THE International Sugar Journal

NOVEMBER 1973

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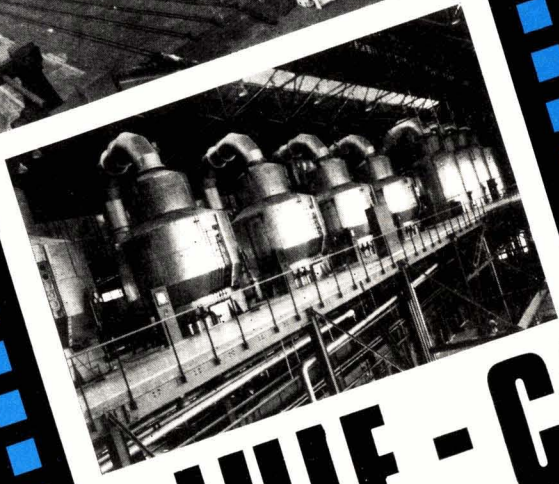

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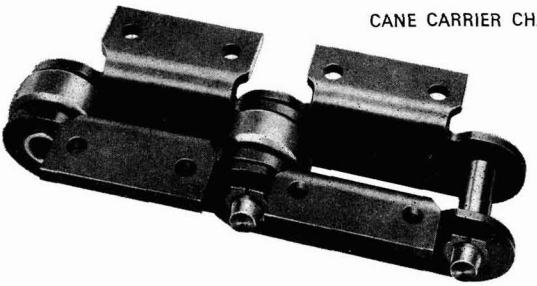

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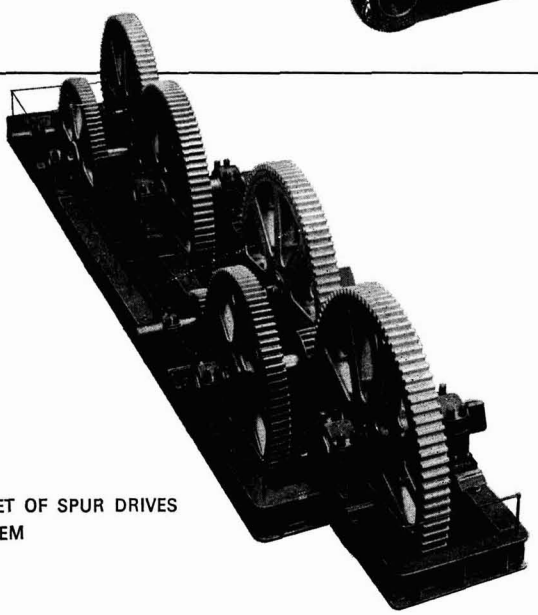

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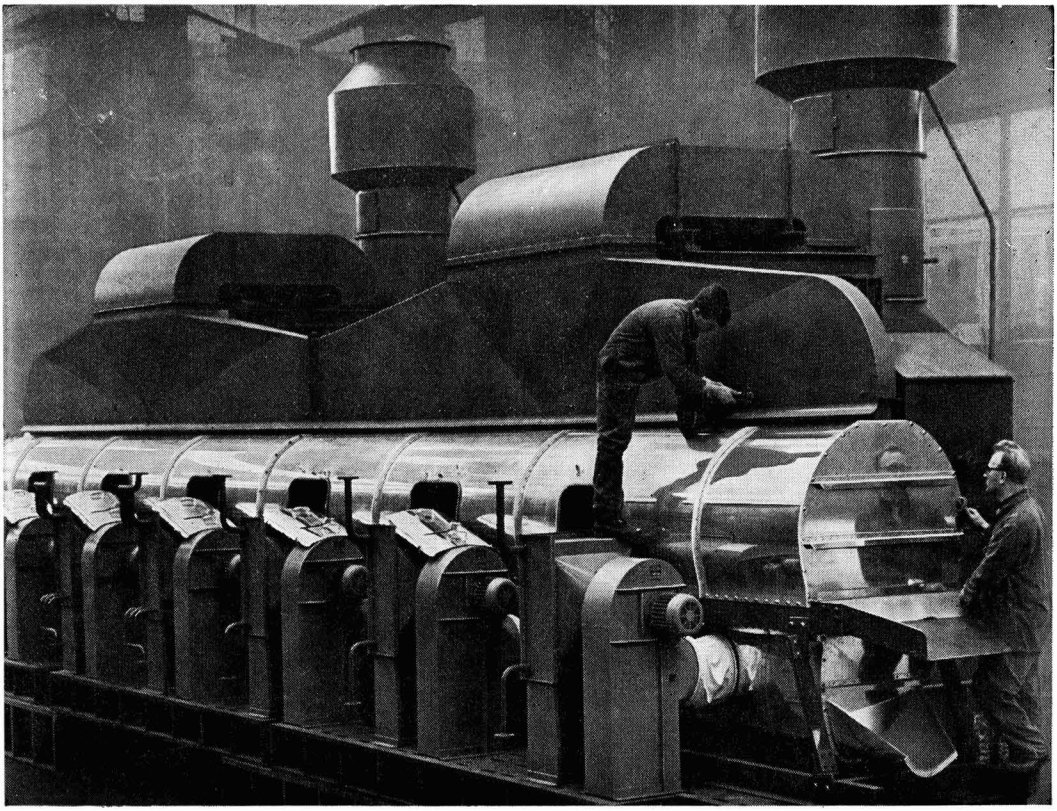

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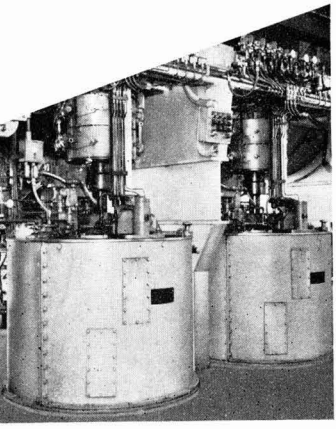

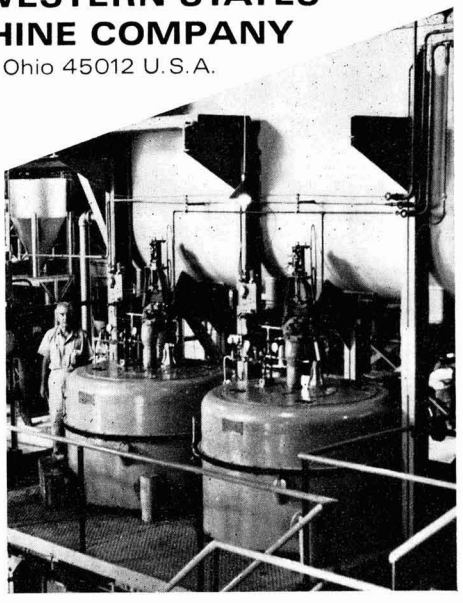

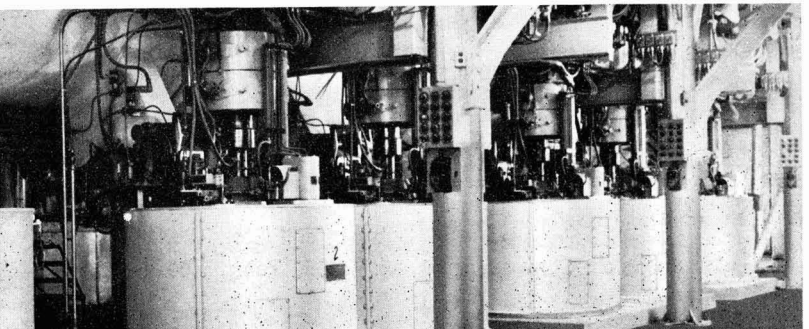

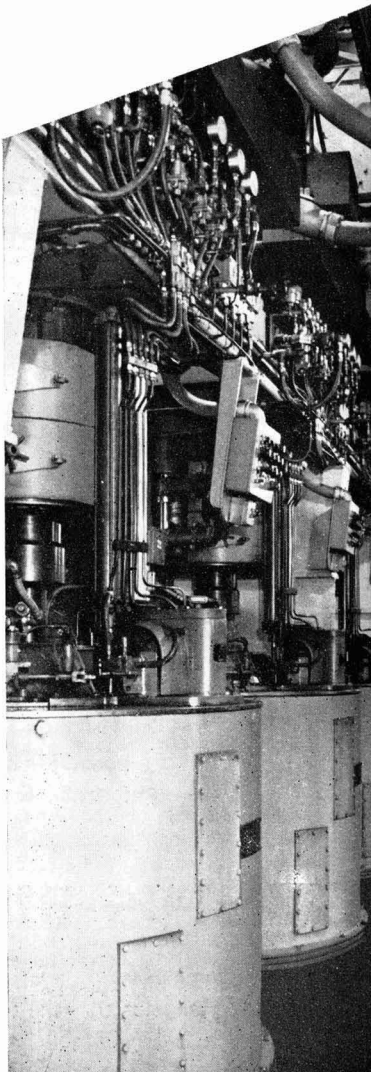

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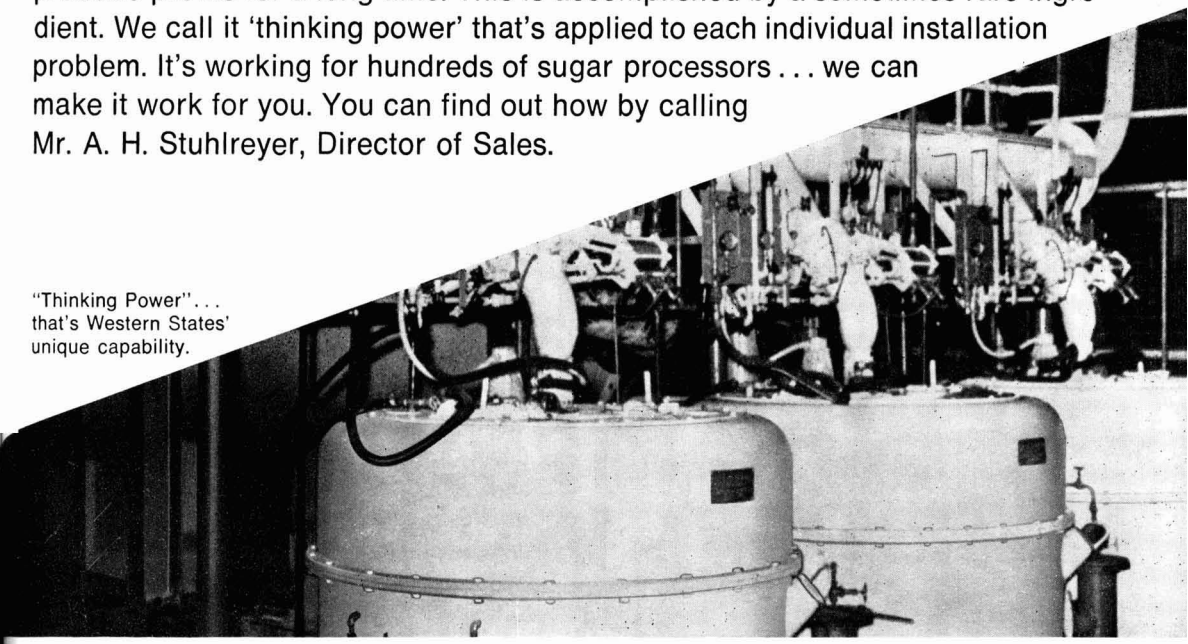

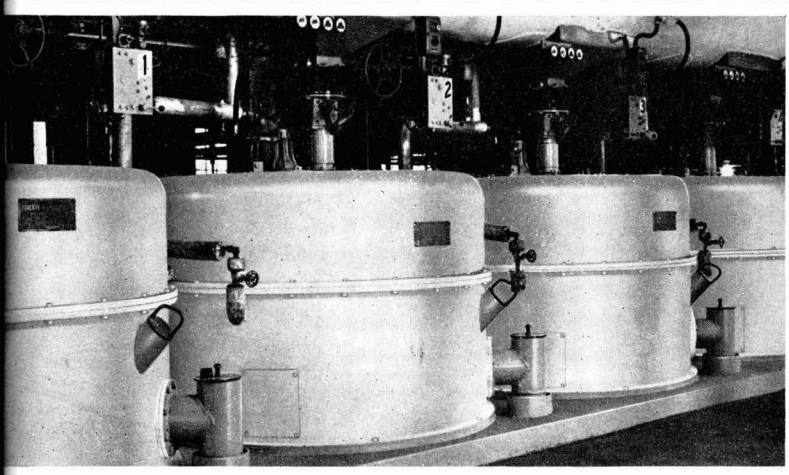

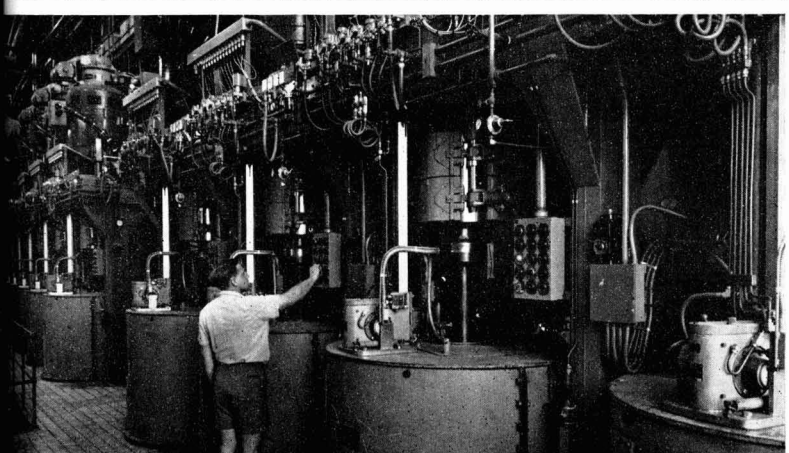

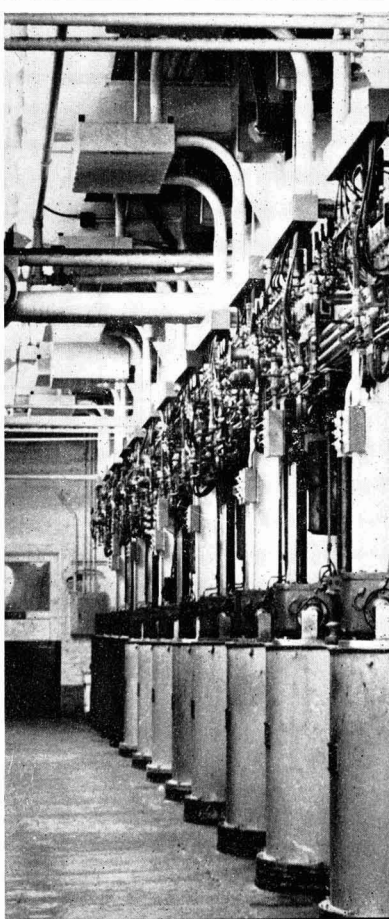

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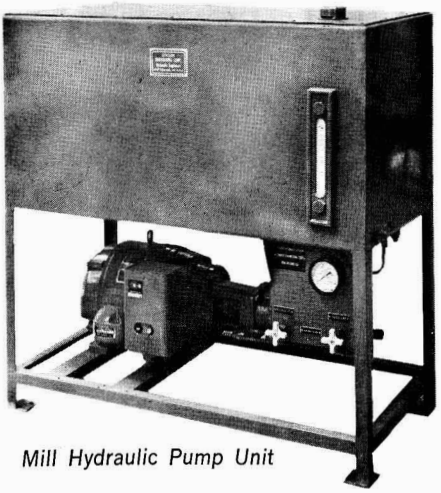

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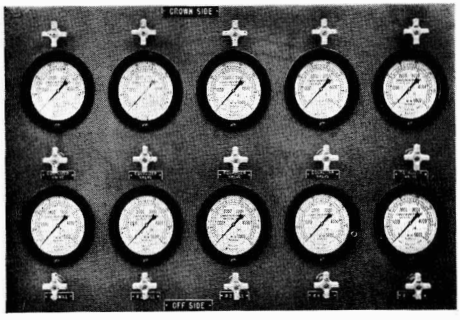

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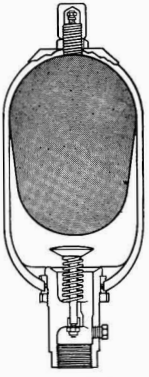

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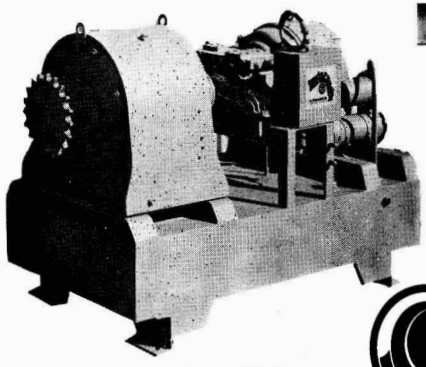

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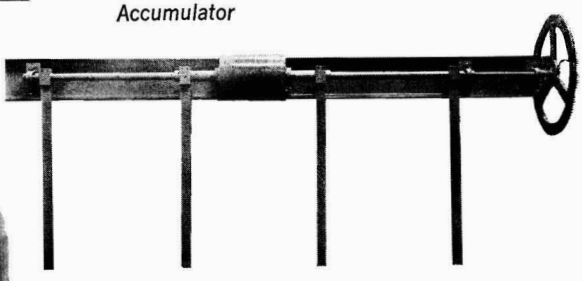

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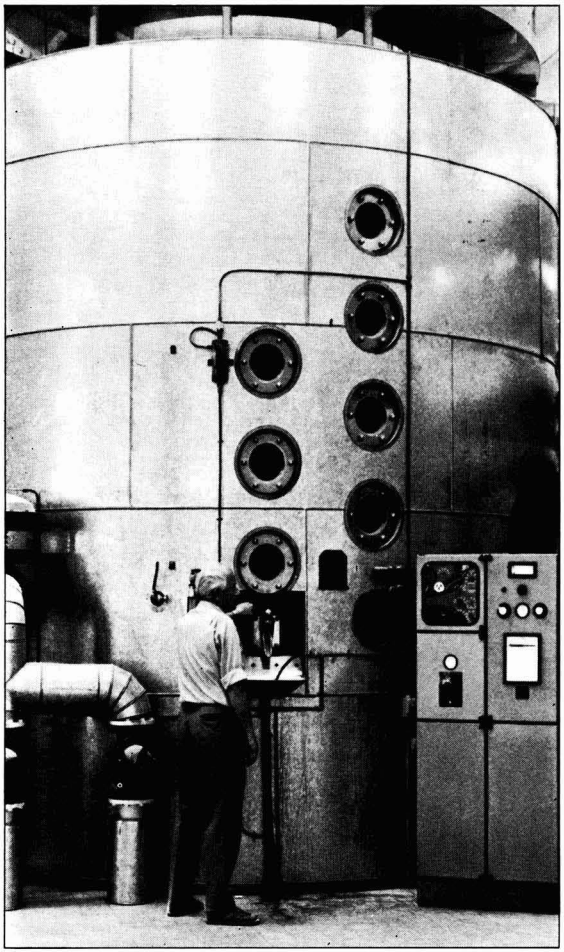

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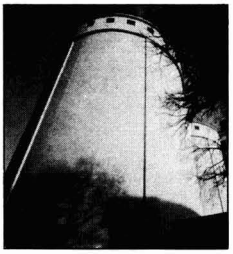

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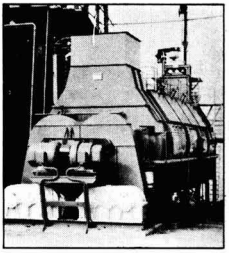

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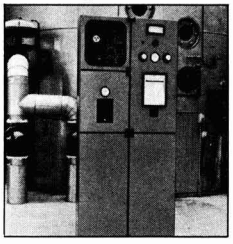

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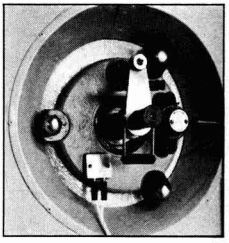

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International Sugar Journal

November 1973

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Fréquences et retards temporels observés dans un train de presses. Ie Partie. W. McWHINNEY. *p.* 331–334

L'auteur démontre comment l'observation des opérations d'un tandem de presses à canne peut être utilisée pour évaluer les mécaniques du procédé de pression. A cet effet on enregistre et on analyse simultanément les entrées vers et les sorties du processus. La première partie contient les données et les graphiques utilisés pour établir le nombre d'auto-corrélations (corrélation d'une variable avec elle-même) et de corrélations croisées (corrélation de deux variables différentes). Cette partie renferme également les déductions qu'on a pu faire à partir de ces résultats.

* * *

Contrôle chimique des nématodes parasites dans la canne à sucre. Ie Partie. K. SINGH et S. R. MISRA. *p.* 335–336

On détaille la recherche au sujet du contrôle chimique des nématodes parasites qui infectent la canne aux Indes. On donne des indications sur la distribution du parasite et la population totale en nématodes dans la zone de la racine pour une variété donnée de canne. On indique également l'effet des méthodes de plantation de la canne sur cette distribution. L'application de nématicides sur des bandes fut comparée à l'application générale. Il fut montré que la dernière était plus effective pour accroître le rendement en canne, en comparaison à un essai à blanc dans lequel on n'a appliqué aucun traitement de nématicides.

* * *

Une analyse de l'influence de la qualité de la canne à sucre sur le rendement en sucre. IIe Partie. E. J. BUCHANAN. *p.* 337–341

Cet article décrit une analyse statistique pour déterminer l'effet de la qualité de canne sur le rendement en sucre. Dans cette deuxième partie on évalue les pertes en sucre dans les écumes et dans les chaudières ainsi que les pertes indéterminées. On présente des conclusions au sujet de l'extraction des non-sucres dans les différents processus, ainsi qu'une formule pour la récupération en trois effets. Cette formule est déduite de l'analyse statistique et elle permet la prédiction du rendement en sucre (% canne) avec une déviation standard inférieure à 0,05.

An einem Mühlenaggregat beobachtete Frequenzen und Stillstandszeiten. Teil I. W. McWHINNEY. *S.* 331–334

Der Verfasser zeigt, wie die Beobachtung der Arbeitsweise eines Tandem-Rohrmühlenaggregats dazu benutzt werden kann, die Dynamik des Mahlprozesses durch gleichzeitiges Aufzeichnen und Analysieren der in den Prozess eintretenden und der den Prozess verlassenden Mengen zu bewerten. Teil I enthält Daten und Diagramme, die dazu verwendet wurden, eine Zahl von Autokorrelationen (Korrelation zwischen einer Variablen und sich selbst) und Crosskorrelationen (Korrelation zwischen zwei verschiedenen Variablen) aufzustellen und daraus Ableitungen vorzunehmen.

* * *

Chemische Bekämpfung parasitischer Nematoden in Zuckerrohr. Teil I. K. SINGH und S. R. MISRA. *S.* 335–336

Es werden Einzelheiten über Untersuchungen mitgeteilt, die zur chemischen Bekämpfung von bei Zuckerrohr in Indien aufgetretenen parasitischer Nematoden durchgeführt wurden. Die Verteilung des pflanzenparasitischen und des gesamten Nematodenbesatzes in der Wurzelzone einer bestimmten Rohrvarietät wird registriert und der Einfluss der Pflanzmethode auf dier Verteilung angegeben. Die Ausbringung des nematiziden Mittels durch Bandspritzung wurde mit Flächenspritzverfahren verglichen. Im Vergleich zur Kontrolle (keine nematizide Behandlung) erwies sich die letztere Methode hinsichtlich der Steigerung des Zuckerrohrertrages als wirkungsvoller.

* * *

Eine Untersuchung über den Einfluss der Qualität des Zuckerrohrs auf die erreichbare Zuckerausbeute. Teil II. E. J. BUCHANAN. *S.* 337–341

Im zweiten Teil dieser Arbeit, in welcher eine statistische Analyse zur Ermittlung des Einflusses der Qualität des Zuckerrohrs auf die erreichbare Zuckerausbeute beschrieben wird, werden die Zuckerverluste im Filterkuchen und im Zuckerhaus sowie die unbestimmten Verluste erfasst. Schlussfolgerungen hinsichtlich der Extraktion der Nichtzuckerstoffe in den verschiedenen Prozessen werden wiedergegeben, ferner wird eine dreistufige Zuckerausbeuteformel aus der statistischen Analyse abgeleitet. Diese Formel ermöglicht die Voraussage des gewinnbaren Zuckers (in Prozent auf Rohr) mit einer Standardabweichung von weniger als 0,05.

Frecuencias y demoras observado en un tandém de molienda. Parte I. W. McWHINNEY. *Pág.* 331–334

El autor demuestra como observaciones del operación de un tandém de molienda de caña puede usarse para evaluar la dinámica del proceso de molienda por medio de la registración y análisis de cantidades alimentado a y saliendo del proceso. Parte I contiene dados y gráficos que se usan para establecer algunas auto-corelaciones (corelación de una variable con sí) y contra-corelaciones (corelación de una variable con otra), y deducciones hecho de estos.

* * *

Control químico de nemátodos parasíticos en caña de azúcar. Parte I. K. SINGH y S. R. MISRA. *Pág.* 335–336

Se presentan detalles de investigaciónes sobre control químico de nemátodos parasíticos que infestan caña de azúcar en la India. Se recuerde la distribución de populaciones de nemátodos fitoparasíticos y en total en la zona de las raices de una dada variedad de caña y se indica el efecto del método de planteación sobre esta distribución. Aplicación de nemáticida en tiras del suelo se ha comparado con aplicación global; la segunda se encontró más efectivo para crecer el rendimiento de caña sobre él del control (omisión de aplicación de nemáticida).

* * *

Un análisis de la influencia de calidad de caña sobre recuperación de azúcar. Parte II. E. J. BUCHANAN. *Pág.* 337–341

En la segunda parte de este artículo, que describe un análisis estatístico para determinar el efecto de calidad de caña sobre recuperación de azúcar, las perdidas de azúcar en cachaza y en la casa de cocción se evaluan tanto como las perdidas no-determinadas. Se presentan conclusiones con respecto al extracción de no-azúcares en los varios procesos, tanto como una fórmula en tres etapas para calcular recuperación que se derive a base del análisis estatístico; esta fórmula permite pronóstico de la recuperación de azúcar % caña con un error standard de menos de 0,05.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXV NOVEMBER 1973 No. 899

Notes & Comments

International Sugar Conference

Some 75 countries were represented at the second round of talks in Geneva which began on the 10th September and were scheduled to run for a month, although the slow pace of progress resulted in provision being made for an extension of two days. There were no plenary sessions and discussions over the first two weeks were confidential; however the Conference Chairman's proposed basic export quota tonnages were then published[1], as below; it was emphasized that they were not to be construed as final.

	Metric tons, raw value
Argentina	180,000
Australia	1,650,000
Belize	25,000
Brazil	1,550,000
Colombia	130,000
Cuba	2,550,000
Czechoslovakia	150,000
Dominican Republic	400,000
Fiji	180,000
Guatemala	75,000
Hungary	25,000
India	200,000
Mauritius	245,000
Peru	90,000
Philippines	80,000
Poland	340,000
Rumania	50,000
Salvador	85,000
South Africa	925,000
Swaziland	80,000
Thailand	325,000
Turkey	75,000
Venezuela	30,000
West Indies	35,000
	9,475,000

The figures were proposed for three years only and provision has been made for Australia's basic quota to rise by up to 361,000 tons to compensate for the loss of her Commonwealth Sugar Agreement quota as it is phased out after 1974. Furthermore, provision has been made for the basic export tonnages of Colombia, India and the West Indies to be raised should they fulfil their quotas in the first or second years of the Agreement. Net export entitlements of up to 15,000 tons are also reported to have been proposed in respect of Bolivia, Congo (Brazzaville), Costa Rica, Ecuador, Ethiopia, Haiti, Honduras, Malagasy Republic, Malawi, Nicaragua, Panama, Paraguay and Uganda. Countries within this group fulfilling their entitlement in the first and second years of the Agreement would receive a basic export tonnage of 25,000 tons in the third year. No basic export tonnage has been allotted to Indonesia but a net export entitlement of 80,000 tons is awarded in the second and third years of the Agreement. Mexico is another country which was not awarded a basic export tonnage on this occasion; but provision has been made for one to be allotted in the second and/or third year.

Delegates from some importing countries, led by Canada, proposed that the price range to be incorporated in the new Agreement should be from 3·75 to 5·75 US cents per pound[2] and that the supply commitment price should remain at 7·60 cents/lb. This proposal was the first response from the importing side to the exporters' proposal in May that the ISA price range should be 6 to 9 cents and the supply commitment price 11 cents. The exporters described the proposed price levels as unrealistic, representing only 0·50 cents over the levels of the 1968 agreement. Further, even the 1968 price range, adjusted to the same purchasing power as then, would be 4·40 to 7·00 cents in 1973[3]. However, not all importing members supported the proposal and it does represent an initial bargaining position. Nevertheless the large gap between the two positions indicated that the importers would expect major concessions from the exporters before they would show their willingness to compromise. One exporter demand, for instance, which the importers demand to be dropped, is that there be a purchase commitment provision in the agreement to match the supply commitment articles.

Subsequently the Conference Chairman, Mr. E. JONES-PARRY, proposed an intermediate price range of 5·40 to 7·90 cents/lb, with a supply commitment price of 8·90 cents/lb[4]; the range is part of a compromise package for negotiation between members.

[1] C. Czarnikow Ltd., *Sugar Review*, 1973, (1146), 169.
[2] *The Times*, 3rd October 1973.
[3] *Australian Sugar J.*, 1973, **65**, 69.
[4] *The Times*, 9th October 1973.

Writing on the question of Agreement prices, C. Czarnikow Ltd. note[1]:

"The level of price is also another important by-product. If set too far below the level of the return received from the sales within national or special arrangements it naturally makes the world market into a residual outlet. On the other hand, if set above the level of national or special arrangements, it might cause leap-frogging to develop between the various markets for supply. At the same time, if set too low against the cost of new expansion, it will restrain growth while, if set too high compared with the cost at which existing industries can produce, it may distort the pattern of supplies.

"The importance of the price quota decisions which it is anticipated will be announced shortly will therefore be of the utmost importance not only throughout the life of the Agreement but also for many years thereafter".

* * *

World sugar production estimates, 1973/74

Early in September F. O. Licht K.G. produced their first estimates of sugar production in Europe, and shortly afterwards incorporated these in their first estimates[2] for the world sugar industry; these estimates are reproduced elsewhere in this issue.

Licht emphasize that the estimate is produced earlier than usual and was published because of the commencement of the 2nd phase of the International Sugar Conference in Geneva on the 10th September. Some of the figures are for cane sugar crops which have not yet started and consequently must be regarded as a matter of conjecture to a certain extent, being based on average yields in the past or on plan figures. Nevertheless, even as a crude first approximation, the estimates are of great interest, reflecting an appreciable increase in both the cane and beet sectors of the industry.

Beet sugar production is expected to reach 33 million tons as against 31·2 million tons in 1972/73; a rise of 5·8%. The increase in Europe is set at 1,934,000 tons while in non-European countries the expected decrease of 400,000 tons in the US beet sugar crop more than outweighs the smaller increases expected in Algeria, Chile, China, Iran and Japan, etc. Sugar production in Europe, with only average crop prospects, is expected to rise as a result of the extra area planted to beet in both East and West. The bulk of the East European increase (800,000 out of 884,000 tons) is set for the USSR where increased area and better crop prospects than in the past two years could restore production to its normal level.

The EEC countries are expected to produce more sugar, except for Italy, the largest increase being in France where the beet area has been raised markedly. In the remaining countries of Western Europe there is expected to be, on balance, a slight fall in production, made up of minor increases and decreases in individual crops.

A total of 48,870,000 tons is estimated for cane sugar production as against 46,100,860 tons in 1972/73; a rise of 6·0%. This is above all attributed to developments in South America and, especially, Brazil. In the last, sugar production is estimated at 7,156,000 tons compared with 6,183,000 tons in 1972/73, an increase of almost a million tons and one which would give Brazil her largest crop on record. Recent reports of drought in northern Brazil indicate, however, that the estimate might have to be reduced at a later date. In North and Central America an increase of 600,000 tons is expected, half of this being expected in Cuba; here again a lack of accurate data mean that this might have to be amended.

Bad weather has adversely affected the South African crop and an overall increase of only 100,000 tons is expected for the African continent. The crop in India is expected to continue its recovery from the bad year of 1971/72 and the 132,000 tons increase for this country is almost half the increase expected for Asia. Australia is expected to produce 112,000 tons more and Fiji 59,000 tons more; recent reports indicate reduced expectations in Queensland as a result of bad weather which has hindered crushing.

The combined beet and sugar crop estimates for 1973/74 total 81,871,500 tons, or some 4,500,000 tons more than the 1972/73 figure. By any standards this is a large jump and is greater than the annual increases in consumption observed in the last few years. It could be, therefore, that if actual outturns match the estimates, stocks could again rise to their normal level instead of their current low level. However, the consumption rises have been limited as a consequence of high sugar prices and it is to be expected that the rate of consumption increase would rise as the statistical position became easier, and this would moderate the fall to be expected in sugar prices. Consequently, even with a world production of nearly 82 million tons prospects for sugar producers still seem to be favourable.

* * *

US sugar supply quotas 1973

The US Dept. of Agriculture announced on the 19th September the shortfall of 8549 short tons, raw value, against the Peruvian quota, as mentioned in our last issue[3]. The Peruvian Sugar Cooperatives Centre (CECOAAP) subsequently denied reports that the shortfall declaration was because Peru had insufficient additional sugar to meet the increase in its quota allocated on the 23rd August; sugar production in the country was normal, according to CECOAAP, but Peru had declined the additional quota because of the growing domestic market and the need to maintain stocks.

The Department also announced a shortfall of 42,000 tons against the quota for Hawaii; the combined deficits were reallocated among the Philippines and Western Hemisphere suppliers and the revised quotas are tabulated elsewhere in this issue.

[1] *Sugar Review*, 1973, (1145), 165.
[2] *International Sugar Rpt.*, 1973, **105**, (25), 17–20.
[3] *I.S.J.*, 1973, **75**, 298.

Frequencies and time delays observed in a crushing train

By W. McWHINNEY

(Sugar Research Institute, Mackay, Queensland, Australia)

PART I

Introduction

A KNOWLEDGE of how a system responds to changes (process dynamics) is important in the design and analysis of processes and their control systems. The equations describing the dynamics of a process might be obtained from a detailed analysis of the basic phenomenon or they might be obtained from observation of the operating plant. The latter method presents the possibility of a more rapid evaluation of dynamics when the detailed relations between variables and, indeed, the major variables themselves, are not definitely known. Using this method of observation, some dynamic properties may be deduced from the simultaneous recording of the inputs to and outputs from the process; that is, a cause-and-effect comparison.

In the simple case of one input and one output, the comparison entails calculating how these signals correlate. The correlation is performed by multiplying the two signals together, integrating this product and then averaging the integral. The process produces a single value analogous to the correlation coefficient in statistics. Further correlations are performed with one of the signals shifted (in time) with respect to the other and the processes of multiplication, integration and averaging repeated. The array of correlation points so produced is called a correlation function (each correlation has a corresponding shift in time which is called the shift parameter). The appendix describes operations in more detail.

If a variable is correlated with itself the function produced is called an auto-correlation while the correlation of two different variables is termed a cross-correlation. In an auto-correlation the first correlation value produced is called the mean square value of the correlation. In general the auto-correlation array is divided by the mean square value to normalize the array. Hence the normalized auto-correlation ranges from + 1·0 to — 1·0 since the first value (mean square value) produced is the maximum value. The normalization of cross-correlations is done using the square root of the product of the separate mean square values for the two variables.

The correlation functions are really a combined plot of the phase and amplitude of the various frequency components in the signals being correlated. By correlating input and output variables, some measure of the response of the system being investigated is obtained. The problem is greatly compounded for multi-input and -output systems but the principles still hold.

The main feature of these correlation functions is to remove the effects of "noise" from the recordings.

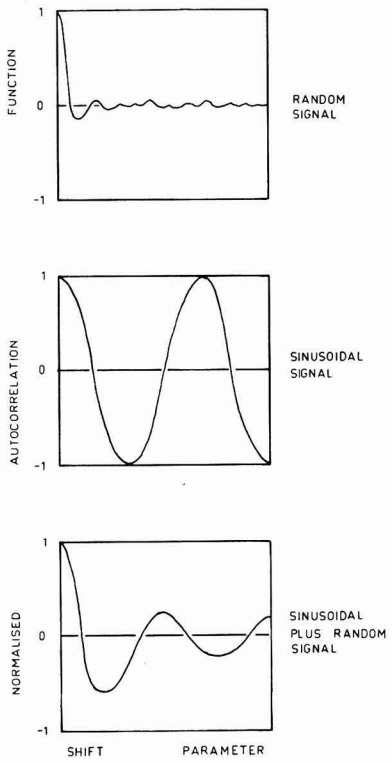

Fig. 1. Some typical auto-correlation functions

Noise may be defined in this context as unwanted signal and its auto-correlation is very characteristic, starting from unity and rapidly decreasing to zero for all subsequent shifts. If there is a single frequency component in a variable, but it is completely masked by noise in the original recording, the correlation function will show this frequency quite clearly. Fig. 1 shows some typical auto-correlation shapes. However, the case of more than one frequency is not as simple. Although the dynamics of a process cannot be evaluated easily from the correlation functions, further transformation of the correlations may allow prediction of the dynamics. The accuracy of prediction of the dynamics depends largely on the nature of the data and precision of the integrations and transformations involved. Notwithstanding, the correlation functions can be used as "shorthand" descriptions of the frequencies present in a process

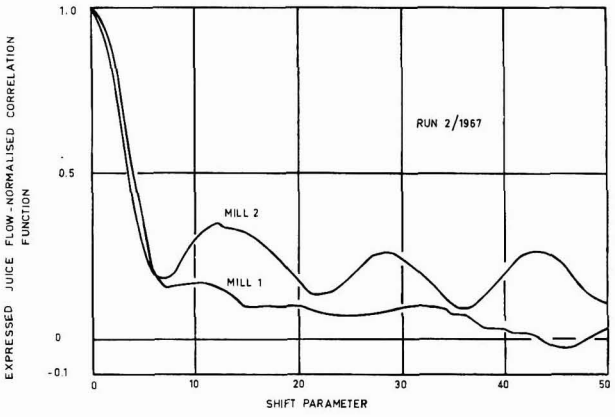

Fig. 2. Typical auto-correlation functions for expressed juice flowrates

and can be employed to validate mathematical models derived by other methods.

Correlation applications

The major proportion of disturbances entering the crushing train originate at the prepared cane since the other inputs, outside imbibition flow and milling conditions, do not vary over such wide ranges. Some measure of the attenuation of a change as it progresses through the crushing train could be obtained from the dye tests reported by McWHINNEY and MURRY[1]. However, a more quantitative measure is the comparison of the coefficients of variation* calculated using the statistics from data logged from a crushing train in the 1967 and 1968 seasons. These calculated coefficients are listed in Table I.

The mean coefficient of variation for the first mill expressed juice is almost twice that of the second mill. Although the flow of expressed juice from the first mill showed larger deviations in terms of coefficients of variation, these deviations were quite random in occurrence while those in the second mill expressed juice flow exhibited more periodicity.

Fig. 2 shows these auto-correlation functions for run 2/1967 which had 1150 data points per logged variable. The second mill flowrate auto-correlation developed a period of approximately 13 units (3·25 minutes) after the initial random transition. This basic period of 3·25 minutes also occurred in the 1968 experiments such as run 3 shown in Fig. 3. Perturbing the outside imbibition flowrate approximately 140 litres per minute above and below the mean flow at different frequencies in runs 5, 7, 8 and 9 changed the predominant periodicity of the second mill expressed juice auto-correlation function. Fig. 3 shows some of these correlations while Table II gives estimates of the periods and frequencies of the forcing and response signals. Runs 7 and 9 are not shown in Fig. 3.

Table I. Coefficients of variation for flow data

Run number	*Coefficient of variation, %*	
	Mill 1	*Mill* 2
2/1968	12·2	8·7
3	13·4	8·5
4	12·7	6·2
5	10·6	6·8
7	13·3	5·6
8	21·9	7·0
9	18·2	5·2
10	14·3	9·3
11	11·3	9·5
12	9·5	8·0
13	10·7	7·0
14	12·3	7·1
15	11·7	10·5
16	11·2	8·4
18	15·1	8·4
19/1968	15·3	8·8
2/1967	12·4	6·9
3	12·5	6·8
4	10·6	5·9
5	23·0	5·6
6	12·4	12·7
7	9·4	3·5
8/1967	10·8	13·1
Mean	13·3	7·8

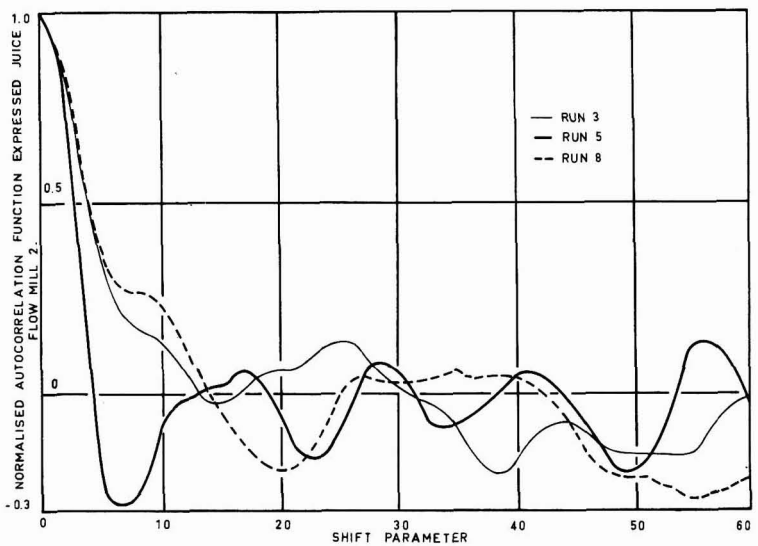

Fig. 3. Effect of outside imbibition flow perturbations on second mill expressed juice flowrates

[1] *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 349-355.

* The coefficient of variation is the standard deviation expressed as a percentage of the mean.

Table II. Effect of outside imbibition flow perturbations on periodicity of second mill expressed juice flowrate

	Imbibition flow		*Second mill flow*	
Run number	*period, minutes*	*frequency, cycles/min*	*period, minutes*	*frequency, cycles/min*
2/1967	—	0	3·25	0·308
3/1968	—	0	3·25	0·308
5/1968	3·25	0·308	2·00	0·500
7/1968	6·33	0·151	11·25	0·089
8/1968	9·50	0·105	8·75	0·114
9/1968	7·00	0·143	8·25	0·121

A plot of the forcing frequency of the outside imbibition flowrate and the predominant frequency (as determined from the auto-correlation function) with which the second mill juice flowrate responded is shown in Fig. 4. The predominant period in second mill juice flow for constant outside imbibition conditions is 3·25 minutes which is approximately half (0·47) the total delay for the crushing train as estimated by cross-correlation techniques. As the forcing frequency was increased, the predominant frequency in the response of the second mill increased almost linearly over the range investigated. It was not practical to increase the forcing frequency beyond 0·308 cycles per minute owing to the slow response of the imbibition supply to flow changes and the physical problem of opening and closing of the gate valve in the imbibition pipeline. By forcing the frequency of the flow of outside imbibition at the same period as that of the crushing train for steady flow of imbibition, resonance of the system might have been expected. Instead the response merely shifted frequency as shown in Fig. 4. It appears virtually impossible to set the crushing train into unstable oscillation by perturbation of the outside imbibition flow. This confirms the fact that over many years of operation of a large number of crushing trains no crushing train has ever been reported inadvertently set into unstable oscillation. The damping effect of the counter-current recirculation system where at each mill a disturbance is attenuated and delayed is very large and probably eliminates any instability. In this discussion of frequencies only the predominant frequency observed in an auto-correlation function is considered. There was, of course, a great number of small random fluctuations superimposed on this frequency in an auto-correlation function.

The changes in the quality of the juice expressed from the first and second mills were investigated in the 1967 tests by sampling the juice streams at frequent intervals and determining the Brix by

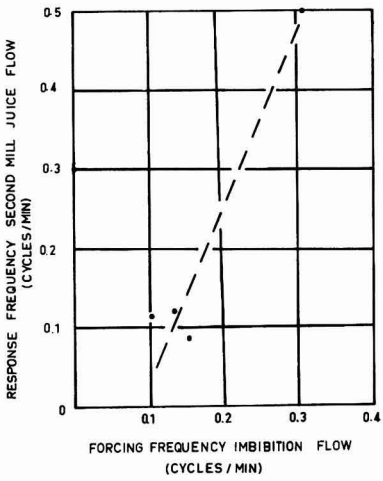

Fig. 4. Effect of outside imbibition flow perturbations on periodicity of second mill expressed juice flowrate

aboratory refractometer. Table III lists the statistics rom these data. No attempt was made to correlate his information. However, these data form an essential part of the information required to construct suitable inputs for the dynamic model.

Figs. 5 and 6 show some of the escribed volume auto-correlations for the 1968 tests. The first mill auto-correlations showed a predominant period of 2·25 minutes (9 shift units) while those for the last mill showed no tendency to oscillate. The crushing train at Pleystowe mill had a pneumatic three-term control system to maintain constant chest pressure in the turbine driving the first mill. The chest pressure is approximately proportional to the torque required by the mill and the torque depends weakly on the fibre rate provided the mill is full and the hydraulically-loaded roll floating. Steam chest pressure records (from the factory's instrumentation) showed almost constant oscillation about a mean value. The period of oscillation was approximately 1·5 minutes. This period is not detected in the first mill escribed volume even before smoothing the raw deviations. The chest pressure oscillations were probably due to the dynamics of the governor system on the turbine drive while the oscillations detected in the escribed volume of the first mill may have come from the dynamics of the prepared cane supply system.

Table III. Juice quality changes for normal operating conditions

	First mill			*Second mill*		
Run number	*Mean*	*Standard deviation*	*C of V**	*Mean*	*Standard deviation*	*C of V**
2	22·31	2·69	12·1	12·54	2·47	19·7
3	21·12	2·28	10·8	10·36	0·84	8·1
4	22·41	1·79	8·0	11·58	1·11	9·6
6	19·99	1·53	7·7	11·11	0·35	3·2
7	21·75	2·27	10·4	11·02	0·80	7·3
8	23·32	1·20	5·1	10·83	0·69	6·4

* C of V is the coefficient of variation.

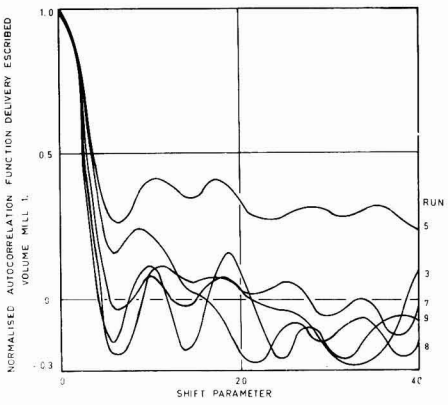

Fig. 5. First mill escribed volume correlations

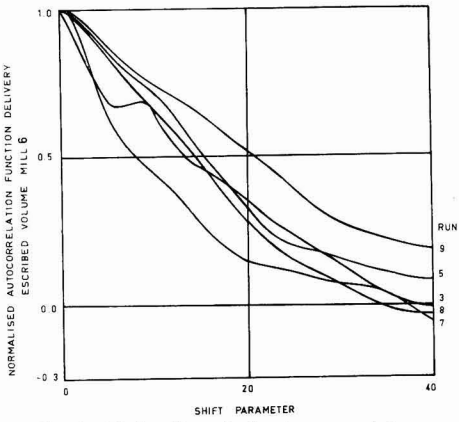

Fig. 6. Final mill escribed volume correlations

Table IV. Work openings at zero lift

Mill number	*Work openings, mm*	
	1967	1968
1	33·73	34·93
6	19·46	15·86

The effect of speed and lift variations on escribed volume is shown in Table IV. Escribed volume can be evaluated using equation 1.

$$V_E = K.S.(W_o + H_{av}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where K is a constant including roll length and diameter, S is the surface speed, W_o is the work opening at zero lift and H_{av} is the average of the drive and pintle lifts.

The effect of lift changes on escribed volume was quite small since the mean lift was only about 10% of the work opening at zero lift shown in Table IV. Comparison of the coefficients of variation in Table V for speed, lift and escribed volume for the first mill with the lift suitably weighted indicates that the surface speed is the controlling variable.

Table V. Speed, lift and escribed volume interaction

Mill number	*Variable*	*Run number*	*Mean*	*Standard deviation*	*Coefficient of variation*
1	surface speed (m/min)	2/1967	13·4	2·97	22·1
		3/1967	13·4	3·00	22·3
		18/1968	13·4	0·78	5·8
		19/1968	13·7	0·89	6·6
6	surface speed (m/min)	2/1967	12·2	1·54	12·6
		3/1967	13·4	1·25	10·0
		18/1968	10·7	1·32	12·3
		19/1968	10·7	1·61	14·5
1	lift (mm)	2/1967	2·46	1·666	67·6
		3/1967	3·40	1·603	47·0
		18/1968	1·78	0·584	32·8
		19/1968	1·27	0·495	39·0
6	lift (mm)	2/1967	5·49	1·532	27·9
		3/1967	6·10	2·184	35·8
		18/1968	5·51	2·202	39·9
		19/1968	5·72	2·090	36·5
1	escribed volume (m^3/min)	2/1967	9·09	1·97	21·2
		3/1967	9·35	2·11	22·6
		18/1968	9·52	0·55	5·7
		19/1968	9·49	0·58	5·7
6	escribed volume (m^3/min)	2/1967	6·71	0·59	8·8
		3/1967	6·97	0·42	6·1
		18/1968	5·13	0·30	5·9
		19/1968	5·04	0·48	9·4

(To be continued)

Chemical control of parasitic nematodes in sugar cane

By KISHAN SINGH and S. R. MISRA
(Indian Institute of Sugarcane Research, Lucknow, India)

PART I

Introduction

SYSTEMATIC work on nematodes associated with commercially grown sugar cane in India was initiated in 1959, although these organisms were suspected to be harmful to cane earlier[1]. The work done in subsequent years showed that at least 32 species of nematodes are associated with sugar cane in most of the important cane growing areas of India. These damage cane roots alone and in association with soil-inhabiting fungi. Their population can be brought down considerably by judicious use of nematicides and such treatment can increase yield by 21·3 to 78·9% over the untreated control, depending upon the degree of infestation and the variety of cane involved[2]. However, the cost of the nematicides has been the main deterrent towards the chemical control of nematodes. In this paper, data have been presented wherein an approach to making chemical control economically acceptable to the farmers has been indicated.

EXPERIMENTAL

Distribution of nematodes in the cane root zone

Plant parasitic nematodes are known to inhabit the feeder root zone of a plant. To ascertain their distribution in the root zone of a six month-old cane crop growing in sandy loam soil, soil samples were drawn from 7 depths from the surface (0–10, 10–20, 20–30, 30–45, 45–60, 60–75 and 75–90 cm) at distances of 0–10, 10–20, 20–30 and 30–45 cm from the base of plants. Each sample comprised six subsamples drawn from six plants. Analyses were done by wet sieving and modified Baermann funnel technique[3]. The nematodes isolated from these samples were species of *Hoplolaimus*, *Helicotylenchus*, *Pratylenchus*, *Tulenchorhynchus*, *Hemicriconemoides*, *Longidorus* and *Xiphinema*.

In the radial direction, the population of plant parasitic nematodes was the highest in the zone 10–20 cm from the base of a clump. *Hoplolaimus*, *Xiphinema* and *Longidorus* were present as a more or less constant fraction of the total population in all the zones studied. But *Helicotylenchus* was at its highest concentration in the 10–45 cm zone, *Pratylenchus* in the 0–10 cm zone and *Tylenchorhynchus* in the 0–20 cm zone.

Marked differences in numbers of plant parasitic nematodes were observed in their vertical distribution. The total parasitic nematode population was the highest in the top 10 cm of soil; below this it decreased gradually, and tapered off sharply below 60 cm. The proportion of different species in the population in the seven depths indicated earlier was 10:6:6:3:3:2:1. *Helicotylenchus*, *Tylenchorhynchus* and *Pratylenchus* were present in the largest numbers

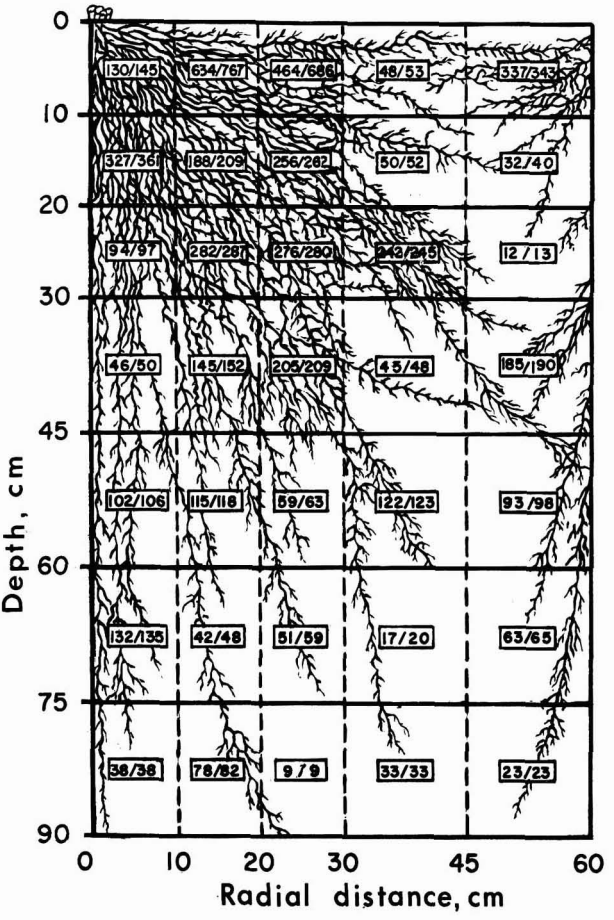

Fig. 1. Distribution of plant parasitic/total nematode population in root zone of sugar cane (variety Co 527)

[1] BARBER: *I.S.J.*, 1919, **21**, 425.
[2] SINGH: *Proc. Int. Symp. Plant Path.* (New Delhi), 1967, 587.
[3] CHRISTIE and PERRY: *Proc. Helm. Soc. Washington*, 1951, **18**, 106.

in the top layer (0–10 cm), *Hoplolaimus* in the second layer (10–20 cm) and *Xiphinema* in the lowermost layer (75–90 cm). *Hemicriconemoides* was found in the top layer only. *Tylenchorhynchus* and *Pratylenchus* were found below 60 cm. *Xiphinema* and *Longidorus* were not present in the top layer. *Hoplolaimus* and *Helicotylenchus* formed the greatest part of the population.

Data thus obtained when superimposed on the pattern of distribution of cane roots[4] on this farm showed that parasitic nematodes were concentrated mostly in the top 10 cm from the surface and 10 to 20 cm from the base of the plant (Fig. 1).

Effect on nematode distribution of the root system spread with two methods of planting

In the light of the above experiment the distribution pattern of plant parasitic nematodes was studied for two methods of cane planting. One system selected was the conventional system of cane cultivation

Table I. Distribution of nematodes in the field in the conventional and strip methods of tilling for cultivation of sugar cane (Planting: March; Sampling: October)

Cultivation system	*Samples drawn from*	*Nematode population*
Conventional	Interspaces	1029
Conventional	Planted row	1297
Strip	Interspaces	486
Strip	Planted row	1313

Table II. Distribution of nematodes in field planted to sugar cane by the IISR strip system of tilling (Planting: March; Sampling: July)

Samples from	*Average total nematode population*	*Average of plant parasitic nematodes % total population*
Cultivated rows	626	50·8
Interspaces	133	11·5

wherein the whole field is tilled and cane planted in furrows 90 cm apart. The other system was of planting the cane at the same distance, but, instead of preparing the whole field, 25 cm-wide strips were sub-soiled and rotovated, the inter-row space remaining untilled. Irrigations were directed to the strips where cane was planted. Soil samples were drawn from within the rows of cane and inter-row spaces, with the help of the IISR core sampler[5]. Each sample was a composite of six samples. These were analysed by the method mentioned above. Data thus obtained are given in Tables I and II.

The tables show that whereas the population of parasitic nematodes did not vary much between inter- and intra-row spaces in the conventional method of planting, there was a marked difference in the strip-tilling method of raising the cane. According to MENON[6] there was no difference between the yield of cane raised by the two methods.

Nematode control in strip method of cultivation

In a pilot experiment, the effect of strip application of nematicide was compared with that of overall application in conventional tillage. There were 4 treatments: conventional tillage with and without nematicide and strip tillage with and without nematicide.

In conventional tillage, the plots were brought into seed bed condition. The operations were done uniformly over the whole plot. After preparation, DD mixture (dichloropropene-dichloropropane) was applied at the rate of 400 litres per hectare using a hand injector. Setts were planted about 3 weeks after treatment. For strip tilling, the rows were first marked out on the fallow plots, and the soil was ripped to a depth of 30 cm along these lines. A narrow strip, 20 cm wide, was then rotovated along the ripped lines to a depth of 20 cm and DD injected in these strips at the rate of 135 litres per hectare using a hand injector. Three-bud cane setts were planted in the furrows opened within the tilled strips about 3 weeks after application of the nematicide.

The data gathered from the experiment (Table III) showed that there was a marked increase in the germination of buds, number of millable stalks, number of canes per clump, length of millable canes and yield of sugar cane in the treated plots as compared with the untreated control. However, the increase in the strip-treated plots was less than that of the overall-treated plot. The increase in the yield of sugar cane over the control was as high as 58·1% in the overall-treated plot, whereas it was 46·8% in the strip-treated plot.

Table III. Effect of preplant treatment of DD on growth and yield of sugar cane

Non-replicated microplot trial; plot size 44 m², treatment applied on 4th April 1968; cane planted on 30th April 1968, harvested on 15th March 1969; variety CoS 510

Treatment	*Germination, %*	*Total number of millable canes/plot*	*Ave. number of canes/clump*	*Ave. length of millable canes, cm*	*Yield, kg/plot*	*Increase in yield over control, %*
Overall treatment	60·8	644	3·8	196·4	329·30	58·1
Control	48·3	400	2·6	160·8	137·95	—
Strip treatment	59·4	520	3·2	191·7	233·85	46·8
Control	41·1	396	2·5	150·3	124·88	—

(To be continued)

[4] SRIVASTAVA and GHOSH: *J. Indian Soc. Soil Sci.*, 1970, **18**, 117.
[5] MENON and SINGH: *Nematologica*, 1963, **9**, 160.
[6] *Proc. 12th Congr. I.S.S.C.T.*, 1965, 531.

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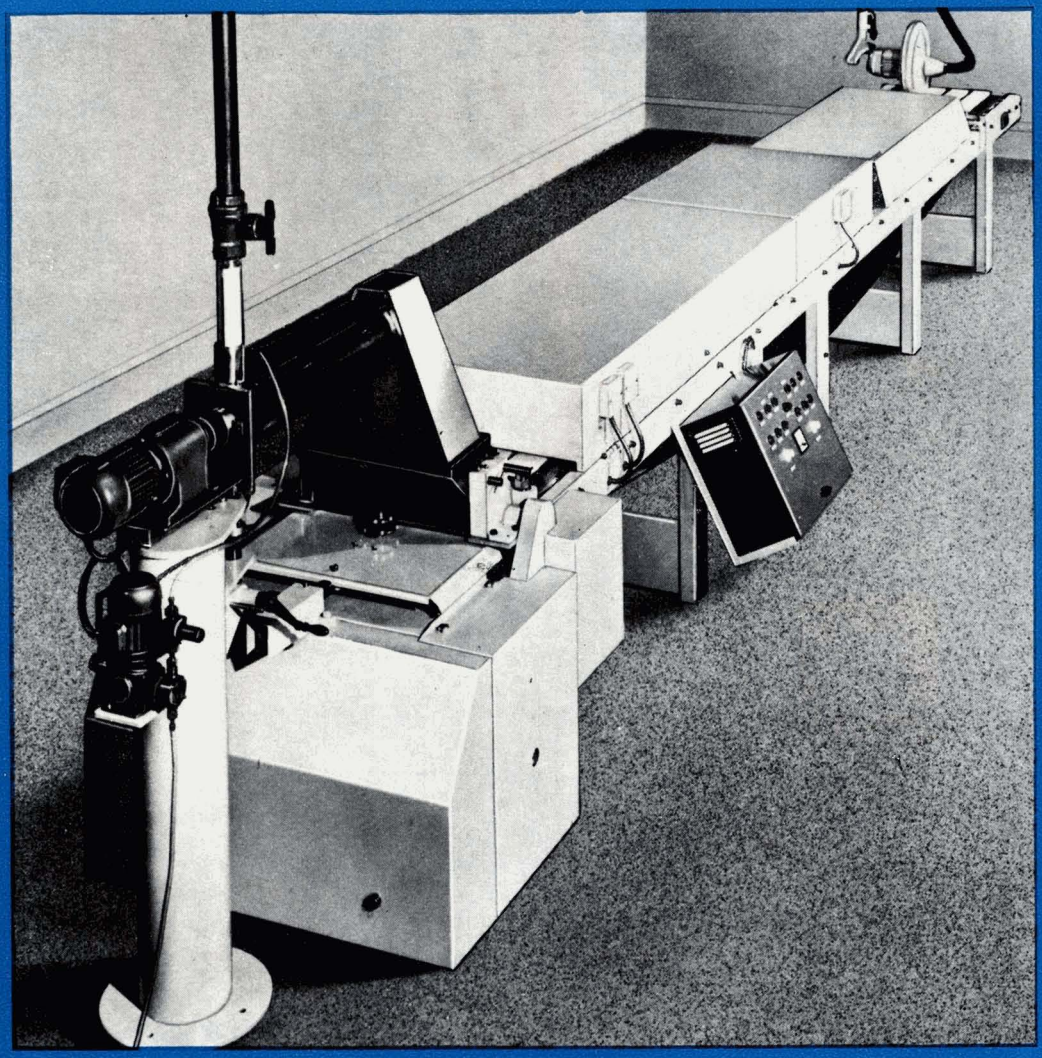

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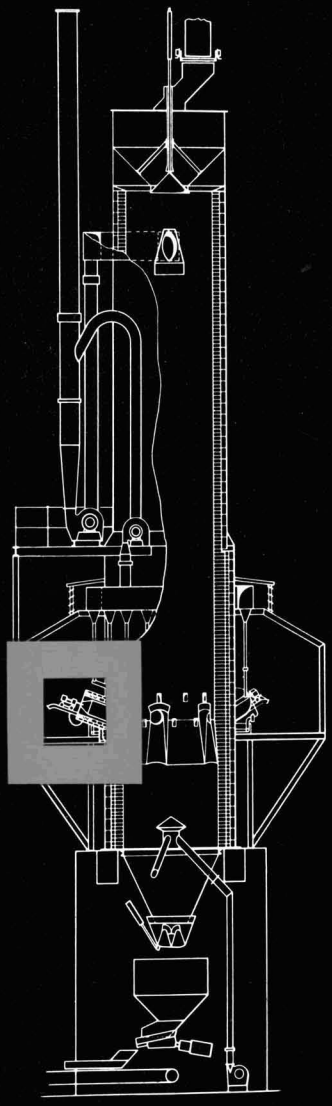

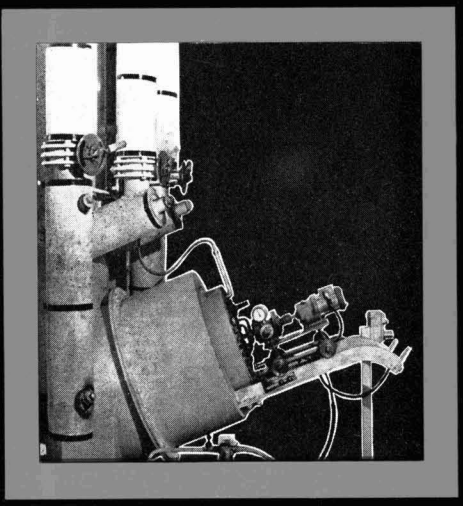

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An analysis of the influence of sugar cane quality on sugar recovery

By E. J. BUCHANAN
(South African Cane Growers' Association)

Paper presented to the 40th Conference, Asociación de Técnicos Azucareros de Cuba, 1972

PART II

Evaluation of Filter Cake Loss

Accuracy of data

The loss of pol in filter cake is relatively small, being only about 0·5% of the pol in cane. The variation within one factory is also relatively small. Expressed in terms of pol in filter cake % cane the industrial average ranges from about 0·05 to 0·07 during a season. Furthermore, owing to its high moisture content and elevated temperature, the filter cake weight may not be absolutely precise when it is weighed by conveying the material by trailer over a weighbridge. In addition, the loss of pol in filter cake is influenced by the consistency of the underflow discharged from the clarifiers. This process is notoriously variable. By the use of data averaged over a month or a year much of the operational variance should be eliminated but a high degree of correlation would not be expected when attempting to account for variances of the order of 0·01 in sugar lost % cane.

Variables associated with filter cake loss

From equations (15) and (16) the extracted non-pol and reducing sugars would be expected to influence the amount of filter cake. If higher levels of reducing sugars:non-pol ratio produce more non-sucrose in molasses then, logically, one should expect less filter cake to be produced. Sustained levels of cane juice concentration may have an influence on the filter cake loss by varying the concentration of clarified juice associated with the underflow from the clarifier and therefore the residual juice in filter cake. The influence of first expressed juice Brix and imbibition: fibre ratio on Brix of clarified juice (annual average for 20 factories) has been found to be:

$$Bx_{clj} = 1{\cdot}2958\ Bx_{fej} - 0{\cdot}01062\ I/F - 8{\cdot}2753$$
$$R = 0{\cdot}8296^{***} \quad \ldots\ldots\ldots (26)$$

Since the cane juice concentration and sucrose in cane are closely related it may be possible that sucrose % cane has an influence on filter cake loss. However, considering that the cake in a thin layer under vacuum is washed with a generous quantity of water, the consistency (even porosity) and quantity may override the influence of concentration. For example, under favourable conditions of porosity as much as 90% of the solute in cake can be recovered by displacement during the initial stages of washing[10]. During rotary vacuum filtration the time is short so that most of the solute is recovered by this mechanism. The structure of the cake could therefore override the influence of clarified juice concentration.

Statistical relationships for filter cake loss and sucrose in cane

The influence of pol % cane on loss in filter cake % cane was analysed statistically for the industrial average and for individual factories using monthly data for 1971–72:

$$S_{fc} = 0{\cdot}0088\ S - 0{\cdot}0501 \qquad r = 0{\cdot}6221 \ldots\ldots\ldots (27)$$

which almost reaches the 5% level of significance ($r^* = 0{\cdot}632$). However, a similar check on individual factories fails to reveal any relationship of near significance, e.g. for Darnall:

$$S_{fc} = 0{\cdot}0081\ S - 0{\cdot}0627 \qquad r = 0{\cdot}5465 \ldots\ldots\ldots (28)$$

which barely accounts for 30% of the variance in filter cake loss. The low levels of significance indicate that a fortuitous correlation is possible and a more

Bx = Brix
C = filter cake
E = extraction, %
F = fibre
I = imbibition
M = molasses
N = non-pol (or non-sucrose)
P = purity
R = reducing sugar
S = sucrose (or pol)
S' = sucrose predicted by calculation
W = water
Y = year number

Subscripts:

b = bagasse
c = cane
clj = clarified juice
e = extracted
f = filter cake
fej = first expressed juice
j = cane juice
m = molasses
mj = mixed juice
n = non-sucrose
p = pol
r = recovered
u = undetermined

(Note that the second subscript refers to percentage, e.g. Sbc refers to sucrose in bagasse % cane)

Correlation data:

R = multiple correlation coefficient
r = simple correlation coefficient
$S.E.$ = standard error
$N.S.$ = non-significant
* = level of significance: * 5%, ** 1%, *** 0·1%

[10] McCabe and Smith: "Unit Operations of Chemical Engineering" (McGraw-Hill, New York) 1956, p. 352.

specific analysis is necessary. Even a more specific relationship between pol in mixed juice and pol % filter cake fails to show significance, e.g. for Darnall:

$$S_f = 0{\cdot}1244\, S_{mj} - 0{\cdot}5081 \qquad r = 0{\cdot}4035 \quad \ldots\ldots(29)$$

which accounts for only 16% of the variance.

Relationships between filter cake and non-pol in cane

It may be anticipated from equations (16) and (17) that the quantity of filter cake is influenced by non-pol and particularly reducing sugars in cane. Statistical analysis supports this, e.g. for the industry during 1971–72,

$$C_c = 2{\cdot}2606\, N_e - 21{\cdot}3841\, R_e/N_e + 4{\cdot}9688$$
$$R = 0{\cdot}7620^{*} \quad \ldots\ldots\ldots(30)$$

The equivalent for Darnall:

$$C_c = 1{\cdot}0088\, N_e - 12{\cdot}7367\, R_e/N_e + 5{\cdot}4106$$
$$R = 0{\cdot}9515^{***} \quad \ldots\ldots(31)$$

which accounts for over 90% of the variance in quantity of filter cake.

These statistics are complementary to (16) and (17) and together confirm that as the reducing sugars: non-pol ratio decreases during maturing of cane, more of the non-pol in cane is removed in filter cake and less passes into the boiling house to make molasses. The amount of filter cake appears highly sensitive to the nature of the non-pol.

Relationships for filter cake loss

It has not been possible to find a significant influence of sucrose in cane, sucrose in cane juice or sucrose in mixed juice on pol % filter cake. Although some influence would be expected it would appear to be overridden by other factors which could include the quantity of filter cake, the type of non-pol and operational variables. For Darnall:

$$S_f = 0{\cdot}1859\, C_c - 0{\cdot}0995 \qquad r = 0{\cdot}6713^{*} \quad \ldots\ldots(32)$$

and this shows a greater significance in the influence of the amount of filter cake on the pol % filter cake than that of pol % mixed juice as in equation (29).

Owing to the above limitation it is difficult to express seasonal variations in pol lost in filter cake % cane in a precise form. At best there is evidence that the nature of the non-pol accounts for the greater part of the variance; e.g., for the industry during 1971–72,

$$S_{fc} = 0{\cdot}1564 - 0{\cdot}3916\, R_e/N_e \qquad r = -0{\cdot}7385^{**} \quad (33)$$

and for Darnall:

$$S_{fc} = 0{\cdot}0822 - 0{\cdot}1706\, R_e/N_e \qquad r = -0{\cdot}6622^{*} \quad (34)$$

In September and October increases in pol lost in filter cake occurred which cannot be accounted for statistically. It can only be pointed out that since these were fairly general through the industry and coincided with the spring rains the increased losses would be associated with the general observation of clarifier underflow compaction difficulties at this time during rainy periods. Again, this would point to the nature of the non-pol as being the determining factor in filter cake loss.

While it is difficult to obtain high degrees of correlation within a season owing to these short term changes in the nature of the non-pol, reasonable correlations can be obtained using data from season to season over a number of years, e.g. for Darnall 1960 to 1971–72:

$$C_c = 0{\cdot}7658\, N_e - 1{\cdot}0563\, R_e/N_e - 0{\cdot}1027$$
$$R = 0{\cdot}9750^{***} \quad \ldots\ldots\ldots(35)$$

$$S_{fc} = 0{\cdot}1063\, N_e - 0{\cdot}6326\, R_{e_1} N_e - 0{\cdot}0656$$
$$R = 0{\cdot}7001^{*} \quad \ldots\ldots\ldots(36)$$

On the other hand there appears to be no reasonable correlation for sucrose in cane for the same data:

$$S_{fc} = 0{\cdot}4436 - 0{\cdot}0287\, S_c \qquad r = -0{\cdot}3914 \quad \ldots(37)$$

$$S_f = 3{\cdot}5041 - 0{\cdot}2412\, S_{clj} \qquad r = -0{\cdot}1614 \quad \ldots(38)$$

The last two equations are non-significant and have no reasonable interpretation showing influence of sucrose or juice concentration on filter cake loss or pol in filter cake.

Treatment of filter cake loss

The statistics suggest that the loss of pol in filter cake is related to the extracted non-pol in cane and particularly the nature of the non-pol. In addition, the amount of filter cake is well related to the amount of non-pol extracted and the reducing sugars: non-pol ratio. On the other hand, there is less statistical evidence of an influence of sucrose in cane or even concentration of juice on pol lost in filter cake. Furthermore, the increase in the quantity of filter cake with decrease in reducing sugars:non-pol ratio is in agreement with the conclusion above that the reverse applies to the amount of non-sucrose entering molasses. The distribution of pol loss between filter cake and molasses is therefore dependent on the reducing sugars:non-pol ratio. These conclusions suggest that it is reasonable to combine the molasses and filter cake losses and to express them as a function of the extracted non-pol and reducing sugars:non-pol ratio.

Evaluation of the Undetermined Loss

Nature of the undetermined loss

Evaluation of the undetermined loss from statistics on cane properties is quite hypothetical. However, if cane quality has any influence on undetermined loss, there should be data available to prove this and, if so, it is possible to express the loss as a function of cane quality. While the undetermined loss can be real, e.g. in the form of sucrose degradation and entrainment, it is more likely to be caused by an imbalance of pol between the input and output streams.

This can be due to weighing, sampling and analytical errors of a nature which results in a bias. If, for example, the sampling of molasses favours molasses of lower viscosity, then this could result in a change in undetermined loss associated with the amount of non-pol in cane. If bias is present in the determination of sucrose in (say) molasses then the undetermined loss change may be associated with the nature of the non-sucrose and/or the quantity. If degradation of sucrose occurs during clarification, filtration and boiling, then the undetermined loss may be associated with the hold-up which in turn can be influenced by the nature and quantity of non-pol. An instrumental error in pol reading is likely to result in a change in undetermined loss *pro rata* to pol in cane while an error due to the nature of the optically active substances may cause an undetermined loss related to (say) the reducing sugar/non-pol ratio. The field for speculation is unlimited but the choice seems restricted to either pol in cane or the amount and nature of non-pol.

Selection of data

In statistical analysis of the undetermined loss the monthly data may be discarded, since there is a general trend showing that high undetermined losses occur in the first month and a reasonable balance is established towards the end of the season. Rare cases of negative undetermined losses in the first month are the exception rather than the rule. The fluctuations have no statistical interpretation and it is concluded that they are unrelated to cane quality. For this reasons the analyses have been unavoidably restricted to annual averages.

It is hardly necessary to add that the chances of being able to obtain a good degree of correlation on restricted data are small and since the influence of cane quality is obscure we should not expect statistics to do more than suggest which of the alternatives outlined above would be more acceptable.

Relationships based on pol in cane

For the period 1960 to 1971–72 the average data for the whole industry showed the following relationship between undetermined pol loss % cane and pol % cane:

$$S_{uc} = 0{\cdot}3897 - 0{\cdot}0160\,S \qquad r = -0{\cdot}2486 \text{ N.S.} \quad (39)$$

and the equivalent for Darnall

$$S_{uc} = 0{\cdot}8451 - 0{\cdot}0494\,S \qquad r = -0{\cdot}3896 \text{ N S} \quad (40)$$

While these relationships are non-significant, the indications are that the undetermined pol loss % cane decreases as pol per cent cane increases. It is rather difficult to interpret this physically.

Relationships based on non-pol in cane

For the same period the industrial data showed:

$$S_{uc} = 0{\cdot}0835\,N_e - 0{\cdot}6765\,R_e/N_e + 0{\cdot}1277$$
$$R = 0{\cdot}6638^{*} \quad \ldots\ldots\ldots\ldots (41)$$

which is almost significant at the 5% level ($R^{*} = 0{\cdot}671$). The equivalent for Darnall was:

$$S_{uc} = 0{\cdot}1798\,N_e - 1{\cdot}270\,R_e/N_e + 0{\cdot}0270$$
$$R = 0{\cdot}7638^{**} \quad \ldots\ldots\ldots\ldots (42)$$

which accounts for 58% of the variance in undetermined loss. The above relationships suggest that the undetermined loss is influenced by the amount and nature of non-pol extracted. Since the loss of sucrose in molasses has been similarly related as shown in equations (24) and (25) one physical interpretation of equations (41) and (42) would be that the undetermined loss increases with an increase in molasses loss. However, there are many other possible interpretations.

Expression of undetermined loss

In view of the inability to relate the undetermined loss to pol in cane and the significant relationship established with the non-pol and nature of non-pol it would appear reasonable to associate the undetermined loss with the molasses and filter cake as a function of the non-pol.

Combined Boiling House Loss

Justification for a combined loss

Statistical evidence has been provided above to show that the filter cake loss is more likely to be associated with the nature of the non-pol while the amount of filter cake is related to the amount and nature of the non-pol. The influence of pol in cane, or, more directly, juice concentration seems relatively limited. The undetermined loss is not significantly related to the pol in cane but the attributable variance suggests a negative relationship. Significant correlations show an influence of the amount and nature of the extracted non-pol on the undetermined loss. These two losses are relatively small and on the basis of statistical evidence, the expression of these losses in combination with the molasses loss seems justified. Furthermore, it provides a simplification of the recovery formula.

Statistical testing of the combined loss

Combining the three losses in the form of an overall boiling house loss, the following relationship has been established for the industry for the period 1960 to 1971–72:

$$S_{(f+u+m)_c} = 0{\cdot}7293\,N_e - 0{\cdot}9986\,R_e/N_e - 0{\cdot}0224$$
$$R = 0{\cdot}8858^{***} \quad \ldots\ldots\ldots (43)$$

and for Darnall during the same period:

$$S_{(f+u+m)c} = 0{\cdot}8012\,N_e - 1{\cdot}9158\,R_e/N_e - 0{\cdot}1395$$
$$R = 0{\cdot}9616^{***} \quad \ldots\ldots\ldots (44)$$

These relationships are highly significant and appear to justify combining the three losses as a function of the quantity and nature of the extracted non-pol.

Statistically-based Recovery Formula

Proposed recovery formula

The statistical evidence suggests that the milling loss is less dependent on the concentration of cane juice than on fibre in cane, and the molasses loss is dependent on the amount of extracted non-pol and its nature as expressed by the ratio of the reducing sugars and non-pol (within the limitations of cane analysis available). The non-pol extraction appears best expressed as proportional to the pol extraction. Finally, statistics point to the expression of filter cake and undetermined losses in combination with molasses loss as a function of the amount and nature of non-pol.

Probably owing to the amount of unaccounted-for variance in the regressions established, the factors against cane juice concentration and reducing sugars: non-pol ratio are variable. Conveniently, the contribution of these variables and their factors are of the order of the constant in the equation. This seems to suggest an approach to the overall recovery formula which would combine statistics with basic technology since the validity of a purely statistical formula in the face of variable coefficients and constants would be uncertain. The compromise proposed at this stage is that the principle of milling and boiling loss being proportional to fibre and extracted non-pol be accepted and that the Brix of cane juice and reducing sugars:non-pol ratio be attributed average factors (based on statistical analysis) and that the average value of these be offset by constants. In addition, the non-pol extraction would be taken as proportional to pol extraction.

Based on these concepts the average industrial data for the period 1960 to 1971–72 the following relationships are obtained:

$$S_e = S - (0{\cdot}0491\ F + 0{\cdot}02\ Bx_j - 0{\cdot}3935) \quad \ldots\ldots(45)$$

$$N_e = 0{\cdot}9379\ N_c.S_e/S \quad \ldots\ldots(46)$$

$$S_r = S_e - (0{\cdot}6275\ N_e - R_e/N_e + 0{\cdot}2120) \quad \ldots\ldots(47)$$

In formula (45) the factor of 0·02 has been selected as the average of all statistically significant correlations and the constant 0·3935 offsets the product of 0·02 and the mean value of Brix of cane juice. In equation (46) the factor 0·9379 expresses the mean ratio of non-pol extraction divided by pol extraction (extraction expressed as a fraction and not a percentage). In equation (47) the mean value of reducing sugars:non-pol ratio is offset by the constant 0·2120. The factor of 1·0 against the reducing sugars:non-pol ratio has been selected after conducting a number of analyses both for the industry and individual factories and appears to provide the best correlation between predicted and actual pol recovered in sugar.

In applying the formula it will be noted that pol and fibre % cane together with Brix of cane juice are substituted into formula (45) to obtain extracted pol % cane. The latter, together with pol % cane and non-pol % cane, are applied to formula (46) to obtain extracted non-pol % cane. The latter in turn is applied to formula (47) together with reducing sugars: non-pol ratio and extracted pol to obtain pol recovered sugar % cane.

Testing the recovery formula

Using the industrial average data for the period 1960 to 1971–72 the following correlation has been obtained between predicted pol recovered % cane (using formulae 45 to 47) and actual pol recovered % cane:

$$S_r = 1{\cdot}0114\ S'_r + 0{\cdot}0238\ Y - 0{\cdot}2963 \quad \ldots\ldots(48)$$
$$R = 0{\cdot}9865^{***} \quad \text{S.E.} = 0{\cdot}0481$$

In the above formula the year number (Y) is intended to attribute part of the variance to a steady improvement in efficiency. According to the formula an increase of 0·0238% pol on cane per year is attributable to improvements in factory efficiency (assuming that the recovery formula is correct). Based on the average pol % cane for the period this would correspond to an increase of 0·1781 units in overall percentage recovery per year or a total of 2·1368 units during the 12-year period. The formula was also tested over the same 12-year period for Darnall factory giving:

$$S_r = 0{\cdot}9815\ S'_r + 0{\cdot}0087\ Y + 0{\cdot}4103 \quad \ldots\ldots(49)$$
$$R = 0{\cdot}9747^{***}$$

The variation in constants is partly attributable to inconsistent changes in factory efficiency and partly to consistently higher efficiency in this particular case.

Similar analyses using monthly data show a high level of correlation between actual pol in sugar recovered % cane and predicted pol in sugar % cane using the formulae. For example, five factories analysed monthly during 1971–72 gave the following correlation coefficients:

Factory	r
Felixton	0·988***
Tongaat	0·987***
Dalton	0·891***
Amatikulu	0·995***
Jaagbaan	0·954***

Mechanical adjustments in the first month and boiling-off at the end of the season as well as fluctuations in undetermined loss caused by stock-taking errors (or adjustments) would account for part of the variation.

Discussion

The three-stage recovery formula is based on highly significant statistics and is able to predict the amount of sugar which would be recovered from cane of quality within the normal range in South Africa by a factory of average efficiency. Since the formula takes some cognisance of the quality as well as the quantity of fibre and non-sugars it is expected that

it could be extrapolated over a reasonably wide range of cane quality without appreciable error. Some support is given to this contention by the fact that the formula provides an accurate prediction of sugar recovered from the immature cane at the beginning of the season to mature cane of a wide quality range at each factory.

The conclusions regarding the dependence of pol losses in bagasse on fibre mainly and to a lesser extent on concentration of cane juice are consistent with recent evaluations by other authors of the term "lost undiluted juice % fibre" as applied to the appraisal of milling performance. The statistical evidence obtained in this investigation would suggest that while "milling loss" (pol in bagasse % fibre) fails to account for the influence of cane juice concentration on loss of sucrose in bagasse, the term "lost undiluted juice % fibre" over-emphasizes the concentration. Hence, if the performance of extraction plant is to be compared under conditions of variable cane quality there would appear to be no alternative to the use of an empirical formulae at present.

The losses of sucrose in the boiling house have been shown to be related not only to the amount of non-pol in cane which is extracted during milling but also to the type of non-pol. It is possible to express this in terms of the ratio of reducing sugars to non-pol in the extracted juice. Predictions of the loss on the basis of non-pol in cane alone is likely to be rather inaccurate. The distribution of the loss in the boiling house varies with variation in the latter ratio. Furthermore, the amount of non-pol extracted varies in accordance with the cane quality factors which vary pol extraction. These conclusions indicate that the precision of boiling house efficiency terms is questionable and again the statistics suggest that there is no alternative to an empirical approach at present.

The importance of distinguishing between factory efficiency and cane quality influences on sugar recovered from cane has been pointed out in the introduction. Relatively small changes in sugar recovered % cane are taken to indicate that one type of extraction or recovery plant is superior to another. A precise recovery formula as proposed in this paper therefore has many applications both direct and indirect in the administration and efficient operation of a sugar industry.

Conclusion

As a result of an extensive statistical investigation, a three-stage recovery formula has been developed which expresses the amount of sugar which may be recovered at average factory efficiency from cane of varying quality. It has been shown that fibre and non-pol in cane alone do not provide for accurate predictions of recovery. This is due partly to their interaction and also to the influence of the nature of these constituents. The proposed formula takes cognisance of these aspects. The proposed formula not only provides an accurate prediction of recoverable sugar in cane but the statistics on which it is based indicate a need for updating existing factory performance parameters.

Summary

An accurate method of predicting the influence of cane quality on sugar recovery in the factory is essential if an industry is to be operated at the highest efficiency. In determining optimum topping level for cane and optimum length of season as well as variety selection, etc., the prediction of recoverable sugar in cane is a prerequisite. In many countries some form of recoverable sugar in cane is used as a basis for cane evaluation.

This paper describes a detailed statistical analysis which was conducted in order to determine the effect of cane quality on the quantity of sugar recovered from cane. Data from twenty factories over twelve years were analysed statistically in order to determine the most precise method of expressing recoverable sugar. Statistics are quoted to indicate that the loss of pol in bagasse is related to the amount of fibre in cane and to a lesser extent (under conditions in South African factories) on the concentration of the juice in cane. Multiple regression analysis indicates that the pol lost in bagasse % cane is related to 0·04 times the fibre % cane and 0·02 times the Brix of cane juice. When these quantities vary, then the pol extraction would be expected to vary. Furthermore, statistics indicate that the extraction of soluble non-pol varies in proportion to pol extraction. Thus the extraction influences the amount of sugar lost in the boiling house. Statistics indicate that, on the average, the non-pol extraction is 94% of the sucrose extraction under local conditions. Thus extractable non-pol may be calculated. A thorough examination of boiling house data shows that the combined filter cake, undetermined and molasses losses are very closely related to 0·63 times the extracted non-pol and inversely related to the ratio of reducing sugar to non-pol in cane juice. A significant conclusion regarding the balance of non-pol is that an increase in the latter ratio reduces the amount of non-pol removed in the form of filter cake but increases the amount forming molasses. This is largely offset by the accompanying decrease in molasses purity as a result of improved exhaustibility of molasses.

On the basis of the statistical analysis, a three-stage recovery formula is proposed. Comparison of predicted and actual sugar recovered over a period of 12 years (on the assumption of a steady increase in factory efficiency) reveals a high degree of correlation suggesting that recoverable sugar % cane may be predicted with a standard error of under 0·05.

Finland sugar factory closure[1].—The Suomen Sokeri Oy. has closed its Kotka refinery. With a capacity of 200 tons of raw sugar per day, it was the smallest of the Company's plants. Refining will continue at Porkkala (600 tons/day) and Vaasa (300 tons/day).

[1] *Zeitsch. Zuckerind.*, 1973, **98**, 358.

Sugar cane agriculture

Weed control in sugar cane. M. V. SANT and V. S. MANE. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.45–A.63.—Results of herbicide trials are given with cane planted in all three planting seasons in Maharashtra. Ten herbicides were used: "Karmex", "Tafapon", "Atrataf", "Tafazine", "Pesco 1815", "Lasso" (in liquid and granular form), "Ansar 529", "Gramoxone" and "Reglone". It is during the early stages of the cane growth, before it forms a canopy, that it is most vulnerable to weed growth, which markedly affects tillering. "Atrataf" effectively controlled the broad-leafed (dicotyledonous) weeds and "Karmex" checked monocotyledonous weeds satisfactorily. "Lasso" granules were superior to the liquid and easier to apply. In general, better weed control was obtained with pre-emergence than with post-emergence herbicides.

* * *

Studies on accumulation of sucrose in some new, promising varieties of cane. P. D. BAJPAI and R. C. TRIPATHI. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.65–A.80.—In the experiments reported, cane samples were drawn at fortnightly intervals from the standing crop and the juice extracted. Several varieties were tested and are listed. Tables give sucrose and invert sugar percentages from (*a*) soils of high fertility and (*b*) soils of low fertility. Details are given showing how sucrose percentage varies with the season. There was an inverse relationship between rate of accumulation of sucrose and that of simple sugars.

* * *

Studies on the composition of cane juice. I. Effect of nitrogen manuring on various inorganic non-sugars in the juice of plant and ratoon crops. A. P. GUPTA and B. PRASAD. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.81–A.90. **II. Effect of nitrogen manuring on various organic non-sugars in cane juice of plant and ratoon crops.** *idem ibid.*, A.91–A.98.

I. Results obtained are given in different tables relating to N, P, K, Na, Ca, Mg, Si, S and Cl. The need for applications of N to be judiciously applied, in order to avoid undue adverse effects on juice quality, is stressed.

II. The effect of nitrogen on various organic non-sugars in the juice of plant and ratoon crops was studied. It was concluded that the composition of cane juice may be greatly affected by treatment with fertilizers, especially N. The juice of ratoon crops was of better quality early in the season. This cane should be harvested at the peak of its maturity.

Maximization of production through cane development. B. M. HAJARNIS. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.99–A.103.—In his introductory remarks the author states "sugar is grown in the field and only bagged in the factory". Improved agronomy is the basis for increasing sugar production. A variety of subjects that may be included under this broad heading are discussed.

* * *

Is Co 740 really deteriorating ? G. K. ZENDE. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.105–A.123.—Up to 1955 the leading sugar cane variety in Maharashtra State was Co 419. It dominated all other varieties in yield and sugar performance and was termed the "wonder cane." It was later superceded by Co 740. Latterly, some cane mill operators and others have contended that this variety is deteriorating. The writer has explored this matter at some depth and gives reasons for believing the assertion to be untrue. The performance of some newer varieties is discussed.

* * *

The performance of a few promising sugar cane varieties at Padegaon. M. R. PATASKAR, S. N. WAKHARE and G. K. ZENDE. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.125–A.134.—It is pointed out that to supplement Co 740, what is needed in Maharashtra is a cane variety which will give a high yield, will attain a high sucrose level at an earlier stage and be resistant to smut. The performance of six promising varieties is discussed. These were tested at different planting seasons and as ratoons. It was observed that Co 1284 as a "suru" crop gave a higher cane yield than Co 740. However it proved to be inferior to Co 740 as regards sugar yields. Co 1340 ranked third in cane yield but it was next to Co 740 with regard to sugar yield.

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Studies on crop logging in sugar cane. R. A. KALE, R. G. WAGH and S. J. RANADIVE. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.135–A.152. Fears are expressed that fertilizer, especially N types, is sometimes wasted by the growers through over-fertilizing (in ignorance). Preliminary data on nutrient indices collected from several experiments indicated that the crop logging technique could be profitably used for reducing the N dose. Sheath moisture and N index are correlated with the uptake of N by the cane crop and also with the ripening of the cane. The normal indices for other factors are given.

Preliminary studies on the control of flowering in sugar cane. M. A. SANT and S. V. CHINCHORKAR. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.153–A.164.—Flowering of cane is desirable for the sugar cane breeder but undesirable for the cane farmer as it reduces sugar yield. Matters discussed include: conditions affecting flowering; determination of photoinduction period; recording the date of flag leaf emergence; dissection of primary stalks; and methods of flowering control, viz. breaking the dark period; withholding irrigation; controlling night temperature; inactivating receptive tissue; spraying of chemicals; and spindle cluster trimming (defoliation). With regard to chemical flowering control, 3 or 4 sprayings at intervals of 3 or 4 days with 200 g "Reglone" or "Gramoxone" diluted with 3·0 litres of water per hectare gave almost 100% suppression of flowering. It would be necessary to reduce the number of sprayings to make the treatment practical and economical on a commercial scale.

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Economics of irrigation requirements of the sugar cane variety Co 740. V. O. MAHAJAN and D. G. DAKSHINDAS. *Proc. 4th Joint Conv. Indian Sugar Cane Tech. Assocs.*, 1971, A.165–A.178.—In many parts of Maharashtra sugar cane is the most important cash crop and can only be grown with irrigation. Irrigation is expensive, amounting to about 12% of the cost of raising a crop. Manuring costs may be 25%. Experiments are reported which were designed to investigate the irrigation requirements during the various growth phases with reference to yield and maturity. Results are given in a series of tables. Water supplied at 10-day intervals during crop growth of 16–17 months gave the best results in regard to yield and profit.

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Mixed crop technology in sugar cane. A. V. PICHUMANI and T. N. KRISHNAMOORTHY. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.187–A.192. Intercropping of sugar cane is discussed from all angles. About 20 different crops have been used or considered for this purpose. Emphasis here is on rice, groundnuts and onions. It is desirable that intercrops be compact in habit and early maturing so that they do not shade the cane and are not themselves affected by shading as the cane grows.

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Problems of sugar cane cultivation in the Telangana region of Andhra Pradesh. Y. S. RAO. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.193–A.194. Nizamabad and Modak are the important cane growing districts of Telangana. Cane cannot be grown without irrigation and water is often the limiting factor to further production. Increasing the number of bore wells would help but the average farmer cannot afford one. It is thought the time has now come for the Government to help and extend facilities for long-term loans.

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The problem of stale cane and its remedies. D. P. SHARMA. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.195–A.198.—As growers are paid for their cane by weight, with no regard for quality, all kinds of tricks are resorted to in order to increase weight. These are described. One is to leave the cut cane in muddy pools, specially prepared, for a week or more. When it is taken out it may be covered in mud and fermentation may have started. The writer advocates a system of mill inspection and penalizing of growers who supply stale cane.

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Relative performance of sugar cane varieties planted in spring under Tarai conditions of Uttar Pradesh. P. P. SINGH and K. SINGH. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.199–A.204. Trials of new cane varieties and their screening at the Experiment Station, U.P. Agricultural University, Pantnagar, Nainital, are described. Characters that receive special attention are germination, tillering habit, yield potential and juice quality. The method of assessing or judging is described. It was found that the variety Co 1336 was the best in relation to yield. The juice quality was also better than that of Co 1148. Next best was Co 6609. Co 1305 was good in yield and juice quality and was followed, in order of merit, by CoS 541, Co 1158, Bo 32, Bo 3 and CoS 562.

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Practical importance of free soil testing in crop production in Uttar Pradesh. B. SINGH, M. SINGH and P. LAL. *Proc. 4th Joint Conv. Indian Sugar Tech. Assoc.*, 1971, A.205–A.214.—The present organization of free soil testing for agriculturalists in India, with its network of soil testing laboratories, is described. The soil laboratory of the Sugarcane Research Station, Shahjahanpur, dealt with over 4000 soil samples in 1968–69. A list is given of other soil testing laboratories. The cane soils of Shahjahanpur, Sitapur and Barabanki districts were analysed for pH, available phosphate, available potash and organic carbon content. In general the soils of these three districts were deficient in nitrogen and had moderate amounts of available phosphate and available potash with a few exceptions. In many cases the soils had a neutral pH. Consequently the liberal application of nitrogen along with phosphate may prove beneficial in maintaining fertility.

* * *

Advantages of harvesting mature cane in India. A. P. GUPTA. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.215–A.218.—Figures are given for 6 major cane-producing countries of the world from which it may be seen that India comes last in terms of sugar/ha. This the writer attributes largely to two factors, viz. the purchase of cane from the grower on a weight and not a quality basis, and the persistent harvesting of immature cane. Possible methods for improving the situation are discussed under the following headings: cane maturity; present system of harvesting in India; how to test maturity of the cane crop; and field survey and preparation of harvesting schedule.

Drought resistance in sugar cane—a new concept. M. LAKSHMIKANTHAM, B. GOPALAM and N. N. V. V. P. RAO. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.223–A.225.—In areas subject to drought in Andhra Pradesh the cane variety Co 997 is popular on account of its drought resistance. It was compared with Co 419, another popular but less drought-resistant variety. It was thought that there might be differences in the stomata or their prevalence but this was not so. From a study of settlings (rooted setts) of the two varieties it was concluded that "the capacity of Co 997 to resist drought appears to be due to the production of more functioning roots in spite of prolonged drought". Further studies are planned.

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Studies on intercropping in sugar cane at Anakapalle. M. LAKSHMIKANTHAM, K. K. P. RAO, B. GOPALAM and N. N. V. V. P. RAO. *Proc. 4th Joint Conv. Indian Sugar Tech. Assocs.*, 1971, A.227–A.235.—Results are given of the intercropping of sugar cane with hybrid maize, chillies and lady's fingers (okra) and the effect on cane yield and juice quality. Intercropping with lady's fingers proved to be the most profitable. Hybrid maize was the least profitable and the most unsatisfactory for it depressed cane yield. Yields of chillies grown as intercrop were poor. The juice quality of the cane was not affected by any of the intercrops.

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Sugar cane investigation and research in Réunion. ANON. *Rpt. Sta. d'Essai de la Bretagne* (Réunion), 1971, 109 pp.—The year was characterized by dry weather conditions and absence of violent cyclones. Cane breeding and hybridization work is discussed and a long list given of the seedlings nursery planted. Work on sugar cane diseases was concerned mainly with gummosis, leaf scald and sugar cane smut. Activities at various sub-stations are described.

* * *

The Julien mechanical cane planter. H. ROBICHAUX. *Sugar Bull.*, 1972, **50,** (18), 6–7.—Some Louisiana cane farmers have not had good results with this planter and have had "gappy" cane. Others have had excellent results. It is pointed out that there are certain precautions that must be taken with this planter for good results. These are outlined under 8 headings.

* * *

Photoperiodic delay and extension of the flowering season of early flowering *Saccharum spontaneum* hybrids. P. H. MOORE and D. J. HEINZ. *Hawaiian Planters' Record*, 1972, **58,** 165–172.—By means of lighting facilities in the field, i.e. 150-watt incandescent flood lamps mounted 15 feet above ground and controlled by automatic timers, the sugar cane plants received supplementary lighting to affect the time of flowering; 242 early flowering clones of *Saccharum spontaneum* hybrids were subjected to photoperiodic treatment to delay date of flowering. The date of appearance of the first inflorescence was only one week later among treated plants than the controls. The date of emergence of the last inflorescence was such that the treated plants had an average flowering season of 31 days as compared with 13 days for the controls. This delay in flowering provided inflorescences from 225 *Saccharum spontaneum* hybrid clones for crossing with commercial or potentially commercial clones, compared with 21 clones from the control plants.

* * *

Influence of osmotic potentials on the growth and chemical composition of sugar cane cell cultures. A. MARETZKI, M. THOM and L. G. NICKELL. *Hawaiian Planters' Record*, 1972, **58,** 183–199.—Unirrigated sugar cane plantations experience occasional involuntary periods of drought, and relatively saline conditions may exist in some areas where sugar cane is grown. On irrigated plantations, an increase in stored sucrose in the sugar cane stalk is achieved by withholding irrigation in the last few weeks before harvest. In sugar cane the influence of reduced water potential, imposed by NaCl treatment, on the translocation of photosynthate has been studied under laboratory conditions. Sugar cane suspension cultures provide a system that can be readily controlled for metabolic studies. The development of a fully defined culture medium for the rapid multiplication of sugar cane cells also facilitated the investigation reported here. The effect of decreasing solute potential on growth and turnover of amino-acids, organic acids, and carbohydrates was investigated in two clones of sugar cane grown in cell suspension culture.

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Study of sugar cane stalk elongation and tiller population as affected by spacing, depth of planting, and irrigation methods. J. C. MONGELARD, C. M. VAZIRI and T. BRAUMILLER. *Hawaiian Planters' Record*, 1972, **58,** 199–211.—The purpose of this investigation was to study the growth response of the sugar cane plant to irrigation variables with adequate water supply under field conditions. A field experiment was carried out to compare the growth of sugar cane plants of variety H 57.6466 under furrow-surface and subsurface irrigation. The variables studied were: temperature of irrigation water, type of irrigation, depth of planting, space between transplants, and number of plants per transplant. The general conclusions derived from this experiment are that, with cane up to three months of age, subsurface irrigation promoted better growth than did surface irrigation, and warm water in the subsurface system enhanced growth. Planting at a 21-inch depth was preferable to that at a 15-inch depth and, three months after transplanting, two-plant transplants had heavier stool weights than did one-plant transplants. There was also higher efficiency in water utilization in subsurface irrigation plots.

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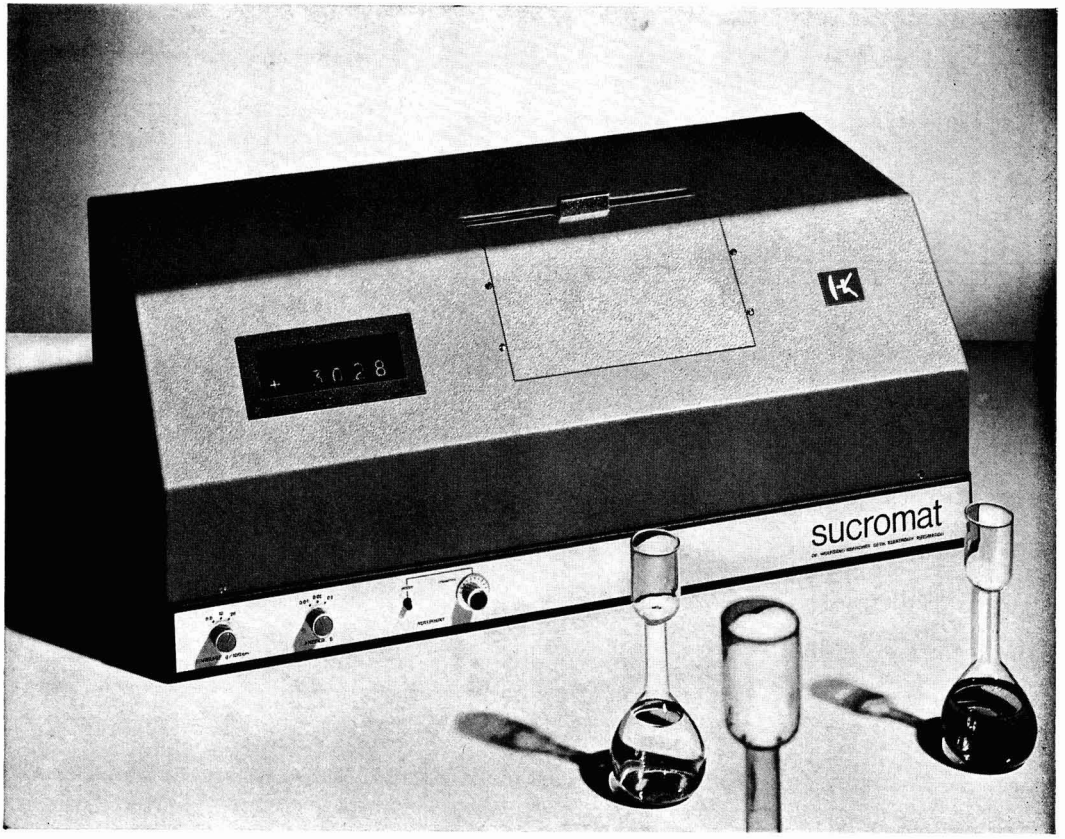
New varieties for New South Wales. ANON. *Producers' Rev.*, 1972, **62,** (5), 25–27.—Details are given regarding six varieties being released, two for each of three areas—Condong, Harwood, and Broadwater.



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The pest and disease position in New South Wales. ANON. *Producers' Rev.*, 1972, **62,** (5), 29–31.—Surveys taken at Broadwater and Harwood during 1971–72 revealed that most diseases of a serious nature had been kept in check. There had been some instances of poor ratooning of the variety Triton which were somewhat puzzling as no apparent disease or insect pest appeared to be implicated. Ratoon stunting disease has not been entirely ruled out. It was pointed out that insufficient seed cane was being hot water treated by growers at both Harwood and Broadwater.

* * *

Cane diseases and their control. A. G. HAYES. *Producers' Rev.*, 1972, **62,** (5), 45.—The importance of healthy seed cane and the precautions that should be taken are stressed, hot water treatment for ratoon stunting disease being essential. Cane planting machines should be thoroughly sterilized either by flame or swab, and "Mirrol" at 1% is a suitable swab to use. Brief notes are given on the following eight diseases: ratoon stunting, chlorotic streak, Fiji disease, bacterial mottle, gumming disease, leaf scald, red rot and downy mildew.

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Sound advice to prospective buyers of mechanical harvesters. L. G. VALLANCE. *Producers' Rev.*, 1972, **62,** (5), 47.—At a meeting, New South Wales cane growers were advised to think carefully about what they needed for their individual properties and to buy only when they were satisfied that the prospective purchase was the harvester best suited to them and their particular conditions. In Queensland during 1971 about 60% of the mechanical harvesters in use harvested less than 100 tons a day, although many cut much more than this. Harvesters should be scheduled to cut an average daily amount of cane no greater than 200 tons and preferably below this figure. Cooperative ownership of harvesters and the advantages of powered trailers are also briefly discussed.

* * *

Tofts produce the sliding wide axle harvester. ANON. *Producers' Rev.*, 1972, **62,** (5), 55.—Toft Bros. Pty. Ltd. of Bundaberg have built a chopper harvester with a revolutionary sliding wide axle. The machine has proved successful in a variety of trials involving extensive steep hillside work. Basically, the harvester is the proven "Robot" and the sliding wide axle is available as an optional extra which must be built-in during factory manufacture. The sliding axle is shown in a photograph.

* * *

"Don 275" planter is a revolutionary unit. ANON. *Producers' Rev.*, 1972, (5), 59.—This new cane planter has impressed Queensland cane farmers. It is manufactured by the Don Agricultural machinery of Wyper Brothers, Bundaberg. (A similar multi-row unit is planned.) Work is also proceeding on a simple low-cost plant cane-cutting device that can be quickly attached to a tractor's three-point linkage. Trailers could be attached to this device which would cut and top the plants and load them onto the trailer. Handling operations would then be almost fully eliminated. In producing the "Don 275" the main objectives were: to reduce the handling of the plant material, to eliminate the stripping of trash from the plants, to keep capital costs as low as possible and to keep the planter simple and foolproof.

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Tractors in miniature. P. PETE. *Producers' Rev.*, 1972, **62,** (5), 61.—Scaling-down tractors for use in inter-row work in cane fields is described and some information given on conversion of a standard tractor to overall axle widths of 30–33 inches.

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Advances in fertilizing technology is increasing sugar cane productivity. ANON. *Taiwan Sugar*, 1972, **19,** 79.–Cane farmers in Taiwan appear to be changing their fertilizing methods by shifting to new varieties of fertilizers. The shift from ammonium sulphate to compound fertilizers and calcium cyanamide to urea has been particularly significant. Even more advanced materials, such as suspension fertilizers and slow-release fertilizers, are currently being tested on Taiwan Sugar Corporation's plantations. With regard to future soil and fertilizer research in Taiwan it is thought that emphasis should be on the following studies: continuing soil tests and leaf analysis for the recommendation of optimum fertilizer application for sugar cane; soil physical properties in relation to cane growth; cane and cane soil micronutrients; soil organic compounds and their effect on soil productivity; the effectiveness of silicates, Mg-containing fertilizers, sulphur-coated urea and suspension fertilizers when applied on cane soils.

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Sugar cane fertilization in Taiwan. C. C. WANG. *Taiwan Sugar*, 1972, **19,** 80–90.—The general fertilizer position in regard to sugar cane in Taiwan is explained and discussed. Information is given on: cane fertilization in the past, composition of fertilizers used on cane fields, fertilizer products used in the past and currently available, soil mapping as a basis for soil test evaluation of cane fertilization in Taiwan, leaf analysis as an aid to cane fertilization, and new fertilizers being tested on cane. Slow-release nitrogenous fertilizers discussed are CDU and sulphur-coated urea. The former, while effective in tests, is considered too expensive for use in Taiwan.

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The effect of ground water table and soil compaction on nutrient uptake and growth of sugar cane. T. C. JUANG. *Taiwan Sugar*, 1972, **19,** 91–97.—Greenhouse pot experiments using two soils, one clay loam and one sandy loam, and F 146 cane are reported. Water tables were maintained at 30, 50 and 80 cm. It was found that the cane performed best in the treatment with the water table held at 80 cm below the surface. This suggests that an 80 cm water table depth is adequate for cane growth on clay loam and sandy loam soils. Absorption of radio-active ^{32}P and ^{86}Rb decreas-

ed with increasing bulk density. This coincided with decreasing root proliferation with increasing bulk density. Cane grown in pots containing compacted soil performed best at 1·6 g.cm^{-3} soil bulk density (a bulk density range of 1·2–1·8 g.cm^{-3} was tested). The critical bulk density which limited root development and caused a sharp reduction in nutrient absorption was found between 1·4 and 1·6 g.cm^{-3}. For comparable bulk densities sugar cane performed better at the higher fertilizer level.

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The use of fertilizers on sugar cane in Taiwan. W. H. LEE. *Taiwan Sugar*, 1972, **19**, 98–99.—A table shows the total consumption of N-P-K fertilizers in Taiwan over the last decade. The different kinds of N fertilizer consumed, arranged according to quantities used, are ammonium sulphate, urea and calcium cyanamide. The phosphatic fertilizer is calcium superphosphate while the potash fertilizer is imported potassium chloride. The rate of nitrogen used per hectare is approximately the same for contract farms and mill farms, but the rate for P and K per hectare are generally higher on the mill farms. In the case of farmers contracted by TSC the fertilizer is loaned to them prior to cane planting. The cost is deducted from the cash portion of the sugar which the farmer is entitled to receive for growing cane on his farm.

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Combating the froghopper. ANON. *Brasil Açuc.*, 1972, **79**, 422–424.—The cost of the campaign waged against this sugar cane pest ("cigarrinha") in parts of Brazil is discussed and figures given for the years 1967–1972.

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Sugar cane pests in Bahia. H. D. DE SOUZA. *Brasil Açuc.*, 1972, **79**, 441–452.—The major pests are discussed. A notable feature of the article is the colour photographs of the pests as they appear on cane.

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Weed control trials in sugar cane on the east coast of Madagascar. M. BETBEDER-MATIBET, H. RODRIGUES and V. HUU HAI. *Agron. Trop.*, 1972, **27**, 274–278; through *Hort. Abs.*, 1973, **43**, 53.—Pre-emergence applications of "Diuron" at 6, "Benzuride" at 3 and "Fluometuron" at 3 kg/ha were compared with post-emergence "Paraquat" at 0·8 kg/ha in plant and ratoon cane. In terms of yield, "Paraquat" was significantly the best in plant cane. In the ratoon cane the best control was provided by the other three herbicides which were comparable with hand weeding. The sugar content was not affected by herbicide treatments. Weeds resistant to each product are listed.

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Recommendations for the control of sugar cane weeds in the Province of Tucumán. R. A. AREVALO. *La Ind. Azuc.*, 1972, **78**, 71–75.—The vegetative cycle of the cane is divided into five stages based on morphological characteristics and sensitivity to herbicides. Weeds common in Tucumán are listed and herbicide formulations recommended for their treatment under different conditions of cane growth and soil humidity; the optimal temperature range of herbicide application is 19–30°C.

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Occurrence of "cigarrinhas" in the cane fields of Santa Catarina. A. K. DODSON. *Brasil Açuc.*, 1972, **79**, 535–537.—The "cigarrinha" or froghopper, *Mahanarva posticata*, is found in all the factory zones of the state of Santa Catarina in Brazil. Feeding from the cane, it injects invertase into the leaf which causes necrosis, reducing photosynthesis and consequently sugar content. Natural enemies include a fungus *Metarrhizum anisopliae* Metchn. and two flies *Salpingogaster nigra* and *S. pygophora*. Suggestions for control of the pest include application of insecticides (2–3% BHC) in limited areas to avoid affecting the natural enemies too much, use of resistant varieties and the artificial breeding and introduction of spores of the fungus above.

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Phosphate content in juice of several sugar cane varieties. M. A. A. CESAR, M. R. MAZZARI and E. R. DE OLIVEIRA. *Brasil Açuc.*, 1972, **79**, 538–542.—Measurements were made of the juice phosphate content in cane varieties grown in random block trials at Capivari in São Paulo. The results showed different juice contents and phosphate uptake from the soil by different varieties and also that the phosphate level increased with the harvest period; in none of the varieties, however, did the juice phosphate reach the level ideal for good clarification, and fertilizer trials should be carried out in an effort to increase juice phosphate content.

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Growing of sugar cane varieties cultivated in the states of São Paulo, Paraná, Santa Catarina, Rio Grande do Sul and Goiás. G. M. AZZI. *Brasil Açuc.*, 1972, **79**, 543–550.—Areas in the above states devoted to cane of a total of 78 varieties were represented in the 1971 varieties census for Central Southern Brazil. The data are tabulated and discussed. CB varieties represent 76·6% of the total area concerned (581,340 hectares), CB 41-76 ranking first with 40·22% of the area. Smut-susceptible varieties in Sao Paulo fell from 19% in 1970 to 7% in 1971.

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Study on the behaviour of standover cane in relation to its agro-industrial characteristics. M. A. A. CESAR. *Brasil Açuc.*, 1972, **79**, 425–440, 561–576.—The characteristics and composition of samples of cane unharvested by reason of a limited sugar production policy were determined to evaluate its potential industrial yield. Statistical analysis of the results showed that industrial sugar yield would not be severely affected by delaying harvest from the usual 18 months to 29 months in the case of plant cane or from 12 months to 24 months in the case of ratoons. In the event of a surplus of cane it would be better to leave the ratoon cane unharvested rather than the plant cane, however.

The gopher pest in the cane areas of Mexico and its control. C. M. RIESS and S. FLORES C. *Bol. Azuc. Mex.*, 1972, (267), 11–14.—A total of eight gopher species have been collected and identified in various cane-growing areas of Mexico and an account is given of control measures including trapping, fumigation of the galleries and, the current recommendation, baiting of the galleries with pieces of cane stalk impregnated with sodium fluoroacetate, which technique has achieved 80% elimination.

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Application of statistical control of quality to fixing the starting and finishing dates for the harvest. L. CASTAÑEDO B. *Bol. Azuc. Mex.*, 1972, (267), 15–20. A method is described for obtaining control figures from daily analyses during one season and using these as a basis for determining harvesting dates from the subsequent crop's analyses.

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Development of sugar cane dry-cleaning stations in Cuba. G. GONZÁLEZ. *CubaAzúcar*, 1972, (April/June), 43–47.—A survey is presented of the growth of the system of in-field dry-cleaning stations ("centros de acopio")[1] which up to 1971 totalled 180 but which were expected to reach 500 by the end of 1972.

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Isolation of ribonucleic acid from germinating buds of sugar cane. C. C. LO. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (55), 1–11.—Details are given of the procedures used to extract ribonucleic acid (RNA) from germinating buds of a number of cane varieties. Subsequent separation of the extracts using electrophoresis on polyacrylamide gel is also described. U.V. absorption spectra are given of the RNA from the different varieties. Three major bands were common to all varieties, while minor bands differed.

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Dark respiration of the sugar cane leaf. L. KONG and C. C. CHU. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (55), 13–24.—Investigations of dark respiration and apparent photosynthesis in cane leaves (most of the studies were made on detached leaves) are reported and a number of conclusions discussed.

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Studies on the control of sugar cane flowering with chemicals. P. C. YANG, T. P. PAO and F. W. HO. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (55), 25–45. Application of 0·75 litre/ha of "Reglone" or 5·6 kg/ha CMU considerably reduced flowering, "Reglone" proving the more effective but also causing scorching of upper leaves and temporary reduction in growth for about 1 month. Results regarding the effects on cane and sugar yields were inconclusive.

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Effect of vertical mulching on sugar cane yield in lateritic soil. M. T. CHEN and C. T. HUANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (55), 47–58.—Application of 40 tons of bagasse/ha as a vertical or surface mulch after subsoiling to a depth of 25–30 inches at 2–3 ft intervals gave 12–23% higher yields of autumn-planted 16-month cane than did subsoiling without bagasse application, although no differences were found between the three treatments in the case of spring-planted and 1st ratoon cane. It is suggested that surface mulching might be more useful than vertical mulching on lateritic soil.

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Studies on soil conservation practices on sugar cane land. M. C. LIAO. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (55), 75–89.—The studies on the major soil conservation practices on sloping land in Taiwan were made during 1959–1965. Run-off and soil losses were minimum with reverse slope bench terraces and maximum with up-and-down planting. However, on slopes of 31% bench terracing gave minimum cane yield, which was greatest with contour planting. No significant differences in cane yields were obtained with slopes of 16%.

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Effect of solar radiation and high temperature on the survival of nematodes in sugar cane fields. C. H. HU, T. K. TSAI and T. T. YANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (55), 91–102.—Since the survival of parasitic nematodes, particularly *Meloidogyne* spp., was greatly reduced when soil was exposed to a temperature of 46°C for at least 24 hr, the use of solar radiation as a means of nematode control is suggested. Covering with PVC sheeting, fallowing or ploughing 2–3 times as a means of combating the pest may rely partly on the soil temperature effect.

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Effects of insecticides and herbicides on the parasitic fungi of nymphs of the grass cicada, *Mogannia hebes* Walker. P. Y. WANG and L. S. LEU. *Rpt. Taiwan Sugar Expt. Sta.*, 1972, (55), 103–109.—Tests showed that applications of "Aldrin", BHC and "Heptachlor" insecticides and "Atrazine" and 2,4-D herbicides had no effect on the pathogenicity of *Isaria sinclairii* and *Metarrhizium anisopliae* fungi towards nymphs of *Mogannia hebes*.

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Nitrogen in sugar cane in Maharashtra. J. R. KAKDE. *Sugar News* (India), 1972, **4**, (1), 21–25.—The author discusses the large quantities of N fertilizer applied to the cane fields of Maharashtra and examines types of N fertilizer and frequency of application as well as a number of other relevant factors.

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Sugar recovery in relation to cane and sugar production. V. G. VAIDYA. *Sugar News* (India), 1972, **4**, (1), 26–30. In a general survey of cane and sugar yields in Maharashtra, the author considers that insufficient attention is paid to the application of potassium fertilizers.

[1] *I.S.J.*, 1972, **74**, 333–334.

Sugar cane pests as targets for biological control. S. NAGARKATTI and V. P. RAO. *Sugar News* (India), 1972, **4,** (1), 32–35.—Biological control of cane pests is discussed with tabulated information showing examples in various cane-growing countries. Among serious pests in India which are examined are the white grub *Lachnosterna consanguinea* and the borers *Tryporyza nivella*, *Chilo auricilius* and *Bissetia staniella*. Possible means of controlling these biologically are called for; in the case of *L. consanguinea* the use of *Bacillus popilliae*, causal agent of milky disease, is suggested.

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The burning of trash and tops. R. W. HEALY. *Producers' Rev.*, 1972, **62,** (6), 6.—Regulations concerning rural fires in Australia are discussed in relation to the pre-harvest burning of cane. Particular mention is made of the problem regarding the suitability of the hours laid down in the Cane Prices Board Award for cane burning.

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Performance of some promising canes of Uttar Pradesh. S. K. OJHA, J. P. SINGH and N. AHMAD. *Sugar News* (India), 1972, **4,** (2), 10–12, 16.—Varietal trials at the Sugarcane Research Station, Shahjahanpur, are reported. The varieties were Co 1148, Co 1158, Co 1336, CoS 673 and BO 54.

* * *

Mole drains remove excess water. I. J. V. STEWART. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 4–6. The use of mole drains to remove excess water from cane fields where surface drainage is inadequate, their preparation, soil requirements, most suitable time at which to make them and their maintenance are described.

* * *

Rat control in the north (of Queensland). R. E. KERKWYK. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 9–10.—In Queensland, greatest cane damage by rats has occurred near open rain forest, while severe damage has also been found in cane blocks near untidy, grassy drains, which, together with low-lying swamp, make excellent breeding areas for both *Melomys littoralis* and *Rattus conatus*, the two species found in large numbers in north Queensland. Control measures recommended include reducing the availability of breeding grounds and baiting with thallium sulphate. Baits should be dry and fresh, as rats ignore damp, mouldy baits.

* * *

A "new look" cane planting system. O. W. D. MYATT. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 11–12. Details and photographs are given of a cane planter carried on a tractor linkage which is fed from small 4-wheeled trailers and automatically cuts the sett to a length of 14½ in (37 cm). With a labour force of five, the unit has maintained a planting rate of 7 acres/day using material in first-rate condition.

Some agronomy projects on the Southern Sugar Experiment Station. R. B. MOLLER. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 13–15.—The projects discussed include a time of harvest trial, a time of planting trial and a test to compare three cultivation methods, in which the highest stalk population was obtained with normal cultivation (gradual filling of the drill), while completely filling the drill at the start of tillering gave the lowest population. Half-filling the drill at the start of tillering and completing the filling at the "out-of-hand" stage gave a population halfway between the other two. Details of the time of harvest and planting experiments, involving Q 47, Q 93 and N:Co 310 varieties, are given.

* * *

Pig damage in the Mackay district. P. J. AMIET. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 15.—Cane damage by wild pigs is briefly mentioned. The only control measure which has proved effective is a heavy-gauge netting fence. Damage includes trampling of roots and uprooting and chewing of the setts.

* * *

Healthy plants will help to combat Fiji disease. B. T. EGAN. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 27–28.—The continuing spread of Fiji disease in the Bundaberg area of Queensland is discussed and possibilities of controlling it mentioned. While N:Co 310 is highly susceptible and symptoms of the disease are difficult to detect in it, it is considered that in the short term every effort must be made to save this variety, since it is far superior to other more resistant varieties as regards sugar yield per acre. Two isolation plots established for the provision of a nucleus of healthy N:Co 310 cane are described.

* * *

Aqua ammonia—the cheapest form of nitrogen. L. S. CHAPMAN. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 29–31.—While ammonium hydroxide is by far the cheapest form of N fertilizer, trials have shown that it is as good as ammonium sulphate with regard to cane and sugar yield per acre.

* * *

Cockatoo damage to cane in Mossman. L. G. W. TILLEY. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 31.—Cane damage by sulphur-crested cockatoos in the Mossman district of Queensland in 1971 was estimated at an equivalent of $A 2,000. Flocks of up to 80 of the birds descend on cane stalks and shred them into unharvestable heaps of fibre and rotting stalks. Control appears to be difficult.

* * *

Pre-harvest burning of flooded cane. J. WRIGHT. *Cane Growers' Quarterly Bull.*, 1972, **36,** (1), 32–33.—Where flooding occurs, much of the cane trash may become covered with silt and hence be difficult to burn. Details are given of the procedure adopted by one grower, viz. knocking the cane forward and down with a tractor and spraying with 20% "Paraquat" solution as desiccant. This permitted the cane to be

burnt, while no difficulties were experienced in harvesting the knocked-down cane. The knocking-down enabled the cane to be sprayed in recumbent position and also helped dislodge much of the dry silt.

* * *

A review of coot control methods. W. A. C. WEBB. *Cane Growers' Quarterly Bull.*, 1972, **36**, (1), 34–35. Control measures against the coot (*Porphyria melanotus*), a relatively minor cane pest, are described. Of these, poisoning with strychnine baits has proved the most effective.

* * *

Chemistry and pesticides. H. W. HILTON. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 45–46.—Present and possible future trends in development and use of agricultural chemicals in cane fields are discussed under herbicides, rodenticides (particularly zinc phosphide for rat control), and fungicides (especially "Benomyl" for protection of cane seed pieces against pineapple disease).

* * *

Insect control for Hawaiian sugar cane fields: theory practice and potential. A. K. OTA. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 47–52.—Among methods of controlling the beetle borer in Hawaii which are discussed are three "old" methods (chemical control, biological control with the tachinid parasite *Lixophaga sphenophori*, and the growing of resistant varieties) and three new methods which are undergoing investigation (sterility induction in the borers, the use of hormones and morphogenetic compounds to cause changes in growth and development of the pest as well as induce sterility and prevent feeding, and the use of pheromones—chemicals used in communication between insects—and sex attractants). The advantages and disadvantages of the methods are considered. The importance of the new methods lies in the possibility of applying them to other cane insect pests which are constantly threatening to become established in Hawaii. The combined use of two or more methods is thought to be the most promising approach.

* * *

Varietal resistance to the beetle borer. V. C. S. CHANG. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 53–55. Details are given of damage inflicted by the beetle borer on different cane varieties growing on the island of Kauai. It is felt that crossbreeding the more resistant varieties with other varieties or species exhibiting resistance characteristics coupled with biological control using *Lixophaga sphenophori* would provide a successful means of control.

* * *

Current Hawaiian cane pathology. C. A. WISMER. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 56–58. A short survey is given of cane diseases in Hawaii. Hawaiian cane varieties are tested in Taiwan and Fiji for reaction to diseases in those countries which do not occur in Hawaii. While two other fungicides have shown promise in pineapple disease control, the only one registered for cane cutting treatment against this disease is "Benlate".

* * *

Trickle irrigation studies, Olokele Sugar Company Limited. J. M. LANGA. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 59–62.—The component parts of a trickle irrigation system as installed at Olokele Sugar Co. are described and the requirements of an economically acceptable system listed.

* * *

Movement of water and fertilizer from a point source in subsurface irrigation. E. OKAZAKI. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 63–70.—Since the successful operation of a subsurface irrigation system depends on adequate capillary movement of water in the soil as well as lateral and downward movement and, where nutrients are being added to the water, the mobility and retention of these, studies were undertaken of the various soil factors having effect under Hawaiian conditions. Full details are given of the investigations.

* * *

CP-41845—a chemical ripener for sugar cane. C. A. PORTER and L. E. AHLRICHS. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 71–72.—Application of Monsanto CP-41845 [N,N-*bis*(phosphonomethyl)glycine] at a rate of 2–6 lb/acre 4–13 weeks before harvest increased the sucrose in plant and ratoon cane by an average of 10% in trials conducted in a number of cane-growing countries.

* * *

Ripening studies in Hawaii with CP-41845. L. G. NICKELL and D. T. TAKAHASHI. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 73–82.—While trials on a number of Hawaiian cane plantations indicated a reduction in cane yield/acre under some conditions, compared with the untreated controls, the general effect was an increase in cane quality and, hence, in sugar yield. Advantages of the chemical are noted.

* * *

Some cane-moisture and cane-temperature relationships. J. C. MONGELARD. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 113–118.—Soil moisture stress was found to cause a decrease in spindle growth rate which was permanent after a 24-hr stress, even with high water potential levels. This reduction was related to a decrease in leaf area, although linearity in the relationship was affected by a number of factors, including temperature variation. Leaf area and cane water usage increased with growth in warm air and ambient root temperature. In cool air, leaf area production with time was reduced but water consumption followed the same curve pattern as for leaf area, whereas with cool root conditions water consumption decreased despite an increase in leaf area with time. Other effects of low temperature on cane are noted.

Sugar beet agriculture

Root-knot nematodes on sugar beet in India. K. SINGH and S. R. MISRA. *Plant Science*, 1970, **2**, 138.—The occurrence of *Meloidogyne javanica* and *M. incognita* on sugar beet is recorded in India, it is thought for the first time. Photographs of the galled roots are shown, the nodules of *M. javanica* being smaller than those of *M. incognita*. To test the pathogenicity of these nematodes, egg masses were released in the root zone of young sugar beet plants raised in pots containing steam sterilized soil. Visible galls were produced within 50 days of the release.

* * *

Sugar beet research in respect of progress achieved and future problems. M. MARTENS. *Sucr. Belge*, 1972, **91**, 275–289.—After discussing the gradual improvement in beet sugar yields in Belgium, where the white sugar yield has risen from 4·8 tons/ha in 1950 to 6·8 tons/ha in 1972 on a beet area of about 100,000 ha, the author looks at factors in beet agronomy which have resulted in the increased yield, including: beet yellows control; improved beet varieties and seed quality; chemical weed control and uses of the help offered to the beet grower by the various beet research organizations and sugar factory agronomy services. Possible directions which beet research can follow in the future are examined, including: the sowing date and its effect on beet processing quality and juice purity; beet transplanting; the effects on storage and processing of topping as opposed to merely removing the leaves; liquid fertilizers; pesticides; the biological activity of soils; growth regulators; and mechanical harvesting.

* * *

Hybrid breeding in sugar beets. E. KNAPP. *Zucker*, 1972, **25**, 459–463.—The special problems in the breeding of sugar beet are discussed, including the depressing effect of inbreeding on quality. Modern varieties are mainly multiple crosses. Since triploid beet often perform well, triploid hybrid seed is of particular interest; it may be obtained by combining a diploid and a tetraploid strain, one of them being male sterile.

* * *

Sugar beet research in France. ANON. *Publ. Inst. Tech. Franç. Betterave Industrielle*, 1971, 411 pp.—An account is given of trials and experimental work of a comprehensive nature in many parts of France during 1971. Matters covered, some in great detail, include: soil and seed bed preparation (photographs of the massive multi-row machinery used for large-scale field work are shown); seed germination and spacing (including the use of electro-mechanical devices); harvesting and harvesting machinery; beet varieties and breeding; nutrition and fertilizers; and herbicides.

* * *

Nematodes. A. AZIZ. *Sucrerie Maghrebine*, 1972, **1**, (1), 23–27.—The serious results that arise from attack by the sugar beet nematode (*Heterodera*) are described. This sugar beet pest was first recorded in Morocco in 1925. Its life history is described and conventional methods of combating it discussed.

* * *

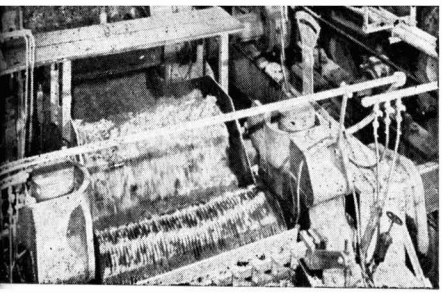
Investigations of sugar beet metabolism during the growth period. II. Citric acid, malic acid and α-ketoglutaric acid. M. BURBA and U. NITZSCHKE. *Zucker*, 1972, **25**, 509–518.—Wide variations in citric acid in growing beet (in the range 490–680 mg/100 g solids) were ascribed mainly to varietal differences, although less citric and malic acid was found in sugar-rich than in high-yielding beets. Close correlation was found between the contents of the two acids and (i) sucrose content and (ii) potassium content. The citric acid content also rose with increase in N, K and Na fertilizer application and reducing plant density. Malic acid averaged 90 mg/100 g solids, while α-ketoglutaric acid averaged only 9·5 mg/100 g solids.

* * *

Comparison of "Pyramin" and "Merpelan" soil herbicides in field trials with sugar beet. W. R. SCHÄUFELE and C. WINNER. *Zucker*, 1972, **25**, 549–553. Trials in which "'Pyramin" was compared with "Merpelan" (both at 4 kg/ha) as pre- and post-emergence herbicides in beet fields showed that each accounted for 85% of the weeds but not when used in combinations with other preparations. There was, however, little effect on beet and sugar yields compared with untreated controls when the herbicides were applied before emergence, while post-emergence application gave somewhat higher yields than the controls.

* * *

Systems of sugar beet growing in West Suffolk. G. H. BATTLE. *British Sugar Beet Rev.*, 1972, **40**, 221–224. Details are given of the agricultural methods used on three beet farms in the vicinity of Bury St. Edmunds in Eastern England. Attention is focused on the type of seed and beet varieties grown, seedbed preparation, drilling and weed control.



Cane sugar manufacture

Effect of lime purity and automation in the cycle of operation of heaters. ANON. *CubaAzúcar*, 1972, (April/June), 48–54.—Studies carried out at "Pablo Noriega" Experimental Unit have shown that, by using high-quality lime and automatic control of limed juice pH, it is possible to extend the working cycle of juice heaters before cleaning becomes necessary.

* * *

Approach to better low-grade sugar boiling, crystallizer treatment and centrifugation. S. C. GUPTA and S. K. D. AGARWAL. *Sugar News* (India), 1972, **4**, (1), 15–20. Advice is given on the best means of obtaining C-sugar of uniform small crystals having a purity of up to 88–90.

* * *

Sugar losses in the sugar industry. I. S. SRINIVASAN and M. MUTHUJOTHI. *Sugar News* (India), 1972, **4**, (2), 2, 13–20; (3), 5–8.—Sources of losses are examined, including cane deterioration, cane preparation and milling, bagasse, filter cake and final molasses. Under undetermined losses the author lists mechanical losses, physical losses (e.g. melting and recrystallization of sugar crystals), chemical losses, biochemical losses and apparent losses. Measures to minimize such losses are discussed.

* * *

Fly ash arrestor installation—criteria and performance tests. A. V. BARRON. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 1–11.—Dust collection systems installed at Hutchinson and Olokele sugar factories for bagasse-fired furnaces are described and tests reported. While the results indicated that mechanical dust collectors can control the type of emission in question, it is emphasized that future legal requirements could be based on use of fossil fuels or on codes for new installations, so that a single collector would not be adequate.

* * *

Hauling, storage and compaction of sugar mill waste. J. V. ELLISON. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 12–14.—Details are given of the system adopted at the author's sugar factory for disposal of bagasse and cane trash, which is taken by truck to a dump site and there compacted. Costs of the scheme are given.

* * *

"Hi-Extractor" operation—1971. B. G. ROSS and B. W. EAVES. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 15–20.—The performance of the "Hi-Extractor" over a 2000-hr period at Honokaa is described, and details given of the wear and maintenance of the unit and ancillary equipment. At a throughput of about 18 tons dry fibre/hr, extraction was about 97%, bagasse pol averaged 1·82 and moisture in final bagasse was 49·3%.

* * *

Bagasse dewatering wih the 5-roller mill. S. G. CLARKE. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 21–27.—The 5-roller cane mill such as used in Australia is described and information given on the Walkers 5-roller mill installed at Paia for dewatering of bagasse from a Silver diffuser. Some performance data are tabulated for 5-roller mills at five Australian sugar factories not equipped with diffusers and at three factories using diffusers. Final bagasse moisture for the former group ranged from 44·2% to 48·4% and for the latter group from 46·1% to 49·5%.

* * *

Paia diffuser. A. M. HIROSE and R. D. MOUNTS. *Rpts.* 1971 *Meeting Hawaiian Sugar Tech.*, 28–33. Operation of a Silver Model 840 cane diffuser, having a rated throughput of 265 t.c.h., at Paia is described, including steam consumption, and performance data for three months in 1971 compared with results from the same three months during 1969 and 1970 when conventional milling was used. These indicate a diffuser extraction of 97·7% (96·2% in 1970), bagasse pol of 1·38 (2·01 in 1970) and bagasse moisture of 42·6% (44·3% in 1970). Total losses in 1971 were 10·90% compared with 11·11% in 1970. Sugar quality was somewhat higher in 1971 although yield from a greater amount of cane was slightly lower than in 1970. Cane throughput (net) was 174·9 tons/hr in 1971 compared with 158·8 tons/hr in 1970.

* * *

Correlation between capacities and reduced efficiencies of Indian sugar factories. S. N. SINHA and M. PRASAD. *Indian Sugar*, 1972, **22**, 75–81.—Statistical evaluation of average capacities, reduced milling extractions, reduced boiling house extractions and reduced overall extractions at sugar factories in 18 regions of India during the period 1960/61–1968/69 showed that there was no correlation between factory size and efficiency and that milling extraction did not increase with factory size.

* * *

The improvement in vapour bleeding to save fuel consumption in sugar factories of Taiwan. S. Y. CHIU. *Taiwan Sugar*, 1972, **19**, 119–123.—Vapour bleeding from a quintuple-effect evaporator for use in juice heating and pan boiling is shown, in a scheme set

out in detail, to permit a calculated saving of 3·7 tons of steam/hr per 100 tons of cane. Other advantages are mentioned. The work is based on vapour bleeding schemes introduced or modified in Taiwan sugar factories.

* * *

Sugar cane washing equipment for removal of mud and sand. C. C. CHOW. *Taiwan Sugar*, 1972, **19**, 124–126.—Details are given of the cane washing systems at Taichung and Pingtung sugar factories and a description is given of the continuous turbo-type separator used at Pingtung for cane juice treatment, which removes 65% of the mud and sand.

* * *

Summarized report on the removal of fly ash using water spraying methods. T. C. LIU, H. S. SHEN and M. P. LO. *Taiwan Sugar*, 1972, **19**, 127–130.—Results obtained with spray-type fly ash arrestors at Taiwan sugar factories are discussed.

* * *

Improved sulphitation automatic pH control system at Yungkang mill. C. M. HWANG and K. H. SHEN. *Taiwan Sugar*, 1972, **19**, 131–134.—A modified automatic pH control system installed at Yungkang factory to replace an earlier automatic system for sulphitation is described and its performance discussed.

* * *

Comparative study on continuous crystallizers. K. F. HSIEH. *Taiwan Sugar*, 1972, **19**, 135–141.—Investigations at three Taiwan sugar factories showed that at one, batch crystallizer operation was better than continuous operation, while results at the other two favoured the continuous process. Tabulated data and graphs are presented.

* * *

Comparative study on the use of "P.P." ("P-50" and "P-100") and cotton filtering cloths. ANON. *Taiwan Sugar*, 1972, **19**, 142–144.—Preliminary results of tests are reported in which various grades of a synthetic fibre ("P.P.") were compared with cotton in use as filter cloths.

* * *

Report on using aluminium tubes for vapour heater in Chishan sugar mill. ANON. *Taiwan Sugar*, 1972, **19**, 145–148.—After 137 days, aluminium tubes used in the vapour heater connected to the last evaporator effect in place of copper tubes were found to have pin holes on the inner surface. Although corrosion caused by polarization where the aluminium was in contact with iron was not serious, it was only slightly reduced by applying epoxy resin and a liquid packing film to the tubes. The question of improving insulation between the tubes, tube plates and baffle plates to reduce polarization is discussed. The data are considered insufficient to permit conclusions on the use of aluminium tubes.

* * *

Sugar manufacture in Mexico. D. SMITH. *Sugar y Azúcar*, 1972, **67**, (8), 22–24.—A brief survey is presented of the Mexican sugar industry which produces about 2½ million tons of sugar annually.

* * *

Rapid methods for calculation of steam tube diameters. P. M. FABREGAT. *ATAC*, 1972, **31**, (3), 28–31.—A nomogram is presented by means of which appropriate diameters may be calculated for flow rates of steam at stipulated pressures and velocities. The nomogram is based on information given in "Industrial tubing" by C. T. LITTLETON. The "Babcock formula" is also presented which relates pressure loss with tube dimensions, and steam density and flow rate.

* * *

Power factor in the sugar industry. O. E. AGUIRRE. *ATAC*, 1972, **31**, (3), 40–48.—The power factor in a sugar factory should be a minimum of 0·80 and preferably it should be about 0·85 to provide for temporary overloads with excessive heating of the electrical equipment. Generally, power factor compensation is provided by combining motor and capacitor as a single unit by one of several methods. The method of arranging the installation of capacitors to reduce the valleys and peaks of the oscillogram produced by a non-variable speed motor is discussed. With modern equipment the ideal is the automatic regulation of power factor by connexion and disconnexion of capacitors.

* * *

System of pan feeding by L.B.T. flow lines. R. LOBATO L. *Bol. Azuc. Mex.*, 1972, (268), 10–13.—Systems of feeding of syrup to pans are briefly surveyed and a method indicated where distribution is through perforated pipes below the calandria and supplied by a polygonal manifold exterior to the pan. The feed enters the lines of circulation of massecuite which is aided by a system of louvres mounted above the central downtake.

* * *

Vacuum breakers. R. VELÁZQUEZ R. *Bol Azuc. Mex.*, 1972, (268), 14–17.—The use of vacuum breakers is briefly discussed with illustrations of the components, an assembled unit, and an indication of locations in a juice heater, evaporator and boiler.

* * *

Economic justification in the use of "Hydrosan H-10" as bactericide. P. P. MAÑA. *Philssuccap Crystal*, 1972, **1**, (2), 12–16.—Application of 5 ppm (on cane) of "Hydrosan H-10", supplied by the Atom Chemical Co., to mill juice once every 8 hr reduced inversion, as indicated by analytical data. The extra sugar recovered more than offset the cost of the chemical.

* * *

Economic evaluation of Passi CMA ("Cane Milling Aid") test. R. G. CAMURUNGAN. *Philssuccap Crystal*, 1972, **1**, (2), 17–19.—The monetary savings obtained by treating mill juice with Fabcon "Cane Milling Aid" are calculated and data obtained from cane sugar factories in Indonesia and other Asian countries are tabulated.

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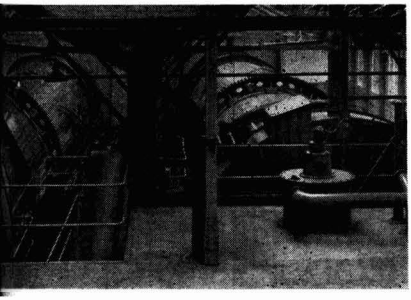

Beet sugar manufacture

Effect of temperature and time on beet tissue plasmolysis and the value of the diffusion coefficient. S. ZAGRODZKI and J. KUBIAK. *Gaz. Cukr.*, 1972, **80,** 217–219. Laboratory tests showed that increase in the temperature of plasmolysis caused a fall in raw juice purity, which also resulted when the scalding time was extended and caused increase in sugar extraction. Optimum values of temperature and time were found to be 75°C and 40 minutes.

* * *

The juice filter station at Racibórz sugar factory. K. KOCJAN and T. DROZDOWSKI. *Gaz. Cukr.*, 1972, **80,** 220–224.—The filter station at this Polish sugar factory consists of 5 filter-thickeners for 1st carbonatation juice, 3 for 2nd carbonatation juice and 3 rotary vacuum filters for mud treatment. The performance of the filters is discussed and advantages and disadvantages of the filter-thickeners listed.

* * *

Automatic controls of technological processes in sugar factories exported by Chemadex. L. OLEDZKI. *Gaz. Cukr.*, 1972, **80,** 225–228.—Information is given on the automatic control systems used in certain beet and cane sugar factories supplied by Poland and a list of 26 factories built during 1962–1972 is given with the type and make of overall controls, e.g. pneumatic or electronic, central or local, etc.

* * *

Flow studies in a factory-scale Robert evaporator. H. BANSKI. *Zucker*, 1972, **25,** 647–652.—Tests with water and aqueous sugar solution showed that while circulation underwent abrupt changes at given apparent liquid levels, the changes did not affect heat transfer in the tubes within the measured range. No relationship was established between heat transfer and the liquid velocity on entering the tubes.

* * *

Effect of sucrose concentration in milk-of-lime on beet juice purification efficiency. J. VAŠÁTKO and A. DANDÁR. *Zucker*, 1972, **25,** 653–656.—See *I.S.J.*, 1972, **74,** 117.

* * *

Application of modern computer techniques in the sugar industry. E. SVOBODA. *Listy Cukr.*, 1972, **88,** 196–202.—The subject is discussed with particular reference to data processing. The economics are compared of a mechanical, semi-automatic calculation, a fully-automatic electronic calculation system and a centralized computer system. The advantages of the last over the other two are discussed, the optimum being considered one computer processing data from 7–14 factories. Various sugar factory parameters and their sub-programme block systems are used as examples.

* * *

Control of rotary vacuum filter operation. R. OSVALD and E. HAVLOVÁ. *Listy Cukr.*, 1972, **88,** 202–206. Relationships have been calculated between filter throughput and mud concentration in the filtered suspension, cake thickness from 1st carbonatation juice and suspension concentration at various rotary speeds, and between the amount of sweetening-off water and cake washing time on the one hand and cake thickness on the other. From test data a nomogram has been constructed for calculation of control parameters in the filtration of first carbonatation juice muds for a given juice.

* * *

Theoretical fundamentals of heat treatment of beet cossettes in diffusion and methods of calculating tissue permeability. B. M. LYSYANSKII *et al. Sakhar. Prom.*, 1972, (8), 8–13.—Details are given of a method for calculating beet tissue permeability in which the Fourier number corresponding to the difference between sugar concentration in the juice and cossette at the start and end of diffusion and to the ratio of juice mass to cossette mass is found from a nomogram and the diffusion coefficient then calculated after substituting numerical values. Finally, the beet tissue permeability is calculated as the ratio of diffusion in the sample to that in a similar cossette heat-treated under laboratory conditions.

* * *

Study of the adsorption-exchange processes on $CaCO_3$ precipitate in beet sugar manufacture. L. D. BOBROVNIK, A. R. SAPRONOV, V. Z. SEMENENKO and YU. V. ANIKEEV. *Sakhar. Prom.*, 1972, (8), 14–18.—The mechanism of adsorption by $CaCO_3$ particles was studied with model sugar solutions of varying pH (adjusted by liming) to which calcium lactate had been added. When the $CaCO_3$ had a negative charge it acted as a cation exchanger and under given conditions adsorbed only Ca^{++} and H^+. When the surface charge was positive, lactate and Ca^{++} were adsorbed, the carbonate obviously possessing specific adsorptive properties with regard to calcium. In 2nd carbonatation the $CaCO_3$ has an isoelectric point at pH 8·9–9·5 and Ca^{++} and anion adsorption are maximum. The adsorption-exchange processes on

the $CaCO_3$ surface cause the pH change in juice to which alkaline compounds are added to be smaller than that equivalent to the Ca salts content.

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Beet cossette quality. V. N. SHCHEGOLEV and G. M. KORBUT. *Sakhar. Prom.*, 1972, (8), 18–22.—Tests have shown that for each type of diffuser the cossettes must be of sufficient strength and contain a minimum of spoilage to permit maximum efficiency. The pH in diffusion should be no lower than 6 and the temperature no lower than 70°C. How to maintain cossette quality is explained.

* * *

Transfer of lime salts and colouring matter from carbonatation mud to juice during over-saturation. S. P. OLYANSKAYA, K. D. ZHURA and N. N. POKRASS. *Sakhar. Prom.*, 1972, (8), 22–25.—While reduction of pH from 11 to 9 after 1st carbonatation caused a marked increase in colorant transfer from carbonatation mud to juice, a pH of 9 was optimum as regards transfer of calcium salts of various amino-acids, as demonstrated by graphs.

* * *

Maintenance of the percolation properties of a layer of beet cossettes in tower diffusers. V. G. DRYNOV and V. G. DMYSHKO. *Sakhar. Prom.*, 1972, (8), 26–27. Automatic increase in scroll rotary speed is suggested as a means of maintaining juice percolation through the bed of cossettes at the bottom of a tower diffuser. In the system described the speed change would be brought about by signals when the pressure below the bottom screen fell as a result of reduced permeability or when the difference in pressure above and below the screen increased.

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Operation of a unit for juice deliming at Otradinskii sugar factory. Z. D. ZHURAVLEVA and K. P. GONCHAROVA. *Sakhar. Prom.*, 1972, (8), 31–35.—Details are given of operation and performance of a cation exchange unit used to remove lime salts from thin juice. Deliming efficiency is 60–70% and the evaporator tubes have remained in good condition, with only one change of pre-evaporator tubes necessary between 1964 and 1972. Advantages of the system are listed.

* * *

Bulk storage of white sugar at Otradinskii sugar factory. A. A. IVANOVA, E. K. BUDANOV and L. A. BORODIN. *Sakhar. Prom.*, 1972, (8), 35–37.—Information is given on the bulk storage system at this Soviet factory which comprises two silos each of 15,000 tons capacity.

* * *

Automatic control of 2nd carbonatation under optimum conditions. B. G. SUSOROV and B. A. EREMENKO. *Sakhar. Prom.*, 1972, (8), 38–41.—The control system described is based on measurement of the difference between electrical conductivity of juice taken from a control chest and that of the same juice treated with an extra quantity of CO_2 gas. A signal proportional to the difference is used to regulate gas feed to the main carbonatation vessel until equilibrium is established, i.e. there is no difference in conductivity. Results of comparative tests show that the scheme described gives better results than conventional pH stabilization.

* * *

Establishing a molasses viscosity norm. N. P. SILINA and E. L. LYAKHTSIK. *Sakhar. Prom.*, 1972, (8), 44–46. In efforts to develop a procedure for establishing a molasses viscosity norm, the authors conducted a number of tests at different factories equipped with different types of centrifugals. The experiments are described, but it is emphasized that a final value can only be found after generalization of a series of observations at different factories under varying conditions.

* * *

Calculation of the thermal complex of a beet sugar factory using mathematical simulation and a digital computer. N. M. SPINUL, I. G. LIBERMAN, M. L. VAISMAN and V. S. VOVCHENKO. *Sakhar. Prom.*, 1972, (8), 47–50.—Mathematical simulation, using a system of algebraic, transcendental and integral equations to describe the material and heat balances, was applied at Yagotinskii sugar factory to establish requirements for conversion of the existing scheme to a standard heat system. The results, expressed in the form of values before conversion, after the first stage of reconstruction and compared with the standard scheme (as simulated), are tabulated.

* * *

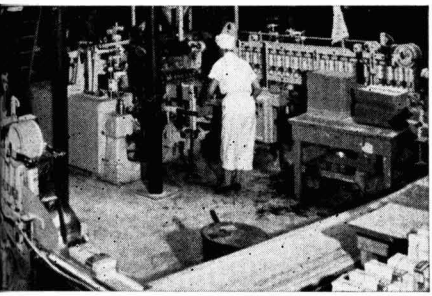
Aspects of sugar technology development S. ZAGRODZKI. *Ind. Alim. Agric.*, 1972, **89**, 993–998. See *I.S.J.*, 1973, **75**, 87.

* * *

Evaluation of beet cossette diffusibility. G. V. GENIE. *Ind. Alim. Agric.*, 1972, **89**, 1021–1025.—See *I.S.J.*, 1973, **75**, 67–70, 99–103.

* * *

Comparative economics of different processes for increasing the extractable sugar in a beet sugar factory. P. DUPONT. *Ind. Alim. Agric.*, 1972, **89**, 1027–1031. Although the fixed costs of saccharate processes (using barium oxide or calcium oxide as in the Steffen process or strontium oxide) are high, the variable costs (those of reagents, steam, electricity, labour and miscellaneous consumption costs) are low. On the other hand, the fixed costs of ion exchange demineralization of juice or syrup are low while the variable costs are high. The overall costs for a beet sugar factory operating a 70-day campaign are compared, showing that the economic optimum (lowest cost per ton of extra sugar) is achieved with the saccharate process plus storage of one-third of the thick juice for post-campaign processing, although it is concluded that ion exchange treatment is justifiable for a short campaign while the saccharate process is more suitable for moderately long to long campaigns.



Sugar refining

Ion exclusion—an overlooked ally. J. F. ZIEVERS, C. J. NOVOTNY and E. A. SELVICK. *Sugar J.*, 1971, **34**, (9), 7–10.—See *I.S.J.*, 1973, **75**, 85.

* * *

Explosion in an ion exchange decolorizing filter. F. JURAČKA, M. SYTAŘ and K. ČIŽ. *Listy Cukr.*, 1972, **88**, 81–84.—Details are given of an investigation into the possible causes of an explosion in an ion exchange vessel filled with 9·6 m³ of "Wofatit EZ" decolorizing resin used to treat remelt liquor. The most probable cause is thought to be rapid heat generation resulting from the Maillard reaction during a standstill period. The conditions necessary for such an explosion to occur are listed.

* * *

Research in the sugar refining industry. M. C. BENNETT, A. R. KING, K. R. HANSON and W. R. USON. *Proc. 30th Meeting Sugar Ind. Tech.*, 1971, 78–82.—The whys and wherefores of refining research are outlined and details given of the research work conducted at Amstar Corporation and the Colonial Sugar Refining Co. Ltd.

* * *

Air and water discharge requirements facing the sugar industry. P. F. MEADS, C. R. BROWN, R. L. KELSEY and J. C. P. CHEN. *Proc. 30th Meeting Sugar Ind. Tech.*, 1971, 83–85.—Questionnaires relating to air and water discharge requirements and methods adopted in order to meet these were sent out and answers received representing 30 refineries in various parts of the world. The answers in the completed questionnaires are discussed.

* * *

Instrumentation of the ion exchange process. H. HASHIMOTO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1972, **23**, 31–37.—Details are given of the automatic ion exchange unit used at Yokohama to decolorize standard liquor; the control system comprises liquor flow and level controls, sequence control, regenerant volume control, a programme timer and an alarm system for the supply tank level. Conductivity, pH, density and temperature meters are also embodied in the system, the last three being provided with alarms.

* * *

Effects of inorganic ions on decolorization and pH drop in char filtration. K. AMAKO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1972, **23**, 54–63. Monovalent cations (e.g. Na^+, K^+ and Cl^-) were found in tests to be little adsorbed by bone char, so did not affect decolorization and pH change in char filtration. Bivalent cations (e.g. Ca^{++}, Mg^{++} and Ba^{++}) improved decolorization and lowered the pH of the effluent liquor. Polyvalent anions (e.g. PO_4^{--}, SO_4^{--} and CO_3^{--} reduced decolorization efficiency and raised the pH of the treated liquor; however, it was not the quantities of polyvalent ions present but the molar difference between them which governed the extent of the effect. Thus, by determining the Ca^{++} and SO_4^{--} contents in the liquor and adding Ca^{++} in the form of $CaCl_2$ when the difference $[Ca^{++}] - [SO_4^{--}]$ becomes negative it is possible to improve decolorization.

* * *

Materials balance in a refinery. F. GARCÍA L. *Cuba-Azúcar*, 1972, (April/June), 23–32.—Calculations of the various stages of a refinery (affination, refined sugar boiling, recovery boiling) are made, using Cobenze crosses to solve product percentage calculations, and are presented individually and then assembled in a composite diagram including all calculations, based on 100% raw sugar solids plus return of *A*-sugar from the recovery section entering the affination mingler. Factors are given to convert solid flows into the different % values used as bases, and the data also assembled in the form of tables.

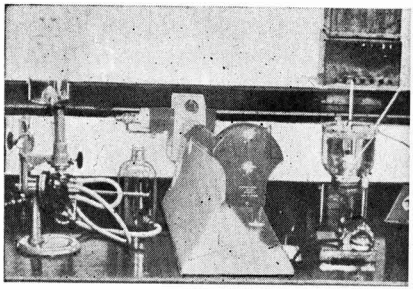
* * *

The kinetics of colorants adsorption on carbons. C. C. CHOU and K. R. HANSON. *Sugar J.*, 1972, **35**, (3), 8–15.—See *I.S.J.*, 1973, **75**, 221.

* * *

Ion exchange in the sugar industry. K. J. PARKER. *Chem. and Ind.*, 1972, (20), 782–790.—The processes involved in sugar production and refining are outlined and the various applications of ion exchange surveyed, including both processing techniques and laboratory analytical procedures. The relative decolorizing capacities of a number of commercial anion exchange resins are tabulated. The operational and economic advantages of ion exchange resins over granular carbon adsorbents are listed as well as their disadvantages. The effect of matrix porosity on dilute molasses decolorization and of NaCl on colorant adsorption are briefly considered, and some information given on decolorizing with non-ionic adsorptive resins and with resin combinations. Brief mention is made of demineralization of low-purity sugar solutions by ion exclusion. Thirty-two references are given to the literature.

Laboratory methods & Chemical reports



A study of beet albumins by vertical electrophoresis in polyacrylamide gel. S. S. MIROSHNICHENKO, G. P. VOLOSHANENKO and K. D. ZHURA. *Izv. Vuzov, Pishch. Tekh.*, 1972, (2), 32–34.—Electrophoresis of albumin extracts from beet using a column of polyacrylamide gel revealed up to 19 components, while raw juice subjected to electrophoresis contained only 4 albumins. Full details are given of the procedure used.

* * *

Effect of certain organic calcium salts on sucrose crystallization kinetics. V. M. KHARIN and V. F. DOBROMIROVA. *Izv. Vuzov, Pishch. Tekh.*, 1972, (2), 168–169.—Calcium acetate, tartrate, succinate and malate reduced the sucrose nucleation and crystal growth rates in experiments.

* * *

Studies on the decolorization of molasses using the hydrogenation technique. S. IWASHINA and T. NAGASAKA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1972, **23**, 16–30.—Treatment of dilute affination syrup and a model aqueous solution of molasses colorants by hydrogenation using Raney nickel catalyst permitted 50–60% decolorization under optimum conditions, which were: an initial hydrogen gas pressure of 100 kg.cm^{-2} and a reaction temperature and time of 100°C and 120 min, respectively; decolorizing efficiency rose with temperature, but sucrose decomposition occurred above 140°C. The solutions were agitated during treatment. Hydrogenation caused changes in more than 90% of the carbonyl groups and about 60% of the unsaturated groups present in the molasses colorant solution.

* * *

The boiling test using a test vacuum pan. M. SUGIYAMA, A. NAKAMURA, T. YAMAUCHI, Y. TAKATORI, K. ABE and R. TOUYAMA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1972, **23**, 38–43.—A simple laboratory boiling process is described which permits sugar yield to be determined when low-grade syrup is being used in the refinery. After massecuite and syrup purity determination, sugar yield is found by weighing and the *s-j-m* formula applied.

* * *

Determination of raffinose in sugar beets and process products by auto liquid chromatography. M. SUGUWARA and Y. SENBA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1972, **23**, 48–53.—A procedure is described in which beet juice was acid hydrolysed, whereby the raffinose yielded melibiose (a reducing disaccharide), followed by separation of the mono-, di- and trisaccharides by a molecular sieve method using ion exchange resin in Na^+ form. The melibiose in the disaccharide fraction was then determined with 3,5-dinitrosalicylic acid as used for reducing sugars determination. An accuracy of $\pm$ 5% is possible at a raffinose content in the range 80–500 mg/100 cm^3. About 1 hr is required for the analysis.

* * *

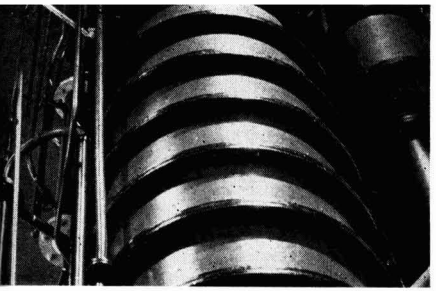
Effective wavelength of the standard quartz wedge saccharimeter and rotation values of the standard quartz plate. R. BÜNNAGEL, D. RIMKUS and F. SIEGELHALTER. *Zucker*, 1972, **25**, 554–559.—The effective wavelength is put forward as a replacement for the wavelength of filtered white light introduced for the ICUMSA standard saccharimeter in 1932. It was calculated (i) from the spectral beam density of the light source, the spectral transmission factor of the filter in the standard instrument and the spectral sensitivity of the eye, and (ii) from the specific rotation of the standard quartz plate of 1932, giving a value of 587 nm, from which the rotation values of the standard quartz plate at 546·2271 and 589·4400 nm standard wavelengths are calculated as 40·6914° and 34·6186°, respectively, compared with corresponding values of 40·692° and 34·619° recommended at the 15th ICUMSA Session in 1970.

* * *

Phosphate content in juice of certain sugar cane varieties. M. A. A. CESAR, M. R. MAZZARI and E. R. DE OLIVEIRA. *Brasil Açuc.*, 1972, **79**, 538–542.—Analyses of phosphate in eight cane varieties at various times are recorded. They reached different levels with different varieties but showed an increase with later harvest date; nevertheless, in no case was there sufficient phosphate in the juice to give good clarification, and fertilizer studies are required in order to raise juice phosphate and give juice which will clarify and give better sugar.

* * *

Use of a laboratory boiling test procedure to investigate sugar refinability problems. T. MORITSUGU. *Rpts. 1971 Meeting Hawaiian Sugar Tech.*, 34–40.—Details are given of a laboratory boiling procedure which has shown good reproducibility in tests comparing laboratory results with results at three Hawaiian sugar factories. The unit has permitted investigation of the effects of the more important boiling variables on sugar and these are discussed under: circulation, temperature, final mother-liquor purity, feed purity and single- *vs.* double-purging of low-grade sugar.



By-products

Molasses as an energy source in low fibre diets for milk production. I. Effect of varying the level of forage. J. CLARK, T. R. PRESTON and A. ZAMORA. *Rev. Cubana Cienc. Agric.*, 1972, **6**, 19–25. **II. Effect of varying the level of cereal grain.** *ibid.*, 27–32.

I. Apart from indicating the optimum level of forage (elephant grass) as 20–24% of dietary dry matter, the tests, in which cows were fed cane molasses *ad lib.* plus 5 kg protein supplement, showed that it is technically feasible to produce milk from cows fed on a basal diet consisting mainly of molasses.

II. The daily milk yield was significantly higher when cows were fed daily 2·6 kg of dietary dry matter containing 25% maize grain, 4·5 kg protein supplement and final molasses *ad lib.* than with the control fed on a non-grain diet. The results are ascribed to a lower molasses intake as a proportion of total metabolizable energy ingested and a higher total energy intake with the increased grain.

* * *

Deaminative activity of rumen microflora with molasses/urea diets. A. RAMÍREZ. *Rev. Cubana Cienc. Agric.*, 1972, **6**, 35–41.—The tests, in which the deaminative activities of ruminal bacteria in bulls fed on concentrates or molasses/urea with and without protein were compared in terms of NH_3 production, showed that a decrease in the activity took place when molasses and urea were introduced. Reasons for this are suggested.

* * *

High-test molasses, *A*-molasses, final molasses and sugar in liquid diets for growing turkeys. S. VALAREZO and R. PÉREZ. *Rev. Cubana Cienc. Agric.*, 1972, **6**, 61–66.—Of the sugar-containing diets tested, *A*- and final molasses were discounted as causing increased mortality (attributable to the greater soluble mineral intake in conjunction with high sucrose levels), while raw sugar and high-test molasses were found to be usable as replacements for cereals in the growing period, even though there was incidence of pendulous crop.

* * *

High-test molasses and restricted amounts of protein supplement for fattening turkeys. S. VALAREZO and R. PÉREZ. *Rev. Cubana Cienc. Agric.*, 1972, **6**, 67–71. Results of tests indicated that undiluted high-test molasses plus a restricted quantity of protein supplement can effectively replace cereals in the fattening period, during which mortality and pendulous crop incidence was smaller than when a mixed diet including partial molasses dilution was used.

The effect of molasses-based diets on rumen epithelial alterations (hyperkeratosis) in beef cattle. N. PERÓN, T. VERDURA, R. RUÍZ and T. R. PRESTON. *Rev. Cubana Cienc. Agric.*, 1972, **6**, 73–80 (+ figs.).—Addition of forage to molasses-based diets reduced the incidence of parakeratosis associated with the feeding of molasses and urea. Full details are given of the findings.

* * *

Heat supply in a high-capacity pulp dryer by means of a flue-gas generator. E. GÖRGÉNYI and Z. ASZTALOS. *Cukoripar*, 1972, **25**, 107–112.—A description is given of a beet pulp dryer in which the conventional type of furnace is replaced by a system fed with flue gas the temperature of which is reduced to a required level. The automatic controls of the heat generator are explained and the financial advantages of the unit described.

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Removal of potassium ion from sugar solution. S. UCHIKUGA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1972, **23**, 44–47.—Ion exchange experiments on beet syrup and molasses are reported in which magnesium and phosphoric acid were added to the resin-treated solution to form an insoluble potassium salt at pH 8–11 which could be used as a fertilizer. K removal was normally 53–65% and ash removal 32–54%, but in the case of the molasses, addition of $Mg(OH)_2$ after basic treatment, followed by a second application of Mg and PO_4, increased K removal from 53% to 85%.

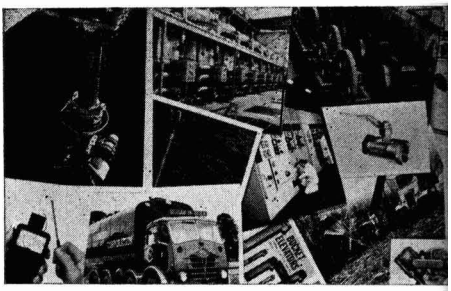
* * *

Heat problems in pulp drying in the sugar industry. A. VIGH. *Cukoripar*, 1972, **25**, 52–58.—The various factors concerning beet pulp drying which are discussed include: the considerable heat requirements; the phases of the drying process; heat losses through conduction, radiation and in flue gas; and drying efficiency and ways of increasing it.

* * *

Study on the efficiency of final molasses as an inhibitor of acid corrosion. F. PÉREZ and S. MÜLLER. *Cuba-Azúcar*, 1972, (April/June), 11–15.—The efficiency of molasses as an inhibitor of hydrochloric acid used for cleaning evaporators was tested by using solutions with 5% HCl and varying molasses contents, and solutions with 0·5% molasses and varying HCl contents. It was concluded that the molasses is effective if used in concentrations higher than 0·01%.

Trade notices



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

Sugar factory chemicals. Fabcon Inc., 1275 Columbus Ave., San Francisco., Calif., 94133 USA.

Among new products mentioned in the latest available issue of Fabcon's "Globetrotter" newsletter are: "Quite", a surface-active sequestering agent which increases massecuite fluidity and, by sequestering a large percentage of the Ca^{++} ions in the molasses, minimizes the increase in viscosity caused by the Ca as well as occlusion of many salts during boiling and crystallization; "Fabcar", which in conjunction with soda ash prevents scaling, corrosion and foaming in boilers; "Clean Oil RF-5", which increases fuel oil efficiency; and "Lub-Aid" oil additive.

* * *

Massey-Ferguson cane harvesters. Massey-Ferguson (Export) Ltd., P.O. Box 62, Banner Lane, Coventry, England.

The latest available issue of Massey-Ferguson "Cane News" carries much information on application of MF cane equipment in various parts of the world, particularly the MF 201 "Cane Commander" chopper harvester. Details are given of the successful performance of a MF 201 in Spain which has led to further orders to quicken the modernization programme needed in view of manpower shortages and high wages; orders have also been placed by Taiwan for the same machines, after initial trials, and more are being supplied for use at Incomati (Mozambique) and in Argentina. Twenty-one MF 201's are being supplied to the Rio Grande Sugar Growers' Association in Texas for use in harvesting the first cane crop at Santa Rosa. The development of mechanical harvesting in Australia and the changeover to chopper harvesters in preference to whole-stick harvesters are also featured, as is a short article offering advice on how to create the best ground conditions in a cane field for mechanical harvesting. Brief details are given of the MF 50B digger loader rig of use in land clearance and forming, digging and maintenance of irrigation and drainage channels.

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Japanese steam turbine manufacturer name change.—Hiro Zoki Co. Ltd., makers of steam turbines and turbo-alternators, and advertisers in this Journal, have changed their name and location; they are now Shinnippon Machinery Co. Ltd., Seio Building, 28-1, 2-chome Shiba, Minato-ku, Tokyo, Japan.

PUBLICATIONS RECEIVED

CHAINS FOR CONVEYING AND POWER TRANSMISSION. Ewart Chainbelt Co. Ltd., Colombo St., Derby, England.

Catalogue No. 540 has been brought up to date; its 54 pages (in English, French, German and Spanish) include a quick-reference summary and index of chains available, followed by sections describing the individual categories in greater detail: steel driving chains, elevator roller and conveyor roller chains, SS-class bushed, combination, detachable, pintle, Gray pin, Ley bushed, drag link, de Grouwer, intermediate carrier, and malleable roller chains, plus appropriate attachment link data.

* * *

"RENOLD REVIEW OF POWER TRANSMISSION". Renold Ltd., Renold House, Wythenshawe, Manchester, England.

The first issue of this new Renold publication is in 9 languages: Danish, Dutch, English, Finnish, French, German, Norwegian, Spanish and Swedish. In future it will be published 5 times a year in 10 languages and will carry articles describing applications of Renold power transmission engineering, with many illustrations in colour.

* * *

STEAM TURBINES. Amalgamated Power Engineering Ltd., Queens Engineering Works, Bedford, England.

Details of Allen HES and SLC turbines are contained in brochures AP.4041 (HES) and AP.4044 and 4054 (SLC). Thirty-six Allen steam turbines have been built for the beet sugar factories of British Sugar Corporation Ltd. in the UK, the latest being a 7·5 MW HES multi-stage back-pressure machine ordered for King's Lynn factory. Three SLC turbines have been supplied to Fletcher and Stewart Ltd., two (each rated at 2400 kW) for installation at Davao cane sugar factory in the Philippines and the other, rated at 3000 kW, for installation at Modern sugar factory in Pakistan, with four 450-bhp Allen-KKK single-stage steam turbines for cane mill drive.

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Glucose factory for UK.— Tate & Lyle Refineries Ltd. is to build a factory at Howden, Yorkshire, for the production of a full range of glucose syrups at the rate of 100 tons/day. Operations are planned to start in October 1974.

* * *

Conveyors for Philippines sugar factory.—Marshall Handling Equipment Ltd. have received an order from Fletcher and Stewart Ltd. for the supply of eight portable belt conveyors to be installed in a sugar factory on the island of Luzon in the Philippines. The conveyors will carry bags of raw sugar from the bagging machine to two Marshall slatted, hinged-boom sack pilers. Other Marshall conveyors and elevators, including screw conveyors, are to be used to carry mud, raw sugar, lime, bagacillo and grit.

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BMA tower diffuser.—Braunschweigische Maschinenbauanstalt have recently received an order from Central Suiker Mij. for the construction of a 65-tons/day tower diffuser at Vierverlaten beet sugar factory in Holland. The diffuser is planned to start operations in the 1974 campaign.

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	,,	411,000	349,000
France	,,	3,350,000	3,046,664
Germany	,,	2,470,000	2,263,165
Holland	,,	840,000	772,447
Ireland	,,	200,000	174,735
Italy	July/Oct.	1,167,000	1,244,443
United Kingdom	Sept./Jan.	1,270,000	986,762
Total E.E.C.		*10,486,000*	*9,522,216*
Austria	Sept./Jan.	345,000	406,867
Finland	,,	87,000	93,225
Greece	July/Oct.*	172,000	131,000
Spain	July/March	890,000	818,317
Sweden	Sept./Jan	273,000	299,000
Switzerland	,,	73,000	68,089
Turkey	Aug./Feb.	833,000	829,399
Yugoslavia	Aug./Jan.	455,000	395,377
Total West Europe		*13,614,000*	*12,563,490*
Albania	Aug./Jan.	19,000	19,000
Bulgaria	,,	260,000	230,000
Czechoslovakia	Sept./Jan.	760,000	770,000
Germany, East	,,	670,000	655,555
Hungary	,,	380,000	329,665
Poland	,,	1,860,000	1,826,000
Rumania	Aug./Feb.	575,000	610,000
USSR	Sept./Jan.	9,300,000	8,500,000
Total East Europe		*13,824,000*	*12,940,220*
Total Europe		27,438,000	25,503,710
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†	29,000	26,667
Japan	Oct./Feb.	444,000	418,838
Lebanon	June/Nov.*	21,000	24,444
Morocco	May/Aug.†	260,000	260,000
Pakistan	June/July†	27,000	26,792
Syria	May/June†	35,000	35,000
Tunisia	May/April	6,000	6,000
United States	July/June	2,750,000	3,150,000
Uruguay	May/April	49,500	44,863
Total Other Continents		5,563,500	5,705,932
TOTAL BEET SUGAR		33,001,500	31,209,642

CANE SUGAR			
EUROPE			
Spain	March/Sept.	40,000	30,000
NORTH AND CENTRAL AMERICA			
Belize	Dec./June	80,000	71,800
Costa Rica	,,	190,000	195,000
Cuba	Nov./July	5,700,000	5,400,000
Dominican Republic	Nov./Sept.	1,270,000	1,270,000
Guadeloupe	Jan./June†	115,000	126,751
Guatemala	Dec./June	290,000	270,000
Haiti	,,	72,000	72,000
Honduras	,,	70,000	65,000
Martinique	Jan./June*	20,000	30,000
Mexico	Nov./July	2,900,000	2,781,425
Nicaragua	Dec./June	175,000	172,000
Panama	,,	132,000	92,532
Puerto Rico	Jan./July†	250,000	270,000
El Salvador	Nov./June	208,000	195,000
USA—Mainland	Oct./June	1,550,000	1,450,000
Hawaii	Jan./Dec.†	1,100,000	1,048,000
West Indies—Barbados‡	Jan./June†	120,000	119,415
Jamaica‡	Jan./June	365,000	361,904
St. Kitts‡	,,	25,000	23,941
Trinidad‡	,,	195,000	191,193
Total North and Central America		14,827,000	14,205,961
SOUTH AMERICA			
Argentina	July/Dec.*	1,600,000	1,328,959
Bolivia	May/Sept.†	205,000	136,000
Brazil	June/May	7,156,000	6,162,906
Colombia	Jan./Dec.†	905,000	840,000
Ecuador	June/Jan.	300,000	270,000
Guyana‡	Oct./June	355,000	298,140
Paraguay	July/Nov.*	67,000	58,722
Peru‡	Jan./Dec.†	1,012,000	922,643
Surinam	Aug./May	12,000	12,000
Uruguay	May/April	20,000	28,276
Venezuela	Sept./Aug.	545,000	535,000
Total South America		12,177,000	10,592,646
AFRICA			
Angola‡	May/March	90,000	93,000
Cameroun	April/Sept.*	19,000	17,000
Congo (Brazzaville)	May/Nov.*	40,000	39,957
Egypt	Dec./June	700,000	680,000
Ethiopia	Nov./June	150,000	146,111
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.*	38,000	37,514
Mali	April/Sept.	10,000	10,000
Mauritius‡	July/Jan.	741,000	727,410
Mozambique‡	May/Nov.*	392,000	326,023
Nigeria	,,	36,000	30,278
Réunion	July/Jan.	250,000	232,245
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.*	192,000	181,901
Tanzania	July/June	119,000	119,000
Uganda	,,	110,000	120,000
Zaire	May/Nov.*	60,000	39,481
Zambia	,,	55,000	51,119
Total Africa		5,570,000	5,476,846
ASIA			
Afghanistan	Oct./April	10,000	10,000
Bangla Desh	Nov./May	20,000	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	4,268,000
Indonesia	May/Dec.*	1,050,000	988,000
Iran	Oct./April	94,000	69,435
Japan	Nov./June	272,000	260,391
Nepal	Oct./April	8,000	7,751
Pakistan	Nov./May	400,000	463,070
Philippines	Nov./July	2,300,000	2,327,824
Sri Lanka	Nov./June	10,000	10,000
Taiwan	,,	830,000	775,838
Thailand	Oct./April	825,000	778,000
Total Asia		12,876,000	12,586,768
OCEANIA			
Australia	May/Dec.*	3,000,000	2,888,000
Fiji	,,	380,000	320,639
Total Oceania		3,380,000	3,208,639
TOTAL CANE SUGAR		48,870,000	46,100,860
TOTAL BEET SUGAR		33,001,500	31,209,642
TOTAL SUGAR PRODUCTION		81,871,500	77,310,502

[1] F. O. Licht, *International Sugar Rpt.*, 1973, **105**, (25), 17–20.
* 1973, 1972 † 1974, 1973 ‡ tel quel

Brevities

Jamaica sugar exports suspension[1].—The Jamaica Sugar Industry Authority has announced that it is suspending sugar exports "until further notice", to supplement domestic supplies. A shipment of 5600 tons of sugar already transported to Kingston wharves for shipment will also be held back—the first time in Jamaica's history that the export of sugar has been embargoed. A statement by the SIA said it had suspended export shipments following advice by the Sugar Manufacturers' Association that local sugar supplies were running low.

* * *

Guatemala sugar exports[2].—Exports of sugar from Guatemala in 1972 reached 102,861 metric tons, raw value, as against 77,768 tons in 1971. The principal destination (70,116 tons) was the USA while Finland, France and Morocco received 10,693 tons, 11,835 tons and 10,217 tons, respectively.

* * *

Indonesia sugar industry modernization.—Indonesia will use a recently-announced 50 million dollars credit from the International Development Association to help modernize nine Government-owned sugar mills in Java[3]. The project, costing 81 million dollars, will boost output by enabling mills to process more cane daily and to keep operating for longer periods each year. The new project is expected to increase production of white sugar by 190,000 tons by 1978. In 1972 Indonesia produced 889,300 tons and in the past few years has imported up to 150,000 tons a year[4]. It was also announced recently[5] that 150/200,000 tons of white sugar had been acquired for shipment during August 1973/January 1974.

* * *

Nigerian sugar development[6].—The Federal Government of Nigeria, in partnership with the Commonwealth Development Corporation and the North Eastern State Government, has set up a sugar refining company in the state. Known as the Savannah Sugar Company, it will be in operation by 1976 with a capacity to produce about 180,000 tons of refined sugar annually while employing about 5000 people. It is reported that a sugar estate in Numan, at the confluence of the Rivers Benue and Gongola, will be developed to supply sugar cane for the factory.

* * *

Malagasy Republic sugar exports[7].—Exports of sugar by the Malagasy Republic in 1972 amounted to 39,327 tons from a production of 110,162 metric tons, raw value. In 1971 exports were 35,806 tons from a production of 99,038 tons.

* * *

Yeast factory for Zaire[8].—A factory for the production of yeast is to be built by the West German company Brown-Boveri of Mannheim, at an estimated cost of DM10 million. Annual production of 1000 tons is envisaged which would cover the country's yearly demand for the product currently being imported. To achieve this output some 4500 tons of molasses will be needed and this will be supplied by the Société Sucrière de Kwilu in the Bas-Zaire region.

* * *

USSR 1973 beet crop[9].—The Soviet Ministry of Agriculture says that 1973 "has not been one of the most favourable" for the sugar beet crop, Tass reports. However, the Ministry added that advanced technology had enabled farms and collectives to produce a "good" crop. The total area sown this year was more than 3·5 million hectares and, the Ministry said, 500,000 hectares have already been harvested in the Ukraine and other Soviet Republics. Soviet sugar beet production was 75·7 million tons last year, according to official statistics, and the total area harvested was 3·49 million hectares.

US sugar supply quotas 1973

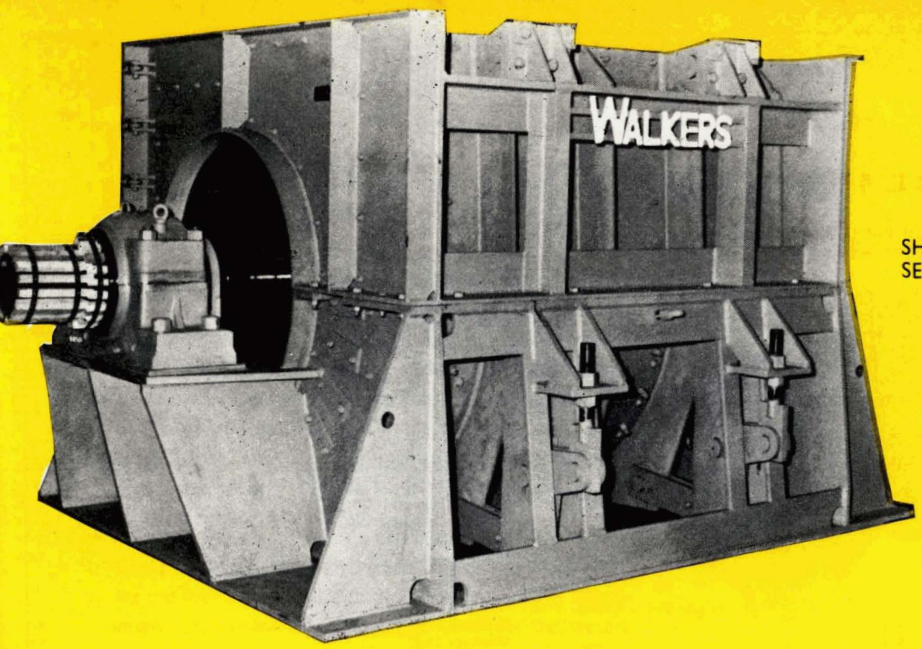
	Initial quotas	*Shortfalls Redistributions*	*Quotas in effect*
	(*short tons, raw value*)		
Domestic Beet	3,500,000	—	3,500,000
Mainland Cane	1,591,000	—	1,591,000
Texas Cane	20,000	—	20,000
Hawaii	1,185,000	—42,000	1,143,000
Puerto Rico	90,000	—	90,000
Philippines	1,426,779	13,273	1,440,052
Argentina	84,207	1,252	85,459
Australia	204,016	—	204,016
Belize	37,425	556	37,981
Bolivia	7,155	106	7,261
Brazil	607,610	9,031	616,641
Colombia	74,851	1,112	75,963
Costa Rica	79,821	1,478	81,299
Dominican Republic	704,475	10,471	714,946
Ecuador	89,712	1,334	91,046
Fiji	44,705	—	44,705
Guatemala	68,253	1,264	69,517
Haiti	15,295	—	15,295
Honduras	—	—	—
India	81,688	—	81,688
Ireland	5,351	—	5,351
Malagasy Republic	12,192	—	12,192
Malawi	15,037	—	15,037
Mauritius	30,074	—	30,074
Mexico	623,021	9,259	632,280
Nicaragua	74,615	385	75,000
Panama	52,500	—	52,500
Paraguay	7,155	106	7,261
Peru	434,794	—8,549	426,245
Salvador	49,744	922	50,666
South Africa	57,709	—	57,709
Swaziland	30,074	—	30,074
Taiwan	84,939	—	84,939
Thailand	18,694	—	18,694
Venezuela	31,902	—	31,902
West Indies	60,207	—	60,207
	11,500,000	—	11,500,000

New Thailand sugar factories[10].—The Ministry of Industries of the Government of Thailand has approved applications for licences for the construction of seven new sugar factories each with a capacity of 3500 metric tons of cane per 24 hours. The Ministry has also under consideration applications for licences for ten additional factories and several of these will probably be approved. Some of the new factories were already under construction at the time the licence applications were approved. while others were only in the project stage with financing contingent on the granting of a licence. Even though the capacity level being approved is 3500 tons of cane per day, some of the plants will be designed larger for later expansion. Thailand is expanding and building up its sugar industry as part of the development of its national economy. To facilitate sugar exports, a modern bulk sugar terminal in the Chao Phya River area is already under discussion.

* * *

New Bolivian sugar factory[11].—Two Brazilian concerns have announced their plan for erection of a new sugar factory with an attached paper plant at Chapare in Bolivia.

[1] *The Times*, 4th October 1973.
[2] *I.S.O. Stat. Bull.*, 1973, **32**, (6), 49.
[3] *Reuters Sugar Rpt.*, 11th July 1973.
[4] *I.S.O. Stat. Bull.*, 1973, **32**, (6), 56.
[5] C. Czarnikow Ltd., *Sugar Review*, 1973, (1134), 118.
[6] *Standard Bank Review*, August 1973, 12.
[7] *I.S.O. Stat. Bull.*, 1973, **32**, (6), 67.
[8] *Standard Bank Review*, August 1973, 18.
[9] *Public Ledger*, 29th September 1973.
[10] *Sugar y Azúcar*, 1973, **68**, (7), 37.
[11] *Zeitsch. Zuckerind.*, 1973, **98**, 535.



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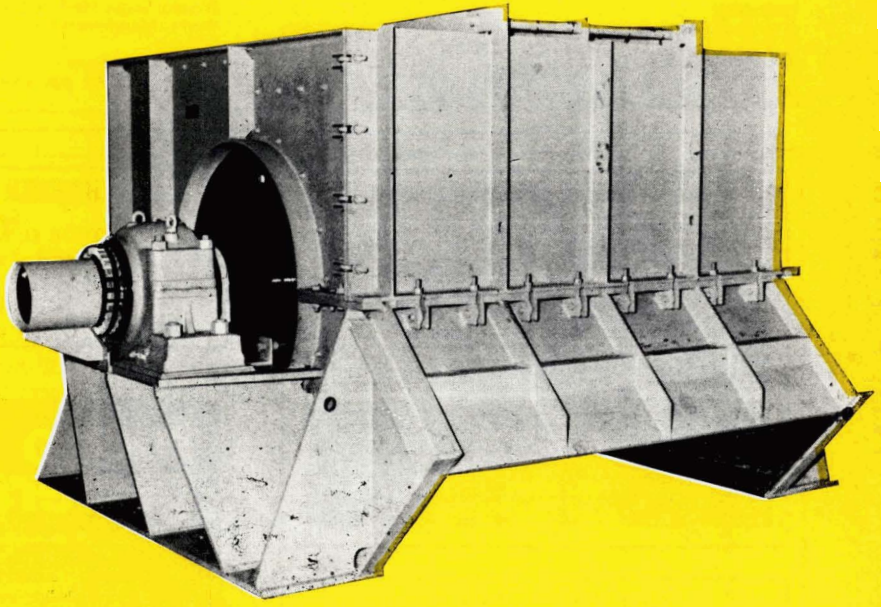

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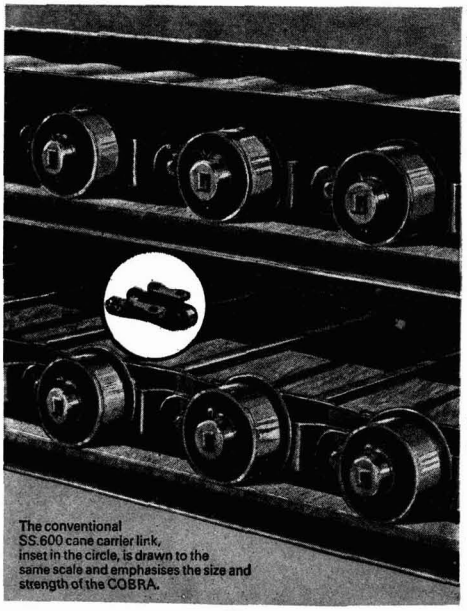

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