



INTERNATIONAL SUGAR JOURNAL

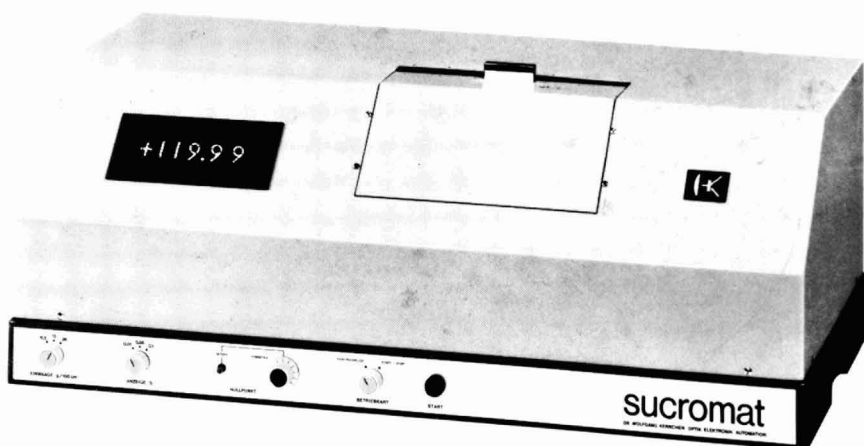


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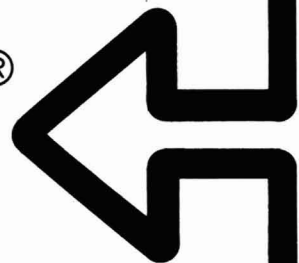
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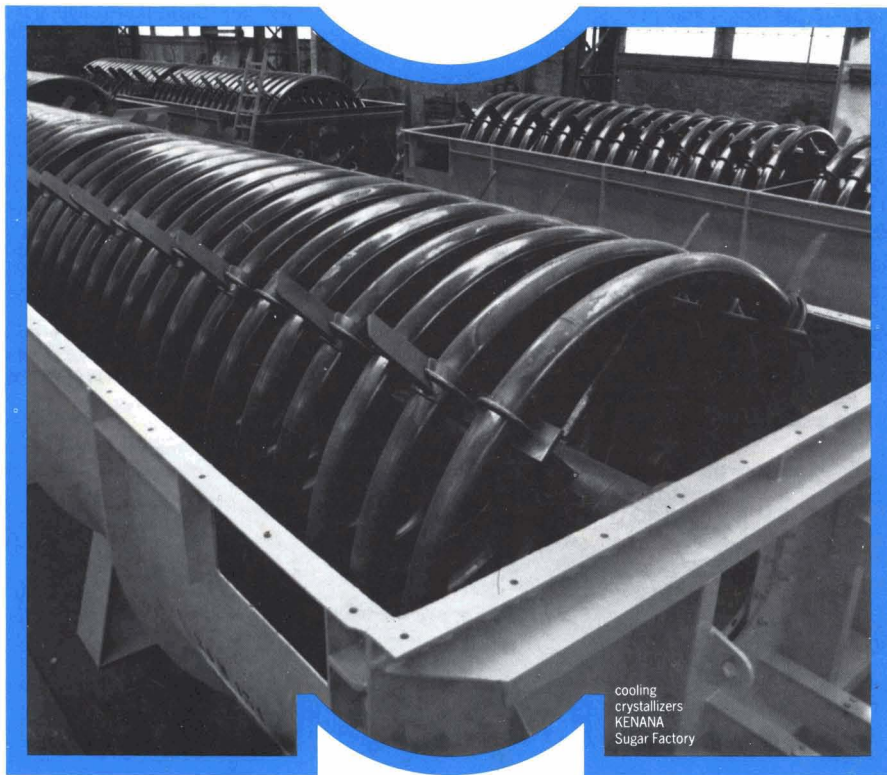
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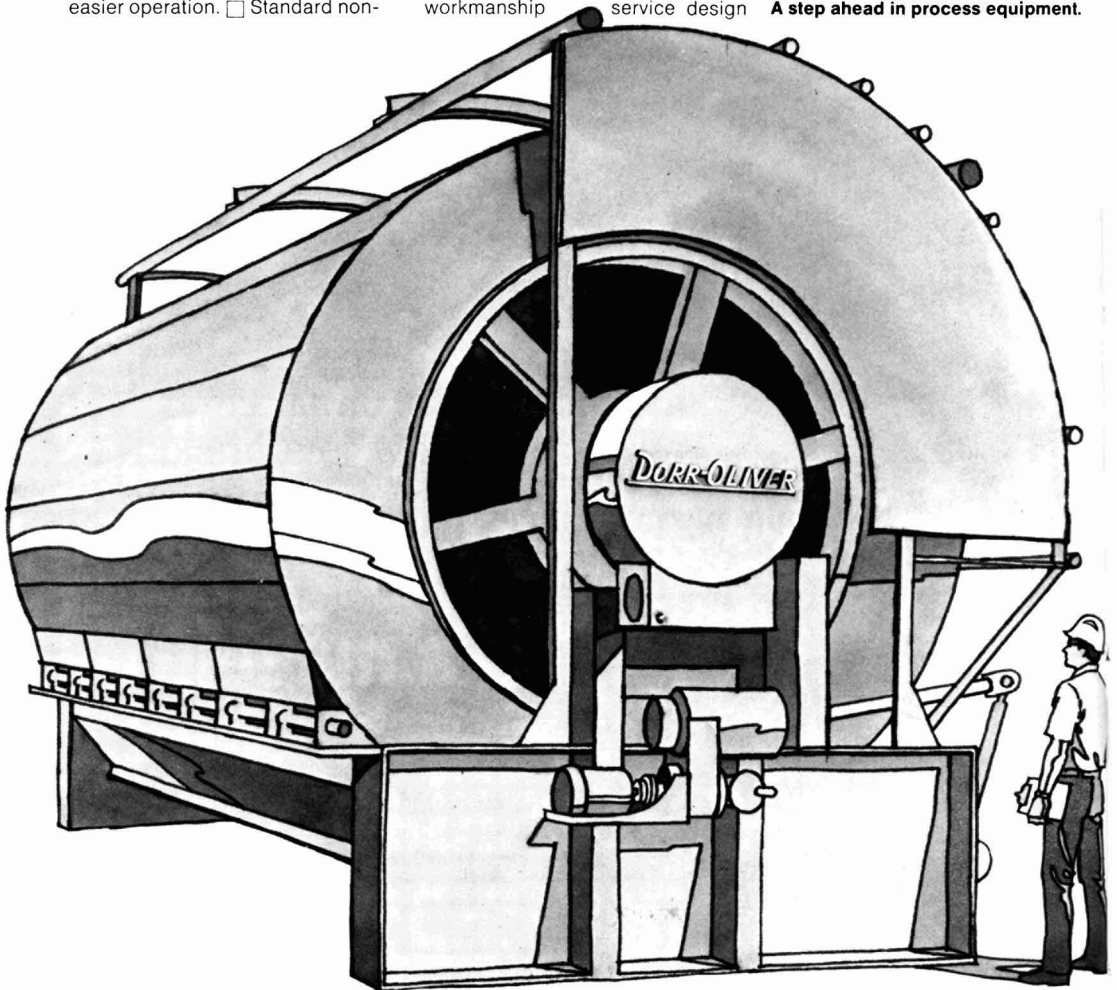
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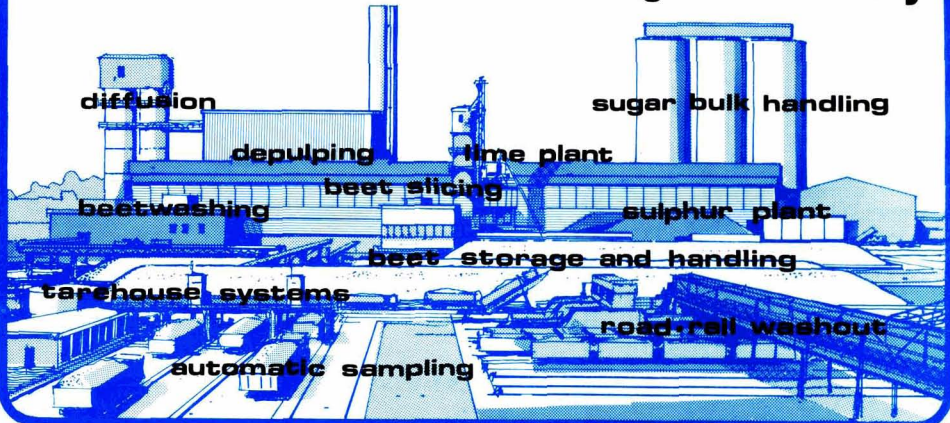
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NOTES AND COMMENTS

World sugar prices

The London Daily Price for raw sugar started the month of November at £153 and improved gently, to reach £159 on November 10. It then declined gently, reaching a two-year low of £148 on November 19. It then improved to £154 on November 25 and ended the month with a sudden rise, reaching £164 on November 30. The slight changes in the first half of the month were mostly due to currency changes, there being little news to affect the market. The further fall was largely due to the continuation of EEC sugar sales and the resumption of sugar exports by India after a ban since February last.

A statement by an EEC representative at the November 19/20 meeting of the International Sugar Council indicating a more positive approach to possible accession to the Agreement improved market sentiment while reports of delays to the Thailand crop and a typhoon striking the Philippines were also positive factors, as were rumours of buying interest by the USSR and Venezuela and actual purchases by Egypt and Jordan.

Initially white sugar values fell relative to raw sugar in the first week of November, from an LDP(W) of £178 per tonne to £172 but thereafter followed the pattern of raw sugar prices, to reach a minimum of £162 on November 19. Thereafter, it increased again but not as dramatically as the LDP, ending the month at £171.50.

Argentina sugar industry problems¹

Unsatisfactory support prices and inadequate production quotas cloud an otherwise encouraging prospect for Argentina's sugar producers. In 1980 the industry exported half a million tonnes, worth US \$400 million, and gained a new major customer in the USSR that bought 68,000 tonnes (a total exceeded only by the USA and Chile). The industry's 1980 output level of 1,716,354 tonnes, raw value, represented an increase of 22% on 1979. Output, from 24 mills, benefited from the harvesting of some cane areas that had not been cut for two years and thus had a far higher yield than normal. Larger areas of cane were cut, too, in response to the government decision to increase the production quota, provided that output was destined for export.

In 1981 the industry needed to produce about 1,100,000 tonnes to satisfy local consumption, while the available cane supply could provide 1,800,000 tonnes, raw value. However, a spell of cold weather in July may have caused some damage. The government required the mills to fulfil the ISA export quota, of 434,183 tonnes (otherwise the ISO might cut the country's basic quota), but the mills were reluctant to do so as the government had fixed the support price for cane at only 77,000 pesos per tonne, a level they claimed to cover barely a third of their production costs.

Other complaints voiced by both cane growers and sugar producers centre on the depressed level of domestic prices which over the past five years have fallen well behind the level of inflation, extremely high interest

rates which have increased the burden of financial costs to the point where for many producers they are the largest single item of expenditure, rapidly rising costs of labour and inputs which have exceeded increases in the domestic price of sugar, and enormous increases in the level of taxes charged by both federal and provincial authorities.

There is not much scope to recover losses on exports by increased domestic sales; consumption has increased by barely 10% overall in the past five years. Also, 1980 saw an abrupt end to sales of sugar cane for the production of alcohol; 2 million tonnes were taken for the purpose in 1979 but only 6000 tonnes in 1980, although this in part reflected increased export sugar production. The cane crushed for sugar manufacture rose from 11.9 million to 16.4 million tonnes in 1980.

International Sugar Agreement

The International Sugar Council met on November 19 and 20 and decided that, in principle, the current Agreement should be extended for a period of two years as provided for in its terms. An observer from the EEC made it clear that the Community is now ready to examine conditions under which it could adhere to the Agreement and confirmed its intention to withhold 2,000,000 tonnes from the world market in the current season. He indicated a number of questions which the EEC considered needed clarification in a new or extended Agreement, including special trade arrangements which came outside ISA rules, provision for special stocks, reallocation of shortfalls, and the total of basic export tonnages.

The Council established a global quota of 12,944,000 tonnes, raw value, for 1982. C. Czarnikow Ltd. note²: "At first sight it would seem quite impossible for export quotas to be reduced, even at their minimum level of 85% of B.E.T.'s and allowing for no redistribution of shortfalls, to match an outlet of this size. Effectively, therefore, a substantial surplus appears likely to continue to overhang the world market during 1982 so that the only economic provisions which the Agreement has which will constructively affect world market supplies will be the establishment of special stocks — not less than 1,000,000 tonnes by June 30, 1982 and a further increase, presumably up to a minimum of 2,000,000 tonnes, by June 30, 1983.

"The problem of establishing basic export tonnages and hence export quotas for the period after 1982 appears likely to create considerable problems for the International Sugar Council. An extension of the formula under which quotas are currently established in relation to performance would appear likely to lead to unrealistically large export quotas. On the other hand, a renegotiation of B.E.T.'s is unlikely to be accepted by many of the countries which have looked to the performance formula as the method of which they can bring a degree of reality into the quota system."

European beet sugar production estimates

As the beet campaigns progress, the various trade houses and sugar statisticians amend their earlier forecasts to bring them into line with the latest reported results. F. O. Licht GmbH recently issued their second estimate of production³ and it is interesting that even by mid-November, no dramatic changes were required in the estimates compared with the first ones of September 1981⁴. Licht has reduced his figure for 1981/82 pro-

¹ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 497-498.

² *Sugar Review*, 1981, (1572), 199-200.

³ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 719-720.

⁴ *I.S.J.*, 1981, 83, 290.

duction in East Europe by 95,000 tonnes, increases in East Germany (30,000 tonnes), Hungary (5000 tonnes) and Poland (90,000 tonnes) being more than offset by reductions of 20,000 tonnes in Rumania and 200,000 tonnes in the USSR. Increases of 140,000 tonnes in the French forecast, 5000 tonnes in Greece, 1000 tonnes in Ireland and 32,000 tonnes in Holland overwhelm a reduction of 4000 tonnes in the UK figure, to give an estimated 174,000 tonnes increase in the overall EEC total. In the remainder of Western Europe, Finland's estimate is reduced by 1000 tonnes, while increases are forecast of 4000 tonnes for Spain, 4000 tonnes for Sweden, 10,000 tonnes for Switzerland and 25,000 tonnes for Yugoslavia. The overall estimate for the whole of Europe shows an increase of 121,000 tonnes to 32,400,000 tonnes.

Nigeria sugar situation¹

According to the International Sugar Organization, imports of sugar by Nigeria rose from 267,416 tonnes to 709,212 tonnes between 1976 and 1980. In the same period domestic consumption of sugar rose from an estimated 250,000 tonnes to 635,000 tonnes. This explosive growth in the market for sugar has not been matched by domestic output. It has fluctuated between 30,000 and 40,000 tonnes in the period in question. The main beneficiary has been the EEC which supplies most of the country's imports and has seen its exports to Nigeria rise from 253,596 tonnes to 681,539 tonnes in the period in question. Brazil is the only other significant source of imports.

The government had intended that sugar production be raised to 80,000 tonnes by 1980 and the Third National Development Plan budgeted for over N350 million to be spent in this regard, mainly on three integrated projects. The Savannah Sugar Company was to operate in the States of Gongola, Bauchi and Borno and to establish plantations at the confluence of the Benue and Gongola Rivers. Production from the mill at Numan, in Gongola State, was planned to reach 120,000 tonnes annually by 1983 and was to be increased to 300,000 tonnes at a later stage.

In conjunction with the local state government, Tate & Lyle (Nigeria) Ltd. was to establish an estate at Sunti, having a sugar production capacity of 60,000 tonnes, while an agreement for the development of the Lafiaji integrated project in Kwara state was signed by the federal commissioner for industry and Mehta Group (International) in India in 1976; capacity was expected to be in excess of 50,000 tonnes and operation was hoped to start in 1982. All these schemes have fallen well behind schedule. Obstacles take the form of imported inflation in the price of raw materials and equipment, local inflation resulting from rising costs generally and distribution costs in particular, and bottlenecks, especially infrastructural deficiencies.

The government has sought to boost production by tax holidays, assistance in the establishment of estates, and generous joint venture arrangements with private companies. Nigeria has also taken part in the financing of a sugar factory in neighbouring Benin which would be able to export an undisclosed quantity of refined sugar to Nigeria after meeting Benin's domestic requirements, but this too has not worked out as expected.

Until 1981 Nigeria possessed only one operational sugar factory, while a substantial but unquantifiable amount of non-centrifugal sugar is also produced for local consumption, especially in rural areas. This factory,

the Nigerian Sugar Company facility at Bacita, currently operates at about two-thirds of its 50,000 tonnes/year capacity.

Although it is now producing sugar, much controversy surrounds the Savannah scheme; because of delays to the \$145 million Kiri Dam on the Gongola River, the 12,000 hectares of cane fields are not assured of adequate water and the factory does not have access to electric power. Financing problems have further hindered the efforts of the scheme's managers, the Commonwealth Development Corporation. The scheme's \$120 million factory was expected to produce 10,000 tonnes of sugar in 1981 but full capacity operation is unlikely in the near future.

The \$560 million Sunti scheme, developed from a pilot farm begun in 1974, had ground to a halt because of the government's decision to acquire 90% of the equity. The resultant loss of Tate & Lyle's expertise caused the authorities to place the management in the hands of a consortium comprising Poland's Polimex-Cekop, Cuba's Imexpal, and Prommash Export, the Soviet foreign trade organization. It seems unlikely that full capacity (now planned to be 100,000 tonnes/year) will be attained until the late 1980's — it had been scheduled to be on stream in 1980 and to be producing 50,000 tonnes by 1985.

Two other sugar projects, one the Lafiaga scheme in Kwara, remain at the planning stage. A feasibility study by the Cubans, to start operations for a 100,000 tonnes/year scheme in Makwa, Niger state, has yet to result in any concrete proposals. The government is in a dilemma over Lafiaga and indeed over sugar generally. Local circumstances make Nigeria a high-cost producer, with production costs alone probably exceeding \$700 per tonne, and the heavy capital investment required might well be put to better use elsewhere, especially since oil-rich Nigeria can, in theory, afford to import the sugar it needs. On the other hand, the employment generation potential of sugar fits in well with national agricultural objectives, which have high planning and political priority.

The prospect for the 1980's is that, whatever increases in domestic output are achieved, they will no more than cover expected increases in consumption (forecast to reach 800,000 tonnes by 1985 and perhaps 1,000,000 tonnes by 1990). Indeed it is quite possible that imports will continue to rise, albeit at a more gentle pace than in the past.

US Farm Bill

As a consequence of opposition by Representative members to the proposed sugar support price level of 18 cents/lb², which threatened the passage of the Bill through the House, the Joint Congressional Committee reduced its proposed support level to 17.5 cents/lb for 1982 and the annual increases to 1985 from ½ cent to ¼ cent per lb. Pressure for further reduction was resisted. The Committee adjourned for the Thanksgiving holiday recess with several other parts of the bill still unresolved and it was believed in some quarters that there would be a return to the support level question after reconvening of the Committee.

New Indian sugar factories³. — Five new sugar factories are to be set up in Madhya Pradesh during the current plan, to be located one each in Narsinghpur, Kargaon and Hoshangabad districts and two in the Chattisgarh region.

¹ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 644.

² *I.S.J.*, 1981, 83, 353.

³ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 733.

Cane juice relationships

By JOHN H. PAYNE and JOSE FELIX SILVA, JR.

(Centro de Tecnologia de Copersucar, Piracicaba, Brazil)

Introduction

To a processor, sugar cane is the raw material delivered to the installation for the purpose of recovering sucrose in marketable form. The processor's job is one of materials separation, firstly a liquid from a solid, juice from fibre, and secondly a dissolved solid, sucrose, from the liquid. For control purposes, the simple relationship $\text{Cane} = \text{Juice} + \text{Fibre}$ is used. Complexity arises in defining these materials, leading to arbitrary concepts chosen for practical purposes.

Many sugar cane regions cling to a definition of "Cane" as a hypothetical section of the cane plant from near the root level to near the growing point, exclusive of leaf portions and non-cane material. Attempts are often made to correct the delivered raw cane to this standard concept. The futility of the effort increases directly as the deviation of the cane supply from the conceptual.

Such, however, is a concern of those responsible for agricultural practices and for grower payments and not the operating staff. Taking that which comes in as raw cane, it is of value to know the quantity and quality of the juice from which sucrose must be obtained. This has led to some hypothetical materials just as in the case of cane. Principal of these is Absolute Juice, or Normal Juice, which is defined as all the juice in the cane. From the equation above, it would be $\text{Cane} - \text{Fibre}$. If in practice Cane is a hypothetical substance, then Absolute Juice becomes also a hypothetical substance.

In most factory control systems, the quality of Absolute Juice is calculated, based upon the analyses of mill juices¹. The assumption is made that the Juice in the Cane consists of the sum of the juice extracted, as appearing in Mixed Juice, and that remaining with the Fibre in the bagasse. Furthermore, the juice remaining in bagasse is usually considered to have the same composition as that of Last Expressed Juice (juice obtained in dewatering bagasse). Since Last Expressed Juice is always of lower purity than Mixed Juice, the calculated purity of Absolute Juice is always lower than that of Mixed Juice.

With the advent of direct analysis of cane and subsequent return in many factories to processing of cane by diffusion rather than milling, calculated figures for Absolute Juice were no longer necessary. Substantial differences were then noted to exist between calculated and measured values. The hypothesis of "Brix-free water" or bound water attached to fibre was advanced. Reasonable certainty exists that the composition calculated from Mixed Juice and Last Expressed Juice does not represent the original juice in cane, nor is that found in direct analysis of cane the same. In the intact cane plant, juice and fibre have an equilibrium homogeneity. When separated, both change. In the absence of direct means of knowing what exists in the plant, it is well to establish relationships between practical figures obtained by the various procedures in common use and to know the extent of the changes which include solubilization of insoluble matter (fibre), peptization, precipitation of

dissolved substances, oxidation, enzymatic action and chemical and physical changes of many types. It is the purpose of this report to present data comparing the analyses of commonly reported juices — Absolute Juice, First Expressed Juice and Mixed Juice — with some speculation as to how they relate to the original juice in cane.

First Expressed Juice is defined as equivalent to that expelled in the first two rolls of the mill. The amount of the total juice in the cane that is expelled varies widely, depending upon the mill, preparation and cane quality, but averages around 50%. The dissolved solids, the pol and the purity of this juice are all higher than those of subsequent extractions and are generally considered to be higher than those of Absolute Juice. Juice expressed in a static press is almost equivalent to First Expressed, although a higher percentage of the total juice can be expressed.

Mixed Juice is all the juice recovered in an extraction plant. Its composition depends upon the quality of the juice in the cane, the efficiency of the extraction process and the changes which have taken place in the extraction process. These changes are largely unknown, at least not established, but include those caused by microbiological action, chemical changes such as inversion, and solubilization of insoluble material.

COMPARISON OF JUICE PRESSED FROM CANE WITH JUICE FROM DISINTEGRATION OF CANE IN WATER

A series of comparisons was made between the composition of juice obtained by static press expression and that obtained by direct analysis of cane by the disintegration method.

Procedure

Cane samples were taken by random coring in the delivery vehicle. The core was prepared in a modified forage chopper and the resulting material was subsampled by quartering.

In the press procedure, a subsample was subjected to a pressure of 245 kg.cm^{-2} and the juice expressed in one minute collected. It was analysed for pol and refractometer solids (Bausch & Lomb Precision Refractometer).

The other subsample was subjected to a disintegrator treatment; 1000 g of sample was blended with 2000 g water for ten minutes using a top driven disintegrator. Juice was analysed for pol and refractometer solids.

Results

The results are shown in Table I.

The data show an average of one point lower purity in disintegrator extract than in juice expressed by pressing. This may be a real difference in composition of juice expelled from that remaining, or it may be that in

¹ Clayton: "System of cane sugar factory control" (ISSCT). 1971, p. 14.

Cane juice relationships

disintegration there is some solubilizing of substances associated with solid fibre, or a combination of both. The question is explored in the next section.

Test No.	Press Juice			Disintegrator Extract		
	Refr. Solids	Pol	Purity	Refr. Solids	Pol	Purity
1	19.38	15.76	81.32	5.95	4.88	82.02
2	19.82	16.39	82.69	6.20	5.03	81.13
3	21.10	18.50	87.68	6.49	5.64	86.90
4	21.04	18.17	86.36	6.45	5.51	85.43
5	22.12	19.57	88.47	6.67	5.92	88.76
6	21.67	18.84	86.94	6.70	5.68	84.78
7	20.85	17.67	84.75	6.56	5.42	82.62
8	19.42	15.67	80.69	6.06	4.72	77.89
9	22.24	19.76	88.85	6.81	5.99	87.96
10	20.61	17.45	84.67	6.45	5.30	82.81
11	21.37	18.74	87.69	6.70	5.77	86.12
12	20.58	17.12	83.19	6.36	5.19	81.60
13	21.19	18.14	85.61	6.45	5.46	84.65
14	20.37	17.05	83.70	6.33	5.21	82.31
15	21.31	17.66	82.87	6.63	5.36	80.84
16	21.34	16.38	76.76	6.36	4.93	77.52
17	20.46	17.12	83.68	6.29	5.16	82.03
18	20.09	16.39	81.58	6.23	5.00	80.26
19	20.00	16.40	82.00	6.23	5.04	80.90
20	20.18	16.71	82.80	6.29	5.14	81.72
Ave.	20.76	17.47	84.15	6.41	5.32	83.05

COMPARISON OF PRESS JUICE WITH FIRST EXPRESSED JUICE AND MIXED JUICE IN A FACTORY

Procedure

Cane was core-sampled in the transport units and the samples were analysed by the press and disintegrator methods as described previously. The attempt was then made to follow the cane through the mill and collect samples of First Expressed Juice and Mixed Juice corresponding to the core-sampled cane.

Results

The results of eight tests are shown in Table II. Each test figure is the average result of four replicates.

Test No.	Cane		Press Juice		First Expressed Juice		Mixed Juice	
	Pol	Fibre	Pol	Purity	Pol	Purity	Pol	Purity
1	12.86	10.74	14.91	84.72	14.68	84.38	13.65	83.74
2	12.80	11.83	15.07	84.66	14.67	85.29	13.56	83.19
3	13.92	11.01	16.22	84.92	15.35	85.75	12.65	82.68
4	15.05	10.77	17.48	85.27	16.44	84.31	13.29	83.06
5	14.92	11.05	17.38	88.67	16.54	87.98	13.12	84.10
6	15.73	13.25	18.90	89.45	18.57	89.32	16.15	87.68
7	16.08	13.77	19.46	88.21	17.26	87.48	16.08	84.14
8	15.31	12.71	18.25	86.00	16.80	84.00	15.60	81.25
Ave.	14.58	11.89	17.21	86.48	16.29	86.06	14.26	83.73

These data indicate that the juice expressed by static pressing is approximately equivalent to Expressed Juice obtained by milling, the average from the mill being somewhat lower in purity.

Mixed Juice, however, averages close to 2.5 points lower than Press Juice or First Expressed Juice. Since the data in Table I show that Disintegrator Extract is only one point lower in purity than Press Juice, then Mixed Juice is approximately 1.5 points lower in purity than Disintegrator Extract.

If it is considered that Disintegrator Extract should be close in composition to Juice in Cane, then the traditional concept of Absolute Juice being of lower purity than Mixed Juice is in error and the traditional method of calculation is incorrect.

The reasons why Mixed Juice is of lower purity than Juice in Cane are probably several, including micro-organism activity in the milling train, enzymatic action, solubilization and chemical changes.

Discussion

It is well established that juice purities drop with continued extraction. In early diffusion studies, Payne found that, in Displaceability Index Tests, the purity of the free juice averaged 0.65 points higher than juice from complete disintegration of the cane. Furthermore, continued disintegration beyond the 15 minutes, standard in the Displaceability Index Test, to 30 minutes, resulted in a drop in purity from 84.9 to 83.3 in six tests.

It was suggested that these results demonstrated some solubilization of "fibre" components with a resulting increase in soluble solids. Recently, the work of Somera *et al.*² in a study on the material balances in a simulated diffuser process, showed an increase in the dissolved solids balance. The results were later confirmed in actual operational diffuser tests³.

In a diffuser there is some inversion because of higher temperatures (75°C) although the average juice retention time is only about 18 minutes. If the pH in the diffuser is that of the juice in cane (5.2-5.5), the calculated chemical inversion is 0.14%. Any chemical inversion, of course, has a significant effect on purity because the purity decreases not only by loss of pol but also to a small extent from increase in soluble solids by incorporation of water in forming the glucose and fructose molecules. For a juice of composition:

Pol	14.00
Refr. Solids	16.67
Purity	84.00

an inversion of 0.14% would reduce the pol to 13.98 and, neglecting the small effect on refractometer solids, the purity would drop to 83.86.

However, the pH of the juice in the diffuser is normally above 6 by liming of return juice or cane, so the purity drop by inversion would be much smaller.

In milling, the fibre is subjected to repeated mulling with juice under high pressures which is conducive to solubilization. Also, by contrast with diffusion, the fibre and juice are exposed to ideal conditions for the growth of micro-organisms. It must be concluded, therefore, that the composition of the extracted juice differs from that originally in the cane owing to factors, including solubilization of fibre and inversion of sucrose, which lower the purity.

Conclusions

Since the processes of extracting juice from cane, either in laboratory or in commercial operation, result in a lowering of purity, the original juice in cane (Absolute Juice) is of higher purity than Mixed Juice. The real purity of Absolute Juice is indicated as lying between the purity of First Expressed Juice and purity of the Disintegration Extract of Cane.

² Ann. Rpt. Hawaiian Sugar Planters' Assoc., 1977, 45 - 46.

³ Sloane, Webster, Tanaka & Somera: Rpts. 37th Conf. Hawaiian Sugar Tech., 1978, 107 - 112.

The authors are indebted to Antonio Carlos Fernandes and Prof. José Paulo Stupiello for their contribution to the experimental work.

Summary

The relationships between the original juice in cane, calculated absolute juice, first expressed juice and mixed juice are explored and the effects of a number of factors, including microbial activity, solubilization of fibre, etc., on the relative purities of the juices suggested as an explanation of observations which are contrary to conventional theory.

Les relations entre les jus de canne

Les relations entre le jus originel de la canne, le jus absolu calculé, le jus de premier pressage et le jus mélangé sont examinées et les effets d'un certain nombre de facteurs, englobant l'activité microbienne, la solubilisation de la fibre, etc., sur les puretés relatives des jus

sont suggérés comme étant l'explication d'observations contraires à la théorie conventionnelle.

Rohrsaftverhältnisse

Die Verhältnisse zwischen dem ursprünglichen Saft im Rohr, dem berechneten absolutem Saft, dem ersten Preßsaft und dem Mischsaft werden untersucht, und der Einfluß einer Reihe von Faktoren, einschließlich der mikrobiellen Aktivität, der Löslichkeit des Fibers usw. auf die relativen Reinheiten der Säfte wird als eine Erklärung für Beobachtungen vorgeschlagen, die im Gegensatz zur konventionellen Theorie stehen.

Relaciones entre jugos de caña

Las relaciones entre el jugo original de caña, jugo absoluto calculado, jugo de la primera expresión, y jugo mezclado se examinan y los efectos de algunos factores, incluyendo actividad microbiana, solubilización de fibra, etc., sobre las purezas relativas de los jugos se sugieren como explicación de observaciones contrarias a teoría convencional.

Potential uses of cane tops and leaves — a preliminary study

By DR. J. C. LI SUI FONG
(School of Industrial Technology,
University of Mauritius)

Introduction

Although every tonne of sugar cane biomass represents an energy equivalent of about 4.2 GJ, yet under current practices up to 20% or more of this biomass is often burnt or discarded in the field as cane tops, leaves and trash¹, partly because reasonable results have not been obtained so far with whole-plant processing. In fact, cane tops and leaves, which contain substantially more fibre and chlorophyll and less soluble solids, interfere with the manufacture of sugar, necessitating major modifications of equipment and operational parameters, give rise to uncertainties in the composition and processing of the juice, and result in a lower sugar recovery².

However, considering that an optimal use is achieved when the sugar cane plant is exploited for both its sucrose and biomass yield³, its seems desirable that, in the shorter term, attempts be made to process cane tops and leaves separately from the millable cane.

Studies were therefore made to evaluate the potential contribution of this neglected biomass to the supply of

food and fuel. In particular, emphasis was placed on the extraction of leaf protein which is potentially the most abundant of the novel protein resources⁴. Leaf protein is by tradition extracted industrially from lucerne (*Medicago sativa*) and on a smaller scale from plant species such as fescue (*Festuca arundinaceae*), water hyacinth (*Eichhornia crassipes*) and from by-products such as peas (*Pisum sativum*), potato (*Solanum tuberosum*) and sugar beet tops (*Beta vulgaris*); but the availability and low cost of cane tops and leaves should be attractive enough to warrant their utilization as well⁵. The soluble, uncoagulable component left after protein separation was then examined as a possible substrate for the production of ethanol or single-cell protein (Figure 1). With the same objective of identifying other potentially feasible applications, tests were also carried out to assess the suitability of the fibrous residue as a supplementary fuel to be used perhaps in combination with bagasse and as a raw material for the production of methane gas.

MATERIALS AND METHODS

Isolation of leaf protein concentrate (LPC)

Extraction of juice from the samples of cane tops and



J. C. Li Sui Fong

¹ Lipinsky: *Science*, 1978, 199, 644 — 651.

² Sloane & Rhodes: *Hawaiian Planters' Record*, 1972, 58, 173 — 182.

³ Irvine: *Sugar J.*, 1979, 41, (12), 15.

⁴ Pirie: *Nature*, 1975, 253, 239 — 241.

⁵ Li Sui Fong: *Proc. Nat. Agric. Prod. Conf.* (University of Mauritius, Dec. 1979), 1980, 407 — 416.

Potential uses of cane tops and leaves

leaves was done by means of various disintegrating devices encountered in the sugar industry, namely a 23 cm x 30.5 cm sugar cane mill (Wm. McKinnon & Co. Ltd., Aberdeen, Scotland), a Suma Wet Disintegrator (Sugar Manufacturers' Supply Co. Ltd., London, England) and a Pinette-Emidecau Hydraulic Press (Type OB-102). The extracted juice was then strained through a 200-mesh sieve and rapidly heated to 80°C, the coagulated protein curd being separated by centrifugation and dried at 40°C to a moisture content of approximately 7%.

the following conditions:

Total sugars content	: 4.2%
(NH ₄) ₂ SO ₄	: 0.1%
P ₂ O ₅	: 0.03%
NaF	: 0.01%
pH	: 4.7
Fermentation time	: 72 hours
Temperature of fermentation	: 30°C
Inoculum (dried baker's yeast)	: 0.05% w/w (aerobic) 0.5% w/w (anaerobic)

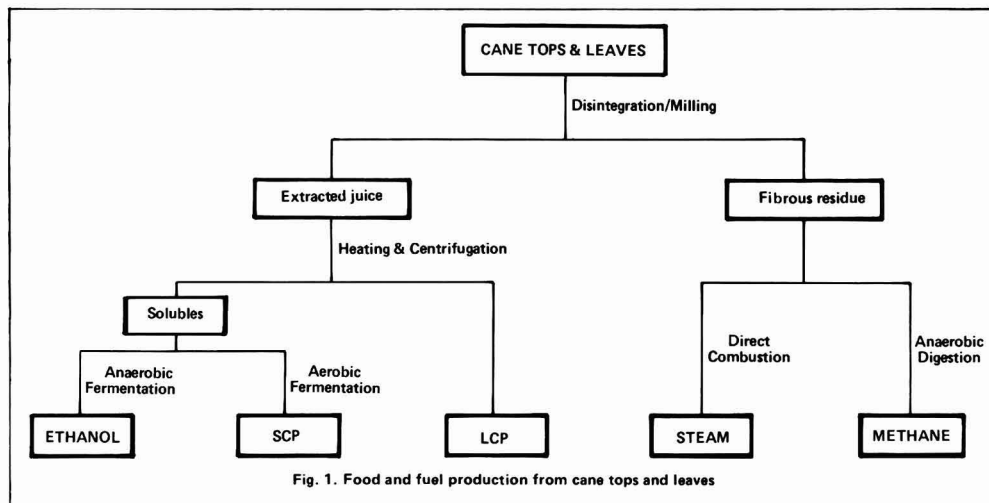


Fig. 1. Food and fuel production from cane tops and leaves

Analysis of LPC

Total solids were found by drying at 105°C to constant weight, total nitrogen was determined by the semi-micro method of Kjeldahl, and ash was obtained by incinerating in a muffle furnace at 600°C to constant weight. The fat content was determined by the Werner-Schmid process⁶ and fibre by the general method laid down in the British Fertilizers and Feeding Stuffs Regulations. The acid hydrolysis carried out prior to amino-acid analysis was effected using the method of Gundlach, Moore & Stein⁷.

Analysis of amino-acids was performed by means of a Technicon Autoanalyzer NC 1 equipped with either (i) a column, 0.6 cm in diameter and 75 cm in height, packed with Chromobeads Resin Type C2 (analysis of all amino-acids after acid hydrolysis) or (ii) a column, 0.6 cm in diameter and 140 cm in height, packed with Chromobeads Resin Type A (analysis of amino-acids after performic acid oxidation and acid hydrolysis). The resolution of the amino-acids was achieved by means of buffer gradients according to the technique of Peterson & Sober⁸. The elution of all amino-acids⁹, including cysteic acid and methionine sulphone, was completed in 21 hours at a flow rate of 0.8 ml.min⁻¹ and was followed by a spectrophotometric determination (at 570 nm and 440 nm for the purple and yellow complexes, respectively) based on the colour developed by the ninhydrin-amino-acid complex.

Fermentation of soluble fraction

This was carried out in batch 5-litre fermenters using

Calorific value of fibrous residue

The determination was done using a Parr Oxygen Bomb Calorimeter (Parr Instrument Company, Illinois, USA).

Anaerobic digestion of fibrous residue

The digestion was carried out in a batch vertical drum digester of 100 litres capacity. Fermentation conditions were as follows:

	<i>per kg fibrous residue</i>
Distilled water	5 kg
Ammonium sulphate	7 g
Triplephosphate	1 g
Inoculum (cow dung)	25 g
Initial pH (adjusted with lime):	7.5

RESULTS AND DISCUSSION

Recovery of LPC

The samples of cane tops and leaves contained on the average 1.1% N on a dry basis. On heating the extracted juice, a coagulum was obtained which yielded a protein concentrate of 5.0 g N per 100 g dry material.

In our pilot plant mill, run at a feed rate of about 120 kg.hr⁻¹, approximately 40% of the weight of the

⁶ Pearson: "The Chemical Analysis of Foods". (J. & A. Churchill, London), 1970, 604 pp.

⁷ J. Biol. Chem., 1959, 234, 1761 - 1764.

⁸ Anal. Chem., 1959, 31, 857 - 862.

⁹ Cuq, Provencal, Guilleux & Cheftel: J. Food Sci., 1973, 38, 11 - 13.

fresh cane tops and leaves was obtained as press juice whereas, with the hydraulic press, which was operated at 200 bar for 2 minutes, the proportion of extracted juice attained 65%. In the case of wet disintegration, a satisfactory degree of extraction was achieved by using a water:raw material ratio of 2.5:1 w/w. The yield of LPC, under these test conditions, was approximately 6 kg/tonne cane tops by wet extraction, 4.5 kg/tonne cane tops by milling and 3 kg/tonne cane tops by pressing. However, it is reasonable to assume that the recovery of LPC could be further improved by optimizing the conditions of extraction.

The composition of the isolated LPC is given in Table I. Table II shows the amino-acid composition of LPC extracted from cane tops and leaves and from cane juice. It is noteworthy that LPC isolated from alfalfa has been shown to be at least equivalent to soya bean meal when fed to chicks¹⁰ and to supplement a pig diet as effectively as white fish meal¹¹.

Table I. Average composition of LPC isolated from cane tops and leaves

	% dry material
Crude protein (N x 6.0)	30.0
Crude fat (ether extract)	10.1
Raw fibre	2.5
Ash	8.0
N-free extract	49.4

Table II. Amino-acids content of LPC (g/16 g N)

	LPC from cane tops	LPC from cane juice
Aspartic acid	9.5	10.8
Threonine	5.1	4.4
Serine	5.1	4.2
Glutamic acid	11.3	11.8
Proline	5.1	5.5
Glycine	6.2	5.2
Alanine	8.2	6.5
Valine	7.5	6.4
Cystine	1.2	0.9
Methionine	1.3	0.8
Isoleucine	5.5	4.9
Leucine	11.0	8.7
Tyrosine	3.9	3.4
Phenylalanine	6.7	5.4
Lysine	8.0	6.9
Histidine	2.4	1.9
Arginine	7.2	5.4
Tryptophane	not determined	

Yield of single-cell protein and ethanol

The composition of the soluble fraction and that of the sample of final molasses used for fermentation together with their corresponding yields of single-cell protein and ethanol are shown in Table III; used as a growth medium, juice extracted from cane tops and leaves yielded for every tonne of cane tops and leaves approximately 6.8 kg yeast biomass or alternatively approximately 7.7 kg of 60° alcohol. Therefore, on a similar sugar concentration basis, both substrates studied seemed to sustain yeast activity to the same extent although factors such as the variation in total sugars

content of the soluble fraction (which largely depends on the proportion of cane tops to leaves and hence on the method of harvesting) and the relative proportions of nonfermentables in the samples could appreciably affect the yields.

Table III. Average composition of fermenting media and corresponding yields of single-cell protein and ethanol

	Solubles	Final molasses
Sucrose (g/100 g)	2.8	33.4
Reducing sugars (g/100 g)	1.6	13.8
Total sugars (g/100 g)	4.5	48.9
Sugar concentration at start of fermentation (g/100 g)	4.5	4.5
Yield of SCP (g dry yeast/kg medium)	19.5	22.0
Ethanol yield (g 60° alcohol/kg medium)	18.8	21.8

Fuel value of fibrous residue

The average calorific values of the fibrous residue left after LPC extraction and of last mill bagasse were found to be 14,800 and 17,000 kJ/kg of dry material, respectively. Therefore, the potential of cane tops and leaves should not be overlooked even in a milling scheme where cane is processed separately from the tops and leaves, for the latter could well be used to increase the energy output of the sugar factory or to economize on bagasse which may then be diverted to other uses.

The rate of biogas liberation during the methanogenesis stage (which lasted for approximately 200 days), as measured with a PS Wet Test Meter, was about 0.05 m³/tonne residue/day. It is evident however that the utilization of cane tops and leaves for methane production should be considered in the light of the problems usually associated with the translation of laboratory techniques into full-scale plant operation, alternative applications for these raw materials and the potential demand for the gas and fertilizer sludge.

Conclusion

The potential undoubtedly exists to substitute cane tops and leaves for a significant portion of the bagasse presently burnt in sugar factory furnaces. A more rational exploitation of cane tops and leaves should also command great interest in so far as they represent a comparatively low-cost and continually renewable resource in many sugar-producing countries. In this respect, an agro-industrial complex based on the utilization of cane tops for food and fuel production, for instance, should be particularly attractive in view of the possibility of using the residual fibrous biomass to meet the energy requirements of the integrated unit operations and conversion processes.

Acknowledgements

The technical assistance of Dr. J. L. Cuq and Mr. K. Deepchand is gratefully acknowledged.

¹⁰ Duckworth & Woodham: *J. Sci. Food. Agric.*, 1961, 12, 5 – 15.

¹¹ Duckworth, Hepburn & Woodham: *ibid.*, 16 – 20.

Summary

Leaf protein was isolated from cane tops and leaves by disintegrating the plant cells and coagulating the protein curd in the extracted juice. The remaining soluble fraction was then utilized as a substrate for the production of single-cell protein or ethanol whereas the fibrous residue was digested anaerobically to yield methane gas. It was concluded that cane tops and leaves, hitherto largely under-utilized, represent a potentially valuable resource for both food and fuel production.

Emplois potentiels des bouts et feuilles de canne — une étude préliminaire

La protéine des feuilles a été isolée des bouts et des feuilles de canne en désintégrant les cellules de la plante et en coagulant le caillé de protéine du jus extrait. La fraction soluble restante était ensuite utilisée comme substrat pour la production de protéine unicellulaire ou d'éthanol tandis que le résidu fibreux était digéré anaérobiquement pour obtenir du gaz méthane. On en déduit que les bouts et feuilles de canne, sous-utilisés jusqu'à présent, représentent une ressource de valeur potentielle pour la production à la fois d'aliments et de combustible.

Mögliche Verwendung von Rohrspitzen und Rohrblättern — einleitende Studie

Blattprotein wurde aus Rohrspitzen und Blättern durch Desintegration der Pflanzenzellen und Koagulation des geronnenen Proteins im extrahierten Saft gewonnen. Der Rest der löslichen Fraktion wurde als Substrat für die Herstellung von Einzellerprotein oder Alkohol verwendet, während der das Fiber enthaltende Rückstand anaerob zu Methan abgebaut wurde. Es wurde festgestellt, daß die Rohrspitzen und Blätter, die bisher weitgehend ungenutzt sind, eine potentiell wertvolle Quelle für die Lebensmittel- und Treibstoffherstellung darstellen.

Usos potenciales de cogollos y hojas de caña — un estudio preliminar

Se ha aislado proteína de cogollos y hojas de caña por disgregación de la células de la planta y coagulación de la cuajada de proteína en el jugo extraído. La fracción soluble que sobró se ha utilizado como sustrato para la producción de proteína monocelular o de etanol mientras que el resto fibroso se ha digerido anaerobicamente para producir el gas metano. Los autores concluyen que cogollos y hojas de caña, hasta ahora sub-utilizados en grande parte, representan un fuente de valor potencial para producción de alimento y combustible.

Isolation and identification of some colour constituents in Egyptian cane molasses

By M. A. EL-MAGHRABY and
A. ABOU EL ELA HASSAN
(Chemistry Department, Aswan Faculty of Science,
Aswan, Egypt)

Introduction

Knowledge of the identity of the colorants is very important in cane sugar technology and many investigators have applied various schemes in an effort to isolate and identify sugar colorants. Decolorizing processes will be more effective when greater knowledge of the chemical and physical properties of the colorants becomes available.

Generally, browning is caused by the formation of unsaturated coloured polymers of different composition. Three broad types of browning reaction are recognized in food technology: melanoidins formation, caramelization and degradation of hexoses. The most common is the carbonyl-amino reaction which includes the reaction of aldehydes, ketones and reducing sugars with amines, amino-acids, peptides and proteins.

If the amino compound is an amino-acid, Strecker degradation usually takes place, whereby carbon dioxide is liberated and an aldehyde or ketone is formed with one carbon atom less than the original amino-acid¹.

Bugaenko *et al.*², Alekseenko *et al.*³, Ivancenko & Heinrichova⁴ and Tu & Degnan⁵ have studied the separation and the determination of colorants in cane products using different methods such as gel filtration, separation on anion exchange resin and Sephadex G-25, and different chromatographic techniques. They found that the main colour constituents in cane molasses are melanoidins and that these colorants, upon hydrolysis, gave amino-acids, glucose, fructose, glyceraldehyde, hydroxyacetone and methylglyoxal.

This conclusion had been confirmed by several investigators such as Cantor⁶, Binkley⁷, and Reynolds⁸ who reported that the amino-acids react with hexoses and dehydration products such as hydroxymethylfurfural and levulinic acid to form coloured bodies generally considered to be N-glycosides; they turn to dark brown or black amorphous substances which are typical melanoidins.

Prey *et al.*⁹ and Sen¹⁰ showed that these colorants vary with the nature of the reactants, pH, temperature, concentration and time. The pigments do not have characteristic absorption bands, but absorb light strongly at the lower wavelengths, and weakly at the higher



M. A. El-Maghraby

- 1 Strecker: *Liebigs Annalen Chem.* 1862, 23, 363.
- 2 *Sakhar. Prom.*, 1970, 44, (12), 13-16.
- 3 *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1972, 18, 161-170.
- 4 *Sb. prec. chem. Fak. S.U. st.*, 1964, 59-86.
- 5 *J.S.J.*, 1972, 74, 259-260.
- 6 U.S. Patent 2,389,119 (1945).
- 7 *J.S.J.*, 1957, 59, 64, 178.
- 8 *Food Technol.* (Australia), 1970, 610-619.
- 9 *Zeitsch. Zuckerind.*, 1963, 88, 371-376.
- 10 *Chem. Tsung. Shorg. Spec. Iss.* (Univ. Hsinchu, Taiwan), 1971, 40-50.

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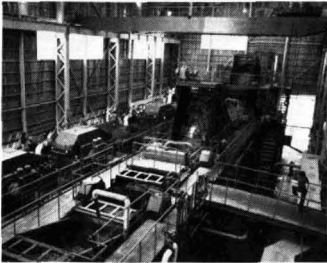
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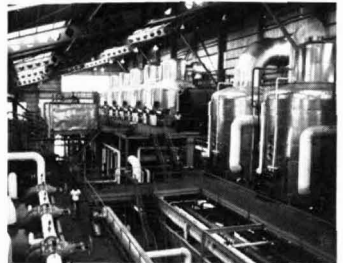
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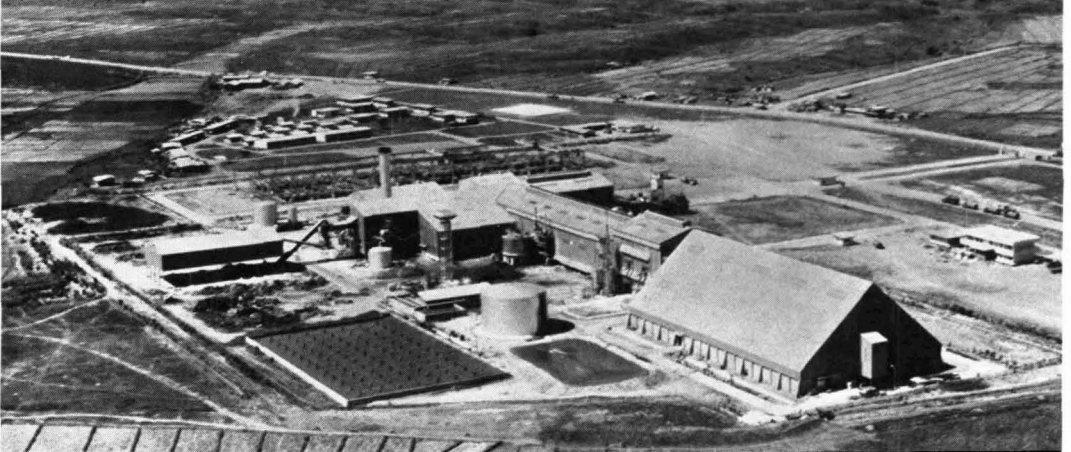


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wavelengths to yield an asymptotic absorption curve ¹¹.

Experimental

Representative monthly composite samples of cane molasses were obtained from Kom Ombo sugar factory; they were diluted with distilled water to about 10% solids, centrifuged and filtered. The clear solution of molasses was passed through a column containing a strongly basic anion exchange resin (Zerolite FS) that had been previously regenerated with 10% NaCl. After the resin was saturated, the molasses application was stopped and colouring matter eluted from the resin using a 10% NaCl solution. The sodium chloride solution, which was loaded with colour bodies, was concentrated at 50°C under vacuum, when most of the sodium chloride crystallized and was separated.

The sodium ions in the concentrate were removed by passing it through a column of cation exchange resin (Zeokarb 225) that had been previously regenerated with 4N HCl ¹², after which the amino-acids combined in the colorant were liberated by hydrolysis with 8N HCl in a sealed tube at 100°C for 36 hours ¹³.

The amino-acids and reducing sugars were identified by paper chromatography using as standards model melanoidins prepared according to the method of M. Abed Akher *et al.* ¹⁴. The separation of melanoidin

constituents and their identification were made using the thin-layer chromatographic technique and spectral measurements.

Results and discussion

The coloured impurities of cane molasses are only a small percentage of the total non-sugars but their removal is one of the most important functions of the sugar industry. Not only does the colour cause problems in refining but the melanoidins increase the viscosity of sugar solutions and hence interfere in the boiling and crystallization stages of sugar manufacture. This present work has been carried out therefore to isolate and identify some of the melanoidins present in Egyptian cane molasses, developed during processing in the sugar industry.

At Kom Ombo sugar factory, the sulphitation process is used for treatment of cane juice and some of the colouring matter in the cane juice is adsorbed on the precipitated CaSO₃.

The colorant separated from Egyptian cane molasses on decolorizing ion exchange resin has been analysed by paper electrophoresis using different buffer solutions (borate buffer at pH 9.0 and acid phthalate at pH 4.0).

This analysis indicates that Egyptian cane molasses contains caramelization and melanoidin-type browning polymers as shown in Fig. 1. Since the isolated colorants moved towards the anode, this indicates that either they themselves form negatively-charged complexes with the buffer or were themselves negatively-charged high molecular weight species.

The amount of melanoidins is only minor, compared with the other types of browning polymer. It is thought that this may be due to the browning polymer formed through a carbonyl-amino reaction requiring a longer time for its formation and polymerization than the caramelization process which is much more rapid.

The amino-acids present, free and combined, in the colorant are illustrated by the following table:

Amino-acid	Free	Combined
L-Cystine	-	+
L-Lysine	+	+
L-Aspartic acid	-	+
L-Serine	+	+
L-Glycine	+	+
L-Alanine	-	+
L-Valine	+	+
L-Glutamic acid	+	+
L-Leucine + Iso leucine	+	+

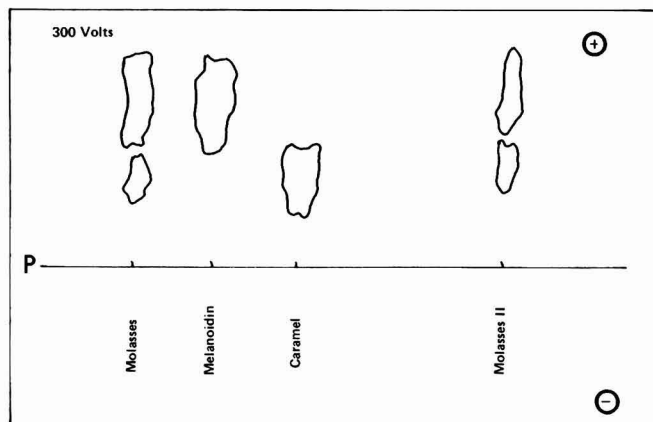


Fig. 1A. Paper electrophoresis of colorants from different stages of production. (Borate buffer, pH 9.0; Time 2 hr; P = point of application)

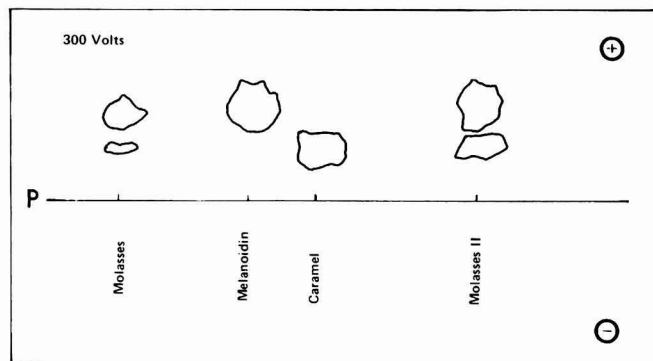


Fig. 1B. Paper electrophoresis of colorants from different stages of production. (Acid phthalate buffer, pH 4.0; Time 2½ hr; P = point of application)

¹¹ Shallenberger & Birch: "Sugar Chemistry", 1975.
¹² Freed & Hibbert: *J.S.J.*, 1955, 57, 399-404.
¹³ Ivor Smith: "Chromatographic and electrophoretic techniques", Vol. I, 1969.
¹⁴ *Die Stärke*, 1966, 18, 243-248.

The free amino-acids are stable throughout the different steps of raw sugar processing, including juice extraction, clarification, evaporation, crystallization, centrifugation and finally drying of the sugar products. Most of the simple amino-acids are not eliminated during these steps and appear in the final molasses.

The combined amino-acids detected in the hydrolysate of the colorant proves that the melanoidins in the molasses are products of reaction between them and reducing sugars. Furthermore these combined acids appear to be linked in the colorants in a relatively simple manner since their regeneration requires only simple hydrolysis. Also, in addition to cystine, aspartic acid and alanine, some free amino-acids react with reducing sugar to form melanoidins. We therefore isolated these melanoidins from the separated colorant using the technique of thin layer chromatography with different solvents.

The best solvent for separation was 4:1:5 butanol:acetic acid: water and we were able to separate four melanoidin compounds present in the colorants isolated from Kom Ombo cane molasses. The identification and recognition of these compounds was by means of paper chromatography with model systems as shown in Figure 2. This figure shows that the melanoidin compounds isolated from Egyptian cane molasses are: glucose-serine, glucose-aspartic acid, glucose-lysine and glucose-methionine.

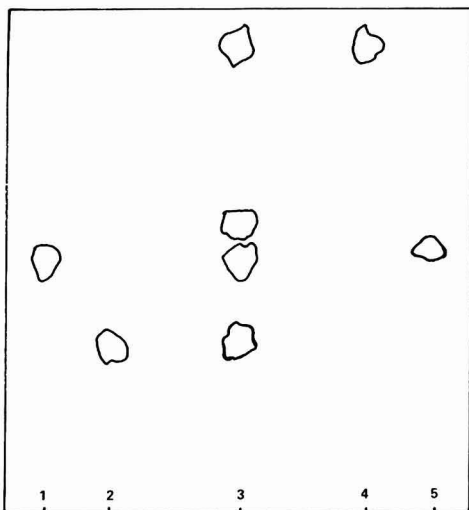


Fig. 2. Paper chromatography of melanoidins: (1) glucose with serine; (2) glucose with aspartic acid; (3) melanoidins isolated; (4) glucose with methionine; (5) glucose with lysine

The infrared spectra of these isolated compounds showed general absorption bands at $1645-1620\text{ cm}^{-1}$, attributed to the $\text{C}=\text{C}-\text{C}=\text{O}$; at $1370-1345\text{ cm}^{-1}$, attributed to the OH of $\text{C}-\text{C}-\text{OH}$; at $1060-1040\text{ cm}^{-1}$, attributed to $\text{C}-\text{O}$ and the $\text{C}-\text{C}$ of $\text{C}-\text{C}-\text{OH}$; and at 820 cm^{-1} , attributable to the pyranose structure. Besides these bands, there are two characteristic bands attributed to COOH and H -bonded NH_2 at $3330-3320\text{ cm}^{-1}$ and $3210-3150\text{ cm}^{-1}$.

Generally the infrared spectra lack discrete peaks in the range 1500 to 700 cm^{-1} indicating very complex molecules, and the interpretation of the spectra can be only a rough guide to the structure of the colorants.

Different chromatographic techniques of separation combined with spectral measurements were employed to investigate the nature of some of the colouring matter present in Egyptian cane molasses, especially melanoidins. This study showed that the melanoidins in Egyptian cane molasses contain the following amino-acids: glycine, aspartic acid, glutamic acid, alanine, serine, methionine, lysine and leucine, and indicated that melanoidin formation is by a carbonyl-amine reaction between these amino-acids and reducing sugars present in the cane juice. This is also confirmed by the presence of the following melanoidin compounds: glucose-aspartic acid, glucose-serine, glucose-lysine and glucose-methionine.

Isolément et identification de certains constituants colorés dans les mélasses de canne égyptiennes

Différentes techniques de séparation chromatographiques combinées avec des mesures de spectres ont été employées pour rechercher la nature d'une partie de la matière colorante présente dans les mélasses de canne égyptiennes, spécialement les mélanoidines. Cette étude a révélé que les mélanoidines des mélasses de canne égyptiennes contiennent les acides aminés ci-après: glycine, acide aspartique, acide glutamique, alanine, sérine, méthionine, lysine et leucine et elle a indiqué que la formation de la mélanoidine a lieu par une réaction carbonyle-amine entre ces acides aminés et les sucres réducteurs présents dans le jus de canne. Ceci est également confirmé par la présence des composés de mélanoidine ci-après: glucose-acide aspartique, glucose-sérine, glucose-lysine et glucose-méthionine.

Isolierung und Identifizierung einiger Farbbestandteile in ägyptischen Rohrmelassen

Verschiedene chromatographische Techniken der Auftrennung in Verbindung mit Spektralmessungen wurden verwendet, um die Natur einiger Farbstoffe, besonders von Melanoidinen, in ägyptischen Rohrmelassen zu untersuchen. Diese Untersuchung zeigte, daß die Melanoidine in ägyptischen Rohrmelassen folgende Aminosäuren enthalten: Glycin, Asparaginsäure, Glutaminsäure, Alanin, Serin, Methionin, Lysin und Leucin. Es zeigte sich, daß die Melanoidinbildung eine Carbonyl-Amin-Reaktion zwischen diesen Aminosäuren und reduzierenden Zuckern im Rohrsaft ist. Dies wird durch die Anwesenheit folgender Melanoidinverbindungen bestätigt: Glucose-Asparaginsäure, Glucose-Serin, Glucose-Lysin und Glucose-Methionin.

Aislamiento y identificación de algunos constituyentes del color de melaza de caña egipcia

Varias técnicas cromatográficas de separación, combinada con medidas espectrales, se han empleado para investigar la naturaleza de una parte de la materia colorante presente en melaza de caña egipcia, las melanoidinas sobre todo. Este examen indicó que las melanoidinas en melaza de caña egipcia contiene los amino-ácidos siguientes: glicina, ácido aspártico, ácido glutámico, alanina, serina, metionina, lisina y leucina, y indicó que la formación de melanoidina ocurre por una reacción del tipo carbonilo-amino entre estos amino-ácidos y azúcares reductores presente en el jugo de caña. Esto es confirmado por la presencia de los compuestos siguientes de la natura de melanoidinas: glucosa-ácido aspártico, glucosa-serina, glucosa-lisina y glucosa-metionina.

SUGAR CANE AGRONOMY

Development of ant-resistant tubes. V. C. S. Chang, A. K. Ota and D. Sanders. *Rpts. Hawaiian Sugar Tech.*, 1979, 92-94. — Comparison of orifice enlargement by ants in drip irrigation tubing showed that, after 49 days' exposure to fire ants, the enlargement was least with polypropylene tubes (36%); polypropylene blend and low-density polyethylene blend materials suffered 358% and 536% enlargement, respectively. Drip tubes of relatively thick material were more resistant than thinner material, while ant damage to orifices made with a mechanical punch was 34-50% of that for orifices made with a laser beam. Slit orifices suffered less than round ones, while damage was reduced by providing obstacles such as a raised ring, linear ridge or a flap overhanging the orifice. The use of linear ridges closer together (1 mm vs. 3 mm) also reduced damage. Tubes were tested in which insecticides were incorporated in the plastic material; ant attack was resisted for 3 months by tubes incorporating 1% Chlorpyrifos, Heptachlor, Bendiocarb or the synthetic pyrethroids Fenvelerate and Permethrin, or 2% of organotin compounds (tributyl tin chloride, oxide, acetate or salicylate).

Scheduling the drip irrigation of sugar cane through the use of a computerized water balance. R. C. Bowden and J. T. Frank. *Rpts. Hawaiian Sugar Tech.*, 1979, 95-103. — Factors affecting a water balance are discussed, and the establishment of such a balance on a basis of six factors is described. A computer is used to allocate water supplies on the basis of this balance.

Herbicide effects on growth and yield of Hawaiian sugar cane. H. W. Hilton and R. V. Osgood. *Rpts. Hawaiian Sugar Tech.*, 1979, 104-106. — Over the 48 years to 1978 a total of 56 experiments involving 155 treatments have been carried out, and the results are summarized and discussed. As a rule, sugar differences result from cane weight rather than juice quality changes. Within the statistical limits of the test programs it has been possible to conclude that a reasonable degree of herbicide injury early in the crop will not limit yields at harvest, provided subsequent growth is normal. There is a continuing need for evaluation of new herbicides and practices, while information should be sought on the influence of water stress, salinity and soil factors on herbicide injury. The change in the apparent physiological age of cane after recovery from injury may affect juice quality and ripening.

Preliminary evaluation of DRIS for nutritional diagnosis at Puna Sugar Company. C. A. Jones. *Rpts. Hawaiian Sugar Tech.*, 1979, 110-113. — The Diagnosis and Recommendation Integrated System¹ for assessing nutritional deficiencies is described and a preliminary report presented on a comparison of this method with the conventional crop-log method in cane fields of Puna Sugar Co. The DRIS method resulted in successful diagnosis of yield response to fertilizer application in 73% of the

treatments examined, while the corresponding figure for the crop-log method was 62%. Increasing the data base by application to more plantations should improve diagnostic capability.

Application of solar water heating for sugar cane seed treatment. K. Mashima. *Rpts. Hawaiian Sugar Tech.*, 1979, 114-116. — A solar heating unit was designed and built to provide water at 52°C for use in treatment of cane setts with a Benlate solution to promote germination and control disease. A back-up oil-fired heater was incorporated for overcast days when available solar energy was insufficient. The system worked, apart from initial trouble with the temperature controller, while thermal losses required fitting of foam insulation to the water tanks. The overall cost for a commercial heater is estimated at \$20,000, while the annual fuel bill is currently \$2200 per annum. Thus, the unit is not an economical proposition at present, although it might become so should oil prices rise as predicted.

Subsurface irrigation research update. W. Bui. *Rpts. Hawaiian Sugar Tech.*, 1979, 117-119. — Subsurface irrigation is that provided by a system of tubes buried sufficiently deep to protect them from damage during cultivation, e.g. 14 inches. Advantages and disadvantages of the system are summarized and an account is given of research on the life and effectiveness of the in-field installation, water requirements by comparison with drip irrigation and the comparative economics. In one trial, tubing installed in January 1974 was still in good condition in August 1979; in another, tubing installed in October 1975 had to be removed in August 1979 because of accidental damage, while, in the third, tubing installed in early 1977 was found to be in excellent condition in November 1978. Stalk population and growth measurements in an experiment with variable row spacing and water applications indicated that subsurface irrigation did not require any more water than drip irrigation for cane to grow as well. A cooperative study with Waiialua Sugar Co. to determine economics is in progress but no results are yet available.

HC & S seed cutting aid. W. Bisgard. *Rpts. Hawaiian Sugar Tech.*, 1979, 182-183. — From 1975 to 1978 cane for seed was produced using Toft 300 harvesters at HC & S Co., but subsequently a portable saw that could be used in the field was designed to produce handcut setts. This saw, its design characteristics and operation are described.

Direct injection fertilizer system at Oahu Sugar Company. J. R. Marshall. *Rpts. Hawaiian Sugar Tech.*, 1979, 189-190. — Fertilizer is injected into the drip irrigation system at Oahu Sugar Co.; it is taken to each filter station in turn in a second-hand Coca-Cola tank truck of 4200 gal capacity. Details of the system and its operation are described. It is expected that the system will be able to cope with a coming expansion of the drip irrigated area to 13,000 acres.

Bundaberg growers use own cane for plants. P. A. Jones. *Cane Growers' Quarterly Bull.*, 1980, 44, 12-13. — Because of Fiji disease, cane growers in the Bundaberg area of Queensland have not been able to use their own cane as planting material since the early 1970's. However, with the development of highly resistant varieties and of a system of plant cane nurseries, this situation is changing.

¹ Beaufils & Sumner: *Proc. 50th Congr. S. African Sugar Tech. Assoc.*, 1976, 118-124.

Made a mistake lately? G. R. Cullen. *Cane Growers' Quarterly Bull.*, 1980, **44**, 14-15. — An account is given of the killing of cane on the headlands or edges of cane fields where Glyphosate (as Roundup) was used instead of Paraquat; the former was absorbed by suckers and translocated into the cane stool, which died. Roundup is also inactivated by soil, so that it has no residual effect and is wasted when sprayed under fences, etc. in an effort to keep the boundary weed-free.

Evaluation of cyclone losses in Q 96. D. J. Olsson. *Cane Growers' Quarterly Bull.*, 1980, **44**, 22-24. — Losses of up to 25% occurred in blocks of Q 96 cane damaged by a cyclone in 1979; most of the loss was due to stalk damage, only a small part being due to loss of sugar content. The wind susceptibility of varieties should be borne in mind when farmers are planning their variety program in cyclone-belt areas.

Proper land preparation essential to productivity. C. A. Rehbein. *Cane Growers' Quarterly Bull.*, 1980, **44**, 28-30. — If a plant crop is to be followed by five ratoons, the initial seed bed preparation can markedly affect output. Aspects of such preparation are discussed, including ploughing-out of the old stubble, protection against erosion, use of a green manure or grass fallow, land planing to reinstate depressions for restoration of efficient drainage, application of appropriate insecticides and fertilizers, etc.

Getting more from irrigation in the Central District. G. C. Wilson. *Cane Growers' Quarterly Bull.*, 1980, **44**, 30-32. — Trials during eight years in the Mackay area showed no significant yield response to irrigation in six of the years but increases of 15 and 34 tonnes.ha⁻¹ in the two driest years of the period. Factors affecting the usefulness of irrigation are described simply, and indications given of methods of determining when and how much water should be applied to the soil.

Response of sugar cane variety J-60-5 to various herbicides in post-emergence applications. E. Quintero F. and I. García R. *Centro Azúcar*, 1979, **6**, (3), 101-112 (*Spanish*). — Trials were carried out in which plant cane and two ratoon crops were treated with a number of post-emergence herbicides and the effects on the cane determined, as well as their weed control effectiveness. Actril X + Diuron affected the cane in both plant and ratoon crops, reducing growth and yield, while Ethazine + 2,4-D was ineffective for control of *Rotboellia exaltata* and *Panicum fasciculatum*, but Actril X + Azulam controlled the former weed without damaging the cane. Unlike the other treatments, however, this mixture did not control *Cyperus rotundus*.

Cultivation of profitable late autumn sugar cane by transplanting rayungans after summer rice in Taiwan. K. H. Tang. *Taiwan Sugar*, 1980, **27**, 122-123. — Trials are reported in which rayungans (pre-germinated plant-lets) of F 160 cane were raised for 55 and 75 days before being transplanted in fields on November 3 and December 3, respectively. Comparison with the results of planting ordinary top cuttings on the same dates showed that sugar yields in two successive crops were at least 9% higher with the rayungans, a fact which may encourage farmers to grow a late autumn cane crop after harvesting of summer rice in November-December rather than intercrop rice and cane, which creates difficulties in mechanical cultivation of rice.

Weed control with new herbicide Oxyfluorfen in sugar cane fields. H. J. Yeh. *Taiwan Sugar*, 1980, **27**, 125-129. Oxyfluorfen at 1.0 or 1.5 kg.ha⁻¹ a.i. proved highly effective against broad-leaf weeds and some grasses up to 50 days after application as a pre-emergence herbicide; similar results were obtained with Oxyfluorfen + Atrazine at 0.5 + 1.0 kg.ha⁻¹ a.i. and with Oxyfluorfen + Diuron at 0.5 + 0.8 kg.ha⁻¹ a.i. As a post-emergence herbicide, Oxyfluorfen had a shorter residual effect on weeds and was phytotoxic to F 160 cane, which, however, recovered some 30 days after spraying.

Planting the whole-stalk seed cane in TSC plantations. Y. C. Ma. *Taiwan Sugar*, 1980, **27**, 130. — Advantages of planting whole stalks in contrast to 2-bud setts are briefly indicated; the system has been adopted on plantations of Huwei sugar factory. It is stressed that close attention must be paid to the quality of the seed cane used.

Louisiana guide to controlling Johnson grass seedlings and annual weeds in sugar cane after planting in summer and fall, 1980. Anon. *Sugar Bull.*, 1980, **58**, (22), 14-17. Advice is given on chemical control of Johnson and itch grass as well as other (unnamed) annual grasses and broad-leaf weeds.

Planting time — seed nurseries. W. Jackson. *Sugar Bull.*, 1980, **58**, (22), 18. — The importance of efficient planting operations for high cane yields is discussed; however, it is stressed that even if all the operations are carried out correctly, yields will still be below the potential maximum if the planting material is of poor quality. Seed nurseries set up by individual growers will provide cane of the required quality, and guidance is given on how to establish a nursery. It is recommended to restrict each nursery to just one variety, and plant in it heat-treated cane or the progeny of heat-treated cane. The nursery should be kept free of grass and borer damage minimized (to prevent destruction of eyes and infection of the damaged area). Application of nitrogen to the nursery soil will increase cane height, thus reducing the number of canes needed for seed material.

Irrigation of sugar cane in Peru. A. Vásquez V., S. Helfgott L. and E. Paz-Vergara P. *Bol. Técn. Divn. Técn. Inst. Central Invest. Azuc.* (Peru), 1978, **7**, 1-52 (*Spanish*). — Irrigation plays an important role in sugar cane cultivation and is used for control of flowering and ripening in areas where water is abundant, and to minimize losses in areas where there is a water deficit. The cost can be substantial; in the cane-growing valleys of Peru, pumped subterranean water costs around 3-4 soles per m³ for an application of more than 1000 m³.ha⁻¹, which makes this cultural practice rather expensive. A survey is presented of the subject, with an account of the water resources in Peru, terminology, methods and types of irrigation most common in the country's sugar industry, aspects of water in the soil and its physiological role in the plant, considerations on improving the efficiency of gravity irrigation, and recommended practices.

Effect of late application of nitrogen to cane variety H 32-8560. IV. Action of the same, with relation to early application, on the variation of quality and nutrients with age. S. Valdivia V., J. Pinna C. and H. Tello A. *Saccharum* (Publ. Cient. Inst. Central Invest. Azuc., Peru), 1979, **7**, (1), 18-48 (*Spanish*). — Nitrogen fertilizer was applied to plant and first ratoon cane both early and

in two parts, one of them late. No statistically significant variations were observed in quality characteristics or plant nutrient contents, although there was a significantly higher moisture content in the treated ratoon cane. Application of N to the soil increased the plant N content and decreased the P content. There are different variations in plant Ca, K, Mg and Na pattern with N fertilization, and these are described. The effects of N fertilization are more pronounced in the early stages of cane growth and are weaker as the cane becomes older; it is deduced that it is not possible to establish the nutrient contents for specific ages and N rates.

Optimization of the dosage of nitrogen and age at harvest of the sugar cane variety H 32-8560. E. Angulo A., S. Saldarriaga A. and H. Tello A. *Saccharum* (Publ. Cient. Inst. Central Invest. Azuc., Peru), 1979, 7, (1), 61-73 (Spanish). — Cane of the title variety, grown in the CAP Cayalti region, was treated with nil and four levels of N fertilization and harvested at five ages between 13 and 29 months. The results were subjected to economic analysis which showed that the maximum net profit per hectare-year was afforded by use of 310 kg N per ha and harvesting at 22.2 months.

Relation of leaf and sheath hydration with yield during ripening of sugar cane. O. Singh and K. Singh. *Maharashtra Sugar*, 1980, 5, (10), 9, 11. — Data from two seasons showed a positive and significant correlation between leaf and sheath moisture on the one hand and cane yield on the other. Relative turgidity of leaf and sheath had a positive but not significant correlation with leaf moisture and contributed only 6.39% to cane yield, compared with 15.79% contributed by leaf moisture. The results indicate that increase of the hydration levels of leaf and sheath tissues under low-temperature ripening conditions causes increase in yield.

Sugar cane research development in India: an appraisal. R. V. Sinha. *Maharashtra Sugar*, 1980, 5, (10), 39, 41-43, 45-46. — A general survey is presented of the history, aims and achievements of cane research in India.

Sugar cane irrigation trial. G. Loynet. *Ann. Rpt. Inst. Rech. Agron. Trop. Cult. Vivr.* (Réunion), 1979, 13-17 (French). — A trial is reported which is the continuation of one started in 1973 and in which irrigation was either continued until harvest or was stopped 4½, 3 or 1½ months before harvest. Results showed no significant differences between cane performances (yield, sugar content, extractable sugar yield, juice purity, cane fibre content and dry solids) with the four treatments. The difference in water consumption between continued irrigation and stoppage 4½ months before harvest was only 10% of the total consumed with continued irrigation, which (at 130 mm) was considered inadequate to have any effect on performance.

Yield-contributing characters of three varieties of seasonal sugar cane as influenced by irrigation based on pan evaporation. D. A. Chavan, K. R. Pawar, D. N. Borulkar and B. D. Jadhav. *Indian Sugar*, 1980, 29, 73-80. — The effect of irrigation scheduling on cane growth parameters was determined. Results showed that irrigation at 75 mm cumulative pan evaporation (CPE) was better than at 125, 175 and 225 mm CPE in terms of number of tillers, height, number of leaves, leaf area, number of internodes and length and diameter of the middle internode. The three varieties investigated reacted differently except as regards height.

Phytotoxicity of chlorine gas on sugar cane. M. M. Guevarra, R. C. Sampang and J. D. Recuenco. *Sugarcane Pathologists' Newsletter*, 1980, (24), 26-27. — Cane affected by chlorine gas leaking from a road tanker suffered no damage to midribs, leaf sheaths or stalks, but the leaf blades turned reddish-brown; in severe cases, premature drying occurred. Leaf blade chlorosis was the only symptom found in cane further from the source of the gas. The toxicity symptoms lasted for about 1 month, after which the cane recovered, old affected leaves being replaced with healthy ones. Growth and stand were apparently unaffected.

Salinity — a burning problem in the sugar cane growing areas of Maharashtra. G. R. Naik, T. M. Patil and P. S. Kokate. *Proc. 29th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1979, (2), 25-30. — While the total soluble salts contents in soil samples from an area near Kolhapur were mostly up to 0.30%, in three cases the values were 0.75%, 0.78% and 1.20%. Soil pH ranged from 7.4 to 8.1. Since the soils were not sodic, application of gypsum would not solve the problem of salinity, but improved drainage would permit the salts to be leached out.

How to manage severely droughted sugar cane. Anon. *S. African Sugar J.*, 1980, 64, 408. — It is stated that there are two distinct categories of cane badly affected by drought and that they should be treated differently. Where the stalk is long enough to be cut and transported to the mill, this should be done before the stalk becomes dry and deteriorates. Where the stalk is too short to be cut and handled in the normal way and there is no green leaf visible, the cane should be left in the field. It is argued that "slashing back", sometimes claimed to save the roots, is inadvisable, since (i) it stimulates the development of new shoots which will die if the drought persists, (ii) the moisture and nutrients in the short stalk help to keep the lower buds alive, and (iii) it does not conserve moisture, as the rate of transpiration is negligible in drought-affected cane. Experiments conducted during the drought of 1973/74 clearly showed that such drastic cutting of the stalk reduced yield in the following harvest. Once normal growing conditions return, the new crop will be regenerated primarily from the underground buds, although some sideshoots will develop and persist until harvest. A weed problem is likely to develop with this type of cane because of the loss of leaf canopy and an inadequate trash blanket. Recommendations are given on fertilization of drought-affected ratoons.

It pays to spray with this S.A.-designed traveller. Anon. *S. African Sugar J.*, 1980, 64, 449-450. — A self-propelled spray irrigator designed by a cane grower is described and illustrated. Advantages of the system are: it does not drag its water supply line, is not limited to straight-line operation (but can negotiate curves, work in circles, along contours, in rectangles, etc.), has an automatic braking system that permits it to work uphill or downhill as well as on level ground, and is simple and of robust construction.

The control of *Cyperus rotundus* in sugar cane fields and in fallow land. G. McIntyre, C. Barbe, J. Pitchen and M. Yeriaha. *Sugar News* (Philippines), 1980, 56, 55-58. See *I.S.J.*, 1981, 83, 173.

CANE PESTS AND DISEASES

Some new developments in the rearing and field release of *Trichogramma australicum* Gir. in the Madurakantam Sugar Factory area of Tamil Nadu. A. R. Solayappan. *Indian Sugar*, 1980, 30, 19-24. — Trials were undertaken on the release of *T. australicum*, an egg parasite, to reduce the incidence of *Chilo sacchariphagus indicus*, the internode borer, which is a serious pest in Tamil Nadu. Cane infestation was reduced from 70-71% to 38-40% and, since the borer causes about 15% weight loss and about 4% loss in sugar recovery, the control method was economical. A cheap method of rearing the alternative host *Cercyra cephalonica* on a rice bran-bajra mixture has been devised.

A new aerated steam oven for control of ratoon stunting disease of sugar cane. R. J. Steib. *Sugar J.*, 1980, 43, (2), 8-9. — A new, larger unit has been designed for the aerated steam treatment of sugar cane planting material which can deal with 3 short tons of cane at a time. It may be fully mechanized and, using a program of 54°C for 4 hours, gives excellent control of ratoon stunting disease and provides cane for growers with 500-750 acres.

Translocation of the herbicide Round-up by the sugar cane sett and the collateral symptoms caused. C. R. dal Piccolo, S. Matsuoka and Y. Masuda. *Brasil Açuc.*, 1980, 95, 200-207 (Portuguese). — The title herbicide has been used to rogue diseased plants in sugar cane nurseries, but it has been suspected that it has been transmitted along a sett to plants growing from other buds. This is confirmed by experiment and occurs with treatment even 90 days after planting. The translocation can occur through at least 5 internodes, the effects diminishing with distance from the plant treated and being inversely proportional to the vigour and size of the plant, independent of age. The effects can be severe enough to cause the death of the plant, or can be milder, causing the death of the apical meristem, lateral shoot development with abnormal pigmentation, or profuse abnormal tillering from the base, continuous white streaks, etc. Some of the symptoms are similar to those of leaf scald disease, genetic albinism or pokkah boeng.

Smut race situation in Hawaii. S. Ferreira. *Rpts. Hawaiian Sugar Tech.*, 1979, 83-86. — In 1976, smut infection was found in H 50-7209, a variety which had previously proved resistant, and the susceptibility was found to be to a new strain of the fungus (*Ustilago scitaminea*). The nature of the genetics concerned is discussed and it is calculated that mutation and hybridization could result in a new strain for every 10,000 acres. This has not been encountered in practice, however, and possible reasons are suggested. The occurrence of different strains in Hawaii is discussed, and it is thought possible that a third strain exists. Steps which should be taken to

reduce the probability of formation of new strains are listed.

Control of the sugar cane borer *Diatraea saccharalis* Fabr. 1794: new trials with insecticides. P. S. M. Botelho, A. C. Mendes and N. Macedo. *Brasil Açuc.*, 1980, 95, 357-380 (Portuguese). — Trials were carried out with various dosages of Decametrin 0.1G, Thiafanox 10G, Carbofuran 5G, Endosulfan 3G and Parathion Ethyl 5G granular insecticides at various periods of application and in different areas. No chemical gave satisfactory control of the moth borer *D. saccharalis*, Endosulfan 3G at 50 kg.ha⁻¹ producing the best results.

Light source tests for trapping *Eldana saccharina* Walker moths. P. R. Atkinson. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 151-153. — Light traps with 13 different sources of light were compared for sampling *E. saccharina* moths. White light proved the most attractive, while ultra-violet light was not particularly attractive. Blue, green and white fluorescent light proved more attractive than red or yellow; however, light intensity seemed more important than colour, bright and very dim sources being less attractive than moderately bright ones.

The incidence of moth borers in South African sugar cane during the 1979/80 season. A. J. M. Carnegie and R. J. Smaill. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 154-157. — Mill yard and field survey statistics showed a general increase in incidence of both *Eldana saccharina* and *Sesamia calamistis* borers in many parts of the South African cane area, the Amatikulu area being most adversely affected. A comparison of borer numbers and aspects of field management practice showed that, where *E. saccharina* is present, there is a marked potential for build-up in numbers as the crop ages.

The evaluation of nematocides on Mount Elias farm at Fawn Leas. E. H. Ringelmann. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 158-160. — A fall in cane yield at the title farm from 119 tonnes.ha⁻¹ in 1974/75 to 69 tonnes.ha⁻¹ in 1979/80 was attributed to nematodes, and a trial using a nematocide applied in the furrow at planting was carried out. The average yield response was 41 tonnes of cane per ha, with increases of 42 tonnes on one soil and 53 tonnes on another. Trials with application of nematocide in bands on both sides of the cane row produced an average response of 23 tonnes.ha⁻¹; however, the poor response on one soil was not economical.

The susceptibility of varieties to mosaic and the effect of planting date on mosaic incidence in South Africa. R. A. Bailey and P. H. Fox. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 161-167. — The majority of South African cane varieties are resistant to mosaic, but N:Co 376 and N:Co 293 are highly susceptible. Application of Temik (Aldicarb) to the soil at planting was not beneficial in controlling mosaic. Mosaic transmission was restricted to January-May, but very rapid spread only occurred in mid-January to March, i.e. late summer and early autumn. The susceptibility of cane to infection varied considerably with plant development. Young plants of N:Co 376 at 6-12 weeks were much more susceptible than older plants. Plants of N:Co 376 at more than 16-20 weeks were not severely infected, although very rapid spread occurred concurrently in younger plants. Differences of only 3-5 weeks

in planting date exerted a marked effect on subsequent mosaic incidence. Planting susceptible varieties in early spring, thus avoiding the coincidence of a young, susceptible growth with maximum vector activity in late summer and autumn, may enable crops to escape severe outbreaks of mosaic.

The development of an improved method for evaluating sugar cane for resistance to smut. H. L. Lloyd and M. Pillay. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.* 1980, 168-172. — The isolation from bud scales and partial characterization of highly active low molecular weight germination inhibitors, in concentrations correlated quantitatively with resistance of N 52/219, N11, N:Co 376 and N:Co 293, holds promise for the development of a rapid, quantitative chemical assay for evaluating sugar cane for pre-infectious resistance to smut. Histopathological studies on stalk and meristem colonization by *Ustilago scitaminea* did show, however, that there are post-infectious forms of resistance that may be independent of pre-infectious resistance. The two forms of resistance may be the basis of differential varietal response to smut races.

Leaf scald declines in Burdekin area. I. T. Freshwater. *Cane Growers' Quarterly Bull.*, 1980, 44, 10-11. — Since the record incidence of leaf scald on farms in the Burdekin area of Queensland was observed in mid-1978, the susceptible variety Q 63 has been removed from the approved list and the area under it reduced from 60 to 28%, with an expected level of 12% for 1981. As a consequence, the number of infected farms had fallen from 325 to 277 by mid-1980. The replacement variety, Q 96, is somewhat susceptible, but heat treatment of planting material is being combined with its use.

Bud moth borers a problem at Tully. C. R. Nalder. *Cane Growers' Quarterly Bull.*, 1980, 44, 11. — The title borer, *Opogona glycyphaga*, has been responsible for poor germination over two years in the Tully area, but is difficult to detect. When susceptible varieties are to be planted, the whole plant source should be inspected for damage, the nature of which is described.

Field sanitation procedures at Central Romana. J. D. Ayata and R. E. Perdomo. *Sugar J.*, 1980, 43, (3), 31-34. — Details are given of the cane quarantine procedures used at Central Romana in the Dominican Republic. Phytopathological surveys are continuously conducted for mosaic, leaf scald, smut and rust on plant and ratoon cane of 2-4 months of age in fields belonging to Central Romana, while growers' fields are also sometimes surveyed, particularly for mosaic. The situation as regards mosaic, leaf scald, Fusarium stem rot, red rot, ratoon stunting disease and smut is discussed for each disease in turn, and a list is given of minor diseases recorded at Central Romana.

Soil infection and the spread of red rot disease of sugar cane. M. N. Sarma, Y. Satyanarayana, M. A. R. Rao and S. V. R. Rao. *Maharashtra Sugar*, 1980, 5, (10), 13-15. Cane setts, planted in soil to which chopped cane pieces, naturally infected with red rot, had been added, exhibited greater red rot incidence (% number of affected clumps/total number of germinated clumps) up to harvest than did setts planted in soil containing chopped cane pieces which had been artificially colonized with the red rot pathogen; controls remained uninfected in soil containing no diseased cane pieces. Setts planted in red rot-infected soil in pots showed the first symptoms

of the disease in the outer scales of the bud, followed (5 days later) by infection of the external nodal region (including leaf scar) and, to a lesser extent, of the internal nodal tissues. Next to be infected was the basal portion of the shoot in contact with the soil. Sett roots and tissues from the cut ends of the setts showed no infection at all.

Further report on leaf scald disease of sugar cane in Andhra Pradesh, India. Y. Satyanarayana and M. A. Rao. *Maharashtra Sugar*, 1980, 5, (10), 31-32. — Out of thirteen cane varieties, only two (CoA 71-1 and CoC 671) were found to be uninfected with leaf scald, while the number of diseased clumps per ha for the other eleven ranged from 70 for Co 62175 to 9090 for Co 62198.

Field observations on sugar cane borers. B. Vercambre. *Ann. Rpt. Inst. Rech. Agron. Trop. Cult. Vivr. (Réunion)*, 1979, 19-23 (French). — Results of a preliminary investigation on borers in Réunion are reported. *Sesamia calamistis* (pink borer) was the main one found on young cane (up to 6 months old), while *Chilo sacchariphagus* (spotted borer) was that chiefly found on cane older than 6 months, although appreciable numbers were found on cane of 3-6 months. The other two borers found, *Argyroplote schistaceana* (white borer) and *Opogona* sp. (maroon borer) occurred only in small numbers. Some information is given on parasites of the first two borers named above.

Artificial breeding of *Chilo sacchariphagus* (Lep.:Pyralidae). B. Vercambre. *Ann. Rpt. Inst. Rech. Agron. Trop. Cult. Vivr. (Réunion)*, 1979, 24 (French). — Brief mention is made of attempts at artificial breeding of the title borer. A bacterial infection has proved difficult to combat, although seven generations were obtained over a 10-month period, but some larvae had to be introduced from elsewhere halfway through the period. Some criteria for successful breeding of the borer are indicated.

Field observations on cane-defoliating night moths. B. Vercambre. *Ann. Rpt. Inst. Rech. Agron. Trop. Cult. Vivr. (Réunion)*, 1979, 25-28 (French). — Of six leaf-eating night moths found in Réunion, the most important in investigations conducted on 13 cane plots attacked (out of a total of 62 plots) were *Leucania pseudoloreyi* (the most frequently found but often at a low level of incidence), *Athetis ignava* and *Simplicia inflexalis* (less frequent but in larger concentrations). Damage has been restricted to pockets as a result of natural factors, among which parasitism is only of minor importance. Trash along the rows favours reproduction of the pests and should be burnt.

Germplasm and disease resistance. O. W. Sturgess. *Sugarcane Pathologists' Newsletter*, 1980, (24), 1-3. The eradication of a particular cane disease may not be the best solution to the problem in the long term because of the danger of releasing susceptible cane varieties not tested for their reactions to a disease which is absent at the time. It is difficult to control diseases in a situation that is constantly changing, while selecting varieties for disease resistance is complicated and expensive. A disease resistance program should extend beyond the field resistance of commercial varieties — it should also take account of past, present and future contributions of the basic germplasm. The author calls for an international collaborative effort to screen the basic

germplasm in the World Collection for resistance to specific diseases and for correct identification of diseases and their strains. The rapid movement of people and plants throughout the world places in question the adequacy of quarantine measures, and mention is made of the severe outbreak of Fiji disease in Australia, where the policy has been changed from one of eradication to acceptance of a low endemic level of the disease, with testing of large cane populations for resistance in the early stages of selection.

The origin of the current rust epidemic in the Caribbean. A. M. Whittle and D. Holder. *Sugarcane Pathologists' Newsletter*, 1980, (24), 4-7. — Theories postulated by various authors on the origin of the rust outbreak (caused by *Puccinia melanocephala*) in the Western Hemisphere in 1978 are surveyed and reasons for their rejection indicated. Measurement of the mean length and breadth of uredospores of the pathogen obtained from different parts of the world showed a fairly wide range of sizes but remarkably small variation in the length: width ratio; on the basis of these findings, it is suggested that a spore cloud moving around the earth resulted in simultaneous epidemics in widely differing locales.

Sugar cane smut in Mexico. S. C. Flores. *Sugarcane Pathologists' Newsletter*, 1980, (24), 8-10. — The reactions of 50 cane varieties to smut (caused by *Ustilago scitaminea*), first identified in Mexico in 1980, are tabulated. The screening trials were conducted at Tower Hill, Belize, on behalf of the Mexican Sugar Institute.

Host range of *Ustilago scitaminea* Syd. in the Philippines. A. S. Latiza. *Sugarcane Pathologists' Newsletter*, 1980, (24), 11-13. — Two methods of inoculation were used in investigations to determine the host range of *U. scitaminea* in the Philippines. Of the 24 species of plants tested, only *Saccharum spontaneum* and *Rott boellia exaltata* proved susceptible to the pathogen, the symptoms (which appeared two months after inoculation) resembling those found on sugar cane. Re-isolation of the fungus and re-inoculation readily produced the same symptoms, while the morphological characteristics of the re-isolated fungus were identical to those of the original isolate.

Association of a bacterium-like organism with ratoon stunting disease of sugar cane in Kenya. W. J. Kaiser and A. H. Ramos. *Sugarcane Pathologists' Newsletter*, 1980, (24), 14-16. — Electron microscopy revealed a bacterium-like organism in juice extracted from RSD-infected cane (Co 421) growing in Kenya. The size and shape of the organism were similar (and probably identical) to those described earlier by other authors and associated with the disease.

Leaf scald ratings of foreign and commercial varieties in Queensland. C. C. Ryan, D. M. Hogarth and B. J. Croft. *Sugarcane Pathologists' Newsletter*, 1980, (24), 16-18. The procedure followed by the Bureau of Sugar Experiment Stations in Queensland in testing for leaf scald resistance is outlined and a list given of ratings of a large number of Queensland and foreign cane varieties.

Recent findings of dwarf disease and striate mosaic in Queensland. B. J. Croft and C. C. Ryan. *Sugarcane Pathologists' Newsletter*, 1980, (24), 19-20. — In 1979, a few stools of Q 87 cane, growing in a mother plot

supplying Fiji disease-free cane in the Bundaberg area (600 km south of Mackay), exhibited symptoms of dwarf disease (short, stiff leaves with many fine white stripes, transverse splits in the leaf blades and distortion and enlargement of vascular bundles in the areas of white striping), although previously the disease had been thought to be restricted to the Mackay district. In view of the six years between appearance of the symptoms and introduction of the cane variety to the area from a section of the Mackay district where the disease had never been reported, and because of the improbability that the disease remained latent during that period, it is suggested that the causal agent must be more widespread in Queensland than was previously thought. In the last few years, cane of Q 97 variety has shown symptoms similar to those of striate mosaic or Trojan mottle; it is not known which of the two diseases is involved — they are very similar, but have only been found together, although they are distinct. They are considered of minor importance in Queensland.

Inhibition of infectivity of sugar cane mosaic virus by leaf extracts. K. Shukla and R. D. Joshi. *Sugarcane Pathologists' Newsletter*, 1980, (24), 21-22. — Leaf extracts from sixteen plant species were tested for their effect on the infectivity of sugar cane mosaic virus (SCMV). The results showed that % inhibition ranged from 10 to 75, extracts from *Capsicum annuum* and *Datura stramonium* having maximum effect. The exact chemical nature of the inhibitors was not determined.

Development of wilt disease in sugar cane through sett and soil inoculations. K. Singh, N. Singh, R. P. Singh and S. R. Misra. *Sugarcane Pathologists' Newsletter*, 1980, (24), 23-25. — Cultures of *Acremonium terricola* and *Fusarium moniliforme* var. *subglutinans* were thoroughly mixed with natural soil in which single-bud setts from apparently healthy stalks of Co 527 cane were planted, while other setts from the same cane variety were inoculated by steeping in spore suspensions of the two pathogens, separately or mixed, followed by planting in microplots. Each of the pathogens caused symptoms of wilt in more than half of the clumps, while the mixed inocula caused a higher disease incidence with both soil and sett inoculation. By comparison, the uninoculated controls suffered only slight disease incidence (attributed to the accidental presence of some pathogens in the unsterilized soil). Because of its high frequency in root and internodes, *F. moniliforme* var. *subglutinans* is regarded as a pathogen of parenchymatous tissue, whereas *A. terricola*, occurring more frequently in the nodes, is a vascular pathogen.

Leaf scorch outbreak in Cagayan Sugar Company mill district. R. C. Sampang, M. M. Guevarra and J. D. Recuenco. *Sugarcane Pathologists' Newsletter*, 1980, (24), 28. — In only the second season of cane cultivation in the title area of northern Philippines, an outbreak of leaf scorch (caused by *Stagonospora sacchari*) occurred, eventually covering 7% of the total 5000 ha under cane. Suggested reasons for the outbreak include the introduction of the pathogen in the planting material or adhering soil, and the possibility that the fungus was present in the area before cane was cultivated, existing on alternative hosts such as *Saccharum spontaneum*, the predominant weed.

Effect of some nematocides on sugar cane in the Punjab. K. S. Waraich. *Sugarcane Pathologists' Newsletter*, 1980, (24), 29-31. — Tests were conducted on nema-

tode control by three different chemicals applied at lower doses than previously in view of their high cost. Most effective in terms of cane growth and yield was Dasanit at 1, 2 or 5 kg.ha⁻¹ a.i., followed by Furadan, then Temik (at the same three dosage rates). However, none of the treatments had any effective control over the nematode populations, but Danit and Furadan at 5 kg.ha⁻¹ a.i. significantly reduced numbers of *Tryporyza nivella* (top borer) and *Chilo infuscatellus* (shoot borer).

Control of nematodes attacking sugar cane with nematicides and organic amendments. J. D. Recueno. *Sugarcane Pathologists' Newsletter*, 1980, (24), 32-34. Pot and field trials on nematode control with various nematicides and organic materials are reported. All treatments markedly reduced the nematode population, while nematicides gave better sett germination than the organic materials, which, however, gave better plant growth. Temik 15G and filter cake increased cane growth considerably and gave the highest cane and sugar yields. Results, in decreasing order of efficiency (in terms of nematode control and growth and yield parameters) were: Temik 15G > filter cake > Furadan 3G > sawdust > bagasse > rice hull > Basudin 10G > Mocap 5G.

A new variety of *Metarhizium anisopliae* from *Pyrilla* leaf hoppers of sugar cane. M. B. Bachchhav and D. G. Hapase. *Sugarcane Pathologists' Newsletter*, 1980, (24), 34. — Parasitization of larger numbers of *Pyrilla purpusilla* by the fungus *M. anisopliae* in cane fields of Maharashtra is reported. The occurrence of the fungus was encouraged by high atmospheric humidity.

Note on two fungi on *Chilo infuscatellus* Snell. A. S. Patil, M. B. Bachchhav and D. G. Hapase. *Sugarcane Pathologists' Newsletter*, 1980, (24), 35-36. — Two fungi isolated from diseased larvae of the early shoot borer, *C. infuscatellus*, were identified as *Aspergillus flavus* and *Penicillium purpurogenum*. Their pathogenicity was tested by two methods. The larvae became lethargic within four days of inoculation and suffered 40-100% mortality in Petri dishes. *A. flavus* was more virulent and caused greater mortality in both methods.

Post-infection physiology of whip smut-infected sugar cane variety Co 740. S. D. Sankpal and J. D. Nimbalkar. *Proc. 29th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1979, (2), 31-38. — The effects of *Ustilago scitaminea* on cane metabolism are described as a result of investigations conducted on a cane variety that is highly susceptible to smut.

Drought devastates RSD-infected cane. Anon. *S. African Sugar J.*, 1980, 64, 405, 408. — Ratoon stunting disease was found in 32% of almost 1000 fields inspected and on 69% out of more than 200 farms visited; distribution of the disease varied from area to area, affecting more than 50% of the fields and all farms in the worst affected districts, incidence being lowest in the more recently established areas in cooler districts. The major cause of the high incidence was considered to be the planting of diseased seed cane. The need for hot water treatment of all planting material and eradication of volunteer cane (in which the disease can survive) is stressed. Control of RSD in the principal cane variety grown in South Africa, N:Co 376, is difficult because this variety does not usually reveal internal symptoms of the disease, so that detection in the field is not easy; it is also highly in-

tolerant of RSD, particularly under dry conditions. In a field trial involving RSD-infected seed cane, the yield reduction caused by the disease was lower in plant cane exposed to ample rainfall than in ratoon cane grown under dry conditions, which almost killed infected N:Co 376 cane; pretreatment with hot water for 2 hr at 50°C allowed the cane to survive the drought.

Studies on the biology and feeding potential of *Chiloonus cacti* L. (Coccinellidae: Coleoptera), a predator on the scale insect of sugar cane, *Melanaspis glomerata* Green. T. A. V. S. Raghunath and B. H. K. Rao. *Indian Sugar*, 1980, 29, 81-85. — Biological studies showed that the average pre-oviposition, egg, larval and pupal periods of the title predator were 9.1, 5.4, 13.6 and 7.8 days, respectively. The total life cycle from egg to adult was 26.8 days, while the longevity and fecundity of the females were 40 days and 36 eggs, respectively. Larvae consumed an average of 52.8 scales, while an adult beetle consumed an average of 104 scales per day.

Seasonal variation in the life cycle of two indigenous predators of the scale insect of sugar cane. T. A. V. Raghunath and B. H. K. Rao. *Indian Sugar*, 1980, 30, 177-179. — Investigations showed variation in the pre-oviposition period, egg period, grub period, pupal period, life cycle, longevity and fecundity with season in the case of two important predators of the scale insect (*Melanaspis glomerata*), viz. *Chilocorus nigrinus* and *Pharoscyrmus horni* (Coccinellidae: Coleoptera). While there were differences in the values of the biological factors between the two predators, the pattern of variation was the same, with maxima occurring in the winter months, November-February.

Determination of a strain of *Xanthomonas albilineans* (Ashby) Dowson isolated in Upper Volta. P. Baudin and M. Chatenet. *Agron. Trop.*, 1980, 35, 288-291 (French). Morphological, physiological, biochemical and biological tests were conducted on a strain of *X. albilineans* (the causal agent of leaf scald) isolated from B 73436 cane growing in Upper Volta. From indirect immunofluorescence tests, the strain appears to be a specific serotype but having antigenic properties similar to those of other heterologous strains of *X. albilineans* isolated in Guadeloupe, Kenya and Réunion.

Fungicide trials for rust disease loss assessment. G. R. McNamara. *Cane Growers' Quarterly Bull.*, 1980, 44, 49-50. — Out of 21 fungicides initially tested for control of rust (caused by *Puccinia melanocephala*), eight were selected for further testing. While Bravo, Dithane, Plantvax and Polyram proved the best when sprayed on infected Q 90 ratoons, the disease was of sufficiently light intensity to warrant further trials under conditions of heavy rust development. Bravo was used in experiments to determine the effect of the disease on cane yield, which was to be compared with that of untreated cane, although again rust intensity was low. Broad-scale application of fungicides to control rust in cane fields is considered uneconomical and is not recommended.

Fiji disease control at Isis. C. D. Jones. *Cane Growers' Quarterly Bull.*, 1980, 44, 60-61. — Measures to control Fiji disease in the Isis mill area of Queensland involve releasing resistant cane varieties and ploughing-out and destroying susceptible ones. Details are given of the varieties.

SUGAR BEET AGRONOMY

Crop maintenance work in beet. A. Vigoureux. *Le Betteravier*, 1980, 14, (142), 11-14 (French). — Advice is given on aspects of field operations after seed drilling. While rolling is sometimes necessary to facilitate use of steerage hoes and/or manual thinning, it is considered better to avoid using rollers, for a number of reasons which are stated, particularly in view of the fact that the press wheels on the drills ensure that the seed gets enough moisture to germinate. Where spacing is less than 17 cm, manual thinning may be beneficial as regards the final plant population. Adjustment of steerage hoe components, how to obtain optimum results, and types of hoe available are described. Post-emergence herbicide application is briefly discussed.

Growth, pests and diseases of sugar beet in Belgium, 1978. L. van Steyvoort. *Publ. Trimest. Inst. Belge Amél. Betterave*, 1979, 47, 145-159 (French, Dutch). — The 1978 beet growing season in Belgium is reported. Pest and disease incidence was relatively insignificant, although mention is made of the adverse effects of heavy rain on sloping ground, which resulted in asphyxiation of the seedlings where they were encased in a bed of mud or were immersed in water (the soil having been laid bare). However, the after-effects were much less severe than had been feared. The effect of rain was also evident in the phytotoxic effect of herbicides — abundant spring rain promoted the action of the herbicides, but where their efficiency was high and the fields freed from weeds, the beets also suffered, so that the populations were reduced.

The effect of weed infestation on the quantity and quality of the sugar beet crop. K. Posch. *Cukoripar*, 1980, 33, 48-53 (Hungarian). — Trials with a number of herbicide mixes over three years at one location are reported. Results varied between the years, so that the mix that gave best results in one trial did not necessarily do so in the others. However, all gave considerably better results in terms of beet and sugar yield than did the unweeded control, while there was little difference in sugar contents between treatment and non-treatment. However, best results were given by hacking the weeds, while hoeing gave results that were better than or at least as good as chemical treatment.

Integrated weed control in sugar beet. I. The aim and importance of competition investigation. J. Pozsgai. *Cukoripar*, 1980, 33, 58-61 (Hungarian). — Before a program of integrated weed control can be established, information must be available on the competition between beet and weeds, which is governed by a number of factors such as type of weed, growth density, distribution, etc. From knowledge of these factors, a competition index can be calculated and hence the level of harm to the beet crop and the protection threshold. Thus, a system can be developed which is optimum both economically and environmentally.

Soil acidity. P. Draycott. *British Sugar Beet Rev.*, 1980, 48, (2), 13. — Acid soils damage beet seedlings and permit the toxic action of excess Mn. The soil pH may be measured by a simple and inexpensive colour indicator kit and lime applied if it is below 5.8. The techniques will vary, depending on whether only a small area or a large one is to be treated, and a form of lime employed, e.g. hydrated lime, ground chalk or limestone, which is not toxic to the plants.

Weed beet — round-up of mechanical control methods. N. Turner. *British Sugar Beet Rev.*, 1980, 48, (2), 22-23. — The most common method of mechanical control is to cut the bolted weed beet an inch or so above the level of the crop beet; cutting too low encourages regrowth from below the crop beet level. Since the beet is not killed, a second pass is needed to remove regrowth after the first. This will achieve 70% control at best, however, and manual treatment is required to achieve the target of 95%. Four machines are available for the purpose, two of which are illustrated. The second mechanical treatment is the use of a herbicide roller which operates above the crop level and kills the weed beets; several passes are required during a season, and care must be taken to avoid damage to the crop, since the herbicide applied, Round-up, is lethal to beet plants.

Weed beet — the developing situation. G. Mughan. *British Sugar Beet Rev.*, 1980, 48, (2), 24. — The increase in the extent of weed beet development in the UK is discussed. From 15% in 1977, the proportion of the beet area in which misplaced seedlings have been found had risen to 24% in 1979. Many farmers have taken no action against weed beet infestation, but it is becoming more generally recognised that the problem is widespread and that measures must be taken to control weed beet.

Summer launch for the Standen Stalwart. W. Hollowell. *British Sugar Beet Rev.*, 1980, 48, (2), 46. — An illustrated description is given of a new beet harvester-cleaner. It can operate in either 2 or 3 rows and with either a 2- or 4-tonne tank. It can handle about 25 tonnes.hr⁻¹.

Weather and the growth of sugar beet. P. Biscoe, P. Draycott and K. Jaggard. *British Sugar Beet Rev.*, 1980, 48, (2), 47-49. — In the UK the incident solar radiation decreases rapidly after July and a beet crop with a full leaf canopy intercepts only as much radiation in August and September as in June and July when leaf cover was incomplete. The potential for sugar production would thus be increased greatly if full leaf cover could be achieved in the earlier months. Leaf growth is hindered by lack of N fertilizer and water, and irrigation can also prevent a further loss of leaf area after mid-July.

Beet agriculture in Belgium. Anon. *Sucr. Belge*, 1980, 99, 225-230 (French). — A survey is presented of beet agricultural practices in Belgium, where 124,000 ha are devoted to the crop.

Beet seed quality in 1980. R. Vanstallen. *Le Betteravier*, 1980, 14, (143), 11-13 (French). — Aspects of beet seed quality are briefly discussed, including germinating capacity, monogerm, vigour, calibration of and seed adaptation to drills, and weight per 100,000 clusters. All but the last characteristic are tabulated for a number of varieties classified under precision seed and genetic monogerm seed.

Weed control in beet. A. Vigoureux. *Le Betteravier*, 1980, 14, (143), 14 (French). — With the aid of photographs, the author briefly advises on measures to adopt in tackling weeds, particularly bolted beet.

Changing agricultural techniques and their effect on productivity in the sugar beet crop. T. P. J. Dyke. *Paper presented to the 25th Tech. Conf., British Sugar Corp. Ltd.*, 1980, 9 pp. — Changes in beet agriculture in the UK are briefly discussed, with mention of increased mechanization after 1945, the introduction of monogerm seed and drilling to stand, and the use of herbicides for weed control. The relationship between sugar yield and intercepted solar radiation has been the subject of study at Broom's Barn Experimental Station, as has the effect of factors such as virus yellows incidence. The need for growers to be aware of development in order to permit them to maximize their crops is stressed.

The economics, productivity and competitiveness of beet cultivation. A technico-economic analysis. G. Kitsopani *et al.* *Hellenic Sugar Ind. Quarterly Bull.*, 1980, (41), 109-199 (Greek). — A detailed analysis is made of the economics of beet cultivation in the regions of four sugar factories (Larisa, Platy, Serra and Xanthi), and comparison is made with the returns on various other vegetable and grain crops as well as cotton. The effects of items such as use of monogerm and multigerm seed and of cropping in the long- and short-term rotation are considered, as well as the costs of individual factors such as agricultural chemicals. The results are given in tabular and graph form.

The beet — irreplaceable vanguard of the rotation? J. Hebert. *Sucr. Franç.*, 1980, 121, 237-248 (French). The significance of the role played by the sugar beet in the rotation centred on wheat is discussed, including its beneficial effect on soil structure, the part played by the fertilizers, fungicides, pesticides and herbicides applied to wheat on the beet (and other crops), and the favourable position of beet as regards the toxic effect of degradation products in the soil on the wheat. On balance, the beet is seen as irreplaceable by other crops, provided the farmer makes greatest use of its advantages, including its role as a source of by-products of agricultural value.

Humus supply and soil treatment — two current problems. W. C. von Kessel. *Die Zuckerrübe*, 1980, 29, (4), 8-10, 12 (German). — The importance of providing humus as a source of organic matter for the maintenance of an adequate beet yield, and the value of ground cover crops as green manure and as a means of preventing soil erosion are discussed.

Optimizing sugar yields with the aid of soil analysis. H. Bronner. *Die Zuckerrübe*, 1980, 29, (4), 13-14 (German). — A rational program of soil analysis is described which involves determination of the N, P, K and Ca contents as well as trace elements. Criteria for soil fertility are indicated.

Irrigation of sugar beet. H. Lang. *Die Zuckerrübe*, 1980, 29, (4), 19-22 (German). — Investigations of the effect of irrigation and N fertilization on beet yield showed that, in areas of low rainfall, irrigation led to an increase in yield, particularly when coupled with intensive fertilization and judicious use of plant protection chemicals. Over a 9-year period, an average increase of 0.2 tonnes of beet per ha was obtained per mm (10 m³.ha⁻¹) of irrigation water in a region of typically

warm weather and low rainfall, irrespective of moisture conditions during the main growth period. Hence, rain plus irrigation provided approx. 100 mm of water in June, 120 mm in July, 100 mm in August and 50-60 mm in September. N fertilization at a "normal" rate increased both root and sugar yield still further, although it gave a sugar content which was only very slightly greater than obtained with reduced N in the absence of irrigation.

Sugar beet irrigation and its technological value. J. Trzebinski and E. Labedzka. *Gaz. Cukr.*, 1980, 88, (6), 128-130 (Polish). — The value of beet irrigation under Polish conditions is discussed, and mention made of investigations in which irrigation increased beet yield but reduced sugar content as well as ash and α -amino-N, although the overall effect was of increased sugar yield.

Management techniques in sugar beet fields. D. Kostka. *Gaz. Cukr.*, 1980, 88, (6), 130-132 (Polish). — Investigations on beet seed spacing, the number of inter-row cultivations and manual vs. mechanical drilling and their effects on final plant population and yield are reported.

Weed control in sugar beet fields. J. Kositorna. *Gaz. Cukr.*, 1980, 88, (6), 132-137 (Polish). — Recommendations are given on chemical control of weeds in general, with greater detail on eradication of wild oats and couch grass. A table indicates the herbicides effective against specific weeds, while descriptions are given of the properties of a number of newer herbicides.

Comparative tests on sugar beet harvesters — method and review. W. Brinkmann. *Zuckerind.*, 1980, 105, 475-480 (German). — Details are given of the method used to evaluate harvester performance, which involves establishing the numbers of residual beets above and below ground after harvesting of a test stretch of field, as well as determining the dirt tare in samples taken by means of a special device. The topping quality, root breakage and surface damage are then determined for each beet.

Investigations of the possibility of reducing the harmful effects of early beet harvesting. D. Ksiązek. *Gaz. Cukr.*, 1980, 88, (5), 141 (Polish). — Investigations are briefly reported which demonstrated the advisability of avoiding harvesting of beet until they have reached commercial maturity. Comparison is made between two varieties, one maturing before the other and giving higher sugar yields and lower losses as a result of harvesting at maturity; moreover, the first variety lent itself to greater plant populations, which also promoted higher sugar yields.

Strip tillage for sugar beet. E. Long. *The Furrow*, 1980, (Sept.), 11. — Winter wheat responds well to the direct drilling-minimum cultivation technique, but sugar beet grown in the same rotation has normally required ploughing. A new technique has been developed in which only strips where the beet is to be sown are cultivated, which allows the benefits of non-disturbance to be retained for the remainder of the land. Comparative trials in 1977 showed that sugar yield was not as high in the strip-tilled fields as with normal ploughing, whereas in 1978 the yield was higher. In wet conditions it was easier to harvest the beet, with probably lower losses, on strip-tilled land.

CANE SUGAR MANUFACTURE

Pelletizing bagasse for fuel. P. E. Bouvet and N. L. C. Suzor. *Sugar y Azúcar*, 1980, 75, (8), 22-23, 26-27. — The Woodex process of Bio-Solar Research & Development Corp., Eugene, OR, USA, has been modified to produce pellets of bagasse which are easy to handle and are of higher bulk density than mill bagasse. The latter is dried by means of flue gases to a moisture content of about 35%, which increases its calorific value by some 30% from 2290 kcal to 2980 kcal per kg, and also raises boiler efficiency from 62% to 78%. A flow diagram of the plant installed by Davies Hamakua Sugar Co. is presented and advantages and disadvantages discussed, with a table of data from which fossil fuel savings are calculated.

Factors influencing milling efficiency — scope and measures for their improvement. B. L. Mittal. *Indian Sugar*, 1980, 29, 761-766. — See *I.S.J.*, 1981, 83, 373.

Economic comparison between rotary vacuum filters in the sugar industry. S. Bolaños R., P. García G. and I. Iparraguirre J. *Centro Azúcar*, 1978, 5, (2), 105-113 (Spanish). — Comparisons have been made between a Dorr-Oliver filter and a Vernay filter having an endless belt. Initial investment cost and operational costs were not significantly different, and the greater consumption of water with the belt filter is not a deciding factor unless shortage of water is critical. The belt filter permitted a higher sugar recovery but requires more attention, a disadvantage which cannot be quantified in cost terms. Availability of water and technical operatives will thus be the deciding factors in a choice between the two types when installing a new filter, or in a case where it is proposed to modify a drum filter to a belt filter.

Mathematical model for optimizing sugar production. A. Pérez G. and J. González R. *Centro Azúcar*, 1978, 5, (2), 115-122 (Spanish). — A mathematical model is proposed which relates industrial losses to optimum sugar production. The author offers a methodology for optimization of work in this field.

Dynamics of the nitrogenous substances in the cane sugar manufacturing process. M. Darias P., M. Quincoces S. and G. Díaz F. *Centro Azúcar*, 1978, 5, (3), 57-62 (Spanish). — Protein and non-protein N, amino-acids and reactive N from peptides and amino-acids were measured in raw juice, clarified juice, syrup and A-, B- and C-molasses. Variations in the contents of the various forms of N in the different products are related to possible transformations of N compounds through the process.

Study of the influence of liming parameters on the volume percentage of mud. O. Navia Z. *Centro Azúcar*, 1978, 5, (3), 63-72 (Spanish). — Experiments were conducted in which variations were made in pH, temperature, mixing, residence time, phosphate content and

sugar content and the volume of mud produced measured. By means of a computer, an equation was developed by means of which the mud volume could be calculated for different pH levels and temperatures.

Project for closed-circuit television and intercommunications systems for a sugar production unit. J. Ledón D. *Centro Azúcar*, 1978, 5, (3), 73-91 (Spanish). — A description is given of the project from justification of the investment involved to the equipment in question.

Current and prospective tasks in the investigation of equipment in sugar factories. O. Boada C. *Centro Azúcar*, 1978, 5, (3), 93-98 (Spanish). — Problems facing the Cuban sugar industry in regard to factory plant and machinery are discussed and the need to apply advanced technology to the design of plant, manufacture of spare parts, centralized repair, etc. is examined with specific references.

Influence of pH and temperature on the microbial composition of cane juice. T. Sais H. and M. López C. *Centro Azúcar*, 1979, 6, (1), 15-24 (Spanish). — Samples of an experimental mill and crusher and mixed juice from a pilot-scale tandem were taken and microbial counts made corresponding to pH values of 4.5, 5.5 and 6.7, and temperatures of 30°, 37° and 45°C on samples incubated for 8 hours. From the counts it was observed that *Aerobacter* spp. are active at higher pH than other genera; that yeasts, predominantly *Hansenula* spp., appear always in a pH range 4.5-5.5; that *Bacillus* spp. appear generally in samples, not incubated and at pH 6.7, maintained at 30-45°C; that *Staphylococcus* and *Clostridium* spp. appeared at pH 6.7 as did *Mycobacterium* spp., the last at a temperature of 45°C; that the fungi appeared generally at pH 6.7 over a wide range of temperatures from 30° to 45°C; that the *Leuconostoc* spp. appeared always in the non-incubated standards, associated with *Bacillus* and *Aerobacter* spp., basically at pH 6.7 and 30°C; that little difference was found between crusher and mixed juices; that the variation of microflora with pH and temperature was related to the number of micro-organisms per g of soluble solids; and that there were differences between the laboratory and semi-industrial scale experiments in that, in the latter, yeasts could be found after 24 hours' incubation while they took 48 hours in the former.

Development of *L. mesenteroides* at different values of temperature and pH. M. T. Hernández N., M. E. Pérez R., R. Sánchez P. and R. Sánchez M. *Centro Azúcar*, 1979, 6, (1), 25-43 (Spanish). — Development of *Leuconostoc mesenteroides* was studied at three pH levels and three temperatures of incubation. Conditions for maximum growth were an initial pH of 6.8 and incubation at 27°C, while maximum sucrose degradation occurred at pH 6.02 and 32°C. Sucrose loss over 7 hours varied between 0.06 and 2.85% of that present in the juice and was a linear function of time, which permits calculation of the loss during short intervals which would not be measurable by conventional methods of analysis.

Study of the composition of yeasts and micro-organisms which form gums in cane juice. T. Sais H. and S. Ulloa D. *Centro Azúcar*, 1979, 6, (1), 45-51 (Spanish). — Juice from cane crushed in an experimental mill, and crusher and mixed juice from a pilot plant were examined for counts and identification of yeasts, coliform micro-organisms and *Leuconostoc* spp. The methods and results are reported. The counts were, respectively, 10⁷,

10^3 and 10^9 per g of soluble solids. There were 73 strains of yeast belonging to eight species (*Hansenula* sp., *H. anomala* var. *anomala*, *Debaryomyces hansenii*, *Torulopsis sphaerica*, *Rhodotorula aurantiaca*, *Torula versatilis* and *Candida intermedia*). The 146 strains of coliforms identified were of two variants of *Aerobacter aerogenes*, two of *Escherichia freundii*, and one of *E. coli*.

Some ways of optimizing the thermal energy in sugar factories. N. A. Priadko, R. Espinosa P., J. Carrillo A. and S. Machado B. *Centro Azúcar*, 1979, 6, (1), 53-74 (Spanish). — Much bagasse is used in Cuba for pulp and paper production and is replaced by liquid fuel, to the extent of 2 gallons per tonne of cane. This could be reduced by optimizing the energy systems used in the sugar factories, and a survey is presented of means to this end.

Experimental investigation of the differential capacitance and conductometric sensor for the volumetric content of solid particles. F. Pantuso N. and V. S. Polonik. *Centro Azúcar*, 1979, 6, (1), 75-85 (Spanish). — Comparison of an instrument similar to that described earlier¹ with another based on capacitance rather than conductance indicated that the former was 10 times as sensitive. It is suitable for massecuites where the crystals are larger than 0.2 mm; below this, the screen used must be so fine that flow of mother liquor to the space between the electrodes is hindered.

Controllability and observability of the sugar crystallization process. M. A. Rodríguez B. *Centro Azúcar*, 1979, 6, (1), 87-94 (Spanish). — While a mathematical model of the sugar crystallization process is a linear because of the inherent characteristics of the process of crystal development and variation in heat transfer coefficient, in small regions of the state space the system can be linearized and considered invariant with time. Such a linearized model permits determination of the dynamics of the process for small changes of the control variable, the average crystal diameter being considered the output variable. By the method of decomposition of the transfer function, the state model of the system is calculated and the controllable and observable character of the process determined.

Determination of optimum parameters in heat exchangers for the sugar industry using the method of accelerated rise. P. García G., R. Espinosa P., J. R. León M. and R. Cruz P. *Centro Azúcar*, 1979, 6, (2), 9-16 (Spanish). By using a multi-dimensional optimization method and the techniques of digital computation, it is possible to obtain, in a very short time, the minimum cost of a series of heat exchangers as a function of their transfer area and the optimum cooling flow.

Problems of perfecting the recording of repairs in the sugar industry. E. Rodríguez P. and V. G. Linnik. *Centro Azúcar*, 1979, 6, (2), 27-37 (Spanish). — The experience of the USSR, Poland and Hungary is taken into account when considering the classification of sugar industry repair costs as capital or current costs and their sources of financing. It is concluded that, under the conditions of the Cuban sugar industry, it is more convenient to finance all repairs by charging them to the cost of production. The accounting method should control and analyse repair costs so as to minimize these and diminish the cost of sugar production.

Thermo-energy balance in a sugar factory. R. Espinosa P., M. J. Carrillo A., S. Machado B. and A. Balboa M. *Centro Azúcar*, 1979, 6, (2), 39-52 (Spanish). — A complete heat balance for a sugar factory was constructed and true values obtained for steam consumption and heat transfer. This permitted identification of areas where abnormal situations occurred, and recommendations are made to bring about good operation.

System for control of the temperature in sugar crystallizers. M. Rodríguez B. and J. Delgado A. *Centro Azúcar*, 1979, 6, (2), 53-69 (Spanish). — A linear mathematical model is developed for a batch crystallizer operation and the general theory of automatic control applied for the design of a control system with the aim of reducing the time of operation. The results of an application to the crystallizer at the Experimental Sugar Factory at the Central University of Las Villas is described.

Current status of the utilization of sugar cane bagasse as a fuel. A. M. Rubio G. and N. Pascual C. *Centro Azúcar*, 1979, 6, (2), 77-85 (Spanish). — The article summarizes the most important criteria encountered in the literature on the properties of bagasse as a fuel. It is a synthesis of current knowledge on the subject, emphasizing the principal properties which characterize a solid fuel: heat of combustion, ash content, fusion temperature of the ash and elemental composition.

Activity of cane juice microflora at different values of pH and temperature. Spontaneous fermentation. M. T. Hernández, M. A. Pérez, R. Sánchez P. and R. Sánchez M. *Centro Azúcar*, 1979, 6, (2), 87-97 (Spanish). — Samples of cane juice from an experimental mill were adjusted to pH 4.5, 5.5 and 6.8 and incubated for 7 hours at 27°, 37° or 40°C, each experiment being replicated 2-4 times. For each incubated juice sample the true sucrose content was measured as was the pH, total acids, and refractometric Brix as well as a microbial count. It was found that maximum sucrose degradation occurred with juice initially at pH 5.5 and incubated at 37°C, the loss of sucrose being in linear relation to the time of incubation and varying between 0.52% and 2.67% of that originally present in the juice.

Control and treatment of sugar factory effluents — development of a cheap and simple system. S. P. Mishra. *Maharashtra Sugar*, 1980, 5, (8), 9-16. — A system adopted by the U.P. State Sugar Corporation has been applied at four new projects over the past three years and has eliminated environmental pollution while disposing of the sugar factory effluents. Effluents are segregated into polluted and unpolluted streams, the latter including cooling water and condensates which are treated in a closed-circuit cooling cycle and re-used in the factory for imbibition and wash water. Polluted effluents are strained and purified by anaerobic and aerobic lagooning in deep and shallow ponds, respectively followed by disposal as irrigation water on the company's cane farms.

Vacuum pan automation. P. H. Petri. *Sugar J.*, 1980, 43, (2), 21-22. — A simple automation system for a raw sugar pan is described which employs an absolute pressure controller, a temperature controller or recorder/controller, a level recorder/controller and a mobility

¹ Pantuso & Polonik: *I.S.J.*, 1979, 81, 219.

controller in conjunction with a mechanical circulator. The cost of such a system is some \$48,000 and is justified by the labour saving, avoidance of the need to train skilled pan boilers, and improved quality and yield of sugar as well as lower amount and purity of molasses.

Bentonite in the manufacture of cane sugar. A. A. Delgado. *Brasil Açuc.*, 1980, 95, 132-139 (Portuguese). — Bentonite is produced in Paraíba and since 1970 good quality material has been used in Brazil to aid purification of cane juices. The characteristics of the bentonite are described, as are applications in the sugar industry and the advantages (reduction in sulphur usage, increase in purity, reduction of inversion and scaling, etc.). The economics of its use are discussed and show the savings possible. Other applications include treatment of clarifier muds and filtrate, and purification of juice to be used in the distillery.

Radioactive tracer investigation of the flow characteristics in sugar crystallizers. S. W. Smith, J. K. Basson and I. A. Smith. *Int. J. Appl. Radiation and Isotopes*, 1977, 28, (10/11), 839-846; through *S.I.A.*, 1980, 42, Abs. 80-1034. — Radioactive ^{131}I was used as a tracer to investigate the behaviour of the last three crystallizers in a 7-unit continuous system at a cane sugar factory. The response curves resulting from a delta-function tracer input were used to compare crystallizers Nos. 5 and 7, which had reciprocating stirrers, with No. 6, which had a rotary stirrer; conversion to the latter mode of stirring nearly doubled the heat transfer coefficient. A dispersed plug-flow model could be fitted to the data obtained, and enabled residence times and dead volumes to be calculated. Compared with the reciprocating stirrers, the rotary stirrer caused much more mixing in the axial direction, which was undesirable, and gave a much shorter residence time.

The sugar economy of the Philippines. J. Wintrebert. *Sucr. Franç.*, 1980, 121, 273-282 (French). — A survey is presented of the history, development and present state of the sugar industry in the Philippines, with mention of the significant role played by sugar in the Philippine economy (particularly in relation to the USA) and of sugar production organization.

Round-link chain — conveyor applications in a sugar mill. D. C. M. Keir. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 32-39. — Round-link chain has been used for many years in the coal mining and timber industries, and engineers at Amatikulu have studied its applicability to use as conveyor chain in the sugar industry. Its three main advantages lie in its much lower cost, higher strength:mass ratio and simple construction. Aspects of its design are discussed, as are the types available, manufacture and material, sprocket design and attachment links, and general considerations on cane carrier design for round-link chain. Three carriers were converted to the chain at Amatikulu, and experience with them and the savings involved are quoted.

Performance testing of wear-resistant material used on shredder hammers. J. M. Moul. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 40-44. — Various hard-facing materials were tested on shredder hammer heads under operational conditions. A typical test chart is reproduced together with illustrations of good and badly worn hammers. Deposition and metal recovery

rates by stick and wire electrodes are compared along with basic material costs. A few replaceable heads were tested, with promising results.

Reducing maintenance costs of shredder hammers and cane knives. A. Koen. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 45-47. — Stages in the improvement of hammers for the Western States bagasse depither at Gledhow are described; provision of a dog-leg and hard-facing with SG70 have provided a hammer which costs R 3.80 and lasts for 21 operating days by comparison with R 4.00 and 1 day for the original hammers. Time efficiency in shredder hammers has been improved by balancing, and adoption of new types of hard-faced inserts has identified types which reduce costs from R 8.37 to R 2.15. Material costs were low for the cane knives, but a new design of palm has permitted much faster replacement when damage occurs.

Juice scale modification from conventional to butterfly valve actuation. D. C. M. Keir. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 48-51. — Handling of higher than previous juice tonnages and at higher temperatures resulted in steam removing lubricant from the linkages of the plug valves fitted to juice scales at Amatikulu sugar factory. New bushes and pins had to be fitted twice a season, and it was decided to fit butterfly valves instead. These and their fitting, pneumatic actuation and performance are described and illustrated. Benefits include reduced maintenance and higher scale capacity.

Preliminary appraisal of a continuous centrifugal operating on A-massecurite at Illovo factory. J. P. M. de Robillard and G. Journet. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 82-86. — Trials were conducted on a Fives-Cail Babcock 100 GCV SE 25° continuous centrifugal for curing A-massecurite during the latter part of the 1979/80 crushing season, comparing the results with those of BMA batch machines receiving the same feed. Details are given of the design of the FCB machine and its operation. Although rated at approx. 20 tonnes.hr⁻¹ it only achieved 12 tonnes.hr⁻¹ when producing sugar of VHP specification, while another disadvantage is the huge size of the monitor casing. Grain size analysis of the sugar was as good as for the batch machines, however, and there was no evidence of higher crystal breakage. At speeds of up to 1200 rpm the moisture content of the sugar was significantly higher (0.25-0.5% vs. 0.05-0.18%) and incrustation of the monitor casing with wet sugar was a physical limitation. Molasses dilution was greater with the continuous machine, as is to be expected, while purity was significantly lower during the commissioning period but not when the machine was operated by factory personnel.

Tracer testing in clarifiers. D. J. Love. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 93-98. Tests are described in which slugs of dissolved NaCl and LiCl were added to clarifier feed and the clear juice monitored for conductivity and Li (by flame emission spectroscopy), respectively. Samples taken every 5 min after addition were analysed and the results shown in graphs, interpretation of which shows that actual residence times in the clarifier are considerably shorter than the theoretical value, as a consequence of inefficient use of clarifier volume and rapid by-passing of juice through the unit with high mud levels and high juice throughputs.

BEET SUGAR MANUFACTURE

Prospects of the sugar beet industry in India — a critical appraisal. S. K. Tewari. *Indian Sugar*, 1980, 29, 779-786. Experiments have been made in various places in India on the growing of sugar beet crops, and the data obtained are used for a survey of requirements in respect of capital, labour, irrigation, managerial requirements, etc. From this it is concluded that growing and processing of beets cannot compete with cane and wheat, so that prospects for a beet sugar industry in India appear bleak.

Application of product return osmosis to reduce energy in beet sugar processing. J. M. Randall, W. M. Camirand and K. Popper. *Proc. Int. Conf. Energy Use Management*, 1977, 837-844; through *S.I.A.*, 1980, 42, Abs. 80-1037. Beet sugar manufacture is stated to be one of the most energy-intensive food processing operations. A form of direct osmosis, called product return osmosis, in which water permeates through a semi-permeable membrane from a dilute process liquid stream into a molasses stream, can decrease the energy required to evaporate water to concentrate the dilute stream. The driving force is the extremely high osmotic pressure of the molasses. The process is described, and some results are given for the systems thin juice-molasses and Steffen filtrate-molasses to show that either system is feasible.

Study on sucrose loss in preliming. G. Pollach and L. Wieninger. *Sucr. Belge*, 1980, 99, 295-301 (*French*). See *I.S.J.*, 1979, 81, 381.

Intensification of sugar massecuite centrifuging. N. I. Shtangeeva, L. I. Trebin and Ya. G. Ropotenko. *Izv. Vuzov, Pishch. Tekh.*, 1980, (3), 42-43 (*Russian*). Three different surfactants were added individually to an artificial low-grade massecuite composed of 40% white sugar and 60% saturated molasses, which was mixed for 15 min at 40°C and then spun for 5 min at 1500 rpm in a laboratory centrifuge. Of the surfactants, only acetylated glycerine monostearate (50% acetylation) had any noticeable positive effect in reducing the amount of molasses adhering to the sugar crystals after centrifuging, while 100% acetylated glycerine monostearate and polyglycerine distearate had almost no effect. Surfactant concentration was an important factor, and 0.01% on massecuite weight was found to be optimum. Addition of this quantity to massecuite 2-3 hours before dropping of the pan contents in subsequent factory tests reduced surface molasses by 10-15% by comparison with the control.

Some notes on the latest position of water legislation and on possible methods of waste water treatment in the sugar industry. D. Kollatsch. *Zuckerind.*, 1980 105, 727-732 (*German*). — West German legislation on effluent treatment and disposal is outlined, and a short survey presented of methods commonly used in the sugar industry for waste water treatment.

Analysis of the static and dynamic characteristics of trough-type diffusers. A. Havlin and V. Valter. *Listy Cukr.*, 1980, 96, 148-158 (*Czech*). — A mathematical model of a DDS-type diffuser, based on ideal conditions, was found to be of value in establishing the effect of change in any one parameter on the overall process, but the calculations involved were time-consuming. An empirical model based on substitution of appropriate values was less precise (greatest difference between the results given by the two models occurring in the case of change in cosettes sugar concentration) but easier to use and of greater practical value. Its use in calculation and analysis of static and dynamic factors relating to mass transfer is described.

Sugar storage in silos. II. Ventilation of TMS cell-type silos with warm air. L. Budicek, O. Mikus and J. Gebler. *Listy Cukr.*, 1980, 96, 158-161 (*Czech*). — Investigations of warm air ventilation of sugar stored in a TMS silo¹ showed that it was not a suitable means of replacing heat lost by the sugar, since the required air flow velocity (allowing for pressure drop) was such as to have an adverse effect on the sugar granulometry.

A stone trap for a deep flume. F. Hruska. *Listy Cukr.*, 1980, 96, 165-167 (*Czech*). — A vertical shaft located below the floor of the flume acts as a trap for heavy impurities. An ascending current of water meets the normal flow of flume water, creating turbulence and thus promoting settlement of the stones, etc., which are then discharged through a special port. A variant of the system used at two Czechoslovakian factories permits the impurities to enter a vertical bucket elevator system which carries them to above flume height for discharge onto a pile. The trap operates efficiently provided that flow requirements in the flume are met.

The stability of predefecation mud. L. P. Reva, G. A. Simakhina and V. M. Logvin. *Izv. Vuzov, Pishch. Tekh.*, 1980, (3), 49-52 (*Russian*). — The quantity of albumin re-dissolved during main liming from coagulate precipitated during preliming was determined as an indication of predefecation mud stability. Both method of main liming and temperature of preliming affected the results. There was little difference between values obtained after preliming for 60, 40 and 15 minutes, respectively, at 20, 40 and 60°C, while 5 min at 85°C gave much poorer results. Main liming at 85°C was in all cases better than a method in which lime was added at 60°C followed by 15 minutes' continuous mixing and then heating to 85°C at which the juice was held for 8 min. (The quantity of albumin denatured as a consequence of initial raising of juice temperature prior to liming at 85°C was found to be practically the same, irrespective of the preliming temperature.) Recycling of 1st carbonation mud to preliming further increased the quantity of albumin removed and increased mud stability during main liming.

Movement of the juice-cosettes mixture in tower diffusers. N. N. Pushanko and A. A. Seregin. *Izv. Vuzov, Pishch. Tekh.*, 1980, (3), 66-70 (*Russian*). — Studies were made of the effect of diffuser loading on compression of the juice-cosettes mixture and on its viscosity and elasto-plastic properties. The importance of the various factors investigated for movement of the mixture and design of the transport system is discussed mathematically, and differences between the angle of move-

¹ *I.S.J.*, 1981, 83, 311.

ment of a specific point in the tower as calculated from an oscillogram and as analysed mathematically are attributed to erroneous assumption of constant coefficients of friction and uniform distribution of the load along the scroll blade.

Separation of a sugar massecuite in a continuous blade-type centrifugal. A. A. Dobik and M. I. Il'in. *Izv. Vuzov, Pishch. Tekh.*, 1980, (3), 115-118 (*Russian*). — Orthogonal experiments have shown that, in a vertical, blade-type centrifugal, maximum separation of crystals and mother liquor is achieved when $\tan \alpha = f$, where f is the coefficient of friction of the massecuite moving along the blade (acting as filtration surface) and α is the angle between the blade and the equipotential surface of the centrifugal field. Hence $\tan \alpha$ increases from f_1 (of the massecuite) to f_2 (of the sugar) linearly relative to the angle at the axis of rotation. Optimum values of $\tan \alpha_1$ and $\tan \alpha_2$ were little affected by the Froude number in the range 1800-2400.

Effect of complete crown removal on quality of sugar beets. D. F. Cole. *J. Amer. Soc. Sugar Beet Tech.*, 1980, 20, 449-454. — Crown tissue constituted 20% of the beet delivered to sugar factories of American Crystal Sugar Co. in Minnesota. Complete removal of all crown tissue did not consistently improve quality as determined from sugar content, nitrate, conductivity and thin juice purity. Crown removal during harvest did not substantially reduce the impurity load on the factory. However, other research has shown that crown removal and mechanical damage increase respiration and rot losses. Consequently, there seems to be no advantage to crown removal from beets at harvest, and it is recommended that beets to be delivered for storage should only be flailed in order to reduce sugar loss by increased respiration and rotting.

Irrigation with sugar beet processing waste water. J. H. Smith and C. W. Hayden. *J. Amer. Soc. Sugar Beet Tech.*, 1980, 20, 484-502. — An account is given of the disposal of waste water from beet sugar factories by using it for irrigation of fields on which grass was grown as a hay crop. Details are given of the nutrients applied to the soil, and the potential problems arising from a high ash content are indicated. Nevertheless, disposal in this manner could continue for many years provided that the loading were not greater than that of irrigation at 4-week intervals (up to 48 cm/year).

Loss of sucrose during controlled and conventional storage. C. L. Peterson, D. J. Traveller and M. C. Hall. *J. Amer. Soc. Sugar Beet Tech.*, 1980, 20, 517-530. Comparisons were made to determine the changes in beet samples in different locations throughout an open-stored beet pile (by comparison with analysis of fresh beet at the time of piling), as well as the changes in beet held in a chamber controlled at 4.4°C and >95% R.H. The results showed clearly the effects of leaving a perishable commodity such as sugar beet at the mercy of unpredictable weather. The centre of the pile was protected by the mass of surrounding roots, but the outside layers were drastically affected, especially when changes in temperature caused alternate freezing and thawing. However, loss in the controlled chamber was 0.37 lb/short ton/day in 1978 and 0.15 lb/ton/day in 1977 against 0.30 and 0.23 lb/ton/day for losses in the commercial pile. Weight and sugar losses are highest

early in the season, the rate of loss decreasing with time. Bruise measurements showed high damage levels in mechanically harvested and piled beets; mechanical damage was a significant storage factor in 1977 but not in 1978, partly owing to extra soil separation from hand-harvested beets in 1978.

Methods for the optimum exhaustion of molasses. H. Schiweck. *Ind. Sacc. Ital.*, 1980, 73, 71-78 (*Italian*). After summarizing the traditional principles on which the technology of reducing sugar loss in molasses is based, the author discusses the effects of unsuitable crystallization conditions and non-sugar composition. The theoretical amount of molasses can be calculated using the Wiklund saturation function and the performance of some German sugar factories are assessed in relation to actual and theoretical purities. The importance of a detailed analysis of the molasses, taking into account the raffinose and invert sugar contents, is emphasized, together with the mechanical characteristics of the crystallizers. Retention time in these, the pre-spinning technique and the presence of fine grain in the massecuite are briefly discussed.

Experience in the use of remote control for beet pumps at Yagotinsk sugar factory. N. F. Shurbovanyi and Yu. I. Voinov. *Sakhar. Prom.*, 1980, (9), 15-16 (*Russian*). Details are given of the remote control system, based on use of a time switch operated from the beet washer control panel, applied to two 160-kW centrifugal beet pumps. The system has reduced labour requirements by one man per shift.

Continuous massecuite boiling at Yagotinsk sugar factory. Yu. V. Tovstenko *et al.* *Sakhar. Prom.*, 1980, (9), 18-21 (*Russian*). — Continuous low-grade boiling during two campaigns is described. The scheme, part of a two-massecuite system, includes a crystal generator followed by three horizontal pans, in series; some of the massecuite is fed to a batch centrifugal and the rest to a continuous machine. Results are compared with those obtained using a conventional batch boiling system, showing superiority of the continuous scheme in terms of massecuite purity and crystal content as well as low-grade sugar purity.

Industrial tests on flocculants for intensifying the settling of suspended particles in 1st carbonatation juice. I. A. Oleinik, I. G. Bazhal, E. N. Shirokikh, R. M. Polishchuk, V. S. Bondarenko and N. I. Nespryad'ko. *Sakhar. Prom.*, 1980, (9), 21-24 (*Russian*). — Tests are reported in which addition of a granular polyacrylamide or one of three gel-type flocculants to 1st carbonatation juice considerably raised the mud settling rate and lowered the juice filtration coefficient, with consequent improvement in the 2nd carbonatation juice purity, colour and lime salts content.

Trials on a pulsatory 1st carbonatation vessel. K. D. Skorik *et al.* *Sakhar. Prom.*, 1980, (9), 26-30 (*Russian*). — A vertical carbonatation vessel is described in which pulsed compressed air is fed from a special duct into the CO₂-juice mixture as it starts to ascend the main cylinder, in which perforated discs and vanes placed horizontally at regular intervals cause the stream to undergo sharp changes in flow direction, thus aiding gas absorption. At a pulsation rate of 76 vibrations per min and an amplitude of 10-30 cm, gas utilization was 85%, compared with 70% in a conventional factory vessel; 2nd carbonatation juice purity was 1-1.5 units higher, and the colour



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and lime salts content 20-25% lower. The settling rate was raised, although filtration was unaffected.

Improving the beet reception system at sugar factories. N. N. Dotsenko and S. V. Valyavskii. *Sakhar. Prom.*, 1980, (9), 33-36 (*Russian*). — In a discussion of losses incurred during beet transport, handling and storage in the USSR, the worst form of transport as regards losses is considered to be the railway. The costs and losses involved in transporting beet to and storing it at intermediate peripheral points, with subsequent transfer to the central factory, are greater than where the beet is taken straight to the factory; this is attributed to the lower skills and poorer technology used at the peripheral points. Moreover, this two-stage system causes irregularity in the pattern of beet transfer to the factory. The situation is generally surveyed, with information on capital outlay on beet yard improvements and expansion at various factories.

Heating circulation juice by direct contact with steam. S. V. Markitan *et al.* *Sakhar. Prom.*, 1980, (9), 43-46 (*Russian*). — A specially designed contact heater is described and tests on using it to heat circulation juice from a rotary diffuser are reported. Results showed that, while juice pH and purity were the same after contact heating and heating in a tubular heater, no sucrose degradation occurred in the contact heater, compared with a 4-25% increase in reducing matter in the other.

The rate of carbon dioxide absorption under conditions of continuous 1st and 2nd carbonatation. I. The overall rate of carbon dioxide hydration. E. Sarka. *Listy Cukr.*, 1980, 96, 198-202 (*Czech*). — Factors governing the CO₂ hydration rate were investigated. Temperature changes (40°, 65°, 85° and 90°C were the values studied) had a marked effect except between 85° and 90°C. Investigations by other authors have shown even more marked effect in the range 0-38°C. pH had no effect on hydration under the test conditions. While catalysis remains the only other possible means of accelerating hydration, tests showed that either specific catalysts had the desirable effect but were highly toxic, or were non-toxic but economically unjustifiable in view of their poor effect.

Sugar storage in silos. III. Treatment of white sugar by stabilization before storage in a TMS cell-type silo. L. Budicek and O. Mikus. *Listy Cukr.*, 1980, 96, 202-207 (*Czech*). — Methods of determining the moisture content and temperature of white sugar intended for storage in a TMS silo are described, and equations are presented for calculation of the design parameters of a white sugar conditioning plant. Required air flow and sugar retention time are calculated for the stabilization area in a storage cell; the effect of moisture content after centrifuging on the stabilization time and the internal moisture content of the dried sugar is discussed.

Deionization of sugar industry products by electro-dialysis. L. D. Bobrovnik, P. P. Zagorodny and N. S. Fedorova. *Centro Azúcar*, 1979, 6, (3), 1-22 (*Spanish*). — The kinetics of desalination of sugar juices are discussed on a basis of the use of electro-dialysis at constant voltage for treatment of sugar solutions containing high concentrations of strong and weak electrolytes. It is found that the last behave differently and that there is no direct dependency between the thermostability and buffer action of industrial sugar solutions. It is also shown that sodium sulphite

is an efficient agent for increasing the thermostability of sugar solutions.

Comparison of juice purification systems used in the Greek sugar industry. P. Christodoulou and P. Pantelara. *Hellenic Sugar Ind. Quarterly Bull.*, 1980, (42), 226-243 (*Greek*). — Comparison is made between the performances of the juice purification stations at Platy, Serrae, Xanthi, Orestias and Larisa sugar factories in the period 1965-78 (or from the year in which the factory started operations up to 1978), while descriptions are given of the classical carbonatation system as used at the first four factories named and the BMA system as used at Larisa. Criteria used for comparison were: non-sugar elimination, invert sugar degradation, lime consumption, juice lime salts content, molasses sugar, juice colour and filter capacity and performance.

The effect of calcium chloride on pulp pressing and on beet juice purity during diffusion in the presence of sulphur dioxide. G. Zountas, D. Hatzeantoniou and P. Christodoulou. *Hellenic Sugar Ind. Quarterly Bull.*, 1980, (42), 244-257 (*Greek*). — Pilot plant experiments and factory trials at Platy are reported in which the effects of aluminium sulphate + sulphuric acid, calcium hydroxide + sulphuric acid or calcium chloride with and without sulphur dioxide on diffusion juice purity and pulp pressability were determined. Best results were obtained with 0.01% CaCl₂ on beet in the presence of SO₂. Appreciable monetary savings were achieved in 1979; these arose from the reduction in fuel consumption (because of the increased pulp solids content), drop in molasses sugar and increase in juice purity.

Applications of a new disinfectant in the sugar industry. E. Duthoit and R. Detavernier. *Ind. Alim. Agric.*, 1980, 97, 667-675 (*French*). — Trials conducted over a number of years on continuous disinfection with DGS 01 are reported. Application of a total of 39 ppm (including 30.9 ppm as a continuous dose to beet wash water, to beets entering the slicer, to cossettes and to press water, 1.9 ppm in the form of various shock doses and 6.2 ppm for treatment of ponded waste water) reduced bacterial infection to a permissible level and considerably reduced fermentation losses. Treatment also reduced odour (particularly that caused by H₂S) and foaming.

Computer simulation of a multiple-effect evaporator in a sugar factory. A. Lebert, F. Rousset, A. Duquenois and P. Bonnenfant. *Ind. Alim. Agric.*, 1980, 97, 691-698 (*French*). — An algorithm has been established which involves the main steam, juice and water variables as a function of time in a multiple-effect evaporator. The resultant simulation program allows a study to be made of different methods of automatic evaporator control.

New development in ion exchange regeneration systems in the sugar industry. W. Pannekeet. *Ind. Alim. Agric.*, 1980, 97, 757-760 (*French*). — A process developed by Akzo Chemie-Imacti allows beet juice softening ion exchanger regeneration without production of an effluent to be disposed of; instead of using NaCl, the exhausted resin is regenerated with NaOH + juice when the Ca⁺⁺ displaced from the resin is dissolved as calcium hydroxide. The juice plus excess NaOH is then sent to carbonatation. A full description is given of the scheme, and comparison is made with the conventional system of regeneration with NaCl.

LABORATORY STUDIES

Sugar solution purification by electro-filtration.

I. G. Bazhal, L. G. Vorona, M. P. Kupchik, T. A. Mikhailik and L. D. Bobrovnik. *Izv. Vuzov, Pishch. Tekh.*, 1980, (3), 70-74 (Russian). — Tests were conducted on treatment of molasses and sugar solutions by electro-filtration, in which brine was passed through a unit separated by ion exchange membranes into a cathodic, neutral and anodic cells, and molasses and sugar solution treated with an inert granular material (porous clay filler or silica gel) in the neutral cell. Titanium and platinum plates acted as conductors. Results showed that treatment removed colloids and high-molecular impurities as well as colouring matter, depending on purity of the untreated solution and field strength (the lower the purity and the higher the field strength, the greater was the impurity removal). The method was particularly suitable in regard to molasses non-sugars removal when it followed electrodialysis, raising the separation to a total of 88% by comparison with 75.8% when only dialysis was used.

The role of heat of crystallization during boiling and crystallization of sugar suspensions. I. S. Gulyi, I. G. Bazhal and V. A. Mikhailik. *Izv. Vuzov, Pishch. Tekh.*, 1980, (3), 74-78 (Russian). — Calculations of the various factors involved in thermochemical investigations of sucrose crystallization in a micro-calorimeter showed that the heat of crystallization plays a significant role in both boiling and crystallization and should not be ignored in theoretical or practical studies of the thermodynamics and kinetics of the processes.

Fractionation of beet pectin on DEAE-cellulose. S. P. Olyanskaya, L. I. Zagorodnyaya, A. A. Gerasimenko and T. N. Ivanenko. *Izv. Vuzov, Pishch. Tekh.*, 1980, (3), 78-81 (Russian). — Chromatographic fractionation of the components of pectin obtained from beet brei on a column of DEAE-cellulose is reported. The experiments revealed D-galacturonic acid, a number of neutral monosaccharides (D-galactose, L-arabinose, D-xylose, D-ribose and D-rhamnose), neutral polysaccharides (araban and a galacto-araban complex with a varying quantity of neutral sugars), a weakly acid fraction composed of partially methoxylated pectic acid and containing arabinose, glucose, xylose and galactose, and a strongly acid fraction containing mainly polygalacturonic acid as well as the neutral sugars, arabinose and galactose.

Some factors affecting the measurement of colour of white sugar. A. Dunsmore and P. Mellet. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 63-65. A selection of refined sugars from all South African refineries was analysed for pH, SO₂, attenuation indices at 420 and 720 nm, colour index and ICUMSA colour, and the relationships between these were analysed statistically. From the results it was established that

sugar solutions vary in pH from refinery to refinery, that the pH has a marked effect on the colour measurements and that, if measurements are made at pH 7, a good correlation between colour index and ICUMSA colour is found.

An attempt to relate floc formation with some components of Natal Very High Pol sugar. B. L. Drew, A. E. Pearson and Z. J. Kimmeling. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 66-71. A comparison of the flocculation properties of VHP sugar delivered for export by the manufacturing mills with the colour, gum and nitrogenous matter content of the sugars showed that there is correlation in sugars made by individual mills but no significant general correlation.

Some factors affecting the Lane and Eynon titration method for determining reducing sugars in sugar products.

A. Dunsmore, P. Mellet and M. Wolff. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 72-76. The effects of (a) method of standardization of Fehling's solution, (b) rate of boiling and (c) method of removal of calcium from solutions prior to titration by the Lane & Eynon method were investigated. It was established that the method of standardization should be uniform and similar to the working conditions used, that the rate of boiling influences the titre, even between 2 and 2½ minutes for bringing to the boil, so that the time should be standardized, and that either EDTA or potassium oxalate may be used to remove the interference of Ca, although EDTA is preferred. The quantity of EDTA to be used for various sugar products was also investigated and the following recommendations made: 4 cm³ of 4% EDTA solution per g of final molasses sample, 2 cm³ per g for A- and B-molasses, 1 cm³ per g for A-, B- and C-masseccuite, 10 cm³ per 50 g of juices and 5 cm³ per 8.33 g sample of syrup.

The new SMRI nutsch bomb. S. Munsamy. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 79-81. A much fuller account is given of the development and design of the new nutsch bomb for analysis of masseccuites¹. Details are given of tests carried out for comparison with the Hulett design of nutsch bomb, and it is concluded that it gives the same results but has the advantages of lightness and easier and faster operation with viscous masseccuites.

The viscosity of molasses and masseccuite. E. E. A. Rouillard and M. F. S. Koenig. *Proc. 54th Ann. Congr. S. African Sugar Tech. Assoc.*, 1980, 89-92. — After a brief account of the theory of viscosity, the literature concerning factors affecting molasses and masseccuite viscosity is reviewed. Experiments were conducted with molasses samples which were de-gassed and mixed with different proportions of sugar crystals to form synthetic masseccuites. Viscosities were measured and also dry substance, sucrose, reducing sugars and ash contents as well as temperature. An equation was derived which gave the best fit to the data obtained; however, it has a standard error of ± 20% with a maximum of ± 108%. Evidently, the viscosity is affected by other factors than those considered and, from the evidence of other workers, it seems that a correction factor for suspended matter in molasses should be applied.

Potassium and sodium in sugar beet metabolism. M. Burba. *Die Zuckerrübe*, 1980, 29, (5), 16, 18-19 (German). — The biochemical and physiological functions

¹ See also *I.S.J.*, 1981, 83, 309.

of K in the beet plant and the mechanics of K uptake by beet as well as movement of the mineral in different soil types are explained. The transport and distribution of K and Na in beet and their behaviour during sugar manufacture are described, and factors governing the K content in beet indicated.

Procedures for continuous measurement of moisture in dry and pressed pulp. G. Witte. *Zuckerind.*, 1980, 105, 823-828 (German). — Vacuum oven drying of beet pulp samples showed that non-uniformity of the material resulted in errors in dry solids determination: $\pm 0.3\%$ (by weight) for pressed pulp, $\pm 0.4\%$ for molassed pressed pulp, and $\pm 0.3\%$ for molassed dry pulp; in batch tests, these errors would have to be taken into account in the establishment of a procedure for continuous moisture measurement. Various measuring principles for continuous procedures are examined: resistance or conductivity measurement, dielectric measurement, the use of microwaves, measurement with infra-red radiation, and with neutrons; each approach is described and advantages and disadvantages discussed. Of importance as regards accuracy of the methods is the extent to which factors such as chemical composition, bulk density and temperature of the pulp have a greater influence on the dry solids measurement than on the change in moisture content. In the case of molassed pulp, the disturbances caused by the three factors are so great that none of the methods described will be sufficiently accurate, while their effect will be very much smaller in the absence of molasses, although allowance must still be made for error, and only temperature-compensated instruments used for dry solids determination. Changes in bulk density caused all the methods, with the exception of the infra-red technique, to have the same relative error in measurement of moisture content. The electrolyte content of the sample was one composition factor that could have a marked effect on accuracy of measurement, particularly in the case of molassed pressed pulp.

Balance data for sucrose metabolism in the continuous culture of a thermophilic bacillus strain. A. Dziengel and W. Mauch. *Zuckerind.*, 1980, 105, 828-836 (German). Using a continuous fermentation unit, the effect of physiological conditions on the metabolic activity of a strain Zb of thermophilic bacillus isolated from a diffuser was determined. Within a sucrose concentration range of 1-15%, biomass formation was in proportion to the quantity of degraded sucrose (20 g.mole^{-1}); below 1% sucrose the conversion rate to lactic acid was 100%, whereas at higher concentrations it was $< 50\%$ of the total sugar loss. At 1-15% sucrose, cell growth was independent of energy production, which remained constant at 5 g.mole^{-1} . Parallel with increase in sucrose concentration, the bacterium secreted increasing amounts of invert sugar up to a maximum of 4.2 g.l^{-1} , corresponding to 22% of the hydrolysed sucrose. Introduction of additional invert sugar into the medium merely caused a slight reduction in sucrose loss, while lactic acid formation increased slightly. Increase in the peptone and yeast extract contents stimulated cell growth and led to disproportionately high sucrose losses. Increase in pH from 5.5 to 6.5 caused a 5-fold increase in sucrose degradation, but only a 3-fold increase in biomass. After modifications to the system to allow fermentation under aerobic conditions, the effect of oxygen (introduced by artificial ventilation) on the metabolic processes was studied. The presence of oxygen caused a considerable delay in the establishment of a metabolic equilibrium; almost all the oxygen was con-

verted to CO_2 , while the bacterial dry mass was almost four times greater than under anaerobic conditions. Even at a high oxygen consumption of $180.2 \text{ ml.hr}^{-1}.\text{g}^{-1}$ dry solids ($7.3 \text{ mmole.hr}^{-1}.\text{g}^{-1}$), there was hardly any change in the amount of sucrose degraded and lactic acid formed in the anaerobic experiments.

Study of the microflora in wash water from the centrifugals. T. Sais H. and T. Castillo D. *Centro Azúcar*, 1979, 6, (3), 31-36 (Spanish). — Samples of wash water from the centrifugals were examined and a total of 43 strains of micro-organisms isolated. The greatest number were mesophilic bacteria and yeasts; no moulds were present. The sugar is in danger of contamination by the wash water, and sanitation methods should be adopted to avoid infection.

Modification of sugar crystal habit by high molecular weight substances separated from syrups and molasses. L. Carrazana R., C. Pérez B. and M. Fernández D. *Centro Azúcar*, 1979, 6, (3), 87-99 (Spanish). — High molecular weight substances were isolated by dialysis from syrups and molasses from two sugar factories in one of which (A) problems had arisen with crystal elongation. The intrinsic viscosity of the substances was measured and their effects on sucrose solubility and saturated solution viscosity were determined. Masecuites were boiled in an experimental pan in the presence of the substances and dimensional analysis applied to the resulting crystals. The substances from factory (A) induced elongation of the crystals to a degree depending on their concentration, while no elongation occurred with the substances from the other factory.

Relationship between sugar quality and its foaming capacity. A. Kurkowska-Mielczarek. *Ind. Alim. Agric.*, 1980, 97, 679-682 (French). — Experiments to determine the possibility of predicting the foaming capacity of a sugar on the basis of its ash, colour and surfactant content (the surfactants being determined polarographically as saponins) are reported. Eight white sugar samples having a colour range of 26-65 ICUMSA units, an ash range of 40.7-251 ppm and a saponin range of 9-118 ppm were selected for the tests; solutions containing 50% sugar were prepared by adding 50°Bx molasses solution in different volume ratios, so that the prepared solutions contained 4-25% molasses dry solids. Oxygen was injected at a controlled flow rate through a capillary immersed in 50 cm^3 of solution in a graduated cylinder. After a given time, the stability of the foam that formed was determined as the time between stoppage of gas flow and disappearance of the continuous foam layer. The results of replicated tests were statistically evaluated, and showed that the time of existence of the foam increased linearly with rise in sugar purity.

Method of determining Brix of a sugar solution by conductimetry. J. Ponant. *Ind. Alim. Agric.*, 1980, 97, 685-688 (French). — On the basis of a formula relating sugar solution conductivity, Brix and purity¹, a mathematical study was carried out, from which a relation between Brix and conductivity at maximum conductivity was obtained. Results of investigations on evaporator thick juice showed close agreement between experimental and calculated values and indicated superiority of the conductimetric method over refractometric Brix measurement.

¹ Ponant: *I.S.J.*, 1979, 81, 220.

BY-PRODUCTS

Problems posed by use of *Schizosaccharomyces pombe* in rum manufacture. B. Ganou-Farfait and A. Parfait. *Ind. Alim. Agric.*, 1980, 97, 575-580 (French). — Trials on the use of *S. pombe* instead of *S. cerevisiae* for rum production are reported. While it has been found that *S. pombe* would permit the desired composition to be obtained more easily, problems of a biochemical, technological and organoleptic nature remain to be solved, for which a better knowledge of the metabolic pathways is necessary. For further investigations, a medium comprising 1 g peptone and 2 g ammonium sulphate in 2 litres of cane juice is suggested. Comparison is made between the quantities of particular fermentation products and fractions formed by the two yeasts.

The storage and conservation of bagasse. D. S. Cusi. *Sugar y Azúcar*, 1980, 75, (8), 39, 42-43, 46-47, 50-51. The stages in deterioration of piled bagasse are discussed. While the softer and more open tissues, i.e. pith, are first attacked by cellulolytic micro-organisms, the fibre is also damaged, to a greater extent as storage proceeds, and this results in poorer pulp quality for paper-making purposes. Factors affecting deterioration, including temperature and pH, are discussed and a temperature-time profile for a bagasse pile illustrated and explained. There are two main methods to prevent deterioration by inhibiting the proliferation of micro-organisms, viz. use of air-drying or chemicals such as SO_2 , etc., and the promotion of non-cellulolytic micro-organism growth which will retard or prevent growth of cellulolytic micro-organisms. The first are generally too expensive to be practical, while the second requires precise conditions which are difficult to meet. However, growth of lactobacilli may be promoted by using a water-laid pile, which gives preferentially horizontal deposition of fibres and higher density. Advantages and disadvantages of other methods of piling, e.g. in bales, air-laid piles, tractor-laid piles and slowly laid piles, are discussed. Because of the complexity of local factors, each case must be considered individually to achieve an efficient and economical operation.

Studies on the rapid treatment of the yeast waste stream. IV. Continuous cultivation of *Aspergillus* sp. 188. P. T. Hwang and Y. T. Chuang. *Rpt. Taiwan Sugar Research Inst.*, 1980, (88), 65-73 (Chinese). — *Aspergillus* sp. 188 has been grown continuously on distillery waste, which was adjusted to 13°Bx (to contain about 42 g carbon per litre), supplemented with N and P, and cultivation switched from batch to continuous when the pH of the medium was raised from the initial 5.5 to 6.2. Feeding with waste at pH 4.8 restored the pH of the medium to its favourable range (5.1-5.6) and a steady state reached after four residence times under constant conditions of temperature (30°C), agitation speed (300 rpm) and aeration rate (0.5 v/v/m). The steady-state values of cell concentration and total carbon

content for different dilution rates (0.075-0.20 hr⁻¹) were obtained. A yield of 1.337 g dry cells per g carbon consumed and a productivity of 1.09 g.l⁻¹.hr⁻¹ of dry cells were obtained at a specific growth rate of 0.10 hr⁻¹. The critical dilution rate and maximum specific growth rate were found graphically to be 0.273 and 0.269 hr⁻¹, respectively. It was concluded that the continuous cultivation of *Aspergillus* sp. 188 on vinasse must be carried out at a specific growth rate of 0.075-0.10 hr⁻¹ in order to maximize active cell production.

Chemicals from sucrose? E. Reinefeld and R. D. Hoffmann. *Zuckerind.*, 1980, 105, 736-744 (German). The potential of sucrose as chemical feedstock for production of a large number of derivatives is discussed in relation to the manufacture of petrochemicals, and the possibility of producing fuel alcohol from beet by fermentation in West Germany is considered.

Utilization of the total energy system with gas turbines in distilleries for production of ethyl alcohol. Anon. *Brasil Açuc.*, 1980, 95, 140-148 (Portuguese). — An analysis is presented in note form of applications of gas turbines in industry, the types, advantages and disadvantages compared with diesel engines, generation of electricity and the total energy system, heat balance and efficiency of the system, etc. A number of flow diagrams are presented, including one for a distillery, and notes are included on consumption of steam and electricity in alcohol production, and the application of a gas turbine.

British Sugar's animal feeds. B. Davis. *British Sugar Beet Rev.*, 1980, 48, (3), 44-46. — The marketing of animal feed products by the British Sugar Corporation is described and an account given of the dried and wet pulp products sold.

Pressed pulp for calves. M. Nuttall. *British Sugar Beet Rev.*, 1980, 48, (3), 47. — Trials in which calves have been fed with dried pulp and with pressed pulp showed that there was little difference in their liveweight gain, and both feed products are acceptable. Choice will therefore be dependent on their relative prices.

South Lincolnshire enterprise maximizes beet by-products and enhances soil fertility. B. Morrish. *British Sugar Beet Rev.*, 1980, 48, (3), 48-49. — At the farm described, which grows sugar beet as part of its rotation, the tops are made into silage and fed to cattle, as is beet pulp silage; the farmyard manure is applied to the fields.

What does pressed pulp offer the animal farmer? E. Thier. *Die Zuckerrübe*, 1980, 29, (5), 22-23 (German). — The benefits of pressed beet pulp as cattle fodder are discussed and typical analyses of pulp of different dry solids contents indicated.

Ensilage of pressed pulp. J. P. Vandergeten and R. Vanstallen. *Le Betteravier*, 1980, 14, (145), 11, 14 (French). — Advice is given on beet pulp ensilage so as to obtain an ideal fodder for dairy and beef cattle.

Protein level in final molasses diets for sows during growth and pregnancy. J. Diaz. *Cuban J. Agric. Sci.*, 1980, 14, 1-11. — Trials showed that feeding of molasses-based instead of cereal-based diets to young sows weighing 40-75 kg at a protein intake of 210 g/day had no negative effect on ovulation rate or embryo mortality, while the best economic results were obtained with

260 g protein/day in the last part of the growing period, at a live weight of 75-90 kg; however, there was a slight negative effect on the gain rate. The possibility of reducing the protein intake with such rations has been suggested.

The use of pasture for beef production. VII. Effects of molasses and maize in the protein supplementation to bulls on non-irrigated pasture. A. Delgado, A. Elías, J. L. Veitia and R. García. *Cuban J. Agric. Sci.*, 1980, 14, 21-28. — Trials are reported in which bulls, grazing during the dry season, were fed on diets containing molasses/urea mixtures, a molasses/maize mixture or maize alone. Results showed that, while the bulls fed the molasses/urea mixtures ingested only 49% of the natural protein consumed by those fed maize, the average performances of the animals were similar, so that considerable savings would be possible in imported feedstuffs. It is recommended to feed a mixture of 63.5% (dry basis) molasses and 12% urea *ad libitum* on poor-quality pastures during the dry season, provided not less than 3 kg of pasture dry matter per 100 kg live weight is offered.

A note on the effect of molasses treated with heat and/or centrifugation on poultry diarrhoea. R. J. Alvarez. *Cuban J. Agric. Sci.*, 1980, 14, 53-56. — In order to reduce the ash content, final molasses was (i) diluted 1:1 with water, centrifuged and concentrated to 84.47% dry matter, or (ii) heated at 80°C for 30 min between dilution and centrifuging, and then concentrated to 80.68% dry matter. Untreated molasses had a dry matter content of 86.22%. Incorporation of the three types of molasses at 54.71% (dry matter) in rations fed to poultry was compared with inclusion of 86.16% maize. Results showed that the dry matter % in the faeces was much higher where maize was included in the rations, and that reduction of the molasses ash content from 11.53% to 8.71% and 8.86% by treatments (i) and (ii), respectively, had no significant effect on poultry diarrhoea.

Metabolizable energy and nitrogen retention in torula yeast diets for broilers. R. J. Alvarez and M. Valdivié. *Cuban J. Agric. Sci.*, 1980, 14, 57-61. — The metabolizable energy (ME), apparent dry matter retention (ADMR) and apparent nitrogen retention (ANR) were determined in male broiler chicks fed on diets containing different torula yeast levels. While the ME values did not differ significantly between treatments (yeast levels of 0, 10, 20 and 30% dry matter), ADMR and ANR values fell as the yeast levels in the diets increased, so that further work on the true nitrogen utilization in torula yeast used in broiler diets is suggested.

Energy — from alcohol. M. Bennett. *Sucr. Belge*, 1980, 99, 303-308 (French). — Technical and economic factors involved in the production of alcohol from cane or molasses are discussed, with particular mention of the Brazilian alcohol program and of the possibility of producing alcohol in Thailand and Sudan. Also discussed is treatment of vinasse as well as market flexibility and the potential production flexibility brought about by adding a distillery to a sugar factory.

Power alcohol or industrial alcohol plants. Systematization of plant concepts and technological solutions. G. Sodeck. *Zuckerind.*, 1980, 105, 836-841 (German). Production of alcohol from various raw materials, including cane juice and molasses, is discussed, with particular mention of the question of vinasse disposal, source of energy supply and the energy balance.

Rheology in the paper industry. A. García R. and A. G. Majonin. *Centro Azúcar*, 1979, 6, (3), 67-75 (Spanish). — A review with 18 references is presented of the literature concerning the rheological properties of fibre suspensions in the paper industry.

Influence of cuttings on the quality of cardboard. C. Bravo U., M. Benito B., J. Carbonel F. and H. Quirós D. *Centro Azúcar*, 1979, 6, (3), 77-85 (Spanish). — The Cuban paper industry employs much bagasse as raw material, because of the scarcity of wood for pulp, and this is supplemented with some wood and recovered material of national or foreign origin. The properties of pulps for cardboard made with various mixtures have been examined to determine the optimum proportions, followed by a study of the influence of the time and degree of milling.

Sugar cane bagasse: a renewable resource of industrial raw materials. V. V. Kore. *Maharashtra Sugar*, 1980, 5, (9), 27, 29-31, 33-35, 37, 41, 43, 45-54. — The manufacture of by-products from bagasse is described, covering paper and board, furfural, α -cellulose, plastics and animal fodder (after ammoniation), with brief mention of building bricks made from bagasse, lime and concrete mixtures used to build a few houses in Barbados, and of bagasse application to soil and as a domestic fuel in the form of briquettes.

Production of bio-fertilizer and bio-gas from agricultural wastes. Director, National Sugar Institute. *Maharashtra Sugar*, 1980, 5, (9), 55-58. — The anaerobic fermentation scheme set up at the NSI for production of fertilizer and methane from a mixture of bagasse (or other agricultural waste) and sewage is described and the economics indicated.

Bio-conversion of molasses to single-cell protein. N. G. Karanth. *Maharashtra Sugar*, 1980, 5, (9), 67, 69-77. A survey is presented of fermentation techniques for production of single-cell protein from molasses or other carbohydrate sources, as well as the engineering, nutritional and economic aspects; 34 references are given to the literature.

An integrated approach to the cane sugar industry. B. S. Burumurthy and G. Venkatraman. *Maharashtra Sugar*, 1980, 5, (9), 79-83, 85. — It is suggested that sugar factories in India should be adapted to an integrated system of manufacturing white sugar, gur and khandsari as well as alcohol from molasses and paper from bagasse. Various aspects are discussed and steam requirements calculated.

Integrated sugar-alcohol-paper complexes. K. P. Ganesan. *Maharashtra Sugar*, 1980, 5, (9), 87-92. — Factors to be considered in the creation of plants for the production of cane sugar, alcohol from molasses and paper from bagasse are discussed.

Chemicals from alcohol. R. S. Dubey. *Maharashtra Sugar*, 1980, 5, (9), 93, 95-99. — The production of ethyl alcohol from sugar and its use as chemical feedstock are discussed.

Ethyl alcohol from sugar cane. S. L. Venkateshwaran. *Maharashtra Sugar*, 1980, 5, (9), 129-131, 133. — The technology and costs of production of fuel alcohol from cane juice are discussed.

BREVITIES

New Kenya sugar factory¹. — Work on the proposed \$11.3 million Aldai Sugar Industry Company's factory is to start later this year. The company is a joint venture between Walchandnagar Industries Ltd. of India and local small-scale sugar cane growers.

Cane smut in Louisiana². — Smut disease has recently been identified in south-central Louisiana and is believed to have resulted from spores carried by southerly winds from Florida and Mexico. It is considered likely that some of the local cane varieties will prove resistant to the disease and that it will be contained. New varieties are smut resistant and no incidence has been observed in the state's test fields.

Philippines distillery contracts³. — The Philippines National Alcohol Commission have awarded contracts to three companies — Starcosa GmbH of Germany, Nichimen-Ube of Japan, and Zanini of Brazil — to build 14 alcohol distilleries costing some 909 million pesos (\$114 million). The distilleries will take four years to build and will have a projected daily output of 1,000,000 litres of anhydrous alcohol to be blended with petrol. The national fuel alcohol program calls for sugar cane or molasses to be used as feedstock.

Thailand sugar export proposals⁴. — The Ministry of Commerce approved a proposal put forward by the Thailand sugar producers that they be permitted to export 100,000 tonnes of white and refined sugar as stocks exceeded 300,000 tonnes. With domestic consumption of about 55,000 tonnes of white sugar per month there were adequate stocks to meet demand until the milling season started in November. The sugar manufacturers have also recommended to the government that emphasis should be placed on exports of white and refined sugar instead of raw sugar as the quality of such sugar is now up to international standards.

Papua-New Guinea sugar project progress⁵. — The Ramu Valley sugar factory is scheduled to be commissioned in August 1982 and the small 1982 crop is estimated to produce about 10,000 tonnes of sugar; subsequently production is expected to build up quickly to the full production target of 40,000 tonnes of sugar by 1984. Some 1500 hectares of commercial cane were planted in 1981 while some 6000 ha will be under cane by 1984. The varieties are mainly the Australian Ragnar and Q 90 though the latter appears susceptible to downy mildew. The objective of the A\$110 million project is to supply the market for sugar in Papua-New Guinea at a price no higher than the cost of sugar imports. The harvesting period will normally begin as soon as possible in early May after the start of the dry season and continue to the second half of November when the wet season begins. Cane planting and cultivation will be machine-intensive with the opening and closing of furrows in one operation to conserve soil moisture. It is projected that cane will be cut green by whole-stick harvesters, manually cleaned and wind-rowed, and mechanically grab-loaded into 8-tonne trailers to be hauled to the factory by tractor, for unloading by a chain-net system. The factory, being built by Kawasaki Heavy Industries Ltd., will have an initial throughput of 2800 t.c.d. and will use the double sulphitation process to produce mill white sugar. A packaging plant is included and storage for up to 20,000 tonnes of sugar.

Comecon aid for Cuban sugar expansion⁶. — In January 1981 Cuba announced plans to expand its sugar production to 10 million tonnes a year by 1985 and to invest \$1800 million on modernizing 40 of the existing sugar factories and constructing 14 new ones. It has now been announced that, under an agreement signed in Sofia in July, the Comecon countries of Eastern Europe are to provide assistance in this project in the form of money and materials to the value of \$635 million. The USSR is to provide equipment for the construction of 11 sugar factories, 8 of which will begin production before 1985.

Israel sugar imports⁷

	1980	1979	1978
	tonnes, tel quel		
Australia	101	0	0
Austria	5,276	0	0
Cameroon	508	0	0
EEC	77,873	169,547	145,166
Finland	88	139	68
Norway	0	17	0
Panama	24,129	34,772	15,984
Paraguay	1,003	0	0
Rumania	0	0	220
South Africa	2,615	44,253	15,150
Spain	0	242	293
Sweden	0	0	66
Switzerland	11	2,741	18,139
USA	7,398	608	816
Yugoslavia	0	5,443	0
Others	0	8	31
	<u>119,002</u>	<u>257,770</u>	<u>195,933</u>

New South African sugar factory⁸. — The Hulett Corporation plans to build a new sugar factory near Richards Bay on the coast of the Indian Ocean. The factory, costing 110 million Rand, is to process 3,300,000 tonnes of sugar cane annually and is to start operations in April 1984. In its first phase it will crush cane from the area previously supplying the Empangeni factory which will be closed in February 1984. When the second phase of the new mill comes into operation in 1985 it will replace the Felixton mill which will also be closed.

Costa Rica sugar imports possibility⁹. — Declining production, increasing domestic consumption and over-committed exports might mean that Costa Rica will need to import sugar before the start of the 1981/82 season. Exports were halted in May, when it became clear that the domestic market was likely to run out of supplies. According to the Liga Agrícola Industrial de la Caña, rising costs and falling prices are making sugar production increasingly uneconomical and it has declined in the last two seasons, a downward trend which will continue unless the change by growers to more profitable crops is halted. The retail price in Costa Rica is 26 cents/lb, compared with over 40 cents/lb in most other Latin American countries, and consumption in 1981/82 is expected to rise to 147,000 tonnes, against 138,000 tonnes in 1980/81.

Mozambique sugar industry rehabilitation¹⁰. — Under a recently signed £15 million contract, Tate & Lyle are to oversee work and import the necessary spares for rehabilitation of the Mozambique sugar industry. The project covers the four state sugar factories as well as the one remaining private factory. Up to 85% of the costs are covered by a British Export Credits guarantee. Sugar and molasses were at one time second only to cashew as the country's main export; production has fallen, however, from 220,000 tonnes in 1979/80 to only 177,000 tonnes in 1980/81, which has cut the quantity available for export to some 55,000 tonnes against 90,000 tonnes in 1979/80.

French loan for Madagascar sugar factory equipment¹¹. — France is to lend Madagascar \$5 million to finance an emergency sugar program involving the purchase of new equipment for the sugar factories at Ambilobe, Namakia, Nossi-bé and Brickaville. The loan is repayable in 15 years including a grace period of 5 years and carries interest at 7% per annum.

Irish sugar factory closure¹². — The Department of Agriculture in Ireland has announced that the sugar factory at Tuam is to be closed after the 1981/82 campaign and its sugar beet supply transferred to the Irish Sugar Company's other three factories at Carlow, Mallow and Thurles.

¹ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 522.

² *Sugar J.*, 1981, 44, (2), 27.

³ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 523.

⁴ *Standard Chartered Review*, September 1981, 35; *Public Ledger*, September 12, 1981.

⁵ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 561-562.

⁶ *World Sugar J.*, 1981, 4, (3), 36.

⁷ *I.S.O. Stat. Bull.*, 1981, 40, (8), xii.

⁸ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 578, 670.

⁹ *World Sugar J.*, 1981, 4, (3), 36.

¹⁰ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 579.

¹¹ *World Sugar J.*, 1981, 4, (3), 37.

¹² F. O. Licht, *International Sugar Rpt.*, 1981, 113, 596.

Typhoon damage to beet in Japan¹. — The typhoon Thad, which caused heavy rain over Hokkaido, caused damage to sugar beet in the north of the island, estimated at 518 million yen, with 3161 hectares of beet fields flooded. The area affected by the typhoon and rains in early August amounts to 12,500 ha from a total estimated beet area of 74,000 ha. With a reduction in sugar content from last year's record 15.08% to 12.13%, and a beet yield reduction of 27%, there may be a reduction of sugar production in spite of an increased original beet area.

A/S De Danske Sukkerfabrikker, 1980/81 report. — Owing to favourable conditions, above-average yields were obtained from the 1980 beet crop and total sugar production was 371,000 tonnes or 11,000 more than the combined Danish A and B quotas. The beet was easily processed during the period from the start to early December but frost damage caused a reduction in production and sugar yield before the end of crop in late December. Production facilities are adequate to satisfy the quotas, and investment at the factories has been focused on lowering production costs, improving sugar quality and environmental protection. The Engineering Division has been involved with projects for modernizing and improving efficiency at five Rumanian sugar factories, and modernizing and expanding a factory in Yugoslavia from 2500 to 5000 tonnes daily slice. Shipments of cane sugar equipment have been made to Vietnam, as well as diffusers for the sugar and alcohol industries, while a number of consultancy contracts have been awarded by sugar factories in Canada and the USA to the office established in the latter country.

South Africa sugar factory expansion². — Among the equipment installed during an expansion program at C. G. Smith Sugar's Illovo sugar factory is a BMA cane diffuser which will raise the capacity from 150 to 200 tonnes of cane per hour. Three mills of the previous six-mill tandem are to be retained for dewatering the bagasse while other new equipment includes bagasse carriers, a juice heater station, power house and transformer room, laboratory and offices, crystallizers, a multi-storage tank, and steam pipe and electricity networks. A new packing station will handle 60-65,000 tonnes of Illovo brown sugar annually, while a new Foster Wheeler boiler was due to go on stream in October 1981. Other new plant include a 5 MW turbo-alternator, workshops, a bagasse store extension, fly-ash dewatering and disposal equipment, an SRI clarifier, evaporator station, a low-grade pan house with two Fives-Cail Babcock continuous pans, lime handling and slaking plant, pumps and piping, four A-centrifugals, a final molasses tank, etc. The cost of the extension will be R 14 million.

Finnish Sugar Co. Ltd., 1980 report. — During the year, the Company was reorganized following the mergers of Oy. Juurikkakeri, Salon Sokeritehdas Oy, and Turengin Sokeritehdas Oy, with Finnish Sugar Co. Ltd. An agreement on cooperation having been reached with Lännen Tehtaat Oy, in August, the basic conflicts within the industry in Finland have been resolved, and commercial operations to do with sugar are to be developed, including intensification of sugar product marketing in the country, investment in starch-based sweeteners, etc. The area under beet in Finland was 31,399 hectares, about 3% less than in 1979, but the quantity of beet was a record 900,248 tonnes, although the sugar content was slightly lower than average at 15.27%. Sugar production at 105,156 tonnes was also a record, Finnish Sugar Co. Ltd. providing 77,200 tonnes or 73.4%. The Porkkala and Vaasa refineries imported 155,216 tonnes of foreign raws as well as 38,602 tonnes of molasses for desugarization. Exports of sugar amounted to 58,134 tonnes, nearly double the 1979 tonnage. Finsugar Engineering reached an agreement with Miwani Sugar Mills Ltd. of Kenya for delivery of a refinery unit to be completed in 1982, while promotion of process equipment sales for export continued.

Zimbabwe sugar and alcohol project³. — The state-owned Industrial Development Corporation has submitted a sugar and alcohol project for government approval. It could provide work for 5000 families on communal land which barely provides subsistence for its present cultivators. The Chisunbanje project, in the south-east, could produce 150,000 tonnes of sugar and 20 million litres of alcohol per year by 1986. The country's first alcohol plant at Triangle produces 40 million litres a year, sufficient for 15% of petrol consumption.

Thailand sugar cane crop increase⁴. — The Secretary-General of the Agricultural Economics Office has estimated sugar cane production for the 1981/82 season at 25 - 28 million tonnes, an increase of 35 - 51% over the 18.5 tonnes produced last season.

Philippines refined sugar production⁵. — Refined sugar production in the Philippines has risen from 501,834 tonnes in 1975 to 800,486 tonnes in 1980. Refined sugar output will increase further since a sugar refinery in Batangas province, 40 miles south of Manila, began production late in 1981. The Philippines has nine operating sugar refineries with a total daily production of 4050 tonnes and construction of refineries has shifted the country's export capability from raw to refined sugar.

Puerto Rico sugar crop, 1981⁶. — The 1981 Puerto Rico season began on January 14 and ended on May 22. Seven mills crushed 2,040,000 short tons of cane, down slightly from the 2,150,000 tons crushed in 1980. However, only 150,840 tons of sugar, raw value, was produced from the 1981 crop, down significantly from the 169,124 tons of a year before. Sugar recovery was disappointing, averaging only 7.4% against 7.87% in 1980 and 8.37% in 1979. Lower recovery rates in recent years reflect the higher proportion of older cane being processed in Puerto Rico, while a great number of rainy days also contributed to low sugar recovery in 1981.

Burundi sugar project⁷. — Two Arab funds approved loans in September totalling \$27 million which will help to finance a \$70.6 million integrated sugar complex near Bujumbura. The complex, to be operated by the Société du Mosso, will require irrigation of 1925 hectares of cane land, construction of a 1000 t.c.d. sugar factory and a new town to accommodate 4-5000 people. Production should satisfy local demand within four years and make substantial savings in foreign exchange.

Philippines ISA quota shortfall possibility⁸. — According to a recent study prepared by the Ministry of Agriculture, sugar carryover stocks are now down to minimum operating levels as a result of large exports during the 1979/80 season because of favourable prices abroad, and consequently the Philippines may not be able to meet its minimum export quota of 1.5 million tonnes under the International Sugar Agreement for the year from September 1981. Production in the 1980/81 season is estimated at about 2,450,000 tonnes, raw value, while exports are expected to total 1,700,000 tonnes. Refined sugar production, which has steadily risen from 501,834 tonnes in 1975 to 800,486 tonnes in 1980, will be further boosted by Batangas Sugar Refinery which started operating in 1981. Construction of additional sugar refineries is part of government strategy to shift sugar exports from raw to refined. Trading of sugar will continue to be handled by the government-owned National Sugar Trading Corporation.

New US corn sweetener project⁹. — A farm cooperative has recently announced plans for construction of a corn wet-milling unit in Mankato, Minnesota, to produce first and second-generation HFCS and corn starch. The new facility will process up to 70,000 bushels of maize per day or 25 million bushels annually. Plans call for the plant to devote a quarter of its output each to corn starch and 42% HFCS and the remaining half to 55% HFCS. This would amount to 105,000 short tons each, dry weight, of the first two products, and 210,000 tons of 55% HFCS. Such a plant would be the third largest HFCS producer in the country. A spokesman for the cooperative said that groundbreaking could be as early as mid-1982 with the plant possibly in operation as early as the summer of 1984.

New Indian sugar factories¹⁰. — It is planned to set up three new sugar factories in Haryana State. A government minister announced that they would be located at Palwal, Jind and Shahbad and efforts would be made to commission them within a year. Each will have a crushing capacity of 1250 t.c.d. and will cost between 80 and 100 million rupees. At present there are four cooperative sugar factories in the state, at Panipat, Sonapat, Rohtak and Karnal, as well as a privately owned factory at Yamunanagar.

¹ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 580.

² S. African Sugar J., 1981, 65, 355-356.

³ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 624.

⁴ *Standard Chartered Review*, October 1981, 31.

⁵ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 603.

⁶ *USDA Sugar & Sweetener Outlook & Situation*, Sept. 1981, 12.

⁷ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 623.

⁸ *Standard Chartered Review*, October 1981, 27.

⁹ F. O. Licht, *International Sugar Rpt.*, 1981, 113, 668.

¹⁰ *Maharashtra Sugar*, 1981, 6, (11), 55.

Sugar Processing Research Conference

The first Conference on Sugar Processing Research will be held in Atlanta, Georgia, at the Omni International Hotel, during April 29 – May 1, 1982. This conference, formerly known as the Technical Session on Cane Sugar Refining Research, will immediately precede the 1982 Sugar Industry Technologists' Conference, also to be held in the Omni Hotel.

The Sugar Processing Research Conference is sponsored by Sugar Processing Research, Inc. in conjunction with the Southern Regional Research Center of the Agricultural Research Service, U.S. Department of Agriculture, to provide a forum for presentation of research findings and exchange of ideas related to sugar processing. On the evening of April 29 there will be an opening reception for the conference. Technical sessions will be held on Friday, April 30 and Saturday, May 1. There will be a cocktail hour and banquet on the evening of Friday, April 30. A ladies' program will be provided, with transportation to attractions and restaurants in the Atlanta area.

Interested technologists should write to Dr. Margaret A. Clarke, Director, Sugar Processing Research Inc., P.O. Box 19687, New Orleans, LA 70179, USA. A partial tentative list of papers to be presented appears below:

<i>General Subject</i>	<i>Author or Source</i>
Bone char decolorization test	Amstar
Dextran effect on refinery yield	Amstar
Dextran and crystallization	Audubon Sugar Institute
Sugar and nutrition	Dr. G. N. Bollenback
Additives and pan boiling	Dr. J. C. P. Chen
Physical constants of sucrose solutions	E. J. Culp
Recent developments in biomass technology	M. C. Ladisch
Clarification of molasses	Sugar Milling Research Institute
Foaming problems in sugars	Dr. G. W. Vane
Mixing bone char and granular carbon	Dr. F. G. Carpenter
HPLC and process technology	Dr. M. A. Clarke
Minor constituents of sugars and filtration	G. M. Elgal
Developments in flavour technology of sugars	M. A. Godshall
Dextran and viscosity	Dr. F. W. Parrish
A new analysis for dextran	E. J. Roberts

Symposium Topic — New methods of analysis and sugar processing technology. (Includes tests for sugars, dextrans, other polysaccharides, ash components, and decolorizing agents and new instruments).

Videcom. — A computerised commodity trading information system developed over the last 10 years in the United States is now available in the UK from a specialist computing services company, ADP Comtrend Ltd. Called Videcom, the service has revolutionised 'chartist' commodity trading; in the US, Comtrend has around 700 computer terminals linked to the system and Videcom terminals are expected to become increasingly common in U.K. commodity brokers' offices, providing additional facilities such as a historic database of price movements and instant graphic displays of information that are not available through other sources. The terminals are connected by leased line to ADP Comtrend's powerful central computer. Information from commodity exchanges is fed into the computer database which contains complete time and price information for all actively traded contracts on the commodity exchanges linked into the system. Subscribers to the service have instant access to detailed information, virtually at the touch of a button — presented in tabular and graphic form for ease of visual assimilation — which is constantly updated as price movements are reported. Displays available through Videcom include: intraday trendline and tic charts, multiday trendline and bar charts, board watch displays, point and figure charts, spread and ratio charts with trendlines, moving average charts, text messages and account watch displays.

Canadian sugar refinery closure¹. — The Cartier Sugar Ltd. refinery in Montreal, Quebec, has been closed.

Sugar in containers from Mauritius. — The multipurpose container-ship Degas of Compagnie Generale Maritime (CGM) recently made a special call at Southampton, to discharge 72 containers of sugar from Mauritius. The Degas is one of the multi-purpose vessels operated by CGM between Europe and the Indian Ocean islands of Réunion, Mauritius and Madagascar.



Erratum. — On page 234 of our August 1981 issue we published a table of sugar exports by Colombia; unfortunately the figures given were from a different table and should have been as follows:

	1980	1979
	tonnes, raw value	
Chile	107,309	98,994
China	0	24,000
Morocco	0	24,800
Portugal	12,096	72,520
Tunisia	0	12,420
USA	173,121	45,480
	<u>292,526</u>	<u>278,214</u>

Sugar production stoppage in Israel. — The Israel government has set up a committee to consider the long-term prospects for the sugar industry in that country. Meanwhile, farmers decided not to grow sugar beet in 1981 because Sugat sugar factory only offered them \$30 a tonne against \$60 a tonne in 1980. The government will only provide support up to \$10 a tonne. The farmers are awaiting the results of the committee's investigations, while Sugat has suspended sugar production.

British Sugar Corporation record profits. — On November 11, British Sugar Corporation announced record pre-tax profits, before extraordinary charges, of £51,035,000, for the financial year ended September 27, 1981. This compares with £34,167,000 the previous year. The Chairman, Sir Gerald Thorley, commented that £150 million spent over the past few years on modernizing and enlarging key factories is really beginning to pay off. "In an industry like ours it is essential to invest heavily in capital equipment and plant; to take full advantage of modern control techniques, for example, microprocessors; and to retrain the work-force. All three elements must be there if the full benefits are to be squeezed out of investment." British Sugar will continue to invest substantial amounts at its factories; the recently completed program had the dual purpose of expanding key factories as well as modernizing them. Now investment will concentrate solely on further efficiency gains. The extraordinary charges of £13.7 million were mainly due to the closure of four small and less cost-effective factories.

Ethiopia sugar project². — The government of Ethiopia has applied for a credit from the International Development Association to help finance a sugar project incorporating the establishment of an irrigated sugar estate of approximately 6500 hectares and a factory having an initial capacity of 4000 t.c.d. The supply and construction period is expected to commence before the end of 1982 and continue for about three years. In addition, the credit, together with other agency assistance, would be used to finance internationally recruited specialists having appropriate agricultural and factory expertise to be stationed at Fincha; and construction management service to provide appropriate design services, supervision and management during construction.

¹ *Sugar y Azúcar*, 1981, 76, (10), 6.

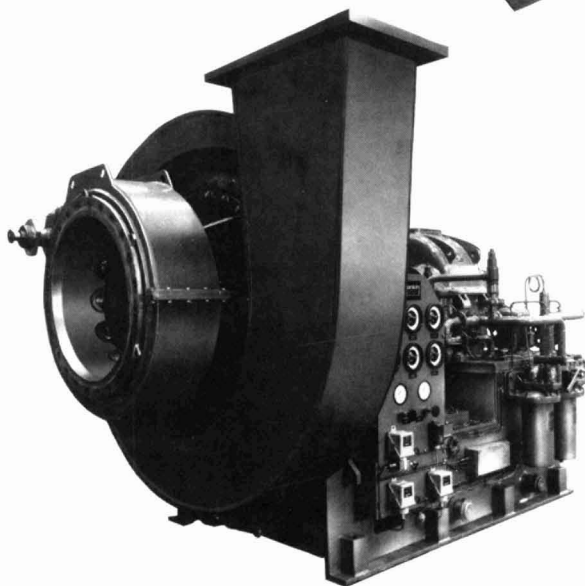
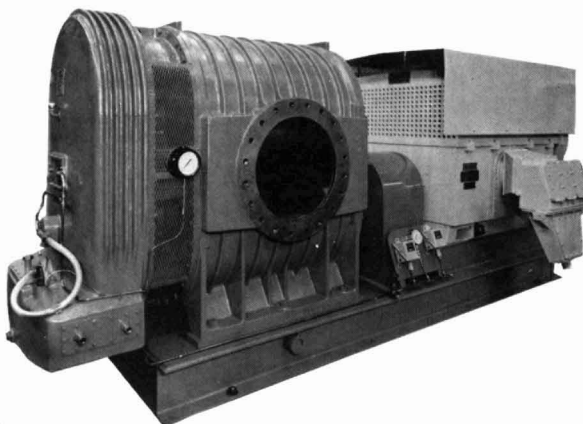
² F. O. Licht, *International Sugar Rpt.*, 1981, 113, 671.

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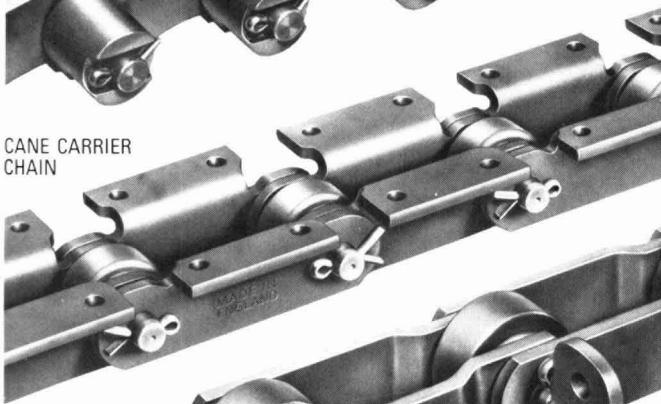
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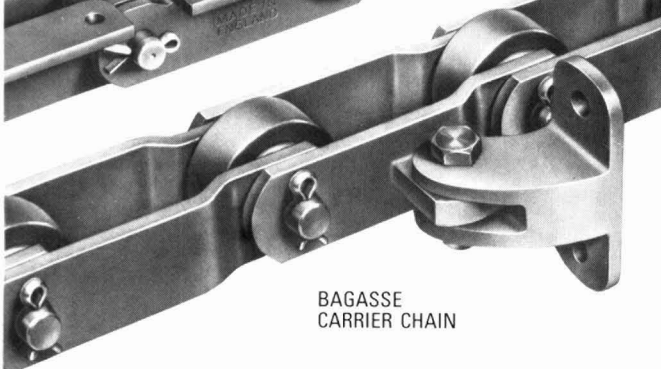
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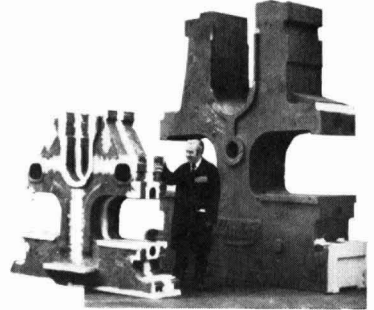


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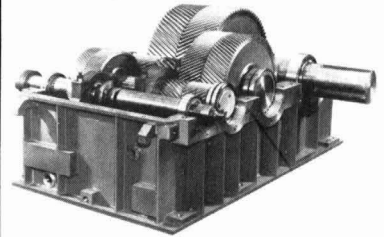
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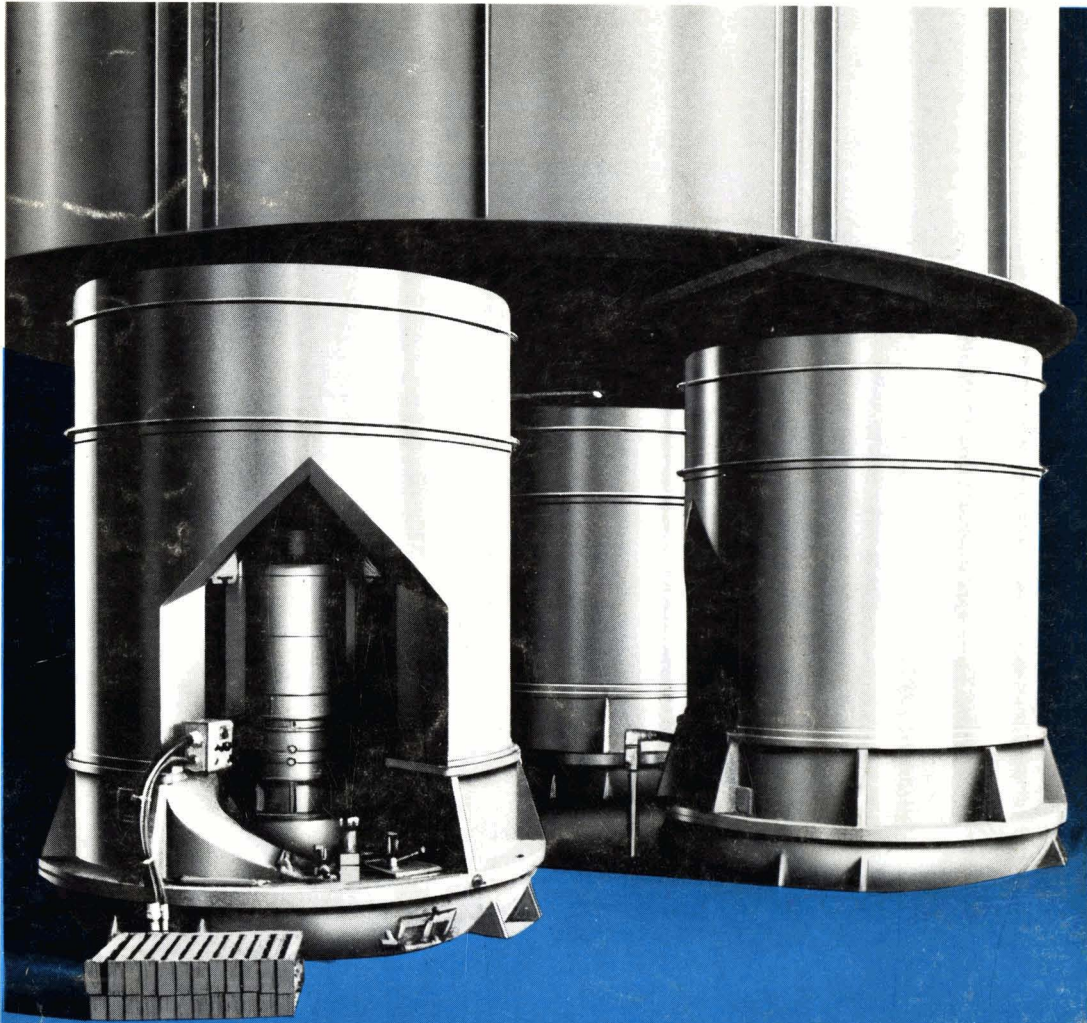


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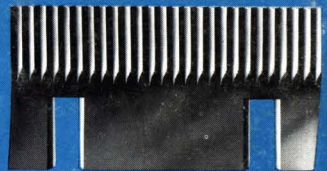


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