35,** (9), 31–33.—Cane agricultural techniques in the Rio Grande Valley of Texas are described and information given on field harvesting trials carried out with M-F 201, "Cameco" and J & L "Bluebird" harvesters. The container system of cane transport under serious consideration for the area is outlined.

* * *

Mahanarva posticata. H. SOUTINHO. *Brasil Açuc.*, 1973, **81,** 18–22.—A dialogue is presented in which the nature of this froghopper cane pest, its harmful activity and measures taken against it are explained to a field worker or small farmer.

* * *

Sugar cane cultivation in Australia. J. A. C. C. SOUSA. *Brasil Acuc.*, 1973, **81,** 26–31.—A description is given of the sugar cane growing industry of Queensland, covering climate, soils, fertilization, varieties, etc., as well as aspects of the industry's organization.

* * *

Handling of sugar cane during the harvest. L. A. R. PINTO and F. O. BRIEGER. *Brasil Açuc.*, 1973, **81,** 39–47.—A detailed description is given of the Integrated System for Bulk Cane Handling introduced by Santal Comércio e Indústria Ldta. at Usina Santa Lydia for the 1972 campaign. Cane is cut manually and mechanically on the estate using a Santal mechanical loader for the hand-cut cane, a Santal whole-stalk harvester for erect cane and a Don Mizzi chopper harvester for lodged cane. The cane is transported in tractor-drawn carts, 2-wheel units of 5–8 tons capacity and 4-wheel units carrying 8–12 tons. Each makes 6–8 trips per day to the factory where their contents are transferred either to storage or to the mill. There are three discharge points: one for chopped cane, one for clean whole-stalk cane, and one for cane which is fed to a washing table.

* * *

Irrigation Commission reports on major undertakings. ANON. *Australian Sugar J.*, 1973, **64,** 484–487.—Some details are given of projects being undertaken by the Commission of Irrigation and Water Supply in Queensland, as reported in the Annual Report for 1971/72 and of interest to cane growers.

* * *

Sub-surface irrigation. L. G. VALLANCE. *Australian Sugar J.*, 1973, **64,** 489–492.—Reference is made to preliminary trials of sub-surface irrigation conducted in Hawaii which showed that the method promoted better cane growth than did surface furrow irrigation. Various factors of importance in operation of sub-surface irrigation are discussed, particularly the economics, and the possibility of using the system in Australia is considered.

* * *

Mechanized loading. R. R. DOWNS. *Sugarland* (Philippines), 1972, **9,** (10/11/12), 6, 33, 37–38.—Mechanical cane loading and infield transport under wet conditions such as prevail during harvesting in the Philippines are discussed, including the costs. It is suggested that such mechanization can be introduced successfully and economically in the Philippines.

* * *

Mechanical harvesting, loading and transporting whole-stalk canes. R. R. DOWNS. *Sugarland* (Philippines), 1972, **9,** (10/11/12), 8, 32.—Advantages, disadvantages and costs of mechanical whole-stalk cane harvesting are briefly considered. (For loading and transport, see preceding abstract.)

* * *

Mechanical harvesting and transporting chopped canes. R. R. DOWNS. *Sugarland* (Philippines), 1972, **9,** (10/11/12), 10, 22, 27.—Advantages, disadvantages and costs of mechanical chopped cane harvesting and transport are discussed.

* * *

Creber green cane mechanical harvester. R. N. CHAPMAN. *Producers' Rev.*, 1973, **63,** (1), 14–16. Details are given of a green chopped-cane harvester designed by R. CREBER and D. CREBER, Queensland cane farmers, and built by Toft Bros., of Bundaberg. Able to deliver up to 30 t.c.h., the harvester removes the trash, which is then distributed evenly over the ground for use as mulch, by means of a 4-bladed topper. Also briefly described is a slasher for keeping drains free of weeds.

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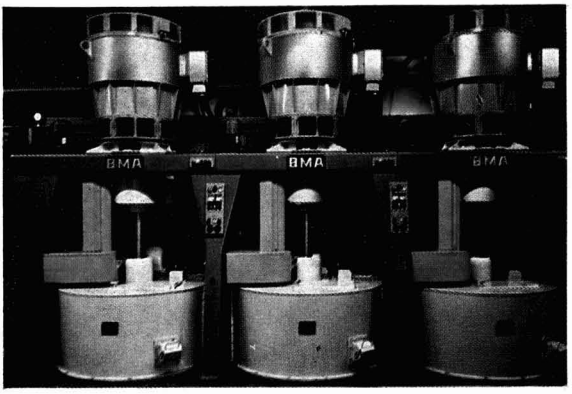

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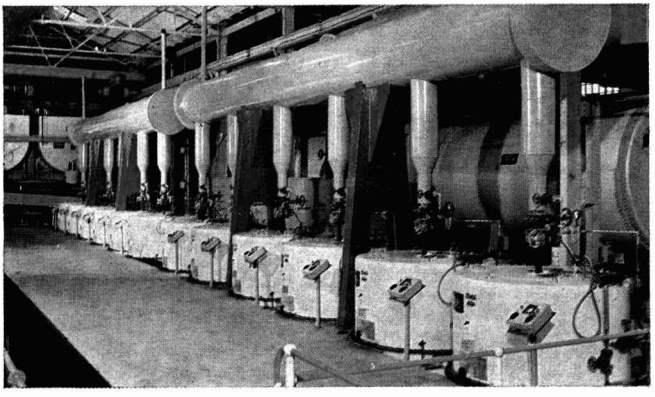

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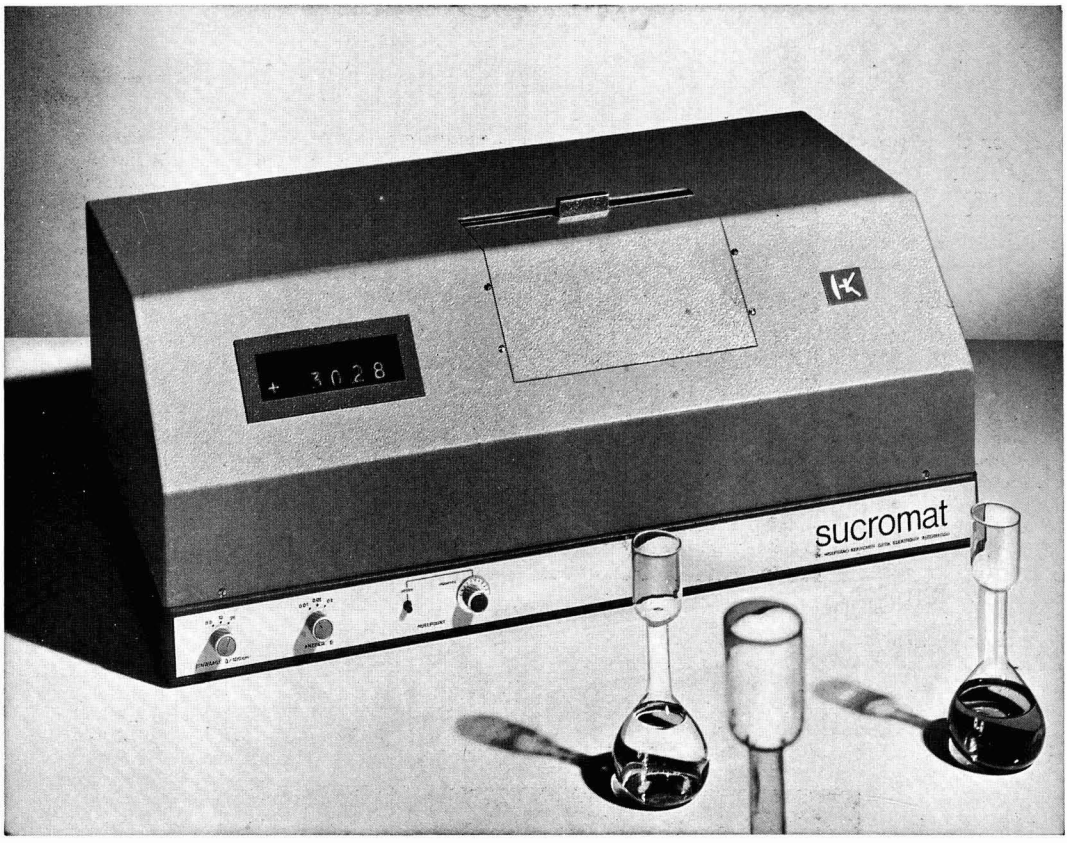

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Insect control—present and future. ANON. *Producers' Rev.*, 1973, **63,** (1), 21, 23.—Techniques of insect control briefly discussed include chemical control, biological control, the growing of resistant canes, male sterilization and use of sex attractants.

* * *

Irrigation spending is record. ANON. *Producers' Rev.*, 1973, **63,** (1), 25–29.—See *I.S.J.*, 1974, **76,** 48.

* * *

Effect of micronutrient deficiencies on macronutrient accumulation in sugar cane. J. E. BOWEN. *Trop. Agric.* (Trinidad), 1973, **50,** 129–137.—The effects of certain micronutrients on N, P, K, Ca and Mg accumulation in tissue of 3½-month-old cane grown hydroponically were examined. While the same synergistic and antagonistic interactions between nutrients were observed in leaf blades and sheaths, the magnitude and direction of interaction frequently differed in the roots. N accumulation in the leaf blade fell in plants deficient in Fe, Mn and Zn, but was not affected by Cu, B or Cl deficiencies. Sheath P levels were higher in Fe-deficient plants, lower in Cl-deficient plants, and unchanged in plants having Mn, Cu, Zn and B deficiencies. K accumulation in sheaths and blades was increased by omitting Fe, Mn, Cu and B from the culture solution, decreased by Cl omission and unaffected by Zn omission. Mg levels in sheath and blade were lower where Cu, Zn, B and Cl were deficient but were higher in Fe-deficient plants. Ca accumulation was greater in Fe-deficient sheaths and blades but was unaffected by Mn, Cu, Zn, B and Cl deficiencies. The interactions were reciprocal in all cases.

* * *

Damaging effects of frost on sugar cane in Punjab. I. Foliar injury and bud mortality. H. S. GILL and S. SINGH. *Indian Sugar*, 1972, **22,** 627–632.—Data from 1961/62 and 1963/64 cane crops in the Punjab are tabulated to show the effects of frost on leaves and buds of a number of varieties, which differed widely in their frost tolerance or susceptibility. Excessive damage was prevented where greater post-monsoon irrigation frequency had been applied (in November-December) before the onset of the December-January frosts. Greater amounts of green foliage indicated reduced bud mortality and *vice versa.*

* * *

Physiological research of sugar cane (response) to auxin and "Agallol". O. SINGH and O. S. SINGH. *Indian Sugar*, 1972, **22,** 633–635.—While soaking setts in water induced early germination, the effect was increased by treatment with "Agallol" (an organo-mercurial fungicide) and still further by treatment with "Agallol + indole-3-acetic acid (IAA), best results being obtained with 200 ppm IAA + 0·2% "Agallol" solution. IAA on its own did not produce any significant increase in the percentage of setts germinating after a given time, compared with the water-treated or untreated controls.

Variations in some leaf sheath characters in relation to varietal susceptibility to the sheath mite of sugar cane. S. SITHANANTHAN, N. KUMARAPERUMAL, S. MUTHUSAMY and T. L. BHASKARAN. *Indian Sugar*, 1972, **22,** 637–639.—In studies on four cane varieties, infestation by *Aceria sacchari* sp. was found to be directly related to leaf sheath moisture, i.e. was heaviest in the variety having the greatest sheath moisture content. A quantitative relationship was also established between infestation and width of the base of the sheath which was greatest in the most susceptible of the varieties tested.

* * *

Relative performance of sugar cane varieties planted in autumn under tarai conditions of Uttar Pradesh. P. P. SINGH, K. SINGH and G. SINGH. *Indian Sugar*, 1972, **22,** 711–715.—Cane varietal tests are reported in which early- and late-maturing varieties were compared.

* * *

Studies on salt tolerance of sugar cane. G. DEVU and M. S. BAJWA. *Indian Sugar*, 1972, **22,** 723–726. Details are given of the tolerances of four cane varieties to salt solutions applied to soil in greenhouse experiments. Results, given in terms of number of tillers, internode length and cane height, indicate the following descending order of tolerances: CoJ 1328, Co 1148, CoJ 46 and CoJ 39.

* * *

Influence of manures and fertilizers on the quality constituents of sugar cane juice. I. MAHAMUNI, T. A. G. IYER, N. RAMAMOORTHY and S. D. RAJAN. *Indian Sugar*, 1973, **22,** 775–780.—Results of three years' tests showed that application of 10 metric tons of compost as basal dressing per acre decreased the juice reducing sugars content and the glucose ratio compared with the control, that increase in nitrogen application beyond 112 kg/acre reduced the c.c.s., that there was no difference in effects between groundnut cake and ammonium sulphate as N fertilizers, that 40 kg of phosphate/acre helped clarification, while potash at 135 kg/acre (in split doses) caused a fall in reducing sugars and non-sugars contents.

* * *

Studies on the response of ratoons of sugar cane to calcium ammonium nitrate. O. SINGH. *Indian Sugar*, 1973, **22,** 781–784.—In terms of number and length of millable canes, number, length and girth of internodes, cane yield per hectare, cane sugar content and juice purity, as well as profit, application of 1 metric ton of calcium ammonium nitrate/ha to ratoon cane was the optimum of the various quantities applied and resulted in 603·1 quintals of stripped cane per hectare compared with 227·5 quintals/ha in the untreated control.

* * *

Co 6812—a new cane variety for western U.P. B. S. MATHUR. *Indian Sugar*, 1973, **22,** 785–790.—Characteristics are given of this mid-season variety, a cross of Co 605 × Co 798, which is resistant to cane wilt

and smut but only moderately red rot-resistant. Its performance is compared with that of Co 312 and Co 1148. The yield and quality of gur from it are also appraised.

* * *

Now is the time to prepare waterways. ANON. *S. African Sugar J.*, 1973, **57**, 118–119.—Preventing run-off by means of conservation terraces and allowing the water to flow across the slopes results in an accumulation of water at the head of a valley after heavy rain. The surplus water can be conveyed to streams or rivers by waterways. Advice is given on their preparation and on terrace construction. The use of strip cropping to aid in soil and water conservation is also recommended.

* * *

Some impressions of cane pest problems in Australia, Mauritius and Madagascar. A. J. M. CARNEGIE. *S. African Sugar J.*, 1973, **57**, 121–125.—Cane pests in the three countries are discussed and possible means of control described (as well as problems created by control methods). Most of the pests examined are insects, but mention is also made of the animal and bird pests in Australia.

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Construction and maintenance of farm roads. ANON. *S. African Sugar J.*, 1973, **57**, 127–129.—Road construction and maintenance on cane farms are discussed and measures to allow roads to meet listed requirements are described.

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Critical growth stages for 2,4-D phytotoxicity to sugar cane in South Africa. F. E. RICHARDSON. *S. African Sugar J.*, 1973, **57**, 143–151.—See *I.S.J.*, 1973, **75**, 381.

* * *

Roots, soils and water. ANON. *Producers' Rev.*, 1973, **63**, (2), 7.—The relationship between the water and air content of a soil is discussed and the importance emphasized of good drainage for promotion of healthy root systems.

* * *

Biological control of cane pests. O. W. STURGESS. *Producers' Rev.*, 1973, **63**, (2), 29.—Methods of control under investigation by the Bureau of Sugar Experiment Stations are reported; these include parasitization of cicadas by the fungus *Cordyceps heteropoda*, adoption of alternate wide-spaced rows to reduce soldier fly damage, and the use of a range of parasites for the leafhopper and scale insect.

* * *

Economical selection of sugar cane. L. A. R. PINTO. *Brasil Açuc.*, 1973, **81**, 108–112.—The comparison of cane in economic terms must be expressed in money terms per unit of area, and this involves evaluation of the crop, i.e. tonnage × sugar yield × value of the sugar. Against this must be set the costs per hectare in producing, harvesting and transporting the cane to the factory, and the cost of milling. Examples are given of the application of the formulae derived for such comparative evaluation.

Comparative dynamics of sugar cane stalk population due to variations in row spacing material and fertilizer levels. B. SINGH, S. C. SRIVASTAVA and A. K. GHOSH. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, 1–9.—Experiments were made on increasing cane shoot population by varying seed rate and row spacing; the best results came from a doubled seed rate combined with halved row spacing (31·2% increase). Almost the same effect (29·6%) was achieved by doubling the nitrogen fertilizer rate at half the cost of the extra seed.

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Studies in tarai and foot-hill soils of Uttar Pradesh—Kashipur zone (Nainital). B. SINGH, M. SINGH and R. N. RAM. *Proc. 38th Ann. Cov. Sugar Tech. Assocn. India*, 1972, 19–28.—Characteristics of the soils in the title area have been examined and their suitability for cane growing is discussed.

* * *

Effect of fertilizers on the release of nitrogen from farm yard manure applied to a sugar cane crop. A. ALI and R. G. SINGH. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, 31–38.—Soil analysis showed that addition of ammonium sulphate and urea with farm yard manure enhanced the release of nitrogen from the latter. The effect on the yield of CoS 510 cane grown on the plot was not significant, however.

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Performance of Co 658 variety. S. K. KULKARNI. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, 41–44.—In spite of its early maturing and high sucrose content, Co 658 reduced mill throughput because of juice settling difficulties, attributed to higher colloids and lower juice phosphate than with Co 419 cane.

* * *

Composition of cane juice. III. Effect of irrigation on uptake of N-P-K nutrients by the sugar cane crop. A. P. GUPTA and B. PRASAD. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, 45–52.—Liberal pre-monsoon irrigation increased nutrient uptake resulting in higher cane tonnage. The effect varied with cane variety and gave better fertilizer utilization where the irrigations were given at closer intervals during the pre-monsoon period.

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Eradication of white grubs by attracting the emerging beetles to their host plants and their instantaneous kill by "Folidol" spray. K. D. PURI and G. R. SANKHLA. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, 63–69.—An infestation of white grubs caused extensive damage to cane roots in the Meerut District. Effective control was achieved by placing 5–8 ft branches of the host plants for the adult beetles—neem and guava trees—about 50 ft from the cane, daily during the early monsoon, and spraying them with 0·1–0·2% "Folidol" which killed the beetles.

Sugar beet agriculture

A technique for blowing soil in the West Midlands. G. H. STYLES. *British Sugar Beet Rev.*, 1973, **41,** 19–20.—On a light, sandy soil such as found in the Kidderminster area of the UK, serious damage to beet crops can be caused by soil particles blown by the wind across the field with such force that the effect is almost the same as sand blasting and leaves are cut from the beets. The problem can be overcome by drilling the beet across the line of the prevailing winds and side-hoeing the beet to form ridges 3–4 inches high.

* * *

Manganese: vital trace element. A. P. DRAYCOTT and R. F. FARLEY. *British Sugar Beet Rev.*, 1973, **41,** 21–27. Symptoms of manganese deficiency in beet are described and the percentages of total beet area in the UK deficient in Mn over the period 1946–1969 are indicated. One common cause of Mn deficiency is overliming of soil. However, it is also mentioned that excessive Mn is equally injurious to beet as a consequence of the soil being acid, which necessitates liming. While spraying beet in the field with Mn sulphate has a number of disadvantages, which are mentioned, soil applications are not effective unless large quantities are used. Field tests are reported in which soil application of Mn oxide and silicate neither prevented Mn deficiency nor increased beet yield at harvest, while foliar sprays of Mn sulphate in two equal doses of 24 lb/acre (8 lb Mn/acre) 10 days apart eliminated all symptoms and increased sugar yield by an average of 8 cwt/acre.

* * *

What we learned about insects and nematodes in 1972. R. RUPPEL and C. LAUGHLIN. *Sugar Beet J.*, 1973, **36,** (2), 12–15.—Apart from the usual insect damage, there was an unprecedented infestation of the variegated cutworm in areas of Michigan. Protection was obtained with "Sevin", "Parathion" or "Dylox", but no explanation has been found for the upsurge. "Temik" proved effective as an adjunct to crop rotation for control of nematodes, and directions as to its use are specified. It is emphasized that a close watch should be kept by farmers so that any infection, such as that of the variegated cutworm in 1972, can be noticed early and control established to avoid losses.

* * *

Space planting. L. HERWEYER *et al. Sugar Beet J.*, 1973, **36,** (2), 16–18.—Experience is described with precision planting and chemical weed control, pre- and post-emergence, adopted in order to remove the need for hand labour. The quoted field men and farmers are enthusiastic as a result of labour saving, uniform stands and yields as good as with hand thinning.

* * *

Starter fertilizer. F. B. RUSSELL. *Sugar Beet J.*, 1973, **36,** (2), 20–21.—The use of a N-P-Mn starter fertilizer below or to the side of the beet seed is recommended, but the complication of the choice of composition to suit placement is indicated.

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For weed control, a total programme is a combination approach. W. F. MEGGITT. *Sugar Beet J.*, 1973, **36,** (2), 22–23.—Pre-emergence herbicide control of weeds was not very successful in Michigan in 1972 because of the lack of rain which prevented absorption of the chemical into the soil ready for action. It is emphasized that, under such circumstances, post-emergence herbicide application is necessary to achieve good weed control.

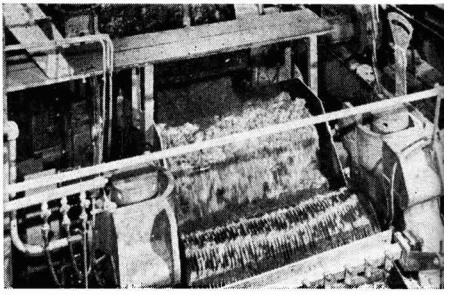
* * *

Control of *Cercospora* leaf spot of sugar beet through aerial application of systemic and surface-protecting fungicides. C. L. SCHNEIDER, H. S. POTTER and F. B. RUSSELL. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16,** 525–529.—Experiments on aerial application of surface protectants triphenyl tin hydroxide and cupric hydroxide (on its own and in oil and emulsifiers) and systemic fungicide "Thiabendazole" to control *Cercospora beticola* leaf spot are reported. Results showed that although cupric hydroxide in oil and emulsifiers controlled the disease, it was phytotoxic and caused irregular brown, necrotic spots on the foliage, so that the resultant root yield and white sugar yield per acre were lower than with the untreated control. All other treatments were effective in controlling the disease and increased root yield, sucrose content, juice purity and white sugar yield. There was little difference in the effects of the treatments.

* * *

The influence of dilution on the hatching activity of sugar beet root diffusate. A. E. STEELE. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16,** 575–576.—In tests in which root diffusate was leached from pot-grown seedlings of sugar beet by adding tap water to the soil around the base of the plants, dilution of the collected diffusate with water to as much as 10% of its original concentration did not greatly affect its hatching activity and larvae emergence from cysts of *Heterodera schachtii.* A graph demonstrates the linearity of the relationship between larval hatch and log of diffusate concentration.

Cane sugar manufacture



Report on sugar cane. ANON. *Sucr. Maghrebine*, 1973, (4), 24–34.—A report is presented of a study mission sent to the Sudan during the summer of 1972 which describes and illustrates cane agriculture and sugar production at Khashm el Girba sugar factory.

* * *

Growth of the sugar industry in Thailand. H. KAMPF. *Zeitsch. Zuckerind.*, 1973, **98**, 141–143.—Information is given on the Thailand cane sugar industry and sugar factory modernization and expansion. Particular mention is made of Supanburi sugar factory.

* * *

Studies on the process of diffusion in a De Smet cane diffuser. ANON. *N.S.I. News* (Kanpur), 1972, **1**, (8), 5–6.—Experiments with a De Smet diffuser at Tanuku indicated that inversion due to acidity at higher temperatures was much lower than that due to enzymatic effects. Magnesium and chloride were also extracted and could not be removed during subsequent conventional clarification, although the former could be separated by slightly modifying the process. Extraction of sugars and colorants was greatest in the bagasse dewatering unit. Extraction of some optically-active substances not only showed an apparent rise in mixed juice pol, but also caused errors in polarization at later stages as a result of formation of complexes. Reports of higher fibre % cane in the case of De Smet diffusers may be due to the calculation method used, to recycling settled mud from clarified, dewatered juice to the bagasse mat, and to evaporation of water from bagasse as a result of the high temperature used. Reduced mill extraction was found to increase and bagasse sugar to decrease, although undetermined and molasses losses rose with a drop in reduced boiling house recovery.

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Purity rise in the clarification process. S. C. GUPTA, N. A. RAMAIAH, S. K. D. AGARWAL and P. C. JOHARY. *Sugar J.*, 1973, **35**, (8), 9–12.—See GUPTA & RAMAIAH: *I.S.J.*, 1972, **74**, 374.

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Hawaii sugar industry. E. B. HOLROYDE. *Sugar J.*, 1973, **35**, (8), 16–18.—The importance of the sugar industry to the Hawaiian economy is discussed and a survey presented of developments in both the sugar manufacturing and cane agricultural sectors which are taking place and which will, the author feels, maintain Hawaii as the leading sugar-producing state in the US[1].

The 3-boiling system for plantation white sugar. T. T. OOMMEN and B. S. GURUMURTHY. *Sugar J.*, 1973, **35**, (8), 20–22.—Variants of a 3-boiling system used by Deccan sugar factories (India) are described and the best scheme regarded as that in which all the *C*-sugar is melted and used as footing for *A*-massecuite to yield a high purity white sugar of C and D size.

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New W. R. Cowley sugar factory. A. N. HULL. *Sugar J.*, 1973, **35**, (9), 12–17.—Details are given of equipment and processes to be used at this cane raw sugar factory near Santa Rosa, Texas, which was scheduled to start operations in December 1973. Owned by the Rio Grande Valley Sugar Growers Inc., a cooperative of 115 cane growers, the factory is designed to crush 7,500 tons of cane a day with the possibility of expansion to 8,500 tons daily. Conventional cane milling will be used.

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Factory construction by critical path method. G. A. ROBINSON. *Sugar J.*, 1973, **35**, (9), 19–21.—The critical path method used for scheduling the activities involved in construction of the sugar factory described in the previous abstract is outlined to show how the technique can be applied to large-scale projects.

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Selection of steam conditions in cane sugar factories. U. C. UPADHIAYA. *Indian Sugar*, 1972, **22**, 619–626, 691–708.—After discussing the basic properties of steam and sugar losses in factory processing, the author examines steam generation and consumption in the various processes and offers advice on establishing optimum conditions.

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On the nature and effect of left-over cane on sugar recovery. B. S. MATHUR. *Indian Sugar*, 1972, **22**, 717–721.—Standover cane quality was sufficiently poor in Uttar Pradesh that it was found preferable to process the cane early in the following season together with cane from that season in a suitable proportion to minimize losses and avoid processing difficulties.

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ISSCT XIV Congress and Louisiana sugar industry. D. P. KULKARNI. *Sugar News* (India), 1973, **4**, (9), 7–16.—A survey is presented, for the benefit of Indian readers, of cane handling and processing at Louisiana sugar factories.

[1] *See also I.S.J.*, 1973, **75**, 96.

Report of seminar on clarification problems and cane varieties. A. C. CHATTERJEE. *Sugar News* (India), 1973, **4**, (9), 17–19.—The seminar, held at Madras under the auspices of the South Indian Sugar Cane & Sugar Technologists Association, dealt with clarification problems and the cane varietal aspects of the problem. Particular attention was focused on the use of liming, particularly simultaneously with sulphitation, and addition of phosphoric acid.

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From the notes of a sugar technologist. VIII. M. ANAND. *Sugar News* (India), 1973, **4**, (9), 20–22. Cane diffusion using DDS, De Smet and Silver ring equipment is briefly described, with mention of costs and certain disadvantages.

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Factories praise Supple system. R. C. HODSON. *Sugar Bull.*, 1973, **51**, (9), 10–11.—Details are given of the front-end loaders used at 11 Louisiana sugar factories to handle cane under the system introduced by E. SUPPLE[1]. Advantages of the scheme are briefly listed.

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Defeco-melt-phosflotation process for the manufacture of white sugar (using the Saranin multicell clarifier). J. P. MUKHERJI and A. C. CHATTERJEE. *Indian Sugar*, 1973, **22**, 769–774.—See CHATTERJEE: *I.S.J.*, 1973, **75**, 388.

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Report on Australian visit. J. R. FITZGERALD and J. P. LAMUSSE. *S. African Sugar J.*, 1973, **57**, 131–139. Impressions gained by the two authors during visits to the sugar industries of Australia, Mauritius and Réunion are presented and details given of the factory equipment and process used.

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Cane in small-scale industry—factory syrup. C. BAYMA. *Brasil Açuc.*, 1972, **80**, 599–605; 1973, **81**, 48–52. The production of a syrup by simple concentration of cane juice to around 73°Bx is described in detail.

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New diffuser for Pongola. ANON. *S. African Sugar J.*, 1973, **57**, 141–142.—Details are given of the Fletcher and Stewart cane diffuser to be installed at Pongola and eventually operated in conjunction with two 84-inch cane mills and a pre-drying system. Developed by A. VAN HENGEL, the diffuser comprises any number of cells placed at an angle of 30° to the horizontal so that bagasse can discharge from one cell into the next. The bagasse, travelling in a layer about 0·6 m thick at 3–4 m/min, is carried on an upper descending slat conveyor over a screen, is transferred to a lower ascending conveyor and, on reaching the top of the run, spills over and falls onto the descending conveyor in the next cell. Juice is sprayed over the bagasse during its travel, and passes through the bagasse and screens to be collected in bottom trays from which it is either returned to the bagasse or overflows to the juice system of the previous cell. Tests on a full-scale experimental cell at Empangeni have shown the diffuser to have an efficiency, in terms of extraction of enclosed juice per unit of time per unit of Brix difference, well above that of other diffusers. The unit at Pongola, replacing the mills, will have an initial capacity of 150 t.c.h., although addition of one cell can easily increase capacity by 35 t.c.h. A guarantee of 97% pol extraction for cane of 14% fibre content, or 97·5% with 12% fibre in cane, at an overall time efficiency of 82% will be given.

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Mills and milling. C. BAYMA. *Brasil Açuc.*, 1973, **81**, 113–117.—A brief discussion is given (with out-of-date references) to cane mills, their capacities, housing, rolls, grooving and openings.

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Caking of raw sugar. W. M. DE OLIVEIRA. *Brasil Açuc.*, 1973, **81**, 122–127.—Caking occurred in high-quality raw sugar from São Paulo during the 1972/73 crop in spite of its temperature being higher than ambient. Packing at too high a temperature is one cause, but high pol and low moisture would also combine to give caking if the hot-bagged sugar was allowed to cool in the bags, the residual moisture being lost to the atmosphere. When this was prevented by using bags lined with a 0·2 mm-thick film of polyethylene, the sugar cooled without caking.

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Sugar technology research in Mauritius. R. ANTOINE. *Mauritius Sugar Industry Research Institute Ann. Rpt.*, 1971, 93–99.—Investigations made include those on difficulties in determining the efficiency of the "Saturne" diffuser at St. Antoine sugar factory because of deficiencies in the inferential method of fibre calculation arising out of evaporation at the high temperatures involved; a survey of final masse-cuite saturation temperatures which indicated some re-solution of sugar during re-heating; assessment of cane preparation by measurement of pol in open cane cells; analysis of sucrose and water in final molasses as well as the reproducibility of Brix determinations and exhaustibility determination in final molasses; cane starch isolation and use for preparing a standard graph for starch analysis, as well as the testing of a new C.S.R. technique for starch analysis; and a comparison between the Jeffress wet cane disintegrator and the Rietz "Varigrator" for cane pol measurement.

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A mechanical sugar cane unloader. K. G. HATHI and S. SWARANSINGH. *Proc. 28th Ann. Conv. Sugar Tech. Assoc. India*, 1972, E1–E4.—The device described consists of a frame carrying two parallel endless chains mounted on sprockets and linked by a series of crossbars carrying rakes. One of the sprocket shafts is driven by an electric motor and the frame is carried on vertical columns arranged perpendicularly to the cane carrier. A loaded truck is located beneath the frame and the latter lowered on the columns

[1] *I.S.J.*, 1972, **74**, 374.
[2] *ibid.*, 1970, **72**, 366.

so that the rakes, moved horizontally by the action of the motor and chains, carry the cane to the end of the truck platform and over, onto the carrier. When the truck is empty the frame is raised ready for the next load.

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Cane leveller reversal. G. K. CHETTY. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, E5–E7.—Trials were made with reverse operation of the cane leveller at Walchandnagar sugar factory. Positive feed was found essential and was achieved by use of a special hood design and installation of a spiked kicker before the leveller. Modification of the equalizer gave good preparation and eliminated current peaks for the leveller motor.

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Automation of old batch-type centrifugal machines. B. L. MITTAL and H. R. MITTAL. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, E13–E16. Automatic timing panels made in India are now available whereby manually-controlled machines may be made semi-automatic, except for ploughing, at moderate cost.

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Automatic regulation of feed to the first body of a multiple effect evaporator. G. K. CHETTY. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, E17–E19. See *I.S.J.*, 1973, **75**, 319, 388.

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Modification in the design of W.I. cylindrical sulphur burner installed at Gola. R. C. SINGH, M. N. SINGH and V. N. SRIVASTAVA. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, E21–E24.—Modifications are described to the air supply arrangements of a Walchandnagar Industries Ltd. sulphur burner whereby capacity was increased and difficulties with low SO_2 content and deposition of sublimed sulphur were remedied.

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An improved system of heating massecuites and like viscous substances. J. P. MUKHERJI, A. C. CHATTERJEE, S. S. GANGAVATI, C. S. SUNDER and P. D. KAMBUJ. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, E25–E31.—A description is given of a unit for reheating massecuite before feeding to the centrifugals. It uses a rotating steam coil inside a trough which receives massecuite discharged from a bank of crystallizers and has been found to give rapid heat transfer without local overheating. The temperature at five withdrawal points for the centrifugals has been measured and shown to indicate uniform heating of the massecuite.

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Planning for continuous crystallizers for *C*-massecuite. T. K. MUKHERJEE, S. C. SETHI and V. K. JAIN. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, E33–E40.—Massecuite viscosity reduction by dilution and by reheating are discussed and the latter preferred. It is proposed that massecuite be cooled in three crystallizers from 64° to 42°C and then heated to 51·5°C in a fourth unit. Calculations are made of areas required for this purpose and it is concluded that the equipment available at the authors' sugar factory is capable of adaptation to the new system.

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Use of precipitated seed slurry in sugar boiling. T. T. OOMMEN and B. S. GURUMURTHY. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, M5-M8.—Seed slurry sufficient for a full day's graining of *B*- and *C*-strikes at the authors' sugar factory is made in less than one hour by dissolving 560 g of white sugar in 200 ml of distilled water at about 70°C and pouring into 220 ml of methylated spirit with stirring. After 30 minutes' stirring the precipitated crystals are allowed to settle and the supernatant replaced with fresh methylated spirit, followed by a further 10 minutes' stirring. The seed crystals range in size from 3 to 14 microns with 85–95% between 5·5 and 8 microns, and have been found to give easily-purged massecuites of uniform and regular crystals.

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Improvement in filtration efficiency. M. P. MATHUR. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, M9–M11.—Rotary vacuum filters and filter presses are compared; the former are more efficient, especially where used in conjunction with a filter-thickener, but presses give better quality juice and are suitable where labour is not a problem.

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Magnesa Preprata in cane juice clarification. S. C. SHARMA and M. NARAIN. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, M19–M26.—Tests have been made on a 79·3% magnesium oxide, Magnesa Preprata, supplied by Industrial Minerals & Chemical Co. Pvt. Ltd. of Bombay, as a clarifying agent in place of lime. The product was used to replace half and all of the lime needed and results were compared with normal liming as a control. The mud volumes produced were about the same but juice clarity was inadequate when 100% of the lime was replaced. No improvement in purity rise or reducing sugars destruction was observed, while the juice Ca and Mg rose, indicating the likelihood of more scale formation. Results were poorer with refractory juices.

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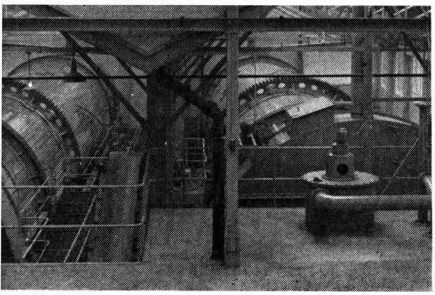
A study of mill capacity at Shimoga. T. T. OOMMEN and S. S. SINGH. *Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, G1–G8.—The crushing capacity of the milling tandem at Shimoga factory—a 14-roller McNeil unit of 27 × 54 in—has been progressively raised from 600 to 1800 t.c.d. without significant loss in mill extraction. This has been achieved by addition of a second engine, two sets of knives and a shredder; by increasing roller speed; by increasing the depth and pitch of the roller grooving, and by opening the mill settings and increasing the feed:discharge ratio.



Beet sugar manufacture

Experiments on thick juice storage. J. NAGY. *Cukoripar*, 1973, **26**, 26–32.—Experiments in which thick juice was stored for 8 months in tanks in the open or under cover at temperatures in the range —8° to +30°C have shown that the quality was maintained, that counts of mesophiles, yeasts and moulds fell during the storage period, and that there was no advantage to be gained by using a protective layer of paraffin or formalin or a nitrogen atmosphere.

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The relationship between the extraction of sucrose and the extraction of some non-sugars. P. W. VAN DER POEL, W. A. FENSTRA, J. KONINGS, N. H. M. DE VISSER and M. A. M. DE SCHUTTER. *Zeitsch. Zuckerind.*, 1973, **98**, 71–76.—See *I.S.J.*, 1971, **73**, 22.

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Cane sugar processing during the beet sugar campaign. E. WOLFF. *Zeitsch. Zuckerind.*, 1973, **98**, 76–77. During the 1971/72 beet campaign in Chile, cane raw sugar imported from Cuba had to be processed together with beet. Details are given of the processes used at individual factories: (i) melting the raw sugar in raw juice to a Brix of 50–60°, liming with 0·8–1·1% CaO (on raw sugar) at 55°C for 20–30 minutes followed by conventional carbonatation, and (ii) melting the affined raw sugar in the beet thick juice. Despite the higher invert content of the cane raws, white sugar quality was unimpaired. The costs of the raw sugar processing were only a fraction of those of post-campaign processing of raw sugar.

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Beet sugar manufacture in India. M. N. SINGH and V. N. SRIVASTAVA. *Sugar News* (India), 1972, **4**, (8), 13–17.—Information on beet processing, based on the Danish sugar industry, is given for the benefit of Indian readers and application of corresponding methods in India are discussed, as is the use of a DDS diffuser for extraction of sugar from cane and beet in separate seasons.

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A visit to the Ofenau sugar factory. J. C. GIORGI. *Sucr. Franç.*, 1973, **114**, 140–142.—Aspects of this West German sugar factory are described, especially the automatic controls, waste water treatment and the pulp dryer.

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Examination of certain variants of raw juice purification. A. KOVAŘÍK and M. ROHLÍK. *Listy Cukr.*, 1973, **89**, 33–41.—Juice purification variants were investigated at two sugar factories. Results indicated that simultaneous liming and gassing in 1st carbonatation gave better settling and filtration than did independent liming and gassing, while slight improvement on the results with simultaneous processing was obtained by recycling 80% 1st carbonatation muddy juice to preliming, although there was wide fluctuation in the values. As regards juice colour and lime salts, there was little difference between the use and omission of juice recycling with simultaneous carbonatation, recycling having a slightly better effect. Use of pre- and main liming, simultaneous carbonatation coupled with precarbonatation, and recycling of 1st carbonatation juice is regarded as most promising where intermediate mud separation is carried out. Low-temperature pre-liming (40° *vs.* 65° and 90°C) had a beneficial effect on juice colour and did not adversely affect settling and filtration, although in all cases prolonged juice retention in the settlers did have a harmful effect on juice colour.

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Method of working with the "Saturoskop" in determination of saturation temperature. P. KADLEC, R. BRETSCHNEIDER and J. ČEPELÁK. *Listy Cukr.*, 1973, **89**, 41–46.—A method is described in which the East German "Saturoskop" was used to determine the saturation temperature of massecuite, molasses or pure and impure sugar solutions and from this the saturation and supersaturation coefficients. The saturation temperature, determined by observing changes in the crystal habit with increase in heating temperature, was found to be independent of the time between sampling and measurement.

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Adsorption purification with calcium carbonate in sugar production. M. I. DAISHEV. *Izv. Vuzov, Pishch. Tekh.*, 1972, (6), 61–66.—The physico-chemical theory of juice purification with calcium carbonate is expounded and a survey presented of work on carbonatation. It is considered undesirable to recycle carbonatation juice to preliming since the result will be dilution of juice with already treated juice and hence a fall in concentration of the impurities to be adsorbed by the $CaCO_3$. On the other hand, precarbonatation with intermediate mud removal is considered a suitable variant. The author also advocates carbonatation of low-grade sugar remelt liquor, as carried out in a number of Soviet sugar factories.

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Inhibition of darkening of raw juice. A. A. LIPETS and I. A. OLEINIK. *Izv. Vuzov, Pishch. Tekh.*, 1972, (6), 119–120.—Aluminium sulphate added to water used

for beet diffusion was found to prevent colour formation in the extracted juice by forming colourless complexes with those beet ingredients which normally are responsible for juice coloration. Addition of the sulphate directly to the juice did not have the same effect.

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The degree of effect of a magnetic field on factory juices. I. M. FEDOTKIN, O. N. SIRYI, V. I. RUDENKO and V. S. BOBROVSKII. *Izv. Vuzov, Pishch. Tekh.*, 1972, (6), 121–124.—The electrical conductivities of various factory juices and pure sugar solutions were determined in the Brix range 13·4–50·5°. The maximum effect of a magnetic field on the hydrodynamics, heat exchange, etc. was found to occur with raw, sulphitation and 1st carbonatation juice at a temperature of 75°C or higher.

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Sugar crystal uniformity. S. GAWRCYH. *Gaz. Cukr.*, 1973, **81**, 25–28.—A method of mathematical analysis of sugar crystal size distribution is described and equations derived for calculation of mean aperture, standard deviation and coefficient of variation. Laplace-Gaussian curves for 1st massecuite boiling based on M.A. *vs.* weight of crystal fraction on a sieve of 0·1 mm mesh demonstrate the effects of deviations in the boiling process. Applicability of the method to characterizing consumption sugar is discussed and possible means of obtaining crystals having a good C.V. examined (batch *vs.* continuous boiling is briefly considered).

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Automation of the crystallization process applied to high purity solutions in the sugar factory. A. JOSEPH. *Sucr. Belge*, 1973, **92**, 93–99.—After reviewing the development of automation of the boiling process and analysing the various methods, the author states that control by a single parameter is not possible but that it can be achieved by use of a combined viscosity-consistency detector. Such equipment is offered by Siemens AG. (See also BÖHM: *I.S.J.*, 1974, **76**, 26.)

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Examination of pulp press water quality. K. MAGYAR. *Cukoripar*, 1973, **26**, 61–68.—Studies showed that recycling press water to beet diffusion had an adverse effect on raw juice and carbonatation juice purities, although increase in the quantity recirculated from 40% to 70% did not have any increasing effect, so that recycling all the press water available is recommended. Also advocated is increase in the pressure, since this was found to have no substantial injurious effect on the water, the purity of which rose slightly while the colloid content fell.

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Steam consumption of a multiple-effect evaporator and an evaporator with steam jet compressors. S. ZAGRODZKI. *Zeitsch. Zuckerind.*, 1973, **98**, 129–131.—Since a reduced demand for bled vapour involves difficulties in concentrating juice to a required Brix, particularly with a juice draft of over 110%, the author advocates the use of steam jet compressors and illustrates his argument with two examples.

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Changes in the processing value of sugar beet which occur during storage. J. ANTKOWIAK. *Gaz. Cukr.*, 1973, **81**, 38–41.—Factors leading to losses in stored beet are discussed. While normal growth processes in healthy beet cause no great change in composition, this is not true of unhealthy beet, and the growth processes in diploid beet continue at a greater rate than in polyploid beet, according to the author's experience. Particular attention is drawn to the considerable adverse effect of rotting on beet processing and storage losses. Expansion of factories is advocated with the aim of reducing the campaign length to 85–90 days.

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Technological parameters of purified juice with 2nd carbonatation in film flow. I. M. FEDOTKIN *et al. Sakhar. Prom.*, 1973, (2), 13–15.—Tests with an experimental film-type 2nd carbonatation vessel are reported, in which the juice flowed in a 1·5–3·5 mm film down a 28·5-mm diameter column of 3·5 m height against an upward flow of CO_2. Comparison with results of 2nd carbonatation in a conventional non-bubbling vessel showed that film carbonatation gave more intimate mixing, resulting in lower lime salts and colour contents than in conventional 2nd carbonatation juice. Carbonatation in the experimental unit was more rapid, leading to smaller, more uniform $CaCO_3$ particles. Although heating to 95–100°C had no real adverse effect on the low lime salts content, a temperature of 80°C is recommended for film carbonatation.

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Sulphitation of beet sugar factory products. L. D. BOBROVNIK *et al. Sakhar. Prom.*, 1973, (2), 19–22. Investigations showed that 50–70% of SO_2 in thin juice was converted to sulphate under evaporation conditions, a considerable quantity was found as free or bound SO_2, while a negligible quantity was volatilized. Much of the SO_2 contributed to considerable scaling. Under boiling conditions, only 15% of the SO_2 added to thick juice was converted to sulphate, while the quantity of free and bound SO_2 was low, so that volatilization was considerable. Free SO_2 had an inhibiting effect on colour formation, this effect increasing with fall in pH of the product, at which the sulphite concentration increases, leading to formation of bisulphite derivatives of hexoses and other carbonyl compounds and hence to prevention of further colorant formation. (See also *I.S.J.*, 1974, **76**, 27.)

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Study of optimum conditions of sulphitation of thick products in beet sugar manufacture. L. D. BOBROVNIK *et al. Sakhar. Prom.*, 1973, (2), 22–27.—Experiments to determine the concentration of sulphites in syrup, after sulphitation, which was necessary to minimize colour formation in subsequent products, including massecuite and white sugar, showed that the presence

of 0·5 mole of free SO_2 per mole of newly formed reducing substances was sufficient for practically complete prevention of reactions involving colorant formation. Sugar losses resulting from decomposition connected with fall in pH were reduced when sodium sulphite was used for sulphitation.

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Investigation of sugar extraction from beet in a boiling layer in a continuous semi-industrial diffuser. V. N. SANOV and A. A. LIPETS. *Sakhar. Prom.*, 1973, (2), 27–33.—Details are given of experiments in which cossettes were prescalded, separated from the juice and fed into an experimental twin-scroll sloping trough diffuser where diffusion was conducted under vacuum with condenser water used as extraction liquid. Results showed that at a retention time of 0·58 hour and juice draft in the range 101·8–122·3% a considerably higher mass transfer coefficient and significantly lower sugar losses were achieved in the unit than under normal conditions.

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Mathematical definition of molasses sugar content. A. YA. ZAGORUL'KO, N. S. KOCHUBEI and V. S. SEMENYUK. *Sakhar. Prom.*, 1973, (2), 33–38.—Two empirical equations derived for estimation of molasses sugar content % beet in terms of water and specific non-sugar fractions have been found to give values in close agreement with experimental data with a difference of less than $\pm$ 0·1%.

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Investigation of the composition of substances adsorbed by granular active carbons from beet factory syrups. YA. O. KRAVETS *et al. Sakhar. Prom.*, 1973, (2), 38–40. The total solids and quantities of invert sugar, raffinose, alcohol-insolubles, saponin, acids, nitrogen and proteins adsorbed from syrups and liquors by granular active carbons of two grades have been determined and are tabulated. Generally, only trace amounts of kestose were removed, if at all, and the maximum chloride separation was still very small.

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Study of gas washer water composition at sugar factories. A. P. PARKHOMETS and A. I. SOROKIN. *Sakhar. Prom.*, 1973, (2), 43–47.—The composition and bacterial content of water from carbonatation gas washers are tabulated and compared with those of fresh or recycled water before use in gas washing. In view of the chemical content and solid particles, the water should be treated as a highly contaminated effluent.

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Addition of raw cane sugar to the beet sugar manufacturing process. G. GARCÍA. *CubaAzúcar*, 1972, (Oct./Dec.), 19–23.—In view of the under-utilization of the crystallization, centrifugal and drying plant in Chilean beet sugar factories, and the need to refine imported raws, tests were made on the dissolving of raw cane sugar in beet raw juice and adding this to the juice going to the carbonatation stage of the normal beet sugar manufacturing process. Details are given of the process used; the high purity of the thick juice permitted crystallization of two white sugar strikes instead of one. The high carbonatation juice Brix caused difficulties in settling and filtration, while there was a certain increase in thin juice colour. The addition of the raws gave lower viscosity in the boiling house products, so increasing the capacity of the pans and especially the centrifugals. Sugar quality remained high, although molasses analysis requires more study since invert sugar present affected the apparent sucrose content and the sugar recovery has not been accurately calculated. Operating costs are discussed and indicate a large saving over separate refining; however, more work is to be done to assess these costs more accurately. (See also WOLFF: *I.S.J.*, 1974, **76**, 55.)

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Conversion of two steam boilers from oil- to gas-firing at Elsdorf sugar factory. H. WEIDNER. *Zucker*, 1973, **26**, 121–129.—The theoretical aspects of conversion from oil- to gas-firing are considered and details given of the two boilers at Elsdorf which were converted from oil-firing to oil- or natural gas-firing in 1971. Some operational data are given and advantages and disadvantages of gas-firing are listed.

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A new type of boiling tube in the evaporator station. K. MATTERN, H. J. SCHMIDT and D. WAGNER. *Zucker*, 1973, **26**, 130–133.—Trials of an evaporator tube having an inner rifled wall are described in which heat transfer was greater than in conventional smooth tubes in the evaporation of thin juice and pure glucose solution.

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Effect of nitrogen fertilization on juice purification in beet sugar factories. N. KUBADINOW and L. WIENINGER. *Zucker*, 1973, **26**, 139–144.—Increase in N application to beet was found to cause an increase in juice alkalinity and non-sucrose matter, particularly the α-amino-N content. Hence, longer retention in carbonatation processes is recommended to avoid glutamine saponification in evaporation with resultant increased acidification caused by free pyrollidone carboxylic acid formation. At a certain level of saponification, removal of ammonia from the juice will cause irreversible fall in pH, leading to corrosion, increased losses and colour formation, etc.

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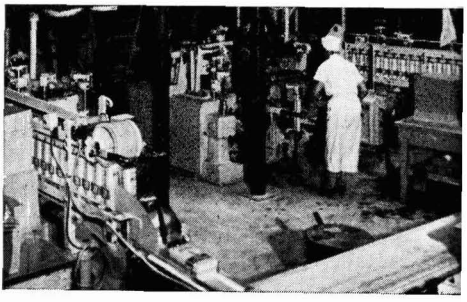
Studies on the permeability of sugar beet tissue to stored sugar. R. M. CRESSMAN. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16**, 595–604.—The rate of diffusion of sugar from cut pieces of beet tissue was studied as a function of salt concentration, pH and temperature, and found to be inversely related to salt concentration up to about 0·2M and minimal at about pH 6·5. It increased with rise in temperature until extraction was complete, and was lower with higher salt concentration until the cells suffered thermal damage, when the sugar loss rose rapidly. Sugar loss from intact cells was separable into a stage attributable to loss from the apparent free space and a stage attributable to diffusion through the protoplasmic membrane. Sugar in the apparent free space was 13–18% of the total sugar in the tissue. Permeability of beet tissue as an indication of the storage and sugar accumulation properties of beet is discussed.

Sugar refining



Line for the preparation of granulated sugar for storage in silos. J. MLYNÁŘ. *La Ind. Azuc.*, 1972, **79,** 95–100. See *I.S.J.*, 1973, **75,** 117.

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Study on cane raw sugar refining by liming and carbonatation. C. J. MITCHEV. *Ind. Alim. Agric.*, 1972, **89,** 1079–1088.—Comparative tests showed that simultaneous liming and carbonatation of melt liquor gave lower colour and lime salts contents and lower filtration coefficient and higher purity than did separate liming and gassing, although the separate processes gave considerably lower reducing matter. Affined sugar syrup subjected to the simultaneous process and sulphitation suffered only slight fall in pH and increase in colour after reheating for 3·5 hr at 90°C. Best of the simultaneous systems tested was that carried out in three stages, to pH 9·5, 8·5 and 7·5, with 60% milk-of-lime added in the first stage and the rest at the second stage. This gave a syrup colour of 6°St/100°Bx.

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Modification to the syrup decolorization scheme at Krasnopresnensk sugar refinery. N. K. KVACHEVA and G. A. CHIKIN. *Sakhar. Prom.*, 1972, (9), 36–38. Fouling of anion exchange resin by colorants removed from 1st product syrup caused a sharp drop in decolorizing efficiency after only three cycles. Increasing the number of filters was considered uneconomical, particularly since the sugar from the 1st massecuite contained too much invert. It is suggested that the sugar should be remelted; discontinuing ion exchange treatment would give a higher syrup Brix and hence reduce steam consumption because of a shorter retention time in boiling, giving quite a significant monetary saving in a year.

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Experience in use of an industrial ion exchange unit at Krasnopresnensk sugar refinery. N. K. KVACHEVA and G. A. CHIKIN. *Sakhar. Prom.*, 1972, (10), 37–40. The syrup decolorization system used is described. Modifications introduced for 1970, whereby each type of syrup is processed in its own resin column, have generally increased the decolorizing efficiency, giving a 1st refined syrup colour of 1·42°St compared with 1·57°St previously.

* * *

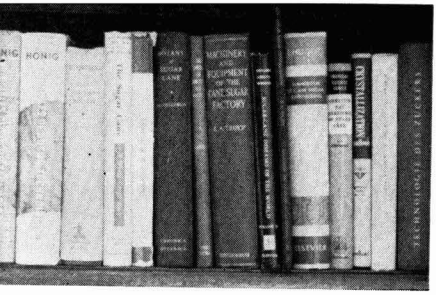
Process for reactivating powdered carbon using vibrating bin activators. H. A. PRISCO. *Sugar y Azúcar*, 1972, **67,** (11), 21–22.—Used powdered carbon is reactivated in a new process developed by Westvaco Corporation. It is discharged from a storage silo onto a belt weigher and via a rotary valve and pneumatic conveying system to a retort at over 1750°C. Flash vaporization and decarbonization (by the oxidizing carrier gas) restores the carbon's adsorptive capacity, after which it passes to a pre-cooler, a bag filter house and then to a truck or hopper car for re-use. A prototype plant has been operating successfully for more than a year. The vibrating bin activator was installed on the spent carbon silo and ensures smooth flow by breaking up lumps of caked carbon, etc.

* * *

Mathematical analysis of a continuous sugar crystallizer. S. HILL. *Sucr. Belge*, 1973, **92,** 47–54.—A mathematical model of a steady-state continuous crystallization system is developed where crystal seed and feed liquor is fed to the first of several vessels in series, additional feed liquor being supplied to one or more of the others. Equations are calculated for water, sucrose, heat and impurity balances in each of the vessels, together with an assumed expression for the dependence of the crystallization rate on concentration and impurities level. Two further equations express the dependence of the total heat of a sugar solution on its concentration, and the relationship between increase in length of a crystal and increase in its volume. A digital computer was used to solve the system of non-linear equations and the coefficients in the crystallization rate equation adjusted to give agreement with the observed performance of such an actual pan. The mathematical model can thus be used now for predicting the performance of the pan under different operating conditions.

* * *

Purification of raw sugar remelt liquor by two-stage fractional defeco-saturation at Kanevsk sugar factory. V. A. RADCHENKO *et al. Sakhar. Prom.*, 1973, (3), 15–17.—The liquor (comprising *C*-sugar melted in *A*-green syrup) was limed with about half of the total milk-of-lime to 0·7–0·9% CaO, gassed in 1st carbonatation to pH 8·5–9·0, treated with the rest of the milk-of-lime and gassed to pH 7·5–8·0 in 2nd carbonatation. After heating to 80°C, filtration and sulphitation to pH 7·0–7·2, the liquor was boiled in four *A*-massecuite pans, from which the green syrup not used for melting was used for *B*-massecuite boiling, and *C*-massecuite boiled from *B*-molasses. The advantages of the scheme, used for post-campaign processing of cane raw sugar, are discussed.



New books

Studies in sugar technology. S. N. GUNDU RAO. 735 pp.; 14·5 × 23 cm. (The Sugar Technologists Association of India, Kanpur 17, India.) 1973.

S. N. GUNDU RAO is President of the Sugar Technologists Association of India and Professor Emeritus of the National Sugar Institute at Kanpur. His career in the sugar industry extends back over many years as do his contributions to the literature of sugar technology. In honour of his 60th birthday, the Association has assembled his published papers and speeches and has re-published them as a compilation under the title "Studies in sugar technology". They date from 1935 onwards and are grouped in sections including 11 general papers, 9 agricultural papers, 11 concerned with by-products, 34 with sugar manufacture and 6 with chemical control. The esteem and affection in which Professor GUNDU RAO is held by his colleagues is evident from this gracious tribute to him.

* * *

Plantation crops. 318 pp; 18 × 24·5 cm. (The Commonwealth Secretariat, Marlborough House, London SW1Y 5HX, England.) 1973. Price: £3.95.

The subtitle to this work is: "A review of production, trade, consumption, stocks and prices relating to coffee, cocoa, tea, sugar, spices, tobacco and rubber" and these aspects of sugar, up to end-1972, are dealt with on pages 119 to 175, as well as brief mention in a general introduction. Two consecutive poor beet crops in the Soviet Union and low cane crops in Cuba led to a stringency in supplies of sugar on the world market which have continued, with correspondingly high free market prices. The book, prepared by and published by the Commonwealth Secretariat, examines changes which are imminent in the institutional arrangements for the non-free market international trade in sugar, e.g. the Commonwealth Sugar Agreement, ending in 1974, the International Sugar Agreement and the US Sugar Act. The compilers conclude that the future for the world's sugar producers appear reasonably good in the longer term and, provided economic development continues at a reasonable pace, the relatively high income and price elasticities for the commodity in the less developed countries should lead to buoyant consumption and a much better balance between production and consumption than occurred in the 1960's.

Sugar y Azúcar yearbook 1973. Ed. D. SMITH. 152 pp; 22·5 × 30 cm. (Sugar y Azúcar, 25 West 45th St., New York, N.Y., 10036 U.S.A.) 1973. Price: $10.00.

This book is unusual in that it starts with Chapter XI, a fact which derives from its being the second edited by DUDLEY SMITH and its continuing the 1972 edition's survey of the sugar industries of the countries of the Western Hemisphere, the 1973 *Yearbook* covering Central and South America. Chapters XI and XII are outside this scheme, however, being reviews in English and Spanish, respectively, of world sugar trends in the early 1970's. These examine briefly, with the aid of consumption and production graphs for the past 20 years, the records and trends in the various areas of the world, and assess changes likely in each during the next few years.

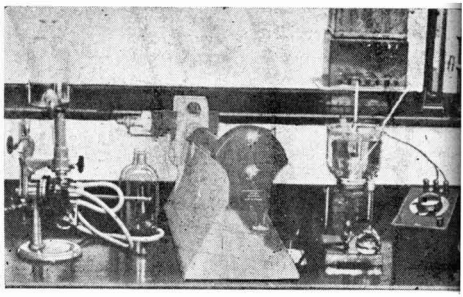
Subsequent chapters deal with Argentina, Brazil, Central America, Colombia, Ecuador, Mexico, Peru, Venezuela and Other South America, each providing a comprehensive survey on the history, geography, agricultural aspects, sugar manufacture, laws affecting the industry, organizations and their inter-relationships, research facilities and future trends. This information has been gathered by the Editor during travel in the areas concerned and provides an interesting and up-to-date account of the sugar industries of Latin America.

* * *

Sugar year book 1972. 375 pp; 10 × 14 cm. (International Sugar Organization, 28 Haymarket, London SW1Y 4SP, England.) 1973. Price: £2.00.

Like its predecessor, the 26th edition of this pocket book contains statistics on centrifugal sugar for all the world's sugar importing and exporting countries. The data, for 1972 and some earlier years, have either been submitted by member countries of the International Sugar Agreement or been supplied by governments of non-member countries, extracted from statistical publications or estimated. With exceptions, the tables are on a calendar basis and the values are expressed as metric tons 96° pol raw sugar. Where possible, a breakdown into raw and white sugar is given as well as the raw sugar totals. Apart from the national statistics, other tables are given of world statistics, and there are also tables covering a variety of subjects such as refined sugar prices and sugar stocks in selected countries, US sugar supply quotas and British Commonwealth Sugar Agreement quotas, etc. The book comes up to its usual standard for ease of reference and clarity of print.

Laboratory methods & Chemical reports



The nature of colorants isolated from raw (cane) sugar molasses. I. F. BUGAENKO, I. P. SLAVGORODSKAYA and I. I. PAVLOV. *Izv. Vuzov, Pishch. Tekh.*, 1972, (6), 91–94.—Refinery molasses (from processed raw cane sugar) was treated with adsorbent resin and the resultant colorant fractions dialysed. Analysis revealed that four out of the five fractions contained melanoidins composed of 7–11 amino-acids. The molecular weights of the colorants ranged from 700 to 30,000. Infra-red and ultra-violet spectra of the fractions are discussed.

* * *

Crystallization of calcium carbonate in the presence of sucrose and pectin. V. M. KHARIN, A. V. KOSOVTSEVA and L. S. IVASHINA. *Izv. Vuzov, Pishch. Tekh.*, 1972, (6), 151–154.—The nucleation rates and mass transfer coefficients were determined for $CaCO_3$ in solutions containing sucrose and pectin. Sucrose on its own had no essential effect on the kinetics, but did affect the composition of the precipitate, whereas together with pectin it had a considerable retarding effect on crystal nucleation and growth, while again affecting composition.

* * *

Effect of a prepared crystalline surface on the sucrose crystallization rate. E. E. SHUMSKAYA, V. D. POPOV and S. I. SIRENKO. *Izv. Vuzov, Pishch. Tekh.*, 1972, (6), 155–158.—A method is described which was used for quantitative evaluation of the effect of a prepared crystal surface on sucrose crystallization rate. A solution undergoing normal crystallization as in boiling was allowed to flow through a cylinder, with perforated walls, carrying sugar crystals, the cylinder being located in a circuit provided with a helix as impeller for the crystallizing solution. It was found that the latent period was considerably shortened and the nucleation rate increased when the solution passed through the crystals, which were maintained in a fluid bed state.

* * *

Quantitative determination of pectins and their rôle in sugar production. I. F. BUGAENKO, A. I. LAPKIN and I. P. MOISEEV. *Sakhar. Prom.*, 1973, (2), 15–18.—A rapid method of determining pectins in factory products, e.g. molasses, is described in which the test solution was passed through a column of anion exchange resin, eluted with distilled water and its optical density measured. About 10% kieselguhr (by volume) was added and after 10 minutes' mixing the solution filtered through paper. The optical density was again measured and the difference between the two values used to plot a calibration curve. The results were almost identical to those obtained by dialysis and anion exchange separation. Further experiments demonstrated the increasing effect of pectins on molasses viscosity.

* * *

Effect of salt-type modifiers on sugar solution properties during heating. V. S. GRYUNER *et al. Sakhar. Prom.*, 1973, (2), 40–43.—Addition of various sodium and ammonium salts to white sugar solutions before 3 hours' heating at 94°C was found to have an inhibiting effect on colour and reducing matter compared with their omission. Maximum effect on colour was obtained with 0·003% sodium diphosphate (on weight of sugar), while best results as regards reducing matter were obtained with 0·0015% sodium citrate plus 0·0003% ammonium diphosphate.

* * *

Some questions of production control. Z. D. ZHURAVLEVA and K. P. GONCHAROVA. *Sakhar. Prom.*, 1973, (2), 51–53.—Descriptions are given of: a hot water digestion method for determining beet sugar content using a 201·5 ml flask and lead subacetate clarification; a blank test to use in conjunction with the MÜLLER method for reducing sugars determination; and use of a calibration scale for titration in juice alkalinity determination.

* * *

Application of conductimetric measurements for technological evaluation of sugar beet. M. Z. KHELEMSKII *et al. Sakhar. Prom.*, 1973, (2), 56–62.—Various conductimeters from East European countries were compared for their accuracy in measuring the ash content of beet juice and an instrument from Czechoslovakia (the ŠANDERA-PŘÍDAL conductimeter) found to be the most suitable. Linear relationships were established between conductivity and ion concentration and between conductivity and total acid radicals in solutions of various products after cation exchange resin treatment.

* * *

Application of an electro-osmotic method to determination of the electro-kinetic potential of $CaCO_3$ particles suspended in industrial sucrose solutions. S. ŠUŠIĆ, S. PETROV and J. SABO. *Glas. Khem. Drush. Izv.*, 1972, **37**, (2), I–13.—The electro-kinetic potential of $CaCO_3$ particles suspended in aqueous solutions of sucrose and beet factory juices was determined and the suitability of the method for routine measurements in process control examined. A $CaCO_3$ suspension was

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obtained by saturating milk-of-lime with CO_2 at 85°C and maintaining various pH values. The influence of pH on the zeta-potential was then determined. By separating the suspensions according to their sedimentation rates and measuring the zeta-potentials of the separate fractions, the granulometric composition and its effect on the zeta-potential were established.

* * *

A method for gravimetric determination of the water-insoluble solids content in white sugar using membrane filters. T. CRONEWITZ and W. SERKEZY. *Zucker*, 1973, **26**, 134–138.—Details are given of a method in which membrane filters of 0·45 μm with water-repellent edges (for ease of washing) were used to determine water-insoluble solids in white sugar; the method has proved equally suitable for thin and thick juice and standard liquor. The pH of the distilled water used to dissolve the sugar was found to affect the results (including the determination of colour according to the EEC instructions, in which the colour in solution at low pH was lower than at high pH values while the membrane filter exhibited marked yellowing), so that a pH range of 5–8 is recommended.

* * *

A new method for evaluating the buffering capacity of sugar cane juice. ANON. *N.S.I. News* (Kanpur), 1972, **1**, (8), 5.—Cane juice buffering substances (total acids plus total bases) are measured by diluting juice 1:1 with distilled water; 50 ml aliquots are titrated with N/10 HCl and N/10 NaOH using a pH meter. The total buffering capacity is taken as the total acid + alkali required for pH change from 2·5 to 10·5, as read from calibration curves.

* * *

Techniques for leaf sampling and automated analysis of sugar beet leaf amino-acids. G. W. MAAG, R. J. HECKER and P. A. WHITAKER. *J. Amer. Soc. Sugar Beet Tech.*, 1971, **16**, 530–540.—Techniques of beet leaf sampling, sample preparation and analysis for amino-acids are described; these were developed in order to conduct investigations with the aim of detecting possible relationships between leaf amino-acids and *Cercospora beticola* leaf spot resistance. Column chromatography using a Technicon "Auto-Analyzer" permitted quantitative determination of 21 free amino-acids and 2 amides; in addition, several unknown amino-acids (identified since completion of the studies) were detected, including citrulline, α-aminoadipic acid, α-amino-*n*-butyric acid and possibly *iso*-valine and pipecolic acid. Relative quantities of the individual amino-acids in different sections of the leaves from medium-aged beet (young, medium-aged and old beet were studied) varied considerably between sections and populations of the four beet varieties grown. The mid-section of the medium-aged leaves was probably the most representative for amino-acid determination. Greater accuracy is probable if the calculations are made on a dry weight rather than a fresh leaf weight basis. Data for the two leaf spot-resistant and two leaf spot-susceptible varieties are tabulated.

Determination of alpha-nitrogen in beet and raw juice. II. R. BRETSCHNEIDER, J. ČOPÍKOVÁ, P. KADLEC and E. FIALOVÁ. *Listy Cukr.*, 1973, **89**, 55–58.—Experiments on determination of noxious nitrogen (blue number) in beet press and raw juice showed that the blue colour created by the reaction between the α-amino-N and the copper reagent can most suitably be measured colorimetrically at 600 nm after adjustment of the juice pH. Results were mainly in agreement with calibrated standard values.

* * *

Copper determination in white sugar. B. TICHÁ and M. FRIML. *Listy Cukr.*, 1973, **89**, 69–72.—In the determination of copper in white sugar by a colorimetric method using diethyldithiocarbamate (as used in the food industry), ashing in a muffle furnace at 550–600°C caused substantial error which, however, was considerably reduced by wet ashing with a mixture of nitric and sulphuric acid during 30–40 minutes; this gives good reproducibility with an accuracy of ± 2·7% in 1-kg samples of white sugar.

* * *

Stability of sucrose in the presence of lactic acid salts. S. Z. IVANOV, Z. A. MIL'KOVA and I. P. OROBINSKII. *Sakhar. Prom.*, 1973, (3), 18–19.—In experiments in which 0·5M sucrose solutions were heated under reflux on a boiling water bath in the presence of 0·1 mole/litre K, Na and Ca lactate solutions, respectively, each of the salts was found to accelerate sucrose inversion.

* * *

Investigation by ion exchange sorption of coloured products of invert sugar decomposition. V. A. KOLESNIKOV and D. M. LEIBOVICH. *Sakhar. Prom.*, 1973, (3), 19–23.—Colorant fractions formed in invert sugar heated at 100° and 130°C for 1 hr at pH 7 and 9 were eluted from anion exchange resin by NaCl, HCl and NaOH solutions and their optical densities measured. The relative elution properties of the three solutions are discussed as are the spectral curves of the colorant fractions. The effects of the presence of furfural and of SO_2 in the initial invert solution are discussed. One colorant fraction remained uneluted under all circumstances.

* * *

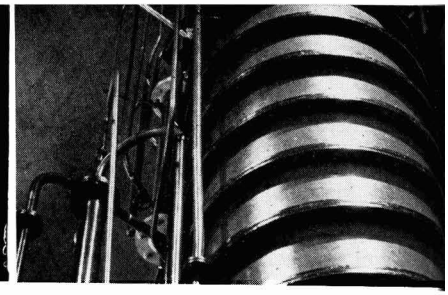
Determination of standard molasses purity. I. N. AKINDINOV. *Sakhar. Prom.*, 1973, (3), 53–54.—The method described by GOISMAN[1] is criticized.

* * *

Determination of beet sugar content at reception. N. P. DUTOV, S. V. MOROZOV, N. M. IGNATOV and V. K. IVANOV. *Sakhar. Prom.*, 1973, (3), 56–59. Details are given of tests to find a suitable method under Soviet conditions for determining beet sugar in samples normally taken from transport for dirt tare determination instead of determining the sugar in samples extracted from the piles.

[1] *I.S.J.*, 1973, **75**, 59.

By-products



Beet pulp for milk production. M. E. CASTLE. *British Sugar Beet Rev.*, 1972, **40**, 269–272.—Dried beet pulp is widely regarded as a palatable source of highly digestible energy for cattle and also encourages the voluntary intake of dry matter when incorporated in the ration of dairy cattle. Beet pulp and barley can replace each other on a weight-for-weight basis in the concentrate part of cattle fodder and large amounts of dry pulp can be fed with complete safety and produce high milk yields.

* * *

Bagasse to be used in new plant; new process for dried molasses concentrate. ANON. *Sugar Bull.*, 1973, **51**, (7), 5, 8.—A new plant to be built[1] at Lockport, Louisiana, adjacent to Valentine Pulp & Paper Co., producers of printing and converting papers from bagasse, will use cane molasses and the pith separated from the bagasse at the Valentine plant to provide a concentrate of 50% sugar content (19% higher than the US standard for dried molasses used as animal fodder.) The free-flowing, non-caking product, equivalent to 104% liquid cane molasses, will also contain minerals and vitamins and will be marketed under the name "Sweetone 100".

* * *

Establishing the optimum conditions for the development of fodder yeast on molasses and molasses pulp. M. STOICA. *Ind. Alimentara*, 1972, **23**, 134–137; through *Abs. Rom. Sci. Tech. Lit.*, 1972, **8**, 975. Diluted molasses (1:18) or undiluted molasses-pulp, at 30°C and pH 4·6, with added superphosphate and $(NH_4)_2SO_4$ as nutrients, were used as substrates for development and selection of the best strains of *Torula utilis*, *Candida tropicalis* and *Monilia murmanica*. Two strains were selected and a method developed for production of fodder yeast from molasses and pulp.

* * *

Industrial wastes from resin plants in beet sugar factories. P. BALDASSARI. *Ind. Sacc. Ital.*, 1972, **65**, 163–168.—Effluents from ion exchange plants in beet sugar factories can be used as raw material for obtaining fertilizer salts and protein concentrate for use as fodder. With present decalcification and demineralization plants, however, this requires a rather high consumption of chemicals for treatment of the wastes and the "Reggiane 3D/ES" process is therefore recommended since this involves lower consumption of chemicals and smaller quantities of nearly neutral effluents which are richer in fertilizer salts and protein. A plant for their recovery is easily adjoined to the resin plant in the factory, eliminating waste disposal problems and yielding a considerable profit.

* * *

Influence of the concentration of reducers on yield in the production of torula yeast on cane final molasses. O. ALMAZÁN and A. SÁEZ. *CubaAzúcar*, 1972, (July/Sept.), 2–6.—Experiments showed that the yield of biomass was reduced by about 30% when the reducing sugars content of a final molasses substrate was increased from 30 to 100 g/litre.

* * *

Study of the influence of recirculation of black liquor on the processes of alkaline extraction of nitrated bagasse. N. MAXIMOVA, Y. TERENTIEV and P. LOPEZ. *CubaAzúcar*, 1972, (July/Sept.), 13–20.—In the manufacture of α-cellulose from bagasse by nitric acid pulping, the amount of NaOH used is a principal cost factor. This can be reduced by recirculation of the black liquor, and the effect of so doing has been studied; the properties of the product (yield, brilliance, moisture, ash, lignin, pentosans, alcohol-benzene extract) have been related to the active alkali and total solids of the extraction liquor by regression equations.

* * *

Determination of monosaccharide content in sugar cane bagasse cellulose hydrolysates by paper chromatography and its influence on viscose filtration. C. J. TRIANA F. and Z. PORTALES. *CubaAzúcar*, 1972, (July/Sept.), 46–53.—Dissolving pulp prepared from bagasse was milled, screened, hydrolysed with dilute H_2SO_4, the hydrolysate neutralized and a fraction subjected to paper chromatographic analysis. Xylose, arabinose, mannose, glucose and galactose were identified and the concentrations determined. Correlation of the monosaccharide contents with measurements of the filtration index of the viscoses obtained from the pulps showed that a high xylose content in the pulp contributed to a low filtration index.

* * *

Technology of beet pulp dehydration. A. ROCHE. *Hautes Etudes Betterav. Agric.*, 1973, **5**, (19), 20–24. Production of dried beet pulp is considered in four phases, the first being the treatment of cossettes in the diffuser, followed by pressing of the pulp, heat drying of pulp, and the conditioning of pulp in the form of granules. All are linked, and conditions for each phase should be selected to provide the best conditions for the next.

[1] *See I.S.J.*, 1973, **75**, 232.

World sugar production estimates 1973/74[1]

BEET SUGAR	Campaign	Estimate 1973/74	1972/73
		metric tons, raw value	
EUROPE			
Belgium/Luxembourg	Sept./Jan.	778,000	685,000
Denmark	,,	389,000	348,889
France	,,	3,222,000	3,050,000
Germany	,,	2,424,000	2,268,000
Holland	,,	835,000	772,447
Ireland	,,	200,000	174,735
Italy	July/Oct.	1,217,000	1,317,000
United Kingdom	Sept./Jan.	1,111,000	984,926
Total E.E.C.		*10,176,000*	*9,600,997*
Austria	Sept./Jan.	378,000	406,812
Finland	,,	85,800	93,225
Greece	July/Oct.*	161,110	131,471
Spain	July/March	867,000	818,317
Sweden	Sept./Jan.	263,000	298,889
Switzerland	,,	73,000	68,424
Turkey	Aug./Feb.	800,000	829,399
Yugoslavia	Aug./Jan.	467,000	395,377
Total West Europe		*13,270,911*	*12,642,911*
Albania	Aug./Jan.	19,000	19,000
Bulgaria	,,	260,000	230,000
Czechoslovakia	Sept./Jan.	700,000	770,000
Germany, East	,,	670,000	655,555
Hungary	,,	380,000	329,665
Poland	,,	1,740,000	1,826,000
Rumania	Aug./Feb.	600,000	610,000
USSR	Sept./Jan.	9,500,000	8,500,000
Total East Europe		*13,869,000*	*12,940,220*
Total Europe		27,139,911	25,583,131
OTHER CONTINENTS			
Afghanistan	Nov./Feb.	9,000	9,213
Algeria	June/Nov.*	25,000	20,000
Azores	June/March	8,000	8,000
Canada	Oct./Dec.*	122,000	127,611
Chile	April/June†	168,000	114,288
China	Jan./Dec.†	900,000	850,000
Iran	Oct./March	700,000	574,216
Iraq	,,	10,000	10,000
Israel	May/July†	30,000	30,164
Japan	Oct./Feb.	414,000	418,838
Lebanon	June/Nov.*	26,000	25,000
Morocco	May/Aug.†	260,000	260,000
Pakistan	June/July†	10,000	11,446
Syria	May/June†	35,000	35,000
Tunisia	May/April	5,600	4,078
United States	July/June	2,750,000	3,268,916
Uruguay	May/April	51,000	44,951
Total Other Continents		5,517,600	5,811,721
TOTAL BEET SUGAR		32,657,511	31,394,852

CANE SUGAR			
EUROPE			
Spain	March/Sept.†	30,000	31,140
NORTH AND CENTRAL AMERICA			
Belize	Dec./June	82,000	71,800
Costa Rica	,,	210,000	205,000
Cuba	Nov./July	5,700,000	5,400,000
Dominican Republic	Nov./Sept.	1,270,000	1,192,980
Guadeloupe	Jan./June†	115,000	126,751
Guatemala	Dec./June	293,000	265,826
Haiti	,,	72,000	72,000
Honduras	,,	70,000	65,000
Martinique	Jan./June*	20,000	22,000
Mexico	Nov./July	2,950,000	2,805,000
Nicaragua	Dec./June	175,000	172,000
Panama	,,	132,000	92,532
Puerto Rico	Jan./July†	230,000	240,000
El Salvador	Nov./June	237,000	205,000
USA—Mainland	Oct./June	1,550,000	1,502,484
Hawaii	Jan./Dec.†	1,100,000	1,037,000
West Indies—Barbados‡	Jan./June†	120,000	118,221
Jamaica‡	Jan./June	365,000	341,400
St. Kitts‡	,,	25,000	23,695
Trinidad‡	,,	195,000	186,678
Total North and Central America		14,911,000	14,145,367
SOUTH AMERICA			
Argentina	July/Dec.*	1,600,000	1,328,959
Bolivia	May/Sept.†	205,000	136,227
Brazil	June/May	7,156,000	6,162,906
Colombia	Jan./Dec.†	905,000	840,000
Ecuador	June/Jan.	260,000	270,000
Guyana‡	Oct./June	370,000	298,140
Paraguay	July/Nov.*	72,000	58,722
Peru	Jan./Dec‡.	980,000	913,832
Surinam	Aug./May	10,000	11,415
Uruguay	May/April	23,000	28,276
Venezuela	Sept./Aug.	510,000	533,111
Total South America		12,091,000	10,581,588
AFRICA			
Angola‡	May/March	100,000	93,000
Cameroun	April/Sept.*	20,000	16,942
Congo (Brazzaville)	May/Nov.*	40,000	39,957
Egypt	Dec./June	700,000	680,000
Ethiopia	Nov./June	150,000	145,823
Ghana	April/Sept.*	15,000	10,000
Kenya	July/June	115,000	117,000
Madeira	March/Sept.*	3,000	3,301
Malagasy Republic	July/June	110,000	110,162
Malawi	May/Nov.*	55,000	35,295
Mali	April/Sept.	10,000	10,000
Mauritius‡	July/Jan.	725,000	727,410
Mozambique‡	May/Nov.*	392,000	326,023
Nigeria	,,	36,444	30,278
Réunion	July/Jan.	260,000	251,052
Rhodesia	May/Nov.*	225,000	200,000
Somalia	Dec./April	50,000	50,000
South Africa	May/April	1,950,000	2,035,344
Sudan	Dec./June	100,000	100,000
Swaziland	May/Dec.*	185,000	181,901
Tanzania	July/June	119,000	119,000
Uganda	,,	120,000	120,000
Zaire	May/Nov.*	62,363	39,481
Zambia	,,	58,000	51,119
Total Africa		5,600,807	5,493,088
ASIA			
Afghanistan	Oct./April	10,000	10,000
Bangla Desh	Nov./May	25,000	21,439
Burma	Nov./April	100,000	100,000
China	Jan./Dec.†	2,550,000	2,500,000
India, excl. khandsari	Oct./July	4,400,000	4,281,000
Indonesia	May/Dec.*	1,000,000	889,000
Iran	Oct./April	94,000	69,435
Japan	Nov./June	230,000	234,298
Nepal	Oct./April	9,000	7,751
Pakistan	Nov./May	677,000	460,488
Philippines	Nov./July	2,350,000	2,327,824
Sri Lanka	Nov./June	20,000	13,427
Taiwan	,,	850,000	779,975
Thailand	Oct./April	780,000	778,000
Total Asia		13,102,000	12,479,437
OCEANIA			
Australia	May/Dec.*	2,875,000	2,893,000
Fiji	,,	330,000	320,639
Total Oceania		3,205,000	3,213,639
TOTAL CANE SUGAR		48,939,807	45,944,259
TOTAL BEET SUGAR		32,657,511	31,394,852
TOTAL SUGAR PRODUCTION		81,597,318	77,339,111

[1] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (34), 1–4.
* 1973, 1972 † 1974, 1973 ‡ tel quel

International Commission of Sugar Technology (C.I.T.S.)

BY kind invitation of the Verband der Zuckerindustrie Oesterreichs the 15th General Assembly will be held in Vienna from Tuesday, 13th May to Friday, 16th May, 1975. The meeting will take place in the Wiener Kongresszentrum of the Hofburg.

All who are interested in problems relating to the manufacture of sugar are cordially invited to attend this conference. Languages will be English, French and German.

Communications

The themes of priority for the conference are:

(1) The principles of the extraction of beets, and

(2) The behaviour of non-sucrose substances in the sugar manufacturing process.

It is important to note, however, that papers may be presented on other subjects which deal with matters of concern to those who are engaged in the sugar industry.

Authors are reminded that their papers must describe original work of a scientific or technical nature and may not seek to promote any commercial interest.

Members of the Scientific Committee should inform the General Secretary prior to 1st January 1975 the title(s) of the paper(s) they wish to present and the name(s) of any co-author(s).

Non-members who are not sponsored by a Member of the Scientific Committee should submit 3 copies of their papers to the General Secretary prior to 1st January 1975.

150 copies of all admissible papers should be received by the General Secretary in sufficient time to allow for circulation to all participants and certainly not later than 15th March, 1975.

Each paper must include an adequate summary in each of the three official languages, English, French and German.

Registration of Participants

The office of the organization will be held in the Fachverein der Zuckerfabriken Oesterreichs, Wien III, Am Heumarkt 13.

Postal address: A-1037 Wien, Postfach 9
Telephone: 0222/72 21 94
Telex: 01.1492

The participants to the general assembly are invited to send a provisional registration to the organization office before 30th April 1974. On account of the great number of congresses held in Vienna, the hotel registration must be done at that time.

On the basis of the provisional registrations, the participants will receive in March 1975 the programme of the meeting, an inquiry card relating to several points: the desired class of hotel, propositions concerning group air travel costs and the list of the several festivities organized during the period of the Assembly (dinner, trips, opera, etc.)

Additional information may be obtained from

Dr. J. HENRY
Aandorenstraat, 1
B-3300 TIENEN (BELGIUM)

Brevities

Zambia refined sugar production[1].—The Zambia Sugar Co. Ltd. is to build another refinery at Nakambala Sugar Estate which will handle the refining for the Southern Division of the Company. It will be the second refinery in Zambia and is expected to be completed in March 1974. The first refinery at Ndola will serve the needs of the company's Northern Division. The rapid growth of the company has also necessitated expansion of the sugar estates; well over K18 million (£11·6 million) will be spent in this direction to make Zambia completely self-sufficient in sugar by the end of 1974.

* * *

The late R. R. Panje.—Shri RAMA RAO PANJE, former Director of the Indian Institute of Sugarcane Research at Lucknow, died recently following injury in a traffic accident. Born in 1909, Shri PANJE graduated from Madras University in 1931 and obtained his M.Sc. (Botany) in 1933. In 1934 he joined the Sugarcane Research Station at Pusa, Bihar, where he stayed until 1940, subsequently working on various agronomic and varietal aspects of cane at Muzzaffarnagar and Shahjahanpur Research Stations for about a decade. Subsequently he was engaged on the "Spontaneum Expedition" of the Sugarcane Breeding Institute, Coimbatore, to study the wild relatives of cane growing in India, South-East Asia, the Middle East and Africa, and started the collection which has developed into the World Repository of Germ Plasm. During his ten years as Director of the I.I.S.R. he carried out and instigated valuable developments in cane agronomy and breeding, and also initiated investigations on sugar beet cultivation. At the time of his death he was organizing the sugar cane research wing of Somaiya Sugar Works.

* * *

International Sugar Council.—The final meeting of the International Sugar Council under the 1968 Agreement took place on the 6th December. Formalities in connexion with the winding-up of the Agreement were completed before its expiry on the 31st December. The new Agreement, open for signature of adhering countries up to 24th January, is purely administrative but the Council has been charged with studying the framework for a new Agreement with the calling of a new UNCTAD Conference in mind, as soon as a successful outcome is envisaged.

* * *

Tate & Lyle Enterprises Inc.—This new company has been established (as a subsidiary of the UK Company) since the 1st October 1973 at 2121 Ponce de Leon Boulevard, Coral Gables, Florida, USA. The Resident Manager had previously completed the design work undertaken by Tate & Lyle Technical Services Ltd. for Lang Engineering of Miami in their contract to build a 5500 t.c.d. sugar factory at Ferkessedougou in the Ivory Coast. The new company will be able to offer all the services of the Tate & Lyle Enterprises Group with the added advantage of local availability to customers in North and South America and the Caribbean.

[1] *Barclays International Review*, November 1973, 24.

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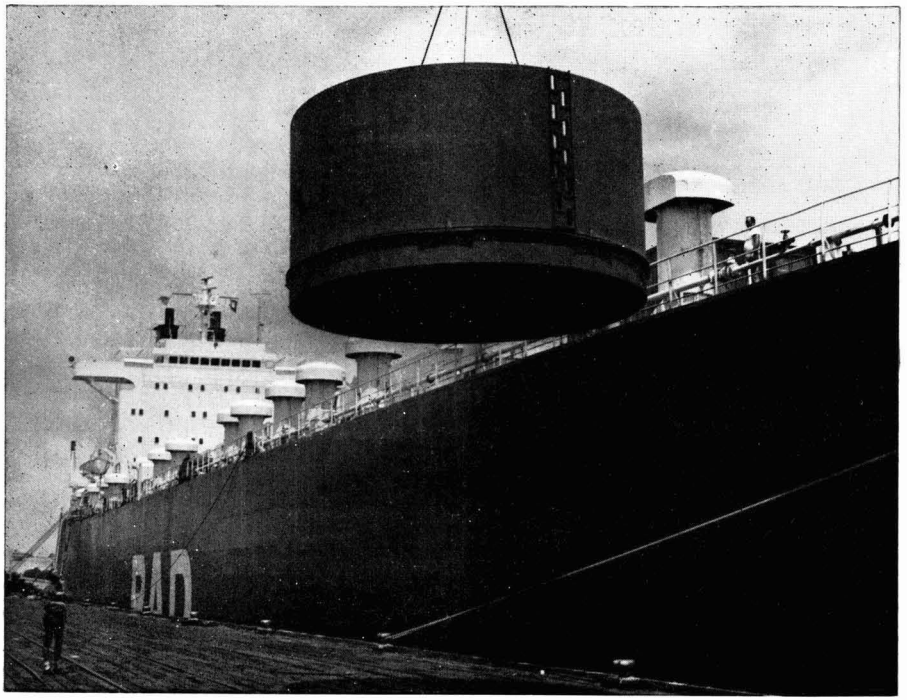

Part of a vacuum pan being loaded at Brisbane en route to the island of Hawaii.

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