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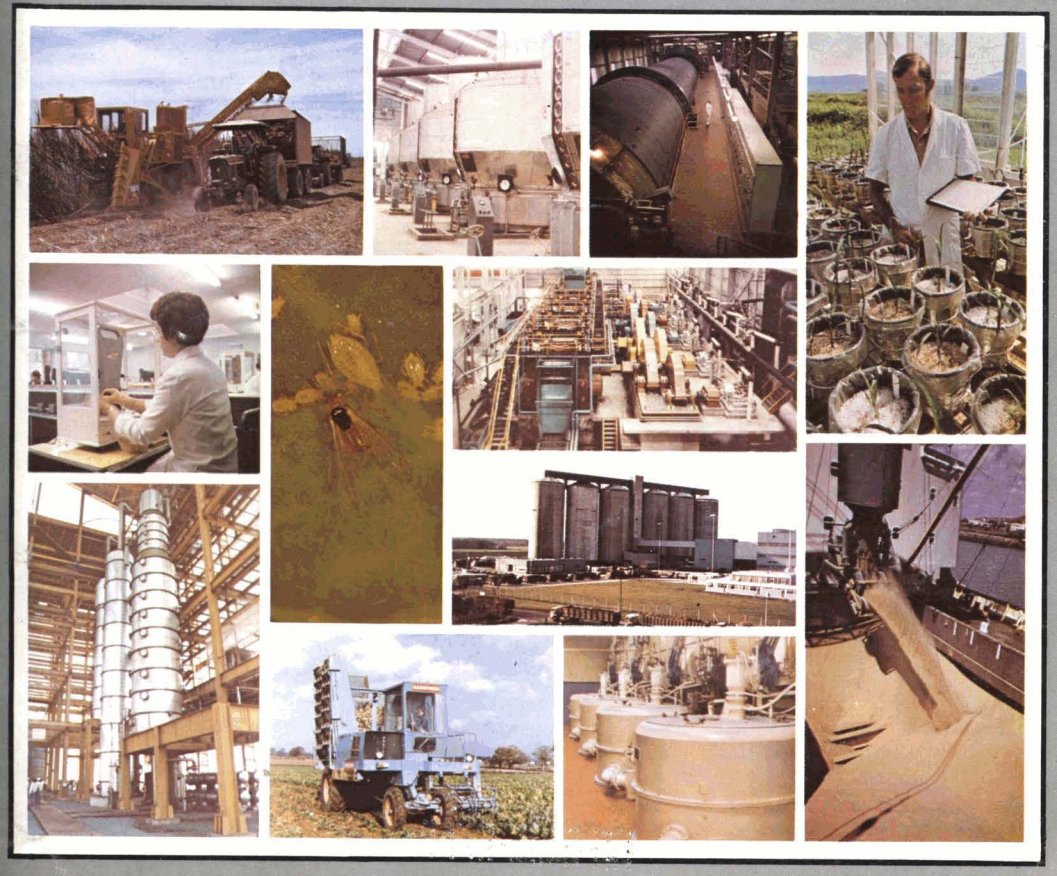

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NOTES AND COMMENTS

World sugar prices

The slide in the London Daily Price of raw sugar continued during April while the premium over it of the LDP(W), £31 on April 1, fell sharply at the beginning of the month and generally was in the range of £13-£18 during the remainder. From £226 per tonne, the LDP fell to £173 by April 30 while the corresponding white sugar values were £257 and £200, respectively. The fall in the white sugar premium coincided with the change of policy by the EEC Commission whereby, instead of being adamantly opposed to the granting of restitutions (subsidies) on sugar sales, these were resumed on a fairly lavish scale which brought sugar values to below the market level. Of course, the Commission is faced with the problem of disposing of 900,000 tonnes of surplus sugar from the 1980/81 campaign as well as amounts, estimated at between 300,000 and 400,000 tonnes, of sugar for which export licences were issued last year but which have not been taken up owing to the subsequent fall in prices. This surplus should be sold before the end of the community's sugar year — June 30 — and, although an extension has been agreed, the Commission is clearly intent on disposing of as much sugar as possible in the period.

Towards the end of the month there was a slight recovery as a result of the occurrence of frosts and snow in Europe after Easter but damage was apparently not such as to cause significant crop losses and required only some resowing of beet seed. The limitations of imports of sugar by ISA members from non-members became applicable on April 21 but, as mentioned before, this will have little practical effect this year. Towards the end of the month, however, the ISA daily price dipped below 16 cents/lb and the impositions of quotas — automatic when the prevailing price remains below 16 cents for five days — appears to be likely in the near future.

International Sugar Agreement

The Council of the International Sugar Organization met in London in April and among other matters considered a report by its panel which had considered claims of *force majeure* regarding shortfalls in their 1980 sugar exports made by Colombia, Cuba, Dominican Republic, India, Mauritius, Peru, South Africa and Thailand. Most of the applicants were dissatisfied with the panel's recommendations and the question was referred back for further study and a further report to the Council at its meeting on May 21; in the meantime it was necessary to postpone calculation of Basic Export Tonnages for 1981. It was decided, however, to permit the limitations of imports by members from non-members to come into effect on April 21.

F. O. Licht GmbH note[1] that "if the present level of prices continues and a prevailing price below 17.00 cents per pound is established early in May the Council will find itself in something of a dilemma. Either it will have to bring forward the date of its next meeting from the currently scheduled May 21, or it will have to forego the possibility of imposing quotas once the prevailing price falls below 17.00 cents per pound, or it will have to work on the basis of notional performance figures for 1980, to be adjusted in case of need at a later stage. One way or another it might be better from many points of view — though perhaps not from buyers' — if the price were to rise again, at least for the time being.

"One other provision which will come into force, should quotas be reimposed, is the one providing for the establishment of special stocks. These have already been built up once and subsequently released but, although it is possible that the Council would, through the exercise of the somewhat cumbersome special vote procedure, decide not to re-establish these stocks, it is much more probable that steps would be taken to ensure they were rebuilt as soon as possible.

"The accumulation of special stocks brings into consideration the question of financial assistance from the stock financing fund. When stocks were previously accumulated the fund was not in operation and so stock holders were unable to take advantage of their entitlement under the Agreement, even though it appeared to many exporters that the provision of finance was a necessary counterpoint to the establishment of stocks. Now, however, the fund is in being and if exporting members are to hold special stocks they will expect to receive financial assistance as specified under Article 49 of the Agreement. It was originally provided under the Agreement that the rate of contribution to the fund would be 0.28 cents per pound or $6.17 per tonne on sugar exported from or imported into the customs territory of members. When the fund finally came into operation the stocks had already been released and therefore, with only the administrative costs of the fund itself to be met, it was agreed that the rate of contribution should be set at $0.50 per tonne. Clearly this will not be sufficient if stocks are once again to be accumulated and the full obligations of the fund are this time to be met. Accordingly it must be anticipated that consideration will be given to increasing the rate of contribution substantially."

EEC sugar prices

On April 1 the Farm Ministers of the European Community eventually reached agreement on prices for the agricultural sector for 1981/82, currency rates applicable and the sugar regime for the five years commencing July 1, 1981. The A- and B-quotas agreed appear below; they are basically the same as proposed by the Commission last September but with the enlargement of the A-quota for Italy and of the B-quotas for Belgium-Luxembourg, the French D.O.M., Holland, Ireland and the UK but lowering of the Italian B-quota. The quotas are, moreover, subject to revision for the last two years of the period. The A-quotas for HFCS manufacture in the Community have been set at 147,127 tonnes.

	A-quotas	B-quotas	Total
	tonnes, white value		
Belgium-Luxembourg	680,000	146,000	826,000
Denmark	328,000	97,000	425,000
France—Metropolitan	2,530,000	759,000	3,289,000
—D.O.M.	466,000	47,000	513,000
Germany, West	1,990,000	611,000	2,601,000
Greece	290,000	29,000	319,000
Holland	690,000	182,000	872,000
Ireland	182,000	18,000	200,000
Italy	1,320,000	248,000	1,568,000
UK	1,040,000	104,000	1,144,000
	9,516,000	2,241,000	11,757,000

[1] *International Sugar Rpt.*, 1981, **113**, 271.

The A-quotas represent an increase from the 9.4 million tonnes of the current regime but the B-quotas represent a decrease of 340,000 tonnes. Producers will also contribute more to the cost of exporting to third countries the sugar produced under A- and B-quotas which is surplus to EEC consumption (they already bear the full cost of exporting C-quota sugar). A co-responsibility levy of up to 2% has been agreed on all production within the A- and B-quotas (the Commission originally proposed 2.5%) and thereafter a levy of up to 30% of the intervention price will be chargeable on B-quota production. In exceptional circumstances, where the levy is insufficient to cover costs, a further levy of 7.5% may be made, to be carried forward to the following year.

The Commission had proposed the phasing-out of national adaptation aids permitted in Italy and the D.O.M. and the regionalized intervention prices; the Ministers have decided to permit their continuation except for the adaptation aids in Italy which will be halved during the period of the new regime. The refining margin has been raised by 8.6% to 3.93 e.c.u. per 100 kg while the differential charge designed to stop preferential cane sugar being processed in beet sugar factories is to be maintained in 1981/82 and then phased out in three equal instalments during the next three years.

For 1981/82 the minimum price for beet will rise by about 8.5% to 35.91 e.c.u. per tonne while the basic intervention price for white sugar has been raised correspondingly to 469.5 e.c.u. per tonne. The raw sugar intervention price increase has been limited to 7.5%, however, bringing the price to 385.8 e.c.u. per tonne.

The "green currency" rates of exchange — the fixed rates used for translating e.c.u. prices into national currencies — have been amended in most cases; the deutschmark has been revalued by 3.582% while the Belgian franc and Dutch guilder have been devalued by 0.685%, the Danish krone and French franc by 2.473%, the Irish punt by 3.776% and the Greek drachma and Italian lira by 5.641%.

C. Czarnikow Ltd.[1] remark: "It is interesting to note that the European Parliament had rejected the proposed levy on A-quota sugar. They recommended instead that an increase in funds from other sources be considered, including an increase in the percentage of value-added tax to be derived from national exchequers. This recommendation appears to have been ignored".

Four of the ACP countries supplying sugar to the Community under the Lomé Convention — Uganda, Kenya, Surinam and Congo — had their export quotas reduced — by 4591, 4907, 532 and 5043 tonnes, respectively — because of failure to deliver in recent years. The four will be eligible to apply for reinstatement if they boost their production and other ACP countries fail to meet their commitments in the future. Only Kenya is likely to be able to do so in the near future, however, and the Commission has never reallocated shortfalls in the past. It is anticipated that the reductions will in practice be given to Zimbabwe.

Representatives of the ACP are seeking increases in the guaranteed price of their raw sugar, in line with those granted to beet sugar producers, in order to meet increases in their costs of production and freight. According to Reuter, they are unhappy that Brussels has returned to granting subsidies on sugar exports and they fear that the cane sugar market in Europe is in jeopardy. Growing EEC beet output and cuts in cane sugar refining capacity in the UK could lead to ACP sugar being sold into intervention. If that happened the Lomé Convention's sugar protocol would come to be regarded as an instrument of aid rather than of equal trade.

Philippines sugar contract cancellations[2]

The Philippines has recently cancelled sugar export contracts with international traders and is still negotiating cancellation of more contracts for shipment in the second half of 1981, according to trade sources. Estimates of the total amount cancelled so far for 1981 shipment vary but some run above 500,000 tonnes. Some earlier cancellations reflected a late crop and shipment delays but later ones indicate that the Philippines has oversold at well above current market levels.

The differences in prices between the original sale and the time of cancellation could be as high as 20 cents per lb and dealers said that this difference would in most cases largely accrue to the Philippines, while traders would not lose as they should have corresponding profits made from hedge sales in world sugar futures markets.

EEC sugar exports finance

The EEC has rejected the Australian complaint made before the General Agreement of Tariffs and Trade (GATT) concerning subsidized exports. Despite support for Australia's case by most members of the GATT Council, the Community argued in March that the Australian complaint was irrelevant because export refunds were not being paid.

It is true that for nearly a year, the Community's Common Agricultural Policy benefited from an influx of funds owing to the difference between the high EEC prices and the even higher world market prices. From May 1980 to March 1981 (apart from a brief period in July 1980), the Community was able to apply a levy to exports, but with the fall in world sugar prices such levies have disappeared and only an export tax of 0.65 e.c.u. per tonne could be applied. With a zero levy, little sugar was sold during March and bids were rejected.

With more than a million tonnes of sugar to dispose of, the Commission has now had to restore the award of restitutions which, of course, has demolished the Community's argument before the GATT Council.

Berisford bid for British Sugar Corporation

The UK Minister of Agriculture, Fisheries and Food acknowledged on April 15 that the government would be prepared to dispose of its holdings in the British Sugar Corporation, which amounts to 24% of the equity, and shares rose on the Stock Exchange the next day from 300 to 305 pence per share. A week later, S. & W. Berisford Ltd. offered by buy all the ordinary share capital of the Corporation for cash, or cash plus Berisford loan stock, which valued the shares at 285 or 291 pence, respectively. In the meantime the shares had reached 315 pence on the Stock Exchange so that the Corporation's Board rejected the offer as "absurdly low", to quote the Chief Executive, while the government indicated that it would not accept the offer for its holdings. It appears, therefore, that Berisford will either have to withdraw its bid, perhaps taking the profit it can make on its own 9% holding, or increase its offer.

Brotherhood steam turbine sales. — Peter Brotherhood Ltd. of Peterborough, England, have won orders for a 600 h.p. steam turbine for a mill drive in the Bahawalnagar Sugar Mills Ltd. sugar factory in Pakistan, to be delivered in June 1981, as well as two steam turbines, one of 800 h.p. and the other of 1000 h.p., ordered by Fletcher and Stewart Ltd. for installation in a Zimbabwe factory for driving cane mills.

[1] *Sugar Review*, 1981, (1538), 53.
[2] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 206.

Foliar enzymes of sugar cane

Part I. Seasonal variation of invertases

By V.K. MADAN, KISHAN SINGH, H.P. PANDE and Y.R. SAXENA
(Division of Plant Physiology and Biochemistry, Indian Institute of Sugarcane Research, Lucknow 2, India)

Introduction

Hatch & Glasziou have studied the role of invertases (acid and neutral) in sugar cane meristem and established a relationship between seasonal variation in their activities and sugar recovery[1,2]. However, reports regarding invertase activity in foliar tissues of sugar cane had been controversial[3–6], and a study, conclusive in this regard, was recently published by this laboratory[7]. The present investigation is concerned with studies on seasonal variation of foliar invertases (acid and neutral) of sugar cane and their possible role in sugar recovery.

Experimental

Leaf samples were collected periodically from varieties Co 419, and CoLK 7701 (high-sugar) and Co 7330 and Lg 7255 (low-sugar), grown at the Institute farm, nitrogen fertilization, as urea, being 150 kg/ha. The criterion for classifying genotypes as high- or low-sugar is based on pol content above or below 18% at 12 months of age. The procedures for processing leaf samples for enzyme assay and protein determination have been reported earlier[5]. The findings are presented in Figure 1.

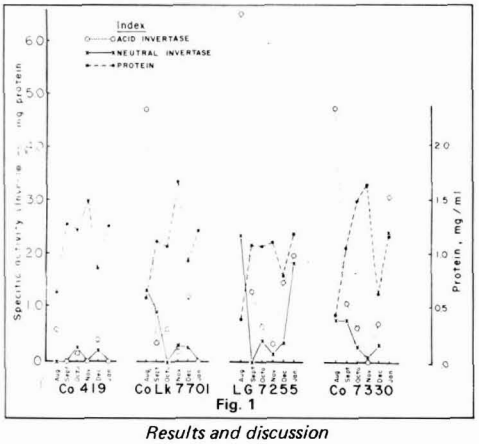

Fig. 1

Results and discussion

Acid invertase. – The specific activity of foliar acid invertase was maximum in all the four genotypes of sugar cane in the month of August, the period of major growth, although the magnitude of activity varied with the genotypes. High-sugar varieties (Co 419 and CoLK 7701) had lower enzymic activity than the low-sugar ones (Lg 7255 and Co 7330). Furthermore, there was a sharp fall in invertase activity from September in all the genotypes, indicating the onset of the maturity phase. The enzyme activity maintained a low pattern in high-sugar varieties and it finally disappeared in January. By contrast, in the low-sugar varieties invertase activity again registered a rising trend from November onward and the activity remained high until January, the month before harvest.

Neutral invertase. – In the initial phase (major growth period), low foliar enzyme activity was observed in high- as well as low-sugar varieties. In the high-sugar varieties neutral invertase almost disappeared during the maturity phase (September/October) while in low-sugar varieties the enzyme remained quite active during this period. It seems plausible, therefore, that presence of acid and neutral invertase during December/January (the two months before harvesting) probably plays a detrimental role in sugar recovery from low-sugar varieties.

It may be pointed out that the overall process of estimation of foliar enzymes in sugar cane is relatively simple as compared to meristem enzymes and, moreover, the sampling is non-destructive. The findings of the present investigation on foliar invertases and their pattern of seasonal variation indicate the possibility that enzyme studies might become one of the salient biochemical parameters in the breeding and selection of sugar cane genotypes. A high foliar invertase activity during the major growth period which drops during the maturity phase and finally disappears on ripening could perhaps be an indication of a high-sugar genotype of sugar cane.

Summary

Comparison of acid and neutral invertases in the leaves of different cane varieties showed that disappearance of the enzymes during maturation was associated with high sugar content while persistence of the enzymes was associated with low sugar content. It is suggested that enzyme content behaviour might be useful as a cane breeding parameter.

Enzymes foliaires de la canne à sucre. I. Variation saisonnière des invertases

La comparaison des invertases acides et neutres dans les feuilles de différentes variétés de canne a révélé que la disparition des enzymes au cours de la maturation était associée à une teneur élevée en sucre tandis que la persistance des enzymes était associée à une faible teneur en sucre. On suggère que le comportement de la teneur en enzymes pourrait être utile comme paramètre de sélection de la canne.

Blattenzyme im Zuckerrohr. I. Jahreszeitliches Variieren der Invertasen

Vergleiche der sauren und neutralen Invertasen in den Blättern von verschiedenen Rohrsorten zeigten, dass das Verschwinden der Enzyme während der Reifezeit mit einem hohen Zuckergehalt verknüpft war, während eine Beständigkeit der Enzyme mit einem niedrigen Zuckergehalt verbunden war. Der Enzymgehalt wird als ein nützlicher Parameter für die Rohrzüchtung vorgeschlagen.

Enzimas foliares de caña de azúcar. Parte I. Variación sazonal de invertasas

Comparación de invertasas ácida y neutral en las hojas de diferentes variedades de caña indicó que desaparecimiento de las enzimas durante maduración es asociado con alto contenido de azúcar mientras que persistencia de las enzimas es asociado con un bajo contenido de azúcar. Los autores sugieron que cambios en el contenido de enzimas pueden ser útil como parametro en la selección de caña de azúcar.

[1] Hatch *et al.*: *Plant Physiol.*, 1964, **38**, 338.
[2] Hatch & Glasziou: *ibid.*, 344.
[3] Fuji: *J. Agric. Chem. Soc. Japan*, 1944, **20**, 421.
[4] Alexander: *J. Agric.* (Univ. Puerto Rico), 1964, **49**, 287.
[5] Alexander & Samuels: *ibid.*, 1968, **52**, 204.
[6] Alexander: "Physiology of Sugar cane" (Elsevier, New York), 1973.
[7] Madan, Singh, Shivapuri, Pande & Saxena: *I.S.J.*, 1980, **82**, 55.

The Groningen sugar factory reconstruction

Coöperatieve Vereniging Suiker Unie U.A. was formed in 1966 by amalgamation of the cooperatives which were operating 6 factories in Holland, all producing white sugar. The group currently processes some two-thirds of the Dutch beet crop. In 1976 the company decided to expand its total slicing capacity from 41,000 to 45,000 tonnes per day in order to be in a position to finish slicing of an average crop within a period of 85 days.

Five of the factories are in the south of Holland and it was only in the north that sufficient agricultural land was available to permit enlargement of the beet area. This meant that expansion of slicing capacity would be limited to that of Groningen sugar factory, the only Suiker Unie facility in the north of Holland.

The project started in 1977 and Industrieprojekt GmbH of Braunschweig were appointed consultants. The objects were defined as the raising of slicing capacity from 7,000 to 11,000 tonnes per day but using the same amount of labour or less, production of only EEC 1 quality white sugar, and achievement of better exhaustion and lower steam consumption by 1980. In 1977 the facilities for beet piling and unloading of trucks were expanded, while the pulp pressing station was enlarged by installation of three new Stord RS80 presses (Fig. 1).

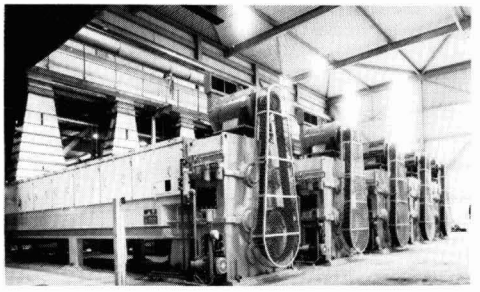

Fig. 1. Five of the nine Stord RS80 presses installed during the reconstruction

In 1978 two new beet washers were installed, outside the factory building (Fig. 2). Beets are transported by way of new beet elevators and belt conveyors with magnets into a 200-tonne bunker over the slicing machines. Three new slicing machines were added.

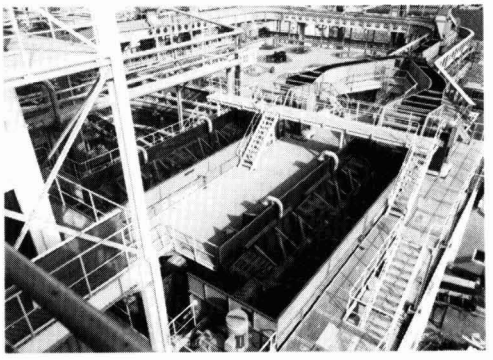

Fig. 2.

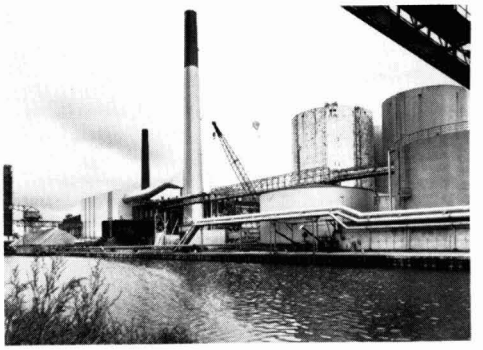

Fig. 3.

A new office building was erected to allow construction of a new sugar house and sugar storage capacity. A new beet yard was built, with samplers and weigh-bridges. The power house was completely changed; two new Stork boilers were installed of 80 tonnes.hr^{-1} capacity, producing steam at 60 bar pressure, and the opportunity was taken to change from gas to oil firing. A new chimney was built (Fig. 3) and new CO_2 pumps fitted. A new 20 MW turbo-generator was installed and produces current at 10 kV as against the 3 kV of the previous system; naturally, the higher voltage required replacement of much electrical wiring by new. A fire broke out during the 1978/79 campaign, damaging the new turbo-generator and causing a shutdown of the factory, but within a month it was back in operation by reactivation of the old turbo-generators and taking power from the grid.

Access to the factory was improved in 1978 by a new road leading from a by-pass (Fig. 4).

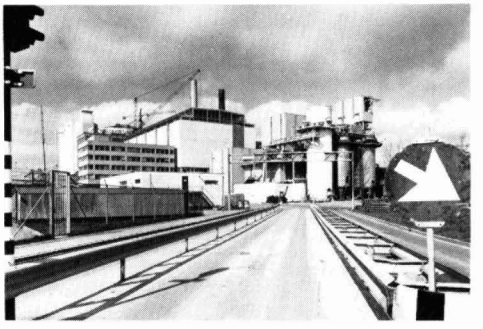

Fig. 4.

During the following inter-campaign a third Buckau-Wolf diffusion tower (Fig. 5) was erected and three more slicing machines were added. The new sugar house was completed. New vacuum pans were installed in the boiling house (Fig. 6) and pulp drying capacity was increased by provision of a new 5.4 metre Buckau-Wolf dryer (Fig. 7). A boiler house was built for central heating of the factory and a new circular anaerobic reactor constructed in concrete for treatment of waste water, as well as a sludge clarifier.

A new Kosik lime kiln of 550 m^3 capacity was erected

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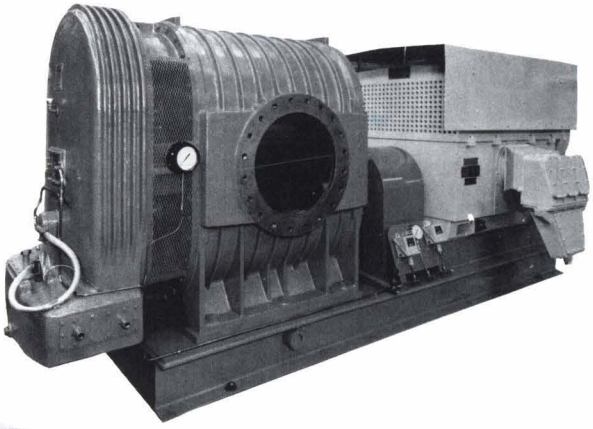

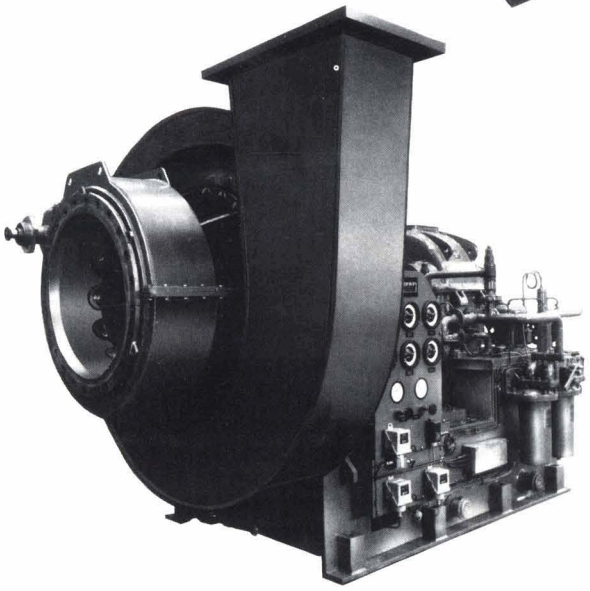

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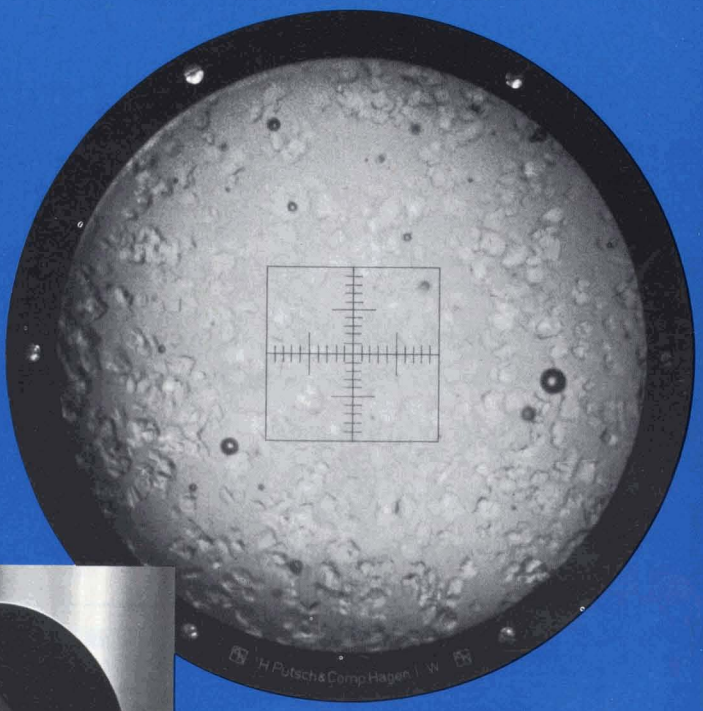

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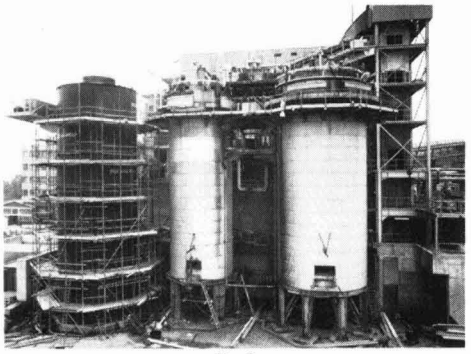

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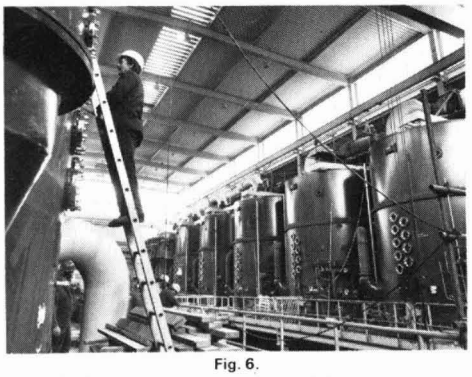


Fig. 6.

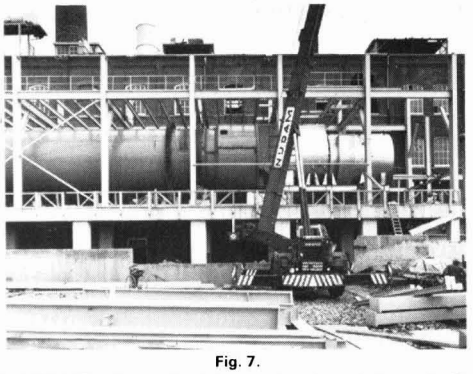


Fig. 7.

in 1980 (Fig. 8) and the juice purification station rebuilt; this involved new preliming, main liming and first and second carbonatation vessels, while a new Fuhrmann evaporator station was constructed providing a total of 22,000 m^2 heating surface (Fig. 9). New automatic Choquenet filter presses were installed (Fig. 10) while a new white sugar silo was built, of 40,000 tonnes capacity (Fig. 11). New screening and packaging plant was introduced and a pulp pellet store built on newly-bought land adjacent to the factory (Fig. 12). A second clarifier was built for wash water, so completing the reconstruction (Fig. 13).

The intended capacity increase has been achieved, with the desired labour economy. A four-shift system is operated with 62 men per shift. The total labour force numbers 500, of whom 380 are employed in the factory.

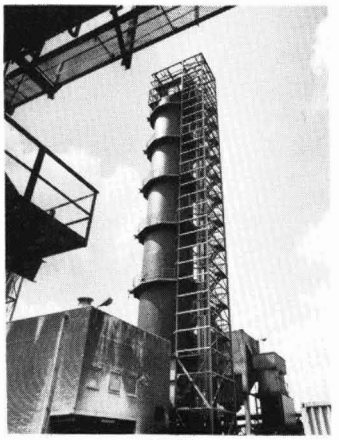


Fig. 8.

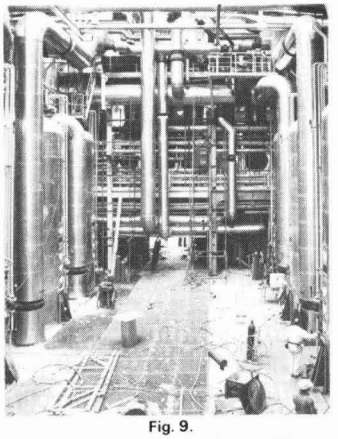


Fig. 9.

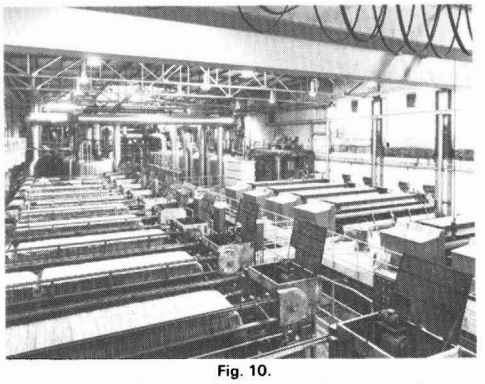


Fig. 10.

A large proportion of these work in the tarehouse; samples are taken from each 10-tonne load of beets and 1600 samples are analysed each day. Beet is received from 6 a.m. on Monday mornings to Saturday afternoon, the storage capacity being such as to permit continuous 7-day working.

Fig. 11.

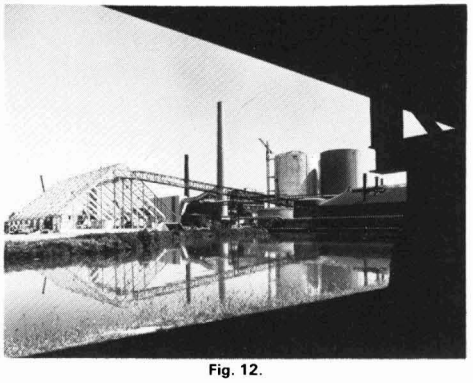


Fig. 12.

Fig. 13.

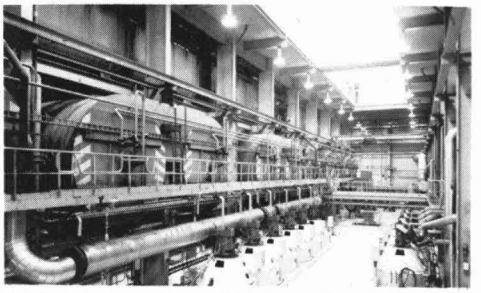


Fig. 14. Partial view of the ten 120 m³ crystallizers for 2nd and 3rd massecuites

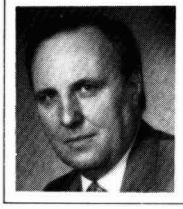
Acknowledgements

We wish to thank Industrieprojekt GmbH for permission to reproduce Figs. 2 and 14 in this article and Fig. 1 in the next. We also thank Stord Bartz A/S for permission to reproduce Fig. 1 in the above article. All the remaining photographs in the article have been reproduced with kind permission of Coöperatieve Vereniging Suiker Unie U.A., to whom we offer our thanks.

Computer-controlled pan boiling at Groningen

By HORST A. PASCHOLD
(Foxboro Industry Sales Group, Düsseldorf)

As part of the reconstruction and expansion of Groningen sugar factory, the boiling house was enlarged and a completely new control system installed. The pan floor now includes 17 new vessels, of which seven pans are for *A*-massecuite, five are for *B*-massecuite and five for *C*-massecuite. All were built by BMA to the specifications of Suiker Unie and were installed during the 1979 inter-campaign.



Horst A. Paschold

The control system was provided by Foxboro Nederland N.V. and allows completely automatic operation of all pans from an air-conditioned two-storey control room at one end of the boiling house. It would have been possible for the pan floor to be completely unattended but certain checks have been deliberately left for operators to do at the pans themselves in order that these will be visited at regular intervals. This is in order to provide an opportunity for observing the grain setting as well as possible small faults which would not be detected by the instruments fitted to the pans and would not be indicated at the operators' consoles. Furthermore it is necessary to fill up the grainpots, for which the computer gives a signal.

The ground floor of the control room houses the U-shaped panel, four operator consoles and four alarm printers. On the upper floor is housed the computer hardware including four central processors, three system terminals, five SPEC 200 racks and eight INTERSPEC

racks, as well as the Kloeckner Moeller programmable logic controller.

Fig. 1. The pan floor at Groningen showing the seventeen 95-tonne pans and control room

Instrumentation of the pans includes, for each a level transmitter, a vapour flow transmitter, a vacuum transmitter, a consistency transmitter and supersaturation measurement based on boiling point elevation. The control is performed by three FOX-3 computer systems, one each for the *A*-, *B*- and *C*-pans, with a fourth system as back-up for the other three; loading of the particular program into the computer by means of the diskette and the actual switch-over have to be done by hand.

A special feature welcomed by the operators is the "inhibit" function when switching from manual to computer control. The computer will not take over when the conditions prevailing are not in line with the software program. A print-out tells the operator the deviation which exists and which must be rectified before the computer will take control.

Each FOX-3 system has a 64K memory, a diskette drive, a system terminal, a monochrome VDU in the operator's console and an alarm printer. As a provision against power failure, each has a 30-minute battery power availability. Direct digital control is employed with manual back-up governing level, vapour flow, vacuum and thin juice/water valve operation for each pan. For each *A*- and *B*-pan there are two three-pen recorders for level, pressure, $T_{pilot\ pan}$, $T_{massecuite}$, steam quantity and consistency, while for each *C*-pan there is a three-pen and a four-pen recorder which also includes a setpoint

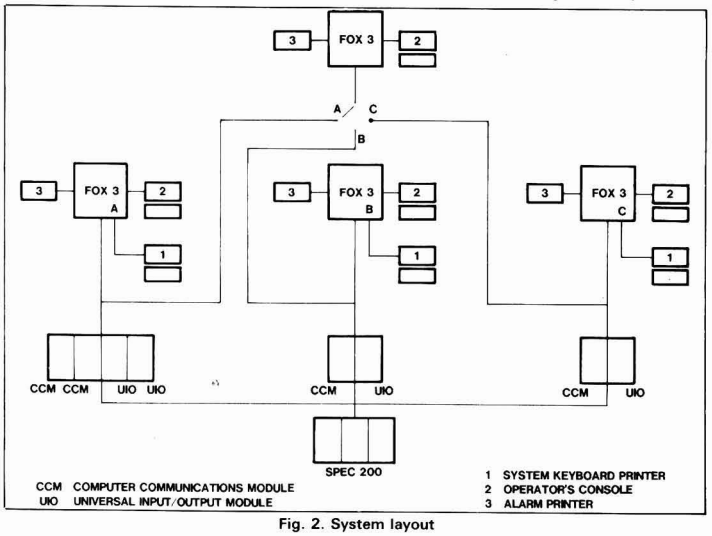


Fig. 2. System layout

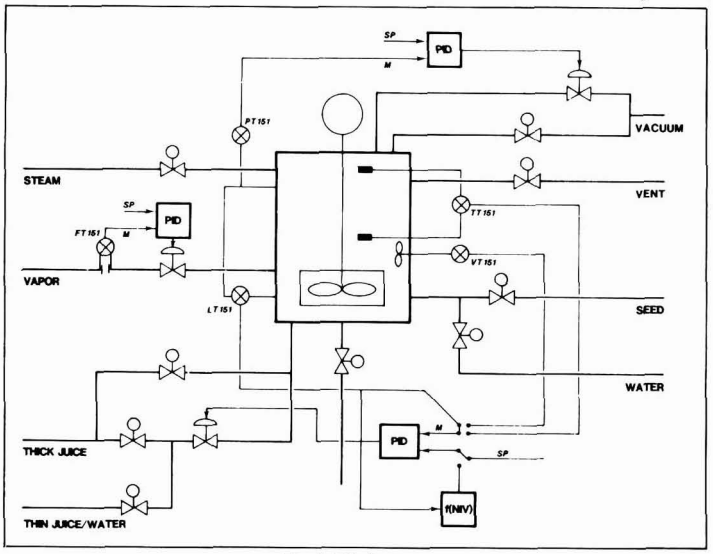


Fig. 3. P/I diagram

OVERVIEW A-PANS

PAN	PHASE	STAP	STATUS
1			HAND
2	CRYSTALLIZING	12	COMP
3	CRYSTALLIZING	12	COMP
4	READY	0	COMP
5	PRE-EVACUATION	1	COMP
6	TIGHTENING	14	COMP
7	EMPTYING	17	COMP

Fig. 4. CRT display of status of A-pans

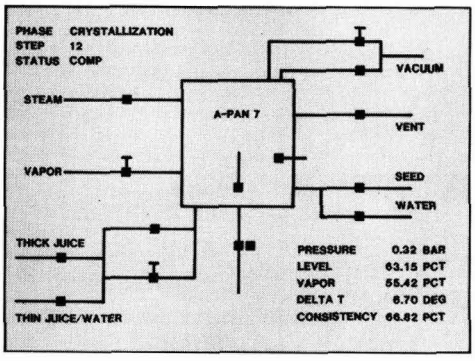


Fig. 5. Typical CRT display for a pan in operation

indication for *A*- or *B*-molasses. Panel instruments indicate analogue measurements such as total vapour, thin juice tank level and similar parameters while the programmable logic controller, in parallel with the three computer systems, provides independent indication of the phase of the cycle on one annunciator per pan.

The boiling cycle is divided into ten phases, as follows: (1) Ready, (2) Pre-evacuation, (3) Charging, (4) Seeding, (5) Stabilizing, (6) Crystallizing, (7) Hold, (8) Tightening, (9) Dropping, and (10) Steaming-out. In Phase 3 the level control loop first operates the feed valve until a first control level is reached, and the supersaturation measurement then determines the seeding point, a B.P.E. of 11°C. After stabilizing for 30 minutes, boiling continues, the consistency (measured by a Siemens viscosity meter) governing the programmed increase in massecuite level, the tightening and, finally, the discharge. The various set-points and their inter-relationships are as specified by Suiker Unie.

GROUP CONTROL LOOPS PAN 7

				VALUE	SETPT	STATE	ALARM
1	PC1517	PRESSURE	BAR	0.3	0.3	AUTO	
2	LC1517	LEVEL	PCT	63.1	64.0	AUTO	
3	FC1517	VAPOR	PCT	55.4	56.0	AUTO	
4	TC1517	DELTA T	DEG	6.7	6.6	AUTO	
5	VC1517	CONSISTENCY	PCT	66.8	67.0	AUTO	
6	LV1517	LEVEL CONTR VALVE	PCT	40.2		AUTO	

PID BLOCK PC1517 PRESSURE

MEASUREMENT	SETPOINT	OUTPUT	ALARM LIMITS HI ABS	LO ABS	HI DEV	LO DEV	MSG
0.3 BAR	0.3 BAR (LOC)	50.0 PCT (AUTO)			.1	.1	

Fig. 6. CRT display of control parameters for an A-pan

The 1979/80 campaign began on October 4, 1979, and the first *A*-pan was under computer control by October 18, the first *B*-pan by October 20 and the first *C*-pan by October 24, 1979. From then on in the campaign and during the 1980/81 campaign, all operating pans have been under computer control. Information is received from the chemical control laboratory during the shifts on e.g. changes in thick juice purity, and the operator then inserts (by means of a bank of 20 push buttons) the new figures which are then used to control the pans.

New Japanese sugar refinery[1]. – A new sugar refinery for Kyushu Seito Co. Ltd., which had been under construction since November 1979, was completed in December 1980 and was to start production in March 1981, when the old refinery was to be scrapped.

[1] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 142.

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requirement.

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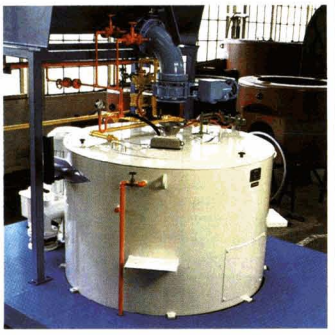

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* Corrosion-resisting quality of the solid-bowl basket and of all those parts coming into contact with the massecuite
* Smooth operation by a special suspension of the rotating parts
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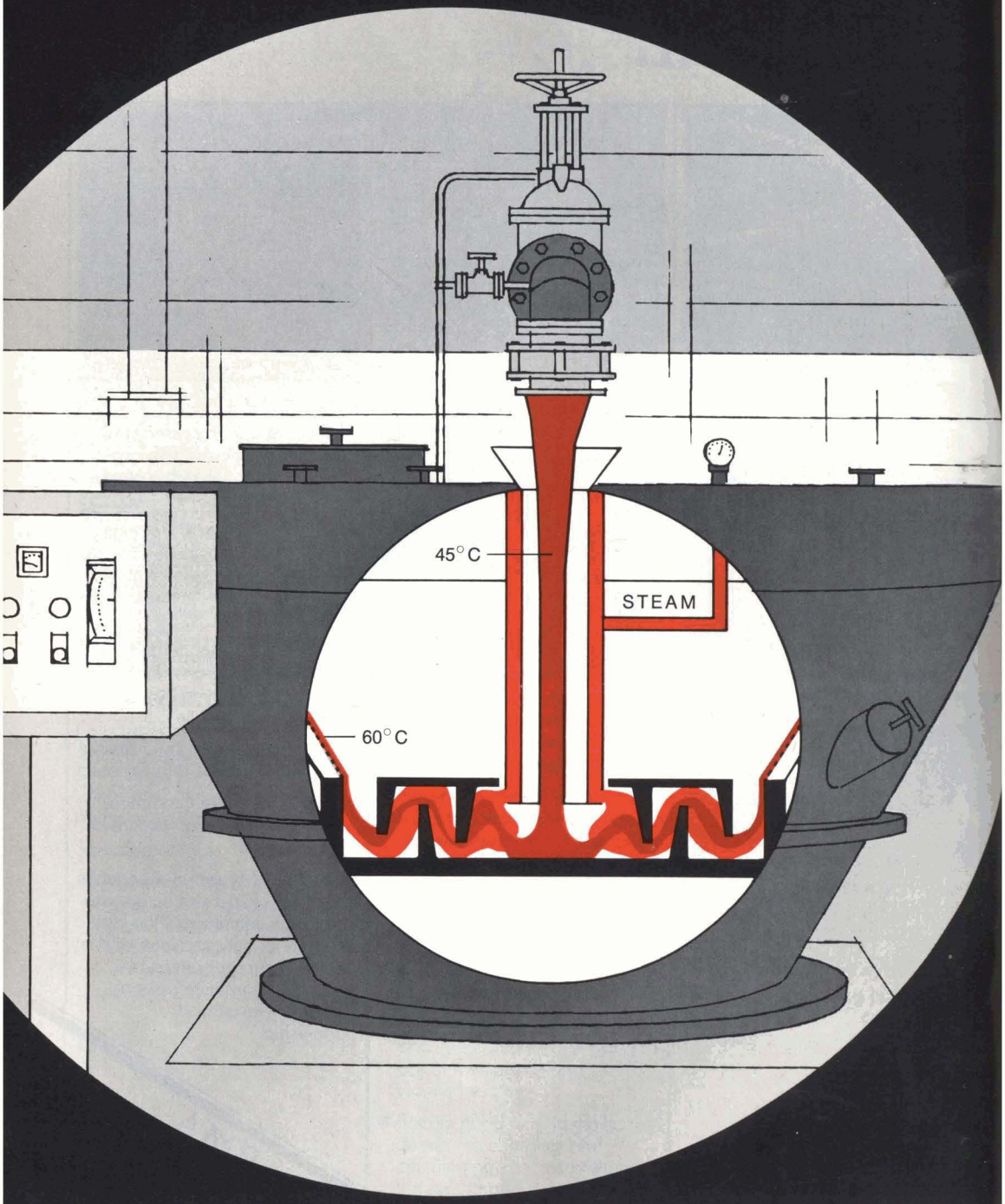

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Analysis of sugars and organic acids

Cane sugar refinery experience with liquid chromatography a sulphonic acid cation-exchange resin

By DONALD F. CHARLES
(California and Hawaiian Sugar Company, Crockett, California, USA)

PART I

Introduction

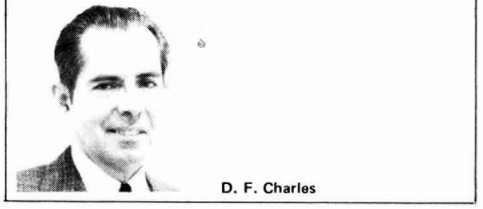
The sugar industry has several traditional methods of sugar analysis which have served well, yet have shortcomings due to their non-specificity. We are always interested in methods of analysis that can be more specific and hence, it is hoped, more accurate. For example, polarization measurement is quite reproducible, but may be influenced by a number of optically active substances. Likewise there may be other reducing substances present besides dextrose and levulose. Also, the usual methods do not distinguish between dextrose and levulose which may be present in unequal amounts.

We did some work with gas chromatography, but there were drawbacks in terms of uncertainties in derivatization procedures. Liquid chromatography seems to offer good potential in not requiring derivatization. In our early work we experimented with the amino column using acetonitrile and water as eluent. We got good separation of dextrose and levulose during the first run but the resolution deteriorated rapidly. We still do not have a sure idea of what is necessary to maintain column function.

Then we went to the sulphonic acid resin cation exchanger, specifically Bio-rad's Aminex HPX-87. Although this requires thermostatic jacketing, it has the advantage of a simple eluent, water, and the column seems remarkably resistant to change due to the types of impurities in our samples. We have used the same column for over a year now; while it does not fully meet our expectations we have found it useful in a number of respects. We review here a number of aspects of our experience with the HPX-87 column in the calcium form, including several minor anomalies which compromise accuracy of peak integration.

Instrumentation

Our equipment is as follows: Waters Associates Liquid Chromatograph ALC/GPC-201 (Serial No. 201-00513) including Waters' Model R-401 Differential Refractometer and Model 6000A Solvent Delivery System, Waters U6K Injector and Valco CV-6-UHPa-N60 Loop Injector with 25 microlitre sample loop. The homemade conductivity cell described below was wired into a Markson pH and conductivity meter, Part No. 4400 (Serial No. 7311). A Heath Schlumberger D.C. Offset Module Model EU-200-02 provided a bucking voltage to permit easy zeroing of the conductivity signal.



D. F. Charles

An E and K Model 232 2-pen recorder gave traces for conductivity and low attenuation refractive index. A second 2-pen recorder (Varian A-25) gave traces for high attenuation R.I. and pump pressure. A Spectra-Physics System 1 Computing Integrator was used with a 4-chromatograph input selector. We used two Haake FE constant – temperature circulating water baths. The first held the column temperature at 60°C, the second jacketed the refractive index detector at 35°C.

Conductivity cell

Fig. 1 shows the construction of the homemade conductivity cell. Two short pieces of the standard 0.009 inch i.d. stainless steel tubing serve both as inlet and outlet tubing and electrodes. A short length of Tygon tubing joins the stainless steel sections and serves to wall-in the interelectrode space. Lead-in wires from the Markson equipment were wrapped tightly around the stainless steel tubes, then electrical tape was wrapped around. Outside the insulating electrical tape another wire was wrapped and connected to earth for electrical shielding. Two short pieces of Tygon tubing (0.025 inch i.d.) serve to connect yet to insulate from the adjacent column and refractometer connexions. Use of a D.C. offset module permitted easy adjustment of zero and permitted changing conductivity attenuation while maintaining the same zero position.

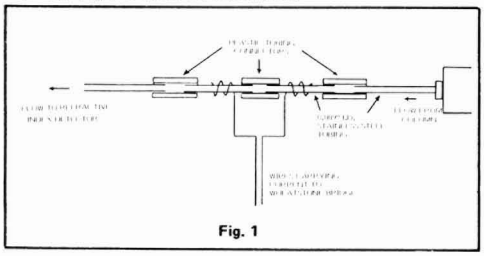


Fig. 1

Credit is due to Dr. Norman H. Smith, recently retired from our laboratory, for both conception and construction of the conductivity cell.

Resin form and sugars separation

Our major interest is to be able to quantify dextrose, sucrose and levulose. The top trace of Fig. 2 is a typical run illustrating the good separation of the three sugars for a raw sugar film sample wherein dextrose and levulose are each about 10% on solids.

We experimented with the potassium form of the resin. We got only slightly better separation of sucrose and dextrose and poorer separation of dextrose and levulose so that mannose was no longer separable. We therefore decided to stay with the calcium form.

Flowrate

The numbers next to the middle trace show the time scale in minutes from the time of injection at the standard flowrate of 0.4 $cm^3.min^{-1}$. In our early work we used 0.8 $cm^3.min^{-1}$ and tried to improve separations by

using two columns in series. Subsequently, we got almost the same result with considerable simplification using one column at half the flowrate. Optimum separation between sucrose and dextrose seems to occur at 0.4 $cm^3.min^{-1}$; slower flow gives no advantage whilst separation is poorer with faster flow. The molecular sieve effect of the resin depends on allowing sufficient time for diffusion into the resin spaces.

Air dip

The middle trace of Fig. 2 shows what happens when air bubbles are injected. Since the eluent is essentially deaerated by boiling, any air introduced along with the sample will soon dissolve. The result is a primary decrease in refractive index followed by a small secondary dip a short time later. The bottom trace shows that nitrogen elutes first and has a response about 3 times bigger than for oxygen. Thus, since air is 80% nitrogen, the major effect is due to nitrogen. Since the nitrogen dip starts before the fructose peak has returned to base-line the effect of the air dip is to increase the apparent area for the fructose.

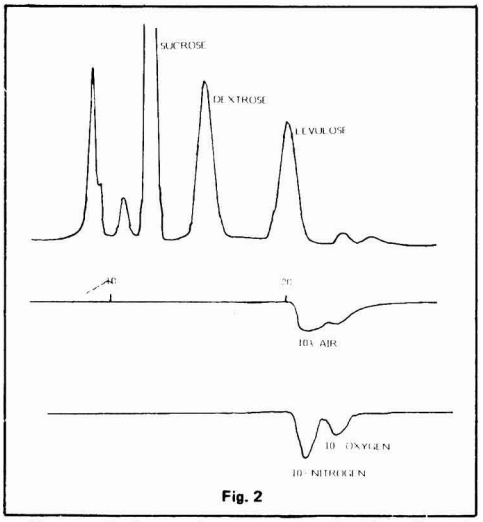


Fig. 2

Our standard operating temperature for the column is 60°C. This value is kept as low as possible to minimize on-column inversion but high enough to give a single smooth peak for dextrose. Fig. 3 shows that, at room temperature, alpha and beta dextrose are separated. Also the levulose peak is broad giving evidence of more than one form. As the column temperature is increased the rate of mutarotation increases and the equilibrium mixture gives a single peak by about 55°C. Fig. 4 illustrates the effect of higher temperatures. As samples are run containing ions other than calcium, particularly hydrogen ions, these replace the calcium from the column and act to hydrolyse the sucrose. The higher the temperature the faster the inversion rate and the more dextrose and levulose are formed. The lowest trace of Fig. 4 shows the normal positions of dextrose and levulose. The location of the dextrose and levulose from on-column inversion depends on the distribution of hydrogen ion on the column.

It is our practice to add lime water to the eluent to bring its pH to about 7.5. Thus, there is a tendency for the column to be maintained in the calcium form. At

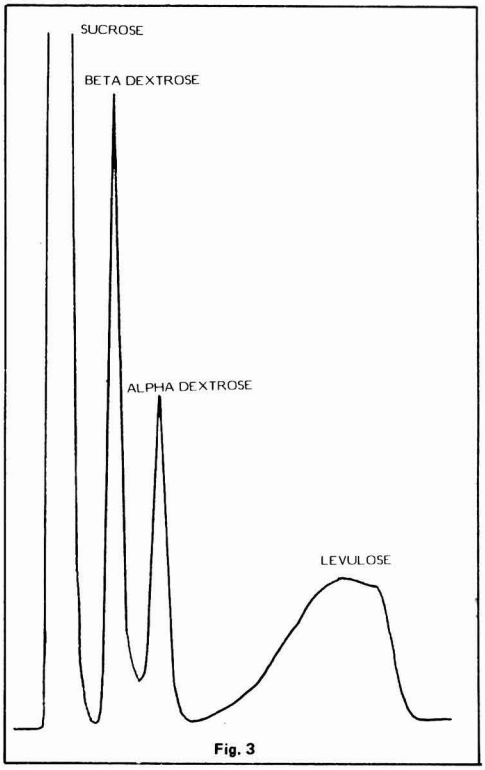


Fig. 3

intervals 2 cm^3 portions of a saturated lime solution are pumped slowly into the column and left in the column overnight to replace calcium.

Below base-line dip

Fig. 4 illustrates another anomaly, the rather sharp drop for the sucrose peak which at 60°C goes below base-line. Fig. 5 shows further examples and illustrates how the excursion below base-line is dependent on the total concentration. Thus, the dip below base-line is greater the higher the peak and is most marked in the case of peaks of which the trailing side is sharpened by column effects like that shown for potassium chloride. Thus the extent of the dip appears to be a function of the concentration gradient in the stream flowing to the refractometer.

This effect seems to be specific to the design of the Waters refractometer in which the flow on average follows a curving course from entrance to exit port, since both ports are in the top of the sample side of the cell. The LDC Refractomonitor in which the flow sweeps from one end of the cell to the other does not show this effect.

Fig. 6 is a schematic of the Waters R-401 differential refractometer showing the paths for two light beams from light source to detector. Fig. 7 is a blown-up schematic of the two-compartment cell to illustrate a likely explanation for the dip below base-line.

We have picked a single entering beam to illustrate its course under three conditions.

(1) If the same refractive index prevails on the sample and reference side of the slanted divider, the beam continues straight through, following the dashed line to a mirror reflection and back to the light sensing detector.

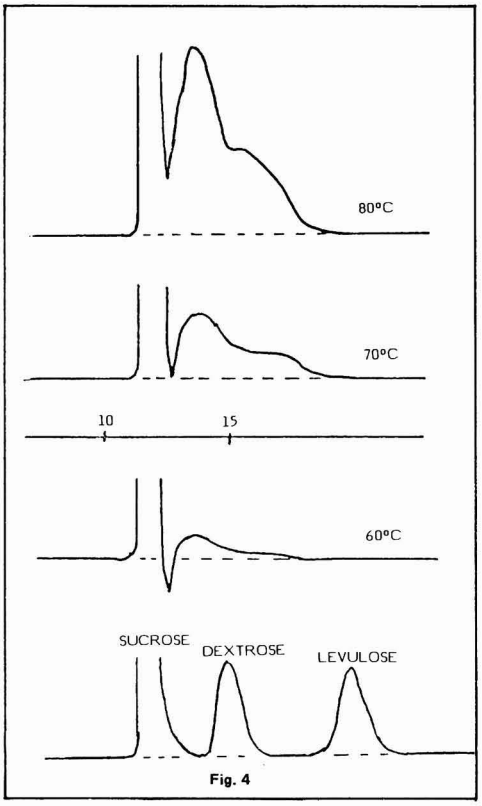


Fig. 4

(2) The presence of dissolved solids in the sample stream results in the beam bending towards the normal (Snell's law) at the cell divider following a track exemplified by the upper solid line and striking the mirror and detector at higher positions.

(3) In the situation where the concentration gradient is strong we can draw some lines of constant density as shown by the curved lines. Near the entrance port the concentration is near zero. Going towards the left and downwards we meet increasingly higher concentrations. The light beam is bent little at the cell divider but, as it crosses the lines of constant density at an angle, it curves towards the perpendicular to the lines of constant density (integrated effect of Snell's law). This condition is illustrated by the lower solid line which curves downwards resulting in a lower position on both the reflecting mirror and the detector. Thus it strikes the detector at a point lower than if the whole cell were filled with eluent water.

This anomalous refraction probably contributes somewhat to variability in integrated peak area.

Sucrose quantitative measurement

Fig. 8 is a chromatogram for evaporator syrup in a raw sugar factory. The solid line in this and other figures is the refractive index trace. The broken line is the conductivity trace, displaced from the refractive index peak by a fixed amount to permit the pens to pass. The first peak to elute is mostly inorganic ions which do not enter the resin because of charge effects. The conductivity peak is very high for these well-ionized species. On the tailing side of both the R.I. and conductivity peak is a slight shoulder which is due to one or more organic acids. Allowing for the displacement, it can be seen that the conducting impurities are out before the sucrose starts to come out, so the sucrose

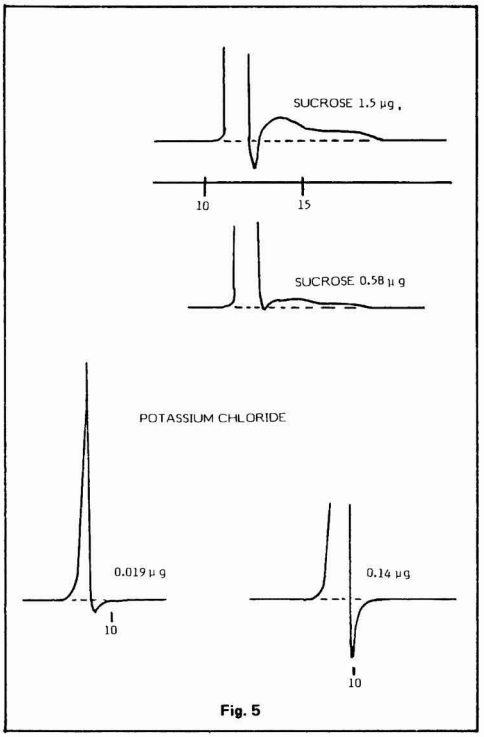


Fig. 5

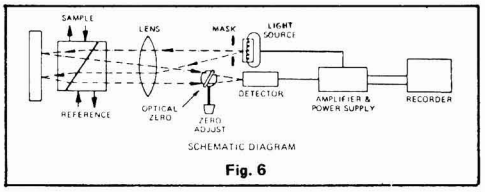


Fig. 6

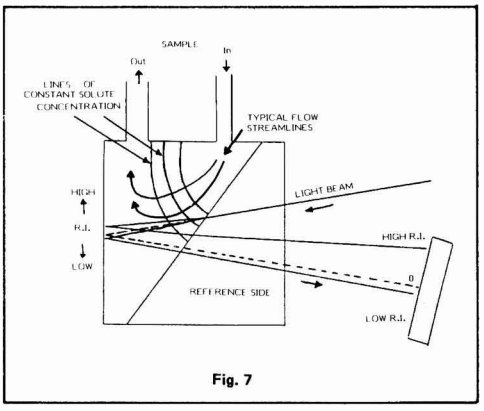


Fig. 7

peak is not affected by the presence of conducting substances hiding under it. This separation is a good sign in that it looks like we do not have to do a prior deionization in order to measure the sucrose. (Our experience has been that batch or short-column pre-treatment with ion-exchange resins to deionize the sample did not remove all inorganic constituents before starting to affect the proportions of the sugars of interest.) As we increase the amount of sample injected, hoping to increase the size of the sucrose peak, we reach a point where the organic ions spill over into the sucrose peak. So long as we do not pass this point it looks as though we may be able to determine sucrose accurately.

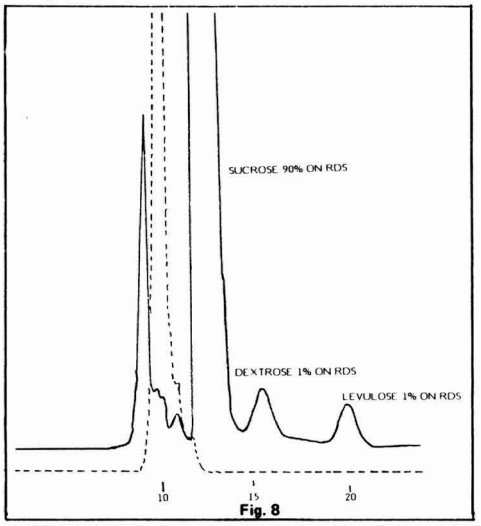


Fig. 8

We studied the response of the system to increasing concentrations of sucrose injected with the constant volume Valco loop. Attenuation on the refractometer was set at 8x. Fig. 9 shows that the peak area from the integrator deviates markedly from a straight line long before the electrical output reaches saturation at about 6% sucrose. If we read off peak heights from the recorder chart we observe that the curve of peak heights goes nearly flat after a sharp bend at about 1.9% sucrose. We can calculate a measure of peak width if we divide area by height. The curve for peak width shows a change in slope at about 1.9% from a relatively flat to a sloping line.

It seems reasonable to interpret this break as the point at which the capacity for sucrose in the resin pores is reached. Beyond this point the sucrose spreads out filling a longer portion of the resin bed. The break point is essentially a function of sucrose amount; a similar set of curves is obtained if we inject varying volumes of a fixed concentration of sucrose.

When we made repeat runs at about 3.5 to 4% sucrose we obtained relative standard deviation well under 0.1%. However, for samples with ionic species present, these and trisaccharides started to spread into the sucrose peak. It appeared better to stay with lower concentrations and to avoid the transition or break-point region. Thus, we settled on the region between 1.0 and 1.5% sucrose. For that region we calculate relative standard deviation at about 0.2% for sucrose standards and 0.4% for the sucrose peak of unknowns. It was observed that the ratio of peak height to peak area was less for process samples than for sucrose standards. It appears that, with the column near capacity for sucrose, the ionic constituents affect the sucrose peak width, presumably exerting their influence as the sample enters the column. Area calibration might then be correct whereas height calibration would result in erroneously low sucrose calculated for process samples. We tested the effect of several added constituents on sucrose peak shape. Glucose and aconitic acid had no effect. KCl, HCl, $CaCl_2$ and $MgCl_2$ sharpened the sucrose peak. Sodium hydroxide, calcium acetate, calcium lactate and malic acid broadened the sucrose peak. We have no explanations as yet for these effects.

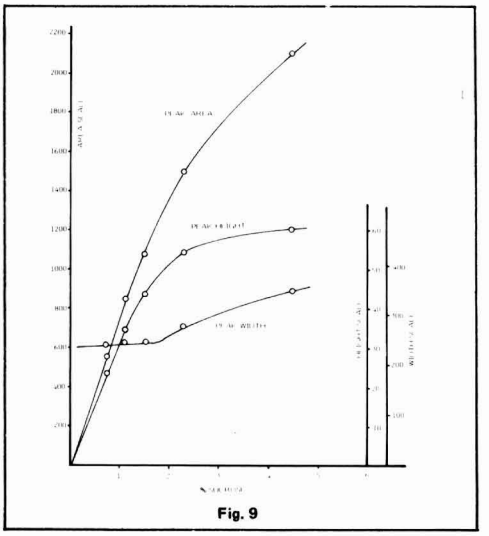


Fig. 9

We run at least 3 standards, preferably in duplicate; then we calculate a second degree polynomial to fit the standards. Thus, we have $y = a + bx + cx^2$ where x is the sucrose peak area from the integrator and y the % sucrose. We make 4 to 6 runs on each unknown and obtain average sucrose peak area. Inserting area for unknowns into the derived equations we obtain the sucrose concentrations.

To look for possible interactions between the sugars and the ionic constituents we have added known proportions of sucrose to evaluate recovery. Thus far, we have found no definite interactions. It appears that, so long as the sample concentration is low enough that the peaks for the ionics do not intrude into the sucrose peak, then the added sucrose is recovered 100%.

Table I compares HPLC results with Clerget sucrose for a few samples analysed thus far. While the agreement is fair, generally within 1%, the differences lack consistency. At least, we cannot say for sure that we have a good reference method.

Table I. Comparison of sucrose results on a few samples

	% Sucrose on Sample Weight		Clerget minus HPLC	
	HPLC	Clerget	Diff.	%
Clarified Juice No. 1	10.259	10.30	+0.041	+0.40
Clarified Juice No. 2	8.730	8.76	+0.03	+0.34
Evaporator Syrup No.1	52.19	53.03	+0.84	+1.58
Evaporator Syrup No.2	49.66	49.66	0.0	0.0
A-Molasses	60.05	59.67	−0.38	−0.64
B Molasses	56.09	56.55	+0.46	+0.81
Final Molasses	44.91	44.94	+0.03	+0.07

(To be continued)

SUGAR CANE AGRONOMY

The control of *Cyperus rotundus* in sugar cane fields and in fallow land. G. McIntyre, C. Barbe, J. Pitchen and M. Yerriah. *Paper presented to the 17th Congr. ISSCT,* 1980, 10 pp. – A number of herbicides have been tested against the two subspecies (types *tuberosus* and *rotundus*) of *C. rotundus* which are among the most troublesome weeds in Mauritius. In ratoon cane, the best results were obtained with Velpar K4 (Hexazinone + Diuron) used alone or in mixtures with Actril DS (Ioxynil + 2,4-D) or 2,4-D amine salt. With the *tuberus* subspecies only one application was needed but two were necessary with the *rotundus* subspecies. In fallow land, exceptionally good control was achieved with Roundup (Glyphosate) while Velpar (Hexazinone) also gave good control.

The effect of various herbicidal treatments on *Digitaria horizontalis* growing in plant cane. G. McIntyre, J. Pitchen, C. Barbe and M. Yerriah. *Paper presented to the 17th Congr. ISSCT,* 1980, 5 pp. – Very good control of *D. horizontalis* in plant cane was given by pre-emergence application of Metribuzin alone or mixed with Diuron. Good post-emergence control was given by mixtures of Metribuzin or Diuron with Ioxynil +2,4-D when the grass was young but, when growth was advanced, only Asulam gave satisfactory control. MSMA did not give satisfactory control and mixtures of Metribuzin and Diuron with the non-phytotoxic oil Seppic IIE were completely ineffective.

The effects of some post-emergence herbicide treatments on a range of sugar cane varieties grown in South Africa. P. E. Turner. *Paper presented to the 17th Congr. ISSCT,* 1980, 16 pp. – Different post-emergence herbicide mixtures (Alachlor + Atrazine + Paraquat; Diuron + 2,4-D + a surfactant; and Ametryne + 2,4-D + surfactant) were applied at double the recommended rates to young plant cane (5–7 leaves unfurled) and at the recommended rates to first ratoons. The six varieties tested showed differing susceptibility in respect of stalk height, leaf damage and cane yield but no good relationship was established between early growth retardation and yield at harvest. The treatments inhibited flowering and, although the results of the ratoon crop treatment were not available, indications were that the patterns of susceptibility or tolerance of the varieties to the different treatments were similar to those recorded for plant cane.

Potassium availability in soils of the South African sugar belt. R. A. Wood and J. R. Burrows. *Paper presented to the 17th Congr. ISSCT,* 1980, 14 pp. Discrepancies have been reported between soil K and cane leaf K (which may be marginal in spite of apparently adequate soil K) and are attributed to slow release from some K sources in the soil. Real availability was measured by growing rye-grass and sorghum in pots of soil and measuring the K extracted, and these figures compared with K measured by different extraction techniques. There was a highly significant correlation with available K measured by extraction from all soils with nitric acid and from light to medium soils with ammonium acetate but practical difficulties mean that the former has little advantage over the latter except with clay. The K which is only slowly available is associated with the clay content and may be assessed by the difference in available K as measured by the nitric acid and ammonium acetate extraction methods.

Response to organo-tablet fertilizer of sugar cane grown on sandy gravel soil. C. C. Wang, Y. Y. Chan, C. H. Chang and S. R. Chang. *Paper presented to the 17th Congr. ISSCT,* 1980, 12 pp. – The fertilizer is made by pressing a mixture of N, P, K and dried and crushed organic materials such as filter cake, bagasse, active sludge and solid pig wastes, the N:P:K ratio being 4.4:1:2. Field trials showed that the tablets in split applications improved cane yield in sandy gravel soil by 17–29% compared with ammonium sulphate applied six times. Loss of plant nutrients by leaching is greatly reduced and the tablets last for 2–3 months. N-P-K uptake by the cane is increased, the cane yield is increased and the cost of fertilization is reduced.

Effect of liming on the production of sugar cane and on the fertility of the soil in the state of Pernambuco. M. A. C. dos Santos, A. F. de Sobral, A. P. Medeiros and J. M. A. Pereira. *Paper presented to the 17th Congr. ISSCT,* 1980, 8 pp. – A red-yellow latosol soil from southern Pernambuco is characterized by high exchangeable Al and low Ca and Mg. Pot trials were used to determine the effect of liming; the exchangeable Ca and Mg contents were increased and exchangeable Al decreased. No significant change occurred in the dry matter of the root system but the aerial part of the cane plant was significantly greater.

Moisture retention curves of soils cultivated with sugar cane in Peru. W. Silva, L. A. A. J. Eppink, E. Angulo and A. Vazquez. *Paper presented to the 17th Congr. ISSCT,* 1980, 5 pp. – Soil cores were taken over the Peruvian cane area to the extent of one every 1600 ha and divided into samples for the top 30 cm, 30–60 cm deep and 60–90 cm deep. Soil moisture retention curves were determined and the water potential of the soil expressed as a function of its moisture content and the saturation percentage (the Arany number, K_A, which depends on the soil texture). The saturation percentage is a commonly used characteristic in the Peruvian cane sugar industry and can be determined easily. Regression analysis showed a correlation coefficient of 0.76 between calculated and measured values.

Effects of topping on sugar cane quality and on sugar, alcohol and energy production. J. F. Silva and G. M. A. Silva. *Paper presented to the 17th Congr. ISSCT,* 1980, 10 pp. – A comparison was made using burned and unburned cane, with and without tops; juice clarification was performed in the laboratory for each type using simple defecation and sulphitation, and the recoverable sugar and alchohol calculated by empirical formulae, and surplus energy produced above the factory's steam and power requirements was calculated. The financial aspects were examined. It was concluded that retention of tops reduced the quality of cane, so giving juice of higher colour and ash with both clarification procedures.

Inclusion of tops gives less recoverable sugar and alchohol per tonne of cane but practically the same sugar per hectare and more alcohol per hectare. The extra bagasse produced will give a bigger surplus of energy and, although the cost of producing sugar and alcohol will be higher per tonne of cane with tops than without, the value of the extra alcohol will give a higher profit per hectare.

Methods of planting sugar cane for sugar and biomass production in Louisiana. R. Ricaud and B. J. Cochran. *Paper presented to the 17th Congr. ISSCT,* 1980, 10 pp. A number of planting methods were examined in two experiments to determine their effect on the yield and number of millable stalks of cane produced. Results indicated that in the first experiment, which covered a plant crop and first ratoon, the highest number of millable stalks and yields of stalks, sugar, total biomass and fermentable sugars was given by planting four drills 90 cm wide, while in the second experiment, covering only a plant crop, the highest yields were given by planting in four drills 120 cm wide. The increases ranged up to 71.7% in stalk yield and 84.3% in sugar yield over V-furrow planting of single drills.

Sugar cane spacing. I. Historical and theoretical aspects. J. E. Irvine, G. T. A. Benda and C. A. Richard. *Paper presented to the 17th Congr. ISSCT,* 1980, 6 pp. Change from close to wide row spacing has evolved in order to permit mechanization but a review of reports over 80 years shows that higher yields result from closer rows. This effect is more pronounced in temperate and sub-tropical areas but significant yield increases with closer spacing have been reported from the tropics. As row spacing is reduced arithmetically the plant population increases exponentially and so does the theoretical yield in spite of lower plant weight and number of stalks per plant.

Sugar cane spacing. II. Effects of spacing on the plant. J. E. Irvine and G. T. A. Benda. *Paper presented to the 17th Congr. ISSCT,* 1980, 12 pp. – Cane planted at 19 cm intervals along rows spaced at 183 cm showed significantly higher yields of biomass, net cane and sugar per hectare when compared with intervals of 38 and 76 cm. In a second experiment, equidistant spacings of 19, 38, 76 and 152 cm produced significant differences in fibre % cane, stalk diameter, leaf area index and yields of biomass, net cane and sugar. There was no significant difference in the sugar content of the cane. In a third experiment, 10 spacings of 26.7 to 179.1 cm produced higher plant population, biomass, net cane and sugar per hectare with the smaller spacings. Stalk diameter, shoot number and plant weight were smaller as inter-plant distance decreased. Varietal differences in yield of cane and sugar per hectare were more pronounced at closer than at wider spacings, but there was a significant correlation ($r = 0.71$) between varietal yield relationships with the two spacings so that selections made on wide row performance should be adequate for closer rows.

Sugar cane spacing. III. Development of production techniques for narrow rows. J. E. Irvine, C. A. Richard, D. D. Garrison, W. R. Jackson, R. J. Matherne, C. Camp and C. Carter. *Paper presented to the 17th Congr. ISSCT,* 1980, 8 pp. – Replicated tests showed that cane and sugar yields from 61 cm rows exceed those from 183 cm rows by more than 60% in small plots and by more than 80% in large plots. Triple-drill rows were not significantly different from 61 cm rows in terms of cane or sugar yield. Sub-surface drainage had no effect on plant cane yields even though the water table levels of drained and undrained plots were significantly different. Large trials gave varied results for 61 cm and triple-drill plantings, partly as a result of inadequate soil cover at planting. Closely-spaced plantings were cut adequately by whole-stalk and chopper-harvesters when the fields were dry and the cane erect. Lodging was pronounced in the heavy-yielding closely-spaced treatments and the development of an economical harvesting and transport system is seen as a major problem.

The suitability of the soils of the Lower Mesopotamian plain for sugar cane cultivation. J. L. Sehgal, A. I. Allam, R. P. Gupta and A. Aziz. *Paper presented to the 17th Congr. ISSCT,* 1980, 20 pp. – Typical soils from three regions of Iraq having different characteristics were examined and their suitability for growing sugar cane tested. They are described in detail and yields produced with plant cane and ratoons are discussed. The surface soil is suitable for most crops but the sub-soils have unfavourable physical properties. A significant negative correlation was established between cane yield and electrical conductivity of a 1:1 water extract of the soil.

Sugar cane ferric chlorosis in excessively calcareous soils. F. A. Fogliata and V. N. Bustos. *Paper presented to the 17th Congr. ISSCT,* 1980, 22 pp. – Iron chlorosis in cane can be caused by iron deficiency and also by non-availability of the iron owing to the presence of excessive $CaCO_3$. A study was made to determine the limits for $CaCO_3$ and it was found that these and the effects of the $CaCO_3$ varied according to the organic matter content in the soil and the height of the water table. With low levels of organic matter and no water table, the critical level of total $CaCO_3$ in the soil was 1.5–2.0%, severe damage occurring at above 3%. Corresponding levels for active $CaCO_3$ were 1–1.5% and 1.5%. With high levels of organic matter and water table present, cane could grow well with values of 10% for total $CaCO_3$ and 4.8% for active $CaCO_3$. The concentration of nutrients in the leaves was altered and chlorosis became marked with higher $CaCO_3$ content of the soil, these effects being reduced by the presence of high organic matter and water table in the soil.

Weeds of mechanized sugar cane fields of Java: their economic importance and control. T. Kuntohartono and P. Tarmani. *Paper presented to the 17th Congr. ISSCT,* 1980, 13 pp. – Prior to the introduction of mechanization, cane in Indonesia was grown by the "Reynoso system" in rotation with rice in flat, alluvial-irrigated fields, with flooding for much of the year for rice-growing, very intensive drainage by ditches and only a small part of the soil (in the cane furrows) cultivated to a fine tilth. Introduction of mechanization because of labour shortage has been shown to result in a change in the prevalent weed species, *Cyperus rotundus* becoming a major problem, while other weeds commonly found include *Amaranthus spinosus, Trianthema portulacastrum, Euphorbia heterophylla* and *Portulaca oleraceae.* These weeds provide less competition for the cane, however, so that yield loss is estimated at 9.5–11.1% less than with the Reynoso system. A series of herbicides have been tested against the weeds in mechanized cane fields and all found to

give satisfactory control of all weeds except *C. rotundus*. No phytotoxic effects on cane were observed with Gesapax at 2.4 kg.ha^{-1}, Karmex at 1.2 and 2.4 kg.ha^{-1}, Sencor at 1.4 kg.ha^{-1}, Ravage at 1.5 kg.ha^{-1} or Totacol plus 2,4-D at 2.4 + 1.4 kg.ha^{-1}, although Goal at 1.6 kg.ha^{-1} caused yellow discoloration and necrotic spots in cane foliage but this did not affect its further growth.

The concentration of juice of different joints along sugar cane stalks. C. Hoffmann. *Paper presented to the 17th Congr. ISSCT,* 1980, 10 pp. – Abnormal juice Brix and purity patterns have been observed in two instances in Argentina. The first was in the second ratoon of a seedling at the Tucumán Experiment Station where the Brix was low near the base (about 14°) but increased to a maximum (22.9°) near the top of the stalk, purity being higher than 90% even in the low Brix juice. This was observed in one stalk of a 7-stalk stool; five of the remaining stalks showed similar abnormalities but not so striking, while the remaining stalk was normal. The second case was among stalks which had suffered frost damage in a commercial field and included an important proportion of the field; Brix was low (about 13°) in the juice of the lower part of the cane and reached up to nearly 22° near the top of the cane.

Farm production data analysis with respect to controllable factors, agronomic inputs and environmental conditions for synchronization of sugar cane field and factory operations. A. C. Early. *Paper presented to the 17th Congr. ISSCT,* 1980, 22 pp. – A description is given of the procedure used for selection of significant factors influencing cane production and the subsequent modelling of these factors for the prediction of rendement and cane tonnage yield with age of the crop and by month of the year. The primary factors determined were rainfall plus irrigation inputs in the 1–30 day period and the 31–60 day period before harvest. Other factors were the year in which the crop was grown with respect to an integrated set of climatic factors, the age of cane at harvest, the month of harvest, the variety and the crop type. The results of various trials were compared and one particular model was analysed graphically to show the effects of varying levels of inputs or factors on the rendement and tonnage yields predicted by the models. The role of these models in synchronization of farm and factory operations is discussed.

The significance of soil non-exchangeable potassium in relation to sugar cane growth. I. J. Fang and C. C. Wang. *Paper presented to the 17th Congr. ISSCT,* 1980, 14 pp. – In trials over a 10-year period, 34 plots were identified where there was a significant response to K fertilization. Yield from these plots was found to be highly correlated to the non-exchangeable K content of the soil (the difference between total and water-soluble K) even though this averaged only 1.14% of total K.

The maximum economical growing period of sugar cane in Malaysia. Y. C. Pan, K. L. Bow and T. H. Su. *Paper presented to the 17th Congr. ISSCT,* 1980, 17 pp. Field trials were made in which four varieties were planted in September and grown for 24 months, sampling at 2-month intervals after 10 months in order to determine yield and sugar content. Peak sugar yield was reached at 16 months with GPB 24 (17.52 tonnes.ha^{-1}) and GPB 1 (18.36 tonnes.ha^{-1}), but at 18 months with GPB 5 (17.95 tonnes.ha^{-1}) and N:Co 310 (16.02 tonnes.ha^{-1}). However, gain in yield before the peak was slow and the occupation of a limited cane-growing area means that it is more economical to harvest at 12–14 months. Efforts in breeding should be directed to securing early-maturing varieties which could be harvested at 10 months.

Liming soils under sugar cane in Mauritius. K. F. N. K. Kwong, L. Ross and C. Cavalot. *Paper presented to the 17th Congr. ISSCT,* 1980, 10 pp. – Liming of acid soils in Mauritius did not improve cane yield and high doses brought about reduction in yield, although the reason for this is not yet known. The lack of positive response is attributed to the absence of Mn and Al toxicities and to the presence of a good Ca status in the soil; above pH 5.0 exchangeable Al was reduced to negligible values, while exchangeable Ca occupied more than 70% of the cation exchange sites and was not appreciably increased by liming. It is concluded that liming should only be practised when the soil pH is below 5.0 and should be sufficient to raise the pH to 5.0–5.5.

Comparison of six tissues for diagnosis of sugar cane mineral nutrient status. S. Thein and G. J. Gascho. *Paper presented to the 17th Congr. ISSCT,* 1980, 12 pp. A comparison was made of a number of tissues used for diagnostic analysis in different parts of the world: (1) the top visible dewlap (TVD) leaf blade, (2) the TVD leaf lamina, (3) the middle portion of the TVD leaf blade, (4) middle portions of the elongating leaf lamina and (5) the elongating leaf sheath. The analyses of these tissues for N, P, K, Ca, Mg, Mn, Cu and Zn were correlated with those of analysis of the whole above-ground plant and with the yields. All tissues were well correlated with the whole-plant nutrient status. All TVD leaf tissues gave relatively higher correlations between cane yield and nutrient concentrations. Nutrient concentrations were not statistically different between the whole TVD leaf blade and its middle portion so that the practice of selecting the latter appeared to be unnecessary. Further, the middle of the TVD leaf blade resulted in large coefficients of variation between replicates.Selection of the leaf, with or without its midrib, ensured precision of tissue analysis by offering low variability between replicates, The TVD leaf is well defined and easily accessible, making it the tissue of choice for estimating the nutrient status of the cane.

Post-emergence spot control of guinea grass (*Panicum maximum* Jacq.). G. F. Mason. *Paper presented to the 17th Congr. ISSCT,* 1980, 8 pp. – Of a number of herbicides tested, Ravage (Buthiadazole) at a concentration of 9 g.l^{-1}, Roundup (Glyphosate) at 12 g.l^{-1} and Velpar (Hexazinone) at 3.6 and 5.4 g.l^{-1} effectively controlled guinea grass growing in cane fields. The first two were moderately-to-severely phytotoxic to cane, however, causing stunting and/or death, particularly in the case of Roundup. Velpar, which caused only marginal stunting of the canes adjacent to the treated guinea grass clumps, was the most suitable treatment for spot control but its use was limited to times when guinea grass growth was vigorous.

Mumias outgrowers scheme: a study in self-sufficient sugar cane production. A. Beevers. *Paper presented to the 17th Congr. ISSCT,* 1980, 11 pp. – Seven-eighths of the cane crushed by the Mumias factory is grown by small farmers numbering over 12,500 who, within a radius of 20 km from the factory, grow a total of

1,400,000 tonnes of cane on 18,600 ha of land. The outgrower scheme is based on supply by the company of machinery for land preparation, healthy seed cane and fertilizers, and supply by the farmer of land and labour for planting, fertilization, weeding and cutting the cane. Details of the scheme, financial aspects and likely future developments are discussed.

Fertilizer management in sugar cane ratoons. E. P. Gotera, R. M. Tapay, M. O. Araneta and W. G. Espada. *Paper presented to the 17th Congr. ISSCT,* 1980, 8 pp. Experiments were carried out using three varieties to determine the influence of N level applied to the plant cane on the performance of the ratoon crop, to determine the influence of plant cane harvest age on the ratoon crop, and to determine the best scheme of N application to the ratoon crop. The cane yield from the first ratoon crop could be as high as that from the plant crop but on average was lower, while the sugar rendement was virtually the same. The rate of N fertilizer application to plant cane did not affect ratoon yield significantly and a much greater influence was the level of N applied to the ratoon crop. The ratoon crop yield was influenced by the age of the plant crop at harvest, being higher at 11 months than 10 and higher at 12 months than 11 except in the case of Phil 5333 cane. Results from application of the N fertilizer to the ratoon crop in a single dose one week, 4 weeks, 7 weeks or 10 weeks after plant cane harvest, or with one half applied after one week and the balance applied at 4, 7 or 10 weeks after harvest, gave variable results, depending on the variety and the total N dosage employed.

Salinity effect in sugar cane response to nitrogen fertilization. S. Valdivia S. and J. Pinna C. *Paper presented to the 17th Congr. ISSCT,* 1980, 10 pp. Trials were carried out using different N fertilizer rates between 180 and 460 kg.ha^{-1} on soil of high salinity (2–8 mho.cm^{-1}), and harvesting at different ages between 12.3 and 26.5 months. The cane required a minimum N level which is a function of soil salinity but did not increase with additional N. The cane and recoverable sugar yields were inversely correlated with soil salinity. The best age for harvesting was 15.5 months when average recoverable sugar yield was highest.

Nitrate reductase activity (NRA) under vegetative and reproductive conditions in *Saccharum* cultivar Co 285. K. C. Rao and M. Vijayasaradhy. *Paper presented to the 17th Congr. ISSCT,* 1980, 4 pp. – Induction and regulation of flowering in cane by means of artificial day-length adjustment has been used to examine the relationship of flowering and nitrate reductase activity. The latter was found to increase in Co 285 cane to almost double the level of vegetative growth at the symptom stage of inflorescence, falling again at the advanced short blade stage. A similar study is to be made of clones in the Coimbatore collection which are known to differ in their flowering behaviour.

Sugar cane responses to filter mud applications on Trinidad soils. B. R. Cooper and E. A. A. Idris. *Paper presented to the 17th Congr. ISSCT,* 1980, 13 pp. Significant plant cane yield increases averaging 37% resulted in five out of six trials in which 125 tonnes.ha^{-1} of filter cake was applied to the soil. A smaller response occurred with the first ratoon crop and the response was still significant in two trials with second ratoons. Soil and leaf P levels were raised by the treatment and remained higher than the controls for 3 years in some cases; other nutrients were less affected. At equivalent rates of P there were no important differences in the availability of P from filter cake and triple superphosphate fertilizer. On a P-deficient soil 25 tonnes.ha^{-1} banded in the cane row was as effective as 125 tonnes. ha^{-1} broadcast and increased cane and sugar yields significantly more than the equivalent rate of triple superphosphate.

The effect of manganese on growth, total protein and nucleic acid in sugar cane plants. A. P. Gupta and G. S. C. Rao. *Paper presented to the 17th Congr. ISSCT,* 1980, 8 pp. – Cane plants were grown in pure sand cultures with varying Mn levels. Stunted growth was observed where Mn was absent or in excess while the total protein content was 54–55% and 29–43% lower, respectively, than where the Mn content was 0.25 ppm. In immature plants no definite relationship was observed between ribose nucleic acid (RNA) and Mn level but 20–46% more RNA was found in normal cane at early stage of maturity than in plants grown in Mn-deficient and excessive-Mn sand. During early stages of growth low accumulation of deoxyribose nucleic acid (DNA) occurred in the growing regions of the normal cane plant but by seven months of age the DNA content was 16–51% higher than in the plants grown in Mn-deficient and excessive-Mn sand.

Some polyphenolic constituents of the sugar cane plant. C. C. Mishra and K. Misra. *Paper presented to the 17th Congr. ISSCT,* 1980, 8 pp. – Peelings from sugar cane, leaves and flowers were extracted with different solvents and the extracts fractionated. From the peelings, 5,7-dimethyl apigenin 4′-O-β-D-glucopyranoside, 5-methyl apigenin 4′-O-β-D-glucopyranoside, peonidin-3-O-D-galactoside and leucopelargonidin were isolated and characterized by chemical and spectroscopic means. From the leaves the only flavone glycoside isolated and identified was the first of those above, while the fresh flowers yielded 5-methyl apigenin and 5,7,3′,4′-tetrahydroxy 3,6-dimethoxy flavone.

Physiological basis of yield variation between and within sugar cane varieties grown under contrasting environments. I. Components of sucrose yield at harvest. G. C. Soopramanien and M. H. R. Julien. *Paper presented to the 17th Congr. ISSCT,* 1980, 11 pp. – Four cane varieties were planted at three locations offering different environmental conditions and at different dates during the planting season. All were harvested at 68 weeks and the yield of sugar analysed according to its components: tiller density, tiller dry weight and sugar content (% dry weight). The tiller density was the major yield determinant. The effect of site and planting date indicated that warm conditions favoured dry matter accumulation while cool conditions favoured sugar accumulation. High sugar yield at harvest among the varieties was associated with biological yield in a low tillering and high stalk dry weight variety. Varietal differences in sugar yield were affected by both site and planting date, indicating possible varietal adaptation. However, neither factor drastically influenced sugar concentration, and varietal adaptation was attributed to tiller density and stalk dry weight. The absence of large differences in stalk weight and sugar content between tillers of different ages showed homogeneity of the population of surviving tillers and that the late tillers were able to compete with the early ones. Treatment

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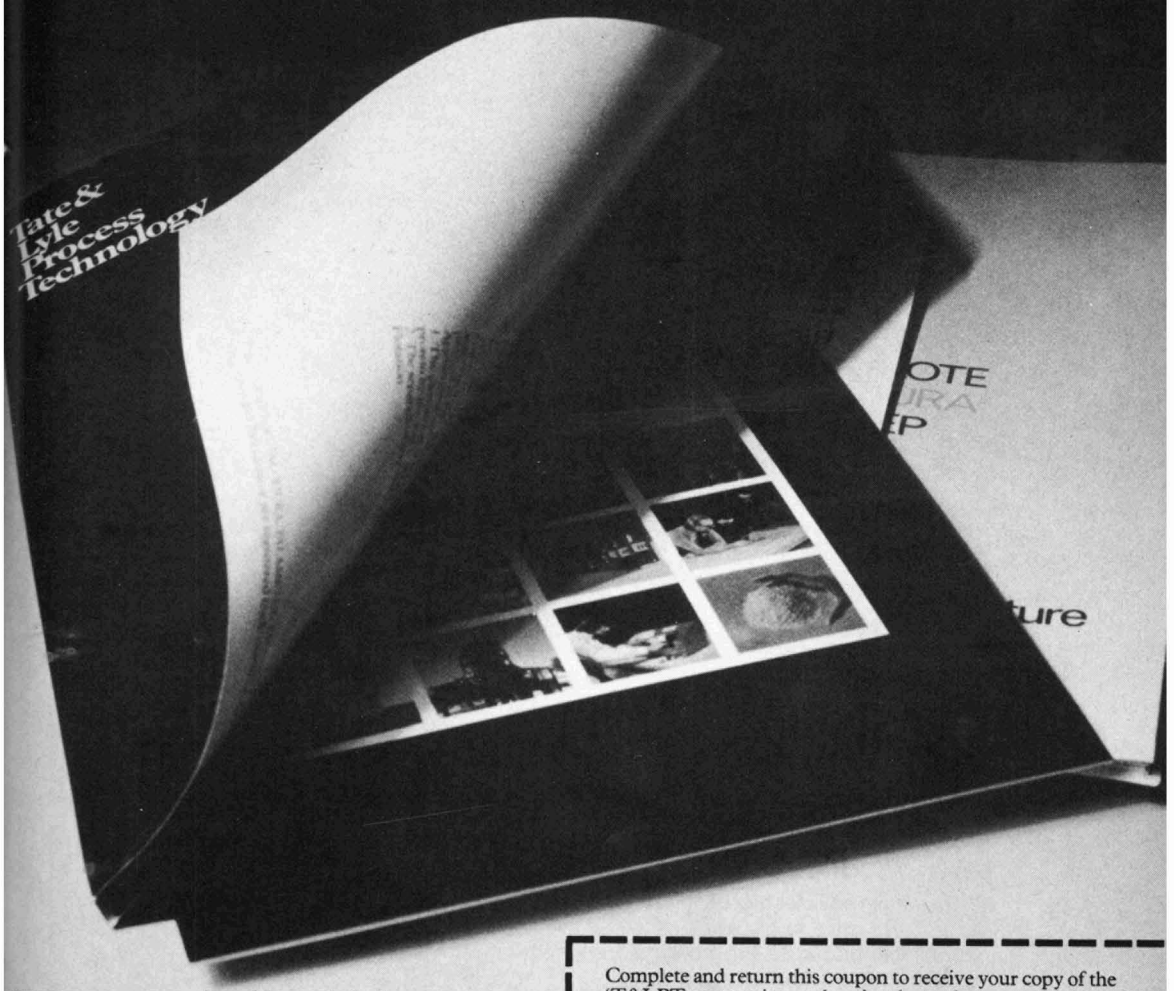

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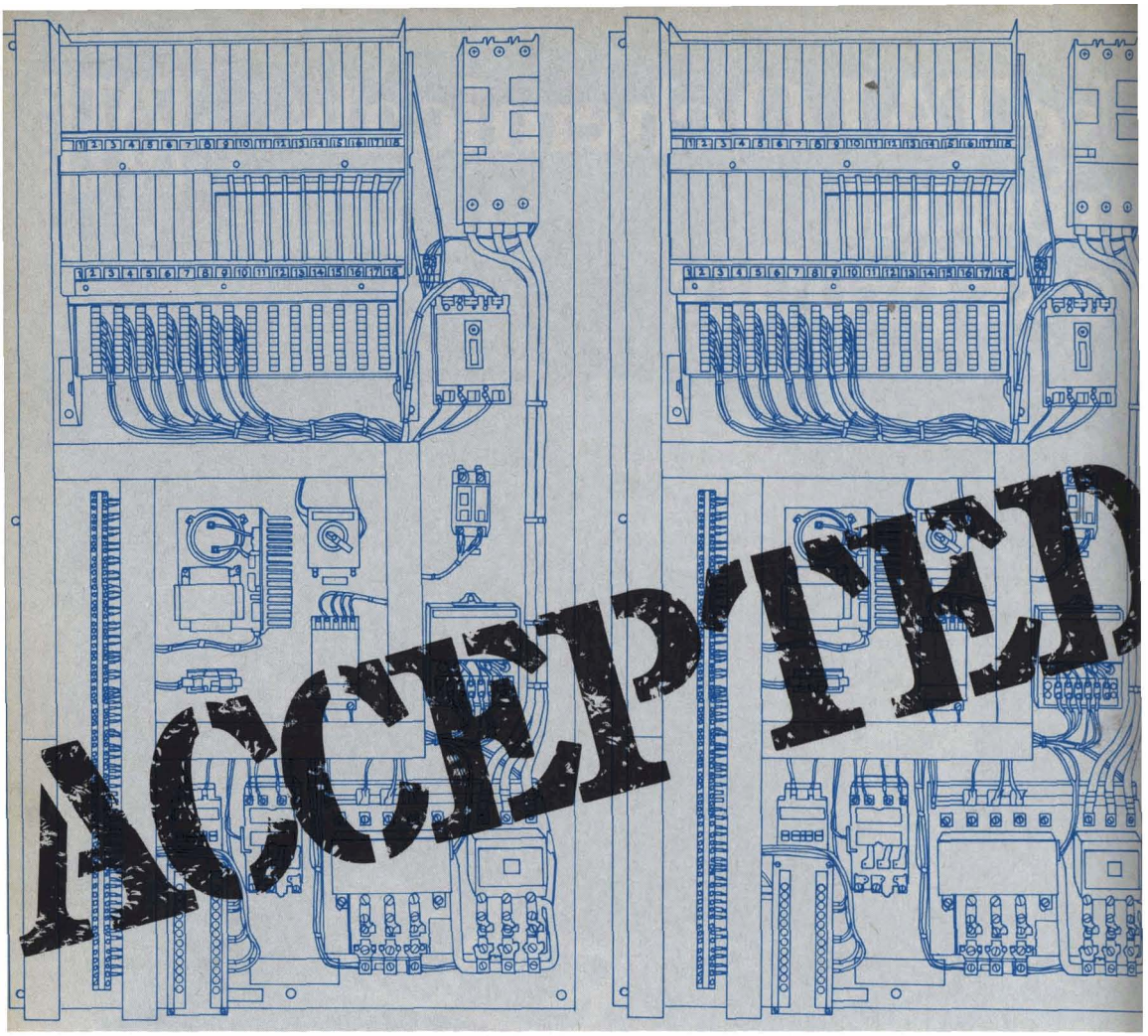

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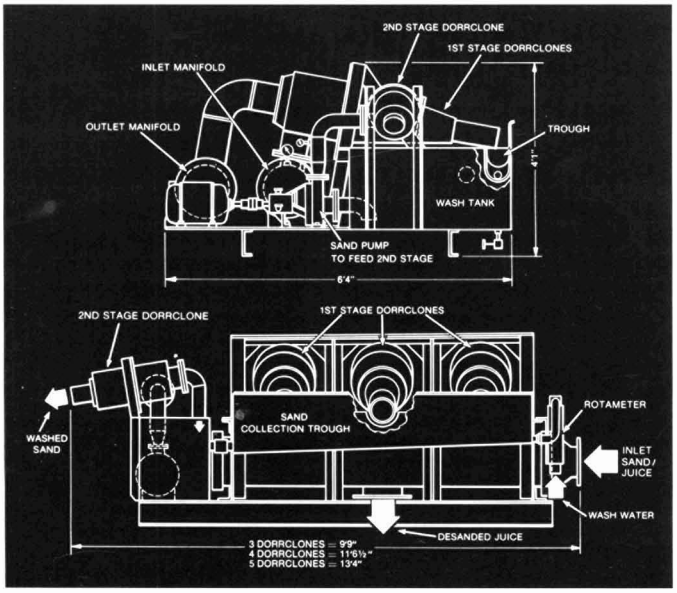

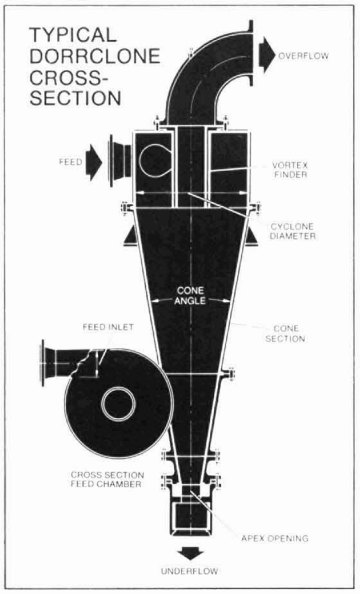

effects on plant morphology as related to physiological attributes are discussed in relation to yield maximization.

Physiological basis of yield variation between and within sugar cane varieties grown under contrasting environments. II. The evolution of tiller density in relation to yield at harvest. G. C. Soopramanien and M. H. Julien. *Paper presented to the 17th Congr. ISSCT,* 1980, 9 pp. – Three phases in the pattern of tiller number changes have been observed between planting and harvest. Tiller production is the dominant feature of the first phase which culminates in a peak tiller number; during the second phase tiller death is predominant and leads to the establishment of a stable population which in the third phase survives until harvest. Environmental conditions affect the rate and duration of tiller production in the initial phase and the peak number of tillers is closely related to the number of millable stalks at harvest, in spite of differences in tiller mortality. Changes within and between stalk populations are discussed in relation to a crop phasing strategy aimed at increasing yield at harvest.

The influence of growth parameters and climatic factors on efficiencies of solar energy utilization in sugar cane. M. Shimabuku, M. Kudo and K. Tamaki. *Paper presented to the 17th Congr. ISSCT,* 1980, 8 pp. Seven varieties were planted in Okinawa and their efficiency of solar energy utilization measured in terms of the dry matter produced, its heat content, the leaf area and the incident radiation in $kcal.m^{-2}$. The highest value achieved during the period of 11 months was 4.14% with variety F 160, varietal averages ranging from 1.15% to 1.70% giving an overall average of 1.44%. The efficiency of utilization was positively correlated with solar radiation and was considered to be affected mainly by the magnitude of the leaf area index in the early period of rapid growth, by net assimilation rate in the later period of rapid growth, and by solar radiation intensity in both periods. Different values of leaf area index corresponding to the maximum efficiency of solar energy utilization were observed with different varieties.

Effects of preharvest burning on cane qualities as assessed by real analysis. A. M. S. Saleh and G. K. Sayed. *Paper presented to the 17th Congr. ISSCT,* 1980, 11 pp. – Part of a cane field was burned and samples of cane cut and stored under open conditions while some of the remainder was bundled to prevent lodging. Samples of unburnt cane were also cut and stored under field conditions. Changes in the cut and standing burnt and cut unburnt cane crops were monitored by analysis at 1, 3, 6 and 9 days after cutting and/or burning. Burnt standing cane showed the best milling qualities, both samples of cut cane showing a decrease in juice and sugar extraction and an increase in bagasse % cane and sugar loss in bagasse. Mixed juice quality as assessed from true purity showed little changes in burnt standing and a small decrease in burnt cut cane whereas a drastic fall in quality occurred within 3 days in unburnt cut cane.

Growth, yield and juice quality performance of sugar cane varieties under different soil moisture regimes in relation to drought resistance. S. Singh and M. S. Reddy. *Paper presented to the 17th Congr. ISSCT,* 1980, 14 pp. – Irrigation restriction was used to maintain soil moisture levels of 60, 40 and 20% of the available moisture and the effects on cane examined. Growth, yield and juice quality were worst affected by decrease from 60 to 20% while the effects of decrease from 40 to 20% were greater than those of decrease from 60 to 40%. The rate of leaf emergence was least affected, while stalk elongation and leaf area were most sensitive to moisture stress. The magnitude of effect differed with variety. The effects were more deleterious at early maturity (10 months) than later (12 months). With lower soil moisture there was a trend to progressively greater reduction in sucrose % juice and increased reducing sugars with increasing maturity lateness and stalk thickness. Depression in cane yield, juice quality and sugar rendement was greater with less drought resistant varieties Co 419, Co 527, Co 658, Co 740 and Co 1158 than with Co 1148, CoS 510, Co 853 and Co 997. Thin-stalked varieties in general appear to resist drought better than those with thick stalks which had fewer green leaves, smaller leaf area, fewer tillers and lower rate of leaf emergence.

Effects of ripeners on sugar quality in cultivar H 50-2036. M. C. Morales and E. A. Angulo. *Paper presented to the 17th Congr. ISSCT,* 1980, 12 pp. – A number of chemicals were applied to 20-months old cane of variety H 50-2036, 64 days before harvest, in order to assess their effect as ripeners. Brix, pol, reducing sugars, purity, recoverable sugar and fibre were determined at intervals between treatment and harvest. It was found that neither Ethrel nor Tween-20 had any significant effect on any of the characteristics measured and, while the pol content of cane was raised by comparison with the untreated control, the recoverable sugar was not affected significantly.

A review of sucrose enhancer trials in Jamaica in 1974–78. T. McCatty. *Paper presented to the 17th Congr. ISSCT,* 1980, 16 pp. – Trials with five chemical ripeners are described. Fields sprayed with Polaris in the high rainfall area had on average 4% higher purity and 7% higher pol % cane than untreated fields, with the maximum effect 6–7 weeks after application. Fields in the irrigated areas did not respond to Polaris. Mon 8000 produced 11% and 15% increases in the pol content of cane in irrigated and high rainfall areas. Embark, Asulox and LFA 2129 produced little or no increases in pol in the varieties treated, and testing of these three products ceased in 1978. Polaris is being used commercially and testing of Mon 8000 is continuing.

Influence of the K/N relationship in fertilization on potassium content and activity of soluble invertases in sugar cane meristem. R. de Armas, E. de la Fuente, S. Naranjo and N. Musienko. *Paper presented to the 17th Congr. ISSCT,* 1980, 7 pp. – Fertilizers containing different proportions of K:N were applied to cane followed by one or two later applications of N and P, and the effects on the cane K content and the activity of acid and neutral soluble invertases in the meristem tissue determined. (It is not stated whether the different K:N ratio was based on a fixed quantity of K and variable N or *vice-versa.*) No effects of any fertilizer regime were observed on the invertase activity and, while the K content of the cane rose with increasing K:N ratio in the initial fertilizer (applied in three stage at sowing and after 6 and 12 weeks), the highest average value was 6.40% against 5.78–5.83% with no K applied. The activity of both invertases was low at the start of the biological cycle but increased during the period of rapid growth, followed by a decrease in acid invertase and increase in neutral invertase activity at maturity.

CANE PESTS AND DISEASES

Stem rot of Trojan caused by *Pseudomonas rubrilineans* **(Lee *et al.*) Stapp.** B. J. Croft, C. C. Ryan and G. Kingston. *Sugarcane Pathologists' Newsletter,* 1979, (23), 17–18. A stem rot, first found on Trojan cane in Queensland in 1961 and shown to be caused by *P. rubrilineans,* the causal agent of red stripe and top rot, has again been observed in both plant and ratoon crops of Trojan cane in Western Australia. The first symptoms were purpling of the leaf sheaths and growth of root primordia; later, the tops began to yellow and senesce prematurely, with initiation of side shoots. When sliced, the stalks revealed brown to red rotted tissue some distance from the growing point; this tissue was often very watery and had an unpleasant odour. Only a few red stripes were observed on the leaves in the affected block of cane, which also included 65A175 cane (severely affected by top rot, with the percentage infection decreasing with increase in distance from the Trojan cane) and Q 100 cane, also affected by top rot. Pathogenicity tests have confirmed that the stem rot was due to *P. rubrilineans.*

Influence of some phenolic acids on the infectivity of sugar cane mosaic virus. K. Shukla and R. D. Joshi. *Sugarcane Pathologists' Newsletter,* 1979, (23), 19–21. Young healthy maize seedlings were inoculated with a mixture of leaf extract, obtained from mosaic-infected maize, and three dilutions of phenolic acids. The number of plants infected after treatment was established as a percentage of infection of controls inoculated only with the leaf extract. Salicylic, gallic and tannic acids (representing mono-, tri- and polyhydroxy phenolic acids) gave maximum disease prevention (30, 40 and 25%, respectively) at their highest concentration (1000 ppm), the effect falling with concentration. Protocatechuic acid (a dihydroxy phenolic acid) had the reverse effect, giving maximum prevention (20%) at lowest concentration (10 ppm). Chlorogenic acid had no effect whatsoever at any concentration.

Effect of moist hot air treatment on germination and invertase activity in RSD-affected sugar cane buds. U. S. Shukla, K. Singh, V. K. Madan and Y. R. Saxena. *Sugarcane Pathologists' Newsletter,* 1979, (23), 21–22. Treatment of 4- and 5-budded setts, infected with ratoon stunting disease, with hot air of >95% humidity for 4 hours at 54°C gave better and earlier germination than in the case of untreated setts. Subsequent examination showed that acid invertase activity in the buds from the treated setts was high, but was completely absent in the buds from untreated setts; the neutral invertase activity was low in the untreated setts and absent in the treated ones.

Serological comparison of RSD-associated bacteria from five sugar cane growing areas of the world. A. G. Gillaspie, R. W. Harris and D. S. Teakle. *Sugarcane Pathologists' Newsletter,* 1979, (23), 23–24. – Plant material infected with ratoon stunting disease was obtained from Brazil, Japan and South Africa and used in tests to determine the serological relationship of isolates of the RSD-associated bacterium in their reaction to antiserum, samples of which were also sent to Australia for tests in that country. The bacterial preparations from the isolates obtained from the Brazilian, Japanese, South African and US cane contained $1–3 \times 10^8$ bacteria per ml and reacted with an anti-serum diluted to 1:1024 but not with one diluted to 1:2048, when the micro-agglutination method was used. Dilution of the preparations to about 6×10^7 bacteria per ml gave a reaction at 1:2048 dilution but not at 1:4096 when the enzyme-linked immunosorbent assay method was used. The Australian preparation, containing 3×10^7 bacteria per ml, produced positive agglutination at 1:800 anti-serum dilution but not at 1:1600. The results thus indicate that the bacteria from the five countries are closely related serologically.

A rapid technique for detecting smut infection in lateral buds of sugar cane. K. Singh, O. K. Sinha and S. R. Misra. *Sugarcane Pathologists' Newsletter,* 1979, (23), 25. – A rapid technique for the detection of smut is described. It obviates the need to await emergence of whips and involves staining the growing point of lateral buds with trypan blue; the growing point is then washed in distilled water, dehydrated and boiled in lactophenol. It is then mounted in lactophenol on a microscope slide for examination; this will reveal clearly the presence of a dark-coloured network of the fungus, which is absent from healthy growing points. The method takes about 12 hr, including the time allowed for leaving the samples in the stain overnight.

A method for joint evaluation of sugar cane variety reaction to smut and mosaic. S. Matsuoka. *Sugarcane Pathologists' Newsletter,* 1979, (23), 26. – Details are given of a method proposed for preliminary evaluation of resistance to smut and mosaic in Brazil, where the two diseases are of such importance (in the centre-south region) that varieties not resistant to them cannot be grown successfully.

Occurrence of rust in El Salvador. A. L.Fors. *Sugarcane Pathologists' Newsletter,* 1979, (23), 33. – Brief mention is made of the discovery of rust on B 4362 cane in El Salvador in 1979.

Knife cut disease of sugar cane in India. –. Kamal and R. P. Singh. *Sugarcane Pathologists' Newsletter,* 1979, (23), 34. – The name of this disease, caused by *Gibberella moniliformis,* stems from the narrow, transverse cuts in the rind which give the impression that the tissue has been removed with a very sharp knife. Observed on BO 54 and BO 70 cane, the disease is more severe in ratoon than in plant cane. The symptoms appeared first on underground portions of stalks, but later almost all the internodes were affected, the knife cuts (confined mainly to the bud side) being usually diamond-shaped; the average size of the lesions was 14 mm long x 4 mm deep. The number of cuts was 1–4 per internode. Affected ratoons were stunted, the internodes and leaves were reduced, and the edges of old cuts became necrotic, slightly raised and were coloured brown to black. Cuttings from affected cane germinated very poorly, all plants showing the same symptoms again after five months. *Fusarium monoliforme,* the imperfect stage of the pathogen, was isolated from infected tissue.

CANE BREEDING AND VARIETIES

Relative assessment of CoJ 64 and Co 1148 cane varieties for different agronomic and quality traits. R. S. Kanwar, P. S. Dhillon and S. K. Bhatta. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India*, 1978, Ag.29-Ag.34. – The performances of the two title varieties were compared in an experiment. While the cane yield of Co 1148, a late-maturing variety, was nearly 11% higher than that of CoJ 64, an early-maturing cane, in the plant crop (no differences occurred in a ratoon crop), the sugar yield was some 8% greater.

Correlation and path coefficient analysis in early maturing genotypes in sugar cane *(S. officinarum* **L.).** K. Singh, R. S Sangwan, G. R. Sharma, A. D. Taneja and M. S. Hooda. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India*, 1978, Ag.81-Ag.83. – Studies of four important quality characteristics, viz. Brix %, sugar %, purity and commercial cane sugar (c.c.s.) % in 21 early-maturing genotypes showed that there was sufficient genetic variability for improvements to be possible through selection. Brix had a greater direct effect on c.c.s. than did sugar content and purity; it is therefore suggested that Brix receive greatest attention from the breeder, at least in early selection stages.

Relative performance of different cane varieties in the low lying area (Khaddar) of Mawana Dist., Meerut. A. K. Garg, J. S. Pandey and S. K. Taneja. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India,* 1978, Ag.85-Ag.91. Two-year trials showed that, of six varieties, BO 70 was the most suitable as a replacement for BO 54 which, as the dominant variety in the title area, has shown a marked drop in performance.

Sugar cane breeding. J. T. Rao. *Maharashtra Sugar,* 1979, 4, (10), 23, 25-26. – The main objectives of cane breeding, problems involved (including flowering induction difficulties), and techniques are briefly explained and reference made to work at Coimbatore.

Cane breeding. G. J. Khudanpur. *Maharashtra Sugar,* 1979, 4, (10), 27-28, 30-32, 34, 36-37, 38, 40-43. Cane breeding research, the need for varietal change and causes of varietal decline are discussed, and the history of cane breeding in a number of countries is surveyed. Characteristics of the five species of the *Saccharum* genus are briefly described, and details given of breeding techniques. The origins of cane hybrids are listed, and brief descriptions given of leading varieties in specific countries. Cane varieties bred at Coimbatore are described.

Evaluation of crosses on the basis of a progeny test in Maharashtra. D. G. Hapase. *Maharashtra Sugar,* 1979, 4, (10), 45-50. – The crossing program at Padegaon cane research station is described, with details given of crosses and promising varieties obtained.

Performance of some promising sugar cane varieties at Padegaon (adsali crop). D. G. Hapase, R. Y. Jadhav, D. D. Whasnik and G. A. Katwe. *Maharashtra Sugar,* 1979, 4, (10), 59-60, 63. – Varietal trials are reported in which Co 7415 proved the most promising of the ten varieties tested.

A brief note on the proven-cross system in sugar cane breeding. B. K. Tripathi. *Maharashtra Sugar,* 1979, 4, (10), 65. – Reference is made to the proven-cross system of progeny evaluation[1], and the percentages of desirable clones are given for a number of crosses studied at the Indian Institute of Sugarcane Research, Lucknow.

Evaluation of crosses based on progeny testing. H. N. Singh. *Maharashtra Sugar,* 1979, 4, (10), 75, 77. Details are given of crosses tested at Shahjahanpur, Uttar Pradesh, from 1967 to 1979, and varieties that have shown promise are indicated.

Biochemical studies on flowering in sugar cane as influenced by photoperiod. VI. Studies on Co 285 ascorbic acid. K. C. Rao and M. Vijayasaradhy. *Proc. 29th Ann. Conv. Deccan Sugar Tech. Assoc. (India),* 1979, (1), A.1-A.9. – Investigations of the ascorbic acid content in the top 6-leaf portion of stems of Co 285 cane subjected to three different photoperiod treatments showed that the content gradually decreased with the progress in flower development; the content was greater in the mature leaves than the young spindle leaves at all stages of flowering.

Maturity and yield studies in different cane varieties planted in spring and autumn. R. S. Kanwar, M. S. Aulakh and S. K. Batta. *Proc. 29th Ann. Conv. Deccan Sugar Tech. Assoc. (India),* 1979, (1), A.12-A.16 + iv pp. Trials with five varieties showed that the yield and c.c.s. were higher for each variety when planted in the autumn than in the spring, the yield from CoJ 46 being more than doubled by autumn planting. CoJ 64, an early-maturing variety, recorded more sugar per unit area than the other varieties and had a higher sugar content.

Studies on post-harvest deterioration in juice quality. Mid-late selections of the 1974 Coimbatore releases – a note. N. Balasundaram and K. V. Bhagyalakshmi. *Proc. 29th Ann. Conv. Deccan Sugar Tech. Assoc. (India),* 1979, (1), A.41-A.42. – The effect of storage for up to 120 hours on juice quality was determined for twelve varieties from measurements of purity and moisture, sugar and reducing sugars contents. The resistance to juice deterioration depended on variety, but all suffered some degree of reduction in quality.

Field trials of sugar cane mutants developed by B.A.R.C., Trombay (Bombay), under different agro-climatic conditions in Maharashtra. H. K. S. Rao, P. M. Gujarathi and B. M. Rannavare. *Paper presented at 29th Ann. Conv. Deccan Sugar Tech. Assoc. (India),* 1979, 6 pp. Growth factors were determined in two mutants of Co 419 obtained by irradiation at the Bhabba Atomic Research Centre and compared with Co 740, the dominant variety in Maharashtra. At up to 11 months, the results indicated better juice quality, improved growth and potential early maturity with both mutants (TS-1 and TS-8); their girth and plant weight were greater than for Co 740, which, however, produced more tillers. (See also Rao: *I.S.J.*, 1979, 81, 117; 1981, 83, 145.

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1 Walker: *Proc. 14th Congr. ISSCT*, 1971, 149-162.

SUGAR BEET AGRONOMY

Nitrogen fertilization and metabolism of the sugar beet. M. Burba. *Die Zuckerrübe,* 1979, **28**, (6), 27–28 (*German*). – With the aid of a diagram, the interrelationships between carbohydrate and nitrogen metabolism in the sugar beet are explained. N is taken up predominantly as nitrate, which is distributed in the xylem to the various parts of the plant. Closely related to the rate of distribution is nitrate reduction to ammonia which, together with α-ketoglutaric acid, forms amino-acids. The origin of α-ketoglutaric acid and other amino-acid precursors is the organic acids formed by dextrose degradation. Therefore, the amount of sugar decomposed will increase with high N uptake, the more so since sugar will also be consumed in cell wall synthesis when new leaves are formed under the effect of the greater quantity of N. Since half of the total N in the root is assimilated in the albumins of the cytoplasm, whereas C (basically cellulose) is contained in the cell walls, in the first instance there is a tendency to small cells with thick walls which are stable and elastic, while in the second instance there is a tendency to large, turgescent cells with thin walls which, in an extreme case (e.g. with very high quantities of N fertilizer) break under the effect of considerable mechanical loads, such as in slicing.

The effect of new harvesters on the processing and storage properties of sugar beet. M. Z. Khelemskii, E. G. Tomilenko and L. V. Pogorelyi. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25**, 39–51 (*Russian*). The performances of a number of beet harvesters have been evaluated, and their performance data are tabulated. While results, in terms of dirt tare, trash and mechanical injury, were satisfactory for 6-row machines operating on a soil of 16–22% moisture content, under more adverse conditions of a hard soil or 27–32% moisture content efficiency fell dramatically.

The optimum nitrogen dose as a function of the mineral nitrogen content in the soil profile. R. Vanstallen and A. Jardin. *Le Betteravier,* 1980, **14**, (139), 21 (*French*). – Tests have shown that the optimum N dosage rate can be established by determining the N content in the 0–30, 30–60 and 60–90 cm layers of soil as well as root yield, sugar content and processing quality for each rate of application, and net profit. This method overcomes the problem of marked variation in soil N between fields at the end of February. Allowance must be made for quantities of N released later in the soil from organic fertilizer or green manure.

Nitrogen fertilization as related to plant population in sugar beet. A. Analogide. *Hellenic Sugar Ind. Quarterly Bull.,* 1979, (39), 574–588 (*Greek*). – Nitrogen trials at three sites are reported. Results showed that at rates up to 160 kg.ha^{-1}, increase in N caused significant increases in root and sugar yields (with one exception) but a significant decrease in sugar content. Some effect of beet spacing was found, whereby denser populations did not respond as well to the higher N rates as did lower populations; the effect is attributed to excessive top growth associated with the closer spaced beet. Wider spacing of beet is therefore advocated, provided the N application rates are not excessive.

Physiological aspects of nitrogen conversion in the sugar beet. II. N coversion in the leaf. K. Bürcky. *Zuckerind.,* 1979, **104**, 1128–1131 (*German*). – The N metabolism of the beet leaf is discussed, particularly the change in concentration and absolute quantity of N during the growth period. From the studies it is found possible to determine the large quantities of N that are transferred to the root from old and dying leaves. Under normal climatic conditions in Central Europe, only about 25 kg.ha^{-1} N is lost in the form of dead leaves, thus explaining the often low optimum N fertilization recommendations. Since, with adequate fertilization, the leaves (and probably the root) form a reservoir of N up to the end of August/start of September, it is considered better, as regards beet quality, to allow the soil available N to be exhausted rather than apply the nutrient.

New approaches to site-specific nitrogen fertilization of sugar beet. I. N requirement of the plant and N supply. A. von Müller and C. Winner. *Zuckerind.,* 1980, **105**, 64–68 (*German*). – The need for greater accuracy in determining the beet nitrogen requirements at one location and in supplying the required amount of nutrient is discussed. Possible means of improving N fertilization on the basis of analysis of both site and soil are examined. (Site analysis covers soil properties, including organic matter, crop history and climate, while soil analysis is restricted to nitrogen in order to establish the N_{min} content[1].)

Catch cropping, an opportunity to improve sugar yield. B. Volger. *Die Zuckerrübe,* 1980, **29**, (1), 14–15 (*German*). – The advantages that green manure crops bring to sugar beet depends on the type of crop and on the practices used, particularly in regard to nematode infestation, nitrogen application and beet plant population. Under optimum conditions, green manuring may increase sugar yield by 0.5 tonne.ha^{-1}.

Herbicides in the beet crop: residual action and effects on the soil microflora. J. Stryckers, H. Goddeeris, M. van Himme, R. Bulcke and W. Verstraete. *Publ. Trimest. Inst. Belge Amél. Betterave,* 1979, **47**, 69–87 (*French, Dutch*). – Investigations carried out in 1975 showed no phytotoxic effects of soil-applied herbicides on various plants grown in earthenware dishes using soil taken from beet fields at harvest. On the other hand, in 1976, which was marked by a long period of drought, the plants were severely affected by the residual action of Ethofumesate which had been applied seven weeks earlier; Pyrazon and Metamitron also had slight inhibiting effect on flax growth, and both had a marked adverse effect on soil micro-organisms and enzymes, which gradually decreased until the effect disappeared by harvest. While there is thus little fear of risk from Pyrazon and Metamitron, Ethofumesate poses a major threat to subsequent crops unless adequate precautions are taken, including ploughing to 15 cm before sowing winter wheat. Because of its relatively mild effect on soil microbes, it is though that its use should not be proscribed.

[1] Scharpf & Wehrmann: *I.S.J.*, 1980, **82**, 180.

BEET BREEDING AND VARIETIES

The present performance of sugar beet varieties. A. von Müller. *Die Zuckerrübe,* 1979, **28,** (1), 16 *(German).* The performances of 16 varieties (13 of them monogerm) are tabulated. While there was little difference between them as regards sugar yield (corrected sugar content as a percentage of the apparent sugar content), there was greater difference in the corrected sugar content, but greatest differences were found in the contents of melassigenic components (K, Na and amino-N). Since the scatter for corrected sugar content was greater than for monetary return, it is pointed out that varietal selection carries a greater risk for the sugar producer than for the farmer.

Comparative tests with genetically monogerm sugar beet varieties. L. Lukács, F. Pőcsy and J. Zana. *Cukoripar,* 1979, **32,** 19–22 *(Hungarian).* – Beet varietal trials carried out at three locations in Hungary in 1977 are reported. Results for the 25 varieties showed that Beta poli M-102, a domestic variety, performed as well as imported varieties in most cases.

New sugar beet varieties in trials and production. J. Siódmak. *Gaz. Cukr.,* 1979, **87,** 39-40 *(Polish).* – The aim of varietal trials and the level of beet breeding in Poland are discussed. By 1980 it was planned to grow genetically monogerm varieties on half of the total beet area in Poland. Some information is given on four important monogerm varieties in the PN series; it is pointed out that these are the result of a West German male sterile line crossed with Polish pollen. Of two purely Polish varieties, one is not sufficiently good for commercial production, while the other has defects in the male line sterility which must be eliminated before it is recommended for commercial production.

Varietal trials with sugar beet seed in 1978. L. Schmidt, L. Jelínková, J. Jaros, V. Benda and M. Nikiforová. *Listy Cukr.,* 1979, **95,** 49-56 *(Czech).* – Trials at five sites are reported. Results showed that Dobrovická A as polished seed gave the best performance; in this form it is sown on almost 94% of the total beet area of Czechoslovakia.

Intergenotypic variability with reference to delayed harvesting in respect of some important characters in sugar beet (*Beta vulgaris* **L.**). T. N. Rao and P. S. Bhatnagar. *Indian Sugar,* 1978, **28,** 461-471. – Four population groups comprising 36 beet genotypes of diverse origin, genetic structure and ploidy levels were selected for a study of inter-population and -genotypic variability in specific parameters with particular reference to tolerance of increased temperature associated with delayed harvesting under climatic conditions such as occur in India. In general, there was a decrease in root yield, sucrose content and gross sugar yield with delay, while the impurity index increased; however, differences were found in response within a population group as well as between the individual genotypes. The genotypic variability provides scope for breeding of beet adaptable to sub-tropical climatic conditions.

Results of comparative trials of sugar beet varieties in Belgium from 1976 to 1978. N. Roussel, R. Vanstallen, W. Roelants and T. Vreven. *Publ. Trimest. Inst. Belge Amél. Betterave,* 1979, **47,** 3-53 *(French, Dutch).* Results of field trials conducted at five sites in 1978 (each involving 54 varieties) are reported in detail, and average results are presented for the 3-year title period.

Trials of commercial varieties of beet. D. Kimber and S. McCullagh. *British Sugar Beet Rev.,* 1979, **47,** (2), 38–40. – Results are given of varietal trials conducted by the National Institute of Agricultural Botany at various locations in 1978 as well as in the previous two years, with the 3-year mean also being given for each of 8 varieties.

Ideotype concepts for sugar beet improvement. R. S. Loomis. *J. Amer. Soc. Sugar Beet Tech.,* 1979, **20,** 323–342. – The author defines "ideotype" as the collective morphological and physiological traits of an ideal genotype, and discusses work in connexion with beet breeding aimed at improving beet performance (particularly in regard to yield). Aspects discussed include partitioning between root, shoot and leaf, respiration and cell size. The effects of these on yield, photosynthesis and sucrose storage, etc. are examined.

Parameters controlling sucrose content and yield of sugar beet roots. R. Wyse. *J. Amer. Soc. Sugar Beet Tech.,* 1979, **20,** 368–385. – Partitioning of photosynthate in beet is discussed, and results of investigations on the inverse relationship between sucrose content and root yield are reported, the aim being to delineate those areas in which research is needed and to propose several physiological principles for use as basis in efficient genetic selection. Root yield is determined by photosynthate supply and balanced distribution of photosynthate between shoot and root, root size being controlled by the ability of the shoot to provide photosynthate and the growth potential of the root. Photosynthate translocated to the root is partitioned between growth and sucrose storage. This partitioning is balanced and appears to be independent of photosynthate supply, although it is affected by environmental and genetic factors. Since sucrose diffuses from the vascular tissue through the free space of the root, diffusive resistance and length of the diffusion path may be factors controlling sucrose accumulation in the root. Narrow rings allow a large proportion of the total number of cells to be exposed to the high concentration of sucrose in close proximity to the phloem. Research should aim to produce large roots with a greater number of rings, a criterion which should be useful in selection of superior genotypes.

Results of sugar beet varietal trials (in Belgium). N. Roussel and A. Roelants. *Le Betteravier,* 1979, **13,** (137), 13–16 *(French).* – Results are given of varietal trials carried out at six sites in 1979.

The quality of our sugar beet varieties. A. von Müller. *Die Zuckerrübe,* 1980, **29,** (1), 22–23 *(German).* Results of beet varietal trials in West Germany are reported. The data for 16 varieties are given in tabular and graph form.

CANE SUGAR MANUFACTURE

New type cane off-loading grab. G. G. Ashe. *S. African Sugar J.*, 1979, **63**, 476-477. – See *I.S.J.*, 1980, **82**, 54.

Trials on centrifuging of final massecuites in continuous centrifugals. T. Ananta. *Maj. Perusahaan Gula*, 1977, **13**, (2), 143-157; through *S.I.A.*, 1979, **41**, Abs. 79-1629. – Tests on various types of continuous centrifugal at nine Indonesian factories in the 1975 and 1976 seasons are reported. The effects of varying the amount of water added at constant throughput, and of varying the throughput at constant water addition, on the properties of molasses and sugar are shown in graphs. Addition of up to 5.5% water considerably improved the sugar purity without appreciably increasing the molasses purity. At a throughput of 1.5 tonne.hr^{-1}, sugar of 83.4 purity and molasses of viscosity < 96 poises at 50°C were obtained; increasing the throughput to 3 tonnes.hr^{-1} with the same % addition of water caused little change. At one factory, a capacity of 7 tonnes.hr^{-1} was easily achieved when the strainer was removed from the feed pipe. Molasses samples obtained at six factories by centrifuging without addition of water were analysed; gum contents ranged from 0.18 to 1.20%. The ratio between the viscosity of massecuite and that of molasses tended to be low at factories where the difference between pycnometric and refractometric Brix was high.

Circulated imbibition system. P. Carebet. *Maj. Perusahaan Gula*, 1977, **13**, (2), 158–189; through *S.I.A.*, 1979, **41**, Abs. 79-1621. – A simple method of increasing the extraction by the mill tandem is to recirculate part of the juice from one or more of the mills as imbibition to the same mill. This method uses no extra imbibition water and thus imposes no extra load on the evaporator. In trials in three cane sugar factories, increases in extraction were obtained, the amounts depending on local operating conditions. The maximum % recirculation is limited by practical factors such as mill slippage; up to 50% recirculation is suggested. A formula for calculating the increase in extraction is given.

Vacuum filter operation in connexion with the clarification results. M. Mochtar. *Maj. Perusahaan Gula*, 1977, **13**, (3-4), 309-322; through *S.I.A.*, 1979, **41**, Abs. 79-1624. – Tests on the operation of the rotary vacuum filter at Bone sulphitation factory are reported. Available bagacillo % mud dry solids was insufficient, with the result that < 80% of the incoming mud solids were retained in the filter cake. The large amount of suspended solids recirculated led to serious overloading of the clarifier as well as undesirable chemical reactions. Mud retention was improved by decreasing the speed of the filter and by increasing the difference between the vacua applied to the pick-up and wash sections. Since there was a high correlation between pol % filter cake and refractometric Brix of liquid in cake, the Brix of liquid squeezed from a sample of filter cake wrapped in Whatman filter paper could be used as a rapid means of assessing filter performance.

Study on performance of rapid crystallizer for final massecuite at Prajekan factory. P. Carebet. *Maj. Perusahaan Gula*, 1977, **13**, (3-4), 254–258; through *S.I.A.*, 1979, **41**, Abs. 79–1626. – Operating results for a rapid and a conventional crystallizer are tabulated. They show that use of the former decreased the cooling time from 21 to 12 hr, increased the recovery from 68.8% to 70.6% and increased the purity of the *D*-sugar from 84.0 to 87.2; however, it decreased the Brix of the *D*-sugar from 95.7 to 94.9, and operating and maintenance costs were higher.

A report on the operation of the Lotus roll at Jenteh sugar factory. K. T. Wang. *Taiwan Sugar*, 1979, **26**, 171–174. – Experiments with Lotus rolls[1] of three different types (two with normal grooving, one with alternate teeth removed and one without circumferential grooving) are described. Results showed that the roll increased mill capacity by at least 15% but that the flange should be improved where the roll has no circumferential grooving (as is normal practice with top rollers in Taiwan) and it is considered desirable to increase the open area of the perforations. It is also thought that the roll will have a high life expectancy because of the cast steel used in its manufacture; tramp iron did not break any teeth, the wear of which could be reduced by use of arc welding.

Studies on filtration of first carbonatation slurry by Oliver filters. C. H. Chen, T. P. Hsieh and Y. C. Cheng. *Rpt. Taiwan Sugar Research Inst.*, 1979, (85), 41–51 (*Chinese*). – In tests, 1st carbonatation juice was treated by a tubular filter, the mud from which was then fed to an Oliver filter. Results showed that the Oliver filter gave a low cake pol at a good filtration rate, but the filtrate was turbid and of high colour. A material balance of the system was calculated and a comparison made between Oliver filter and filter-press performances.

Optimum water requirement at centrifugals. P. K. Singh. *Maharashtra Sugar*, 1979, **5**, (2), 9, 11. – The author explains how to calculate the quantity of molasses adhering to the sugar crystals in a given massecuite and hence the amount of wash water required to separate the molasses and give a sugar of required purity.

Inversion of juice in a quadruple-effect evaporator and other changes. B. B. Khochare. *Maharashtra Sugar*, 1979, **5**, (2), 13–14, 16–17. – The quantity of sucrose inverted in evaporation as a function of pH, temperature and retention time is discussed. Advice is given on maintenance of a minimum crushing rate (so that the retention time is not protracted) and of a pH no lower than 6.8.

The potential for the production of electrical power by sugar mills. P. N. A. M. Chenu. *Sugar y Azúcar*, 1980, **75**, (2), 23, 26–27. – The author calculates, on the basis of typical factory operation in Brazil, the amount of electrical power that could be produced in excess of requirement and sold to the public grid.

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[1] *I.S.J.*, 1980, **82**, 31, 194.

BEET SUGAR MANUFACTURE

Raising the carbon dioxide utilization in 1st carbonatation. I. Friedemann. *Lebensmittelind.,* 1980, **27,** (1), 22–26 (*German*). – The system at Aderstedt for automatic control of CO_2 gas pressure is a dual system in which some of the gas vented to the atmosphere, as in conventional control schemes, is recycled either to the pump intake or is fed into the main gas line to carbonatation. At Zeitz, CO_2 utilization was raised from 71% in the previous campaign to 82% by modifying the 1st carbonatation vessel gas feed and distribution system; the gas was fed from the main feed line at the top of the vessel via five separate vertical branch pipes to chests, one connected to each branch and regularly spaced across the vessel; these chests were open at the bottom and had jagged walls to promote turbulence. A baffle across the vessel prevented local breakthrough of gas above the area of the chests. The vessel operated for 125 days without cleaning. At Aderstedt, a jet spray system for 1st carbonatation mantained CO_2 utilization at an average of 95% (91–99%). With reduction in the rate of mud recirculation from 470 to 350 $m^3.hr^{-1}$, the gas utilization rate was still about 90%, although a reduction in juice level from 4.6 to 3.4 m caused a much more dramatic fall in the rate. A major disadvantage of the system was formation of incrustation at the mouth of the gas nozzle, which was difficult to clean manually and adversely affected filtration. Some scaling was attributed to wrongly installed flange joints. It is suggested that the design should be altered and other materials used for construction, or chemical descaling used.

The route of antifoam agents through the sugar factory. O. S. Malmros and J. Tjebbes. *Sucr. Belge,* 1980, **99,** 21–33. – See *I.S.J.,* 1980, **82,** 381.

Basic trends in raising the efficiency of beet sugar manufacture. P. V. Poltorak and Z. N. Panteleeva. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 3–15. (*Russian*). – The authors examine those areas of beet agronomy and factory processing where improvements can be made as a contribution to the overall aim of raising the efficiency of the Soviet sugar industry. On a wider plane, it is considered necessary to concentrate beet growing in those areas where it is economically sound and to build larger factories (e.g. of 10–12,000 tonnes daily slice) while closing smaller ones, as has been done in other countries. Optimization of the campaign length is also discussed.

Reception, storage and processing of mechanically harvested sugar beet. M. Z. Khelemskii and A. Kh. Starushenko. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 28–38 (*Russian*). – Results of investigations conducted over a number of years are summarized. The effects of beet topping height, mechanical injury and trash on the chemical, biochemical and processing properties of beet are discussed, and possible ways of reducing losses and increasing beet quality and hence that of the sugar obtained are indicated.

New equipment for beet cleaning en route to the factory and for washing it. V. G. Yarmilko, N. D. Khomenko, V. A. Semenovskii, V. A. Gusev and N. M. Datsenko. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 51–61 (*Russian*). – Information is given on equipment for the beet yard, as well as beet washers, developed in the USSR in recent years, including a pulsating flume gate, a beet lift, trash catchers and water separators.

Raising diffusion efficiency by invertase inactivation. M. Z. Khelemskii, M. L. Pel'ts and A. K. Buryma. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 61–68 (*Russian*). – Tests are reported in which the daily sugar losses in stored beet were reduced by 18% by treatment with a 1% solution of sodium azide at 3 litres.$tonne^{-1}$, invertase activity being reduced by 35–40%. Addition of 0.1–0.2% silica by weight or 0.1–0.15% aluminium oxide to diffusion juice also reduced invertase activity, as did the use of ultrasonics in preliminary trials.

Means of raising the efficiency of sugar beet evaluation at reception. V. A. Zaets, B. A. Eremenko and A. V. Kapats. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 87–94 (*Russian*). – A description is given of a centralized automatic system for beet evaluation and information storage and dissemination which is recommended for Soviet sugar factories as a means of increasing efficiency and cutting costs.

Increasing the productivity of manufacturing processes. V. P. Mondzelevskii. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 94–113 (*Russian*). Details are given of innovations in processing and of new equipment developed in the USSR in recent years.

Simulation of the boiling process with continuous production of massecuite. Yu. D. Kot, A. N. Savich and A. K. Sushchenko. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 113–117 (*Russian*). – A mathematical model is presented of continuous boiling which permits calculation of parameters under optimum conditions.

Formulation of the starting system of the electric drive of an inclined diffuser with the aim of increasing the reliability and life of the drive. N. F. Shurbovanyi, V. A. Sibirskii, Yu. P. Dobrobaba, V. V. Malyshev and A. A. Tasenko. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 117–121 (*Russian*). – Equations are presented for calculation of parameters involved in the start-up of the electric drive of a scroll-type inclined diffuser.

The effect of gas distribution grid design on the efficiency of a fluidized bed dryer/cooler for white sugar. A. A. Dmitryuk. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.,* 1978, **25,** 122–128 (*Russian*). – An experimental model of a fluidized bed dryer/cooler was used to study the effect of grid design on heat transfer from air to the sugar above the grid. Mathematical examination of the results obtained has led to development of a new type of pocketless grid[1].

[1] See also Dmitryuk: *I.S.J.,* 1979, **81,** 22.

Inclusion of impurities in yellow sugar crystals. A. P. Kozyavkin, N. I. Odorod'ko and L. D. Bobrovnik. *Sakhar. Prom.*, 1980, (2), 25–27 (*Russian*). – Details are given of analyses of yellow sugar (of 99.5 purity) in view of its high colour. Of the inclusions found in the crystals, invert sugar degradation products were the most common, followed by melanoidins and caramelan. The amino-N content was far lower than that of the colorants, as were the ash components (Ca, Na and K). Since fine and large crystals contained more impurity than medium-sized crystals, it is suggested that the aim should be to produce crystals measuring 0.30–0.35 mm, while liquor treatment should promote maximum possible removal in the 1st strike of those impurities otherwise liable to remain inside the crystal.

Comparative evaluation of chemical preparations used in beet piling with the aim of reducing storage losses. V. A. Knyazev *et al. Sakhar. Prom.*, 1980, (2), 41–44 (*Russian*). – The effectiveness of a number of different preparations sprayed on beet to reduce rotting and daily sugar losses was determined. Details are given of the preparations, of which pyrocatechin proved the best, approximately halving the losses suffered by the control beet.

Means of efficient use of energy in pulp drying in the sugar industry. T. Cronewitz. *Zuckerind.*, 1980, **105**, 129–139 (*German*). – After a brief examination of beet pulp pressing, particularly the questions of how to increase pulp pressability and of costs of energy and total costs of pressing, the author discusses general problems associated with pulp drying. Process optimization and equipment design to obtain best possible moisture reduction at minimum energy consumption are examined, with particular attention focused on flue gas heat utilization and gas recycling. Potential energy savings are calculated, and a description is given of the Carver-Greenfield process in which pulp drying is carried out by mixing the pulp with a liquid carrier, e.g. vegetable oil, and passing it through an evaporator. Trials conducted by Süddeutsche Zucker-AG in collaboration with Wiegand Karlsruhe GmbH showed that the process permits a possible halving of the energy consumption of conventional drying.

Investigations of precipitation in technical purification of sugar juices and of the effect of individual components on separability. E Reinefeld, F. Schneider, K. Thielecke and R. D. Hoffmann. *Zuckerind.*, 1980, **105**, 139–148 (*German*). – Investigations of alkalinity and pectin precipitation showed that during preliming, the concentration of Ca^{++} ions in the pH range (10.8–11.2) at which flocculation normally takes place is too low for pectin precipitation, necessitating addition of milk-of-lime beyond the normal end-point; this causes precipitation as soon as sufficient pectin has been saponified. Of the high-molecular components (MW > 6000) in raw juice, pectin is precipitated only at the end of preliming, but then to the extent of 80–90% within a 0.5 pH range, as a result of conglomeration of substances that cause turbidity, so that the juice becomes clear and translucent. The proteins, on the other hand, are separated from the juice only at later stages (main liming and 1st carbonatation). Model tests with colloids of varying composition showed that increase in the colloid content has a particularly adverse effect on carbonatation mud separation if the increase is in the form of pectin. By contrast, high protein concentrations have only slight effect on mud settling and filtration. Addition of sodium phosphate and oxalate caused the Ca ion concentration to fall below that required for optimum flocculation in preliming. Both these and other sodium compounds had adverse effect on filtration. This effect is attributed to displacement of bound Ca ions in the colloids; this leads to change in the hydration properties and an increase in the swelling of the colloids, which are then not easy to separate. Mg chloride reduced juice colour considerably but gave high lime salts contents (as a result of reduction in the natural alkalinity); mud properties were even more affected than by sodium salts, Mg hydroxide being precipitated and having marked effect on filtration. Determination of the optimum flocculation point by a photometric method is described.

Experiences in the operation of filter-thickeners. E. Havlová. *Listy Cukr.*, 1979, **95**, 267–272 (*Czech*). Details are given of five filter-thickeners of Czechoslovakian and other designs, and their performances discussed.

Granulometry and screening of sugar. III. Industrial screening of crystal sugar. J. Gebler. *Listy Cukr.*, 1979, **95**, 273–277 (*Czech*). – A number of sugar screens are described, and advice is given on screen operation in general.

Automation of transport packing of crystal and powdered sugar. J. Jun and J. Pribyl. *Listy Cukr.* 1979, **95**, 281–285 (*Czech*). – The system designed for Melnik sugar factory is the first automatic packaging, baling and palletizing one in the Czechoslovakian sugar industry. The five basic components are described.

The energy economy in evaporation and drying processes. T. Baloh. *Zuckerind.*, 1980, **105**, 50–61 (*German*). – The concept of exergy and its application in examination of energy economies are explained, and the heat economies of a quadruple-effect evaporator and a pulp drying plant are analysed. Examination of the heat economy of a sugar factory using (i) vapour compression in the evaporator and pan stations, and (ii) a gas turbine for pulp drying shows that both measures can reduce fuel consumption by some 35% in the case of a conventional factory using 45 kg of steam per 100 kg of beet. The heat balance of a factory adopting both (i) and (ii) is given in detail.

Elements in the choice of a system of sampling from beet transport. L. Rigo. *Le Betteravier*, 1980, **14**, (139), 34–37 (*French*). – Two types of beet sampling equipment used in Belgium are described and their advantages and disadvantages discussed. They are the Rüpro and the Silver systems; the former comprises a square-sectioned, hydraulically operated plunger which withdraws samples from six points in the load, while the Silver system consists of a small trolley, which extracts a batch of beets from a load passing along a conveyor, onto which they are tipped from the transport, and transfers them to a basket for further handling prior to analysis.

The development of continuous centrifuging in the field of high-purity sugars. P. Credoz, G. Journet and J. Ledoux. *Sugar y Azucar*, 1980, **75**, (2), 34–35, 38, 42. See *I.S.J.*, 1981, **83**, 119.

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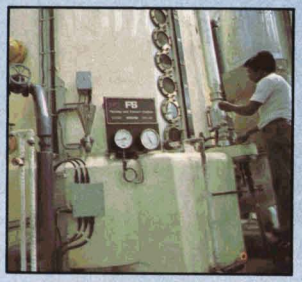

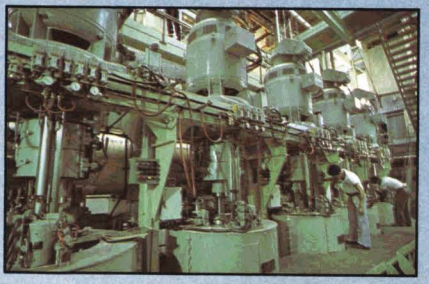

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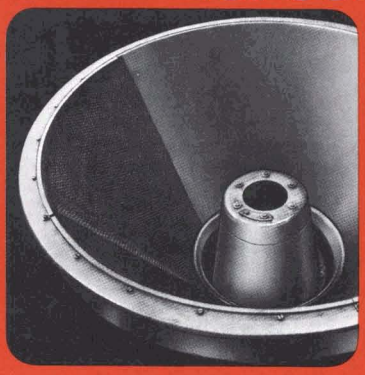

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LABORATORY STUDIES

On the determination of the dry substance content of Quentin molasses. C. A. Accorsi, G. Vaccari and G. Vecellio, *Ind. Sacc. Ital.*, 1979, **72**, 129–132 (*Italian*). Dry substance determinations with Quentin molasses showed that values from refractometric measurements were higher than those obtained by vacuum oven drying and these were higher than figures obtained by Karl Fischer titration. Analysis showed that there was a correlation between the dry substance variation and the magnesium content of the Quentin molasses, and equations produced by regression analysis allow conversion of apparent dry substance to true values within good limits of approximation.

Sugar microscopy. H. E. C. Powers. *Sugar y Azúcar*, 1979, **74**, (12), 27–29. – Sugar crystal growth is explained briefly with the aid of some photomicrographs, and reference made to the author's past work in the field of crystallography. Mention is made of "amorphous sugar" and the relationship between the process by which this is formed and caking of stored sugar.

Determination of total sugars in the products of industrial processing of sugar cane using "direct injection enthalpimetry". A. A. Rodella and W. A. de Oliveira. *Brasil Açuc.*, 1979, **94**, 185–181 (*Portuguese*). The method described is based on measurement, in terms of temperature rise, of the heat of reaction of invert sugar with periodate using thermistors (resistance thermometers) and a Dewar flask to hold the reaction mixture. Cane juice is hydrolysed with HCl before analysis while molasses is clarified with lead acetate. The temperature rise is directly proportional to the quantity of sugars present, and for five different varieties the total sugars was within +1.5 to –0.8% of the figure obtained by the Lane & Eynon method; for five molasses samples, the difference was between +0.7 and –3.9%.

Influence of coloration of sugar solutions on measurements by quartz wedge saccharimeters. H. Melle, K. Zander and A. Emmerich. *Zuckerind.*, 1979, **104**, 1112–1117 (*German*). – The effect of colour of solutions such as raw sugar and molasses on the effective wavelength at which the sugar content is measured by photoelectric saccharimetry was investigated, involving adoption of the ICUMSA-recommended wavelengths of 420 and 560 nm. It was found that, under normal conditions, the sugar content of raw sugar solutions (typically about 97°S) is under-measured by 0.012% relative, while the error is even greater, at 0.02–0.09%, in the case of clarified molasses examined under "realistic" conditions. Comparison is made with results obtained by various authors.

Determination of the ash content in white and refined sugar. T. P. Khvalkovskii and T. V. Zakharova. *Sakhar. Prom.*, 1980, (1), 41–43 (*Russian*). – While the ash contents of 15 sugar samples as determined conductimetrically and gravimetrically as carbonate showed only very slight differences, the gravimetric determination as sulphate ash gave much greater discrepancy, so that the conductimetric method is advocated as standard method.

Selective determination of lime salts in products of sugar manufacture. I. F. Bugaenko, T. N .Samoilova and G. V. Ivanova. *Sakhar. Prom.*, 1980, (1), 43–44 (*Russian*). – Details are given of a method for determining lime salts in e.g. carbonatation and thick juices, in which NaOH and $MgSO_4$ are added together with chalcone carboxylic acid as indicator, which turns red in the presence of Ca^{++} ions in an alkaline medium. The mixture is titrated with EDTA. The typical relative difference between true and determined lime salts, expressed as % CaO, is ± 0.15%.

Reduction of crystallizable sugar losses. Crystallization kinetics of low-grade boiling. V. Maurandi and G. Mantovani. *Sucr. Belge*, 1979, **98**, 389–404. – See *I.S.J.*, 1980, **82**, 348.

Polarographic determination of copper, zinc and lead in refined sugar. M. Zboril and M. Koutoucek. *Listy Cukr.*, 1979, **95**, 278–280 (*Czech*). – Results are given of tests on determination of the title metals in refined sugar by polarography without prior ashing and ion exchange treatment. Provided the sugar concentration did not exceed 40%, the method permitted determination of Cu and Pb down to 1 ppm and Zn down to 0.5 ppm. Details are given of suitable electrolytes and maximum current passage.

Simultaneous fluorimetric and colorimetric detection of carbohydrates on silica gel plates using *o*-aminobenzenesulphonic acid. F. Iinuma, Y. Hiraga, T. Kinoshita and M. Watanabe. *Chem. Pharm. Bull.*, 1979, **27**, (5), 1268–1271; through *Anal. Abs.*, 1980, **38**, Abs. 1C10. An aqueous solution of each sugar was applied to precoated silica gel plates, and chromatograms were developed with 5:3:1 propanol:acetone:water. The plates were sprayed (20 $\mu l.cm^{-2}$) with a 2% (w/v) solution of the reagent in aqueous 4% H_3PO_4. After heating for 5 min at 120°C, the spots were detected by irradiating at 365 nm and the fluorescence intensity was measured by means of a scanning fluorimeter. The calibration graph for dextrose was rectilinear in the range 0.1–0.5 nmol per spot. Detection limits for 24 carbohydrates are listed together with the colours of the spots.

Solubility of impure sucrose solutions. S. Ameneiro and M. Alvarez. *CubaAzúcar*, 1979, (Oct./Dec.), 44–48 (*Spanish*). – From measurements made at Manuel Martínez Prieto sugar factory, using a Saturoscope, multiple regression analysis was used to develop an equation for the solubility of sugar as a function of impurities content and temperature. This gave values in good agreement with experimentally determined values.

The viscosity of sucrose and molasses solutions. R. Ts. Mishchuk and L. G. Belostotskii. *Sakhar. Prom.*, 1980, (2), 27–29 (*Russian*). – The theory of the viscosity of sucrose and molasses solutions as a function of temperature and concentration is examined mathematically and explanations are offered regarding the effect of temperature.

BY-PRODUCTS

Pulp drying with low-grade heat recovery. A. Bausier. *Sucr. Belge,* 1979, **98,** 199-219 *(French).* – See *I.S.J.,* 1980, **82,** 350.

An alcohol fuels prospective: the National Alcohol Fuels Commission. E. J. Bentz. *Paper presented to 1st Amer. Conf. on Renewable Sources of Energy,* 1979, 12 pp. – The activities of the National Alcohol Fuels Commission, which is composed of six US Senators, six Representatives and seven members of the public, are outlined. The aim of the Commission is a study of alcohol fuels, including production, economics and utilization.

Working of potash fertilizer plant at Walchandnagar, utilizing distillery effluent. A. C. Chatterjee. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India.* 1978, G.1–G.15. – Details are given of the plant, which handles 30 tonnes of vinasse per day and produces some 3 tonnes/day of fertilizer containing 7.0% K_2O, 1.50% N and 0.15% P_2O_5. The economics of the process are discussed.

Studies on the utilization of methane by a *Coccus* bacterium for the production of single-cell protein. S. K. Misra and K. A. Prabhu. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India,* 1978, G.17–G.18. – Methane gas obtained by anaerobic fermentation of bagasse and cane trash was found to support a micro-organism which contained 70% crude protein (dry cell weight) and nearly 10% nucleic acids.

Utilization of bagasse for the production of microbial protein. C. Sarkar and K. A. Prabhu. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India,* 1978, G.53–G.64. Treatment of powdered bagasse with 5% NaOH for 5 or 10 min or with 1% H_2SO_4 for 2 hr gave maximum yield of microbial protein when *Cellulomonas* sp. and cellulolytic bacteria isolated from rumen liquid and bioliquid (obtained from a biogas plant utilizing bagasse as raw material) were individually cultured. Treatment with 10% H_2SO_4 for 2 hr at room temperature was suitable only for the *Cellulomonas* culture. The rate of utilization of the bagasse substrate was increased by steaming and cooking under pressure in the presence of NaOH. Pre-treatment with ammonia and separation into fibre and pith fractions did not significantly affect microbial growth.

Further studies on the treatment of ammonified distillery waste using aerobic processes to reduce the BOD. C. B. Agnihotri and K. A. Prabhu. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India,* 1978, G.65–G.79. – A number of methods were compared for their ability to reduce further the BOD of vinasse already subjected to the National Sugar Institute ammonification process [1,2,3]. The use of activated sludge, various forms of aeration, submerged filtration and biofiltration gave varying results, which are discussed. Aerated lagoons were not effective under the experimental conditions, while shallow oxidation ponds were too slow in their effect.

Studies on better utilization of sulphitation press mud. B. P. Sahi and Y. Rai. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India,* 1978, G.105–G.114. – Field trials are reported in which press mud proved effective in helping to reduce the pH of a saline-alkali soil, increased the nutrient content of cane trash compost and was a valuable adjunct to N and P fertilizers. The positive effects on cane yield are indicated.

Utilization of the by-products of the sugar industry. Preparation of xylitol, a nutritive sweetner from bagasse. S. Bose, K. C. Gupta and S. K. Suri. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India,* 1978, G.115–G.121. Details are given of a method for isolation of xylan from bagasse and subsequent hydrolysis to yield xylose from which xylitol is obtained in 60% yield using Raney nickel as hydrogenation catalyst.

The effects of yeast extract and ion exchange treatment of molasses on kojic acid production by resuspending fungal mycelia. P. Bajpai, P. K. Agrawal and L. Viswanathan. *Proc. 42nd Ann. Conv. Sugar Tech. Assoc. India,* 1978, G.153–G.166. – Studies on kojic acid production from molasses by means of *Aspergillus flavus* showed that the yield of 15% could be raised to 38.5% by using the same 10°Bx solution as resuspension medium or to 46.2% by adding 1% yeast extract, but not to the resuspension medium. Neither addition of ammonium nitrate, dipotassium hydrogen phosphate or magnesium sulphate, nor ion exchange treatment increased yield further.

Alcohol technology. K. Eder. *Sugarland,* 1979, **16,** (3), 6, 8, 14–15. – A representative of Vogelbusch GmbH describes the developments in alcohol and fodder yeast manufacture from molasses made by his company, and describes both batch and continuous fermentation processes as well as the specially designed distillation and rectification plant. The economics of the Vogelbusch process are compared with those of a conventional process.

Rules to follow for pressed pulp ensilage. Anon. *Le Betteravier,* 1979, **13,** (135), 9 *(French).* – Some advice is given on best means of piling pressed pulp for optimum ensilage.

Carbonatation "lime" – a sugar industry fertilizer. H. Irion. *Zuckerind.,* 1979, **104,** 920–922 *(German).* Aspects of the use of carbonatation mud for agricultural purposes are discussed.

The application of carbonatation mud to soil and experiences gained in the last two years at Appeldorn. G. Weerth. *Zuckerind.,* 1979, **104,** 922–923 *(German).* The three sources of carbonatation mud in the sugar factory are noted, and its transport and application to soil discussed.

Contributions to a discussion on carbonatation mud application to soil. *Zuckerind.,* 1979, **104,** 925 *(German).* – Transport and agricultural use of carbon-

[1] Dahiya & Prabhu: *I.S.J.,* 1974, **76,** 90.
[2] Prabhu & Prakash: *ibid.*
[3] Dahiya et *al.*: *ibid.,* 1978, **80,** 253.

atation mud is briefly discussed by three authors, particularly the question of dust and smell emission.

The use of carbonatation "lime" as fodder lime. I. Schleede. *Zuckerind.*, 1979, **104**, 946 *(German)*. – Brief reference is made to tests in which powdered filter cake was fed to day-old chicks and continued up to 3–5 weeks. Results showed that the cake can be used in place of pure $CaCO_3$ as calcium supplement where the element is deficient.

Detoxication of molasses by electrodialysis and transport-depletion. R. Audinos and C. Sanchez. *Ind. Alim. Agric.*, 1979, **96**, 819–825 *(French)*. – Treatment of molasses for removal of toxic substances that inhibit the growth of e.g. *Penicillium cyclopium*, is necessary where the molasses is to be used as animal fodder or as substrate in fermentation processes. Experiments are reported in which electrodialysis was applied in two forms in series: with alternate anionic and cationic membranes, and with alternate cationic and neutral cellophane membranes. The second stage, involving transport-depletion, is necessary because of the inhibiting effect of the anionic fraction, from the first stage, on *P.cyclopium* growth; the anions extracted from the diluate remain in the concentrate, while the cations are able to migrate from one end of the dialyser to the other.

The fermenting activity of yeasts in alcohol manufacture from molasses. P. P. Reger, B. A. Ustinnikov and V. L. Yarovenko. *Izv. Vuzov, Pishch. Tekh.*, 1979, (5), 71–73 *(Russian)*. – While recycling of yeast increased the degree of fermentation of molasses in the initial stages (up to 4 hours) by comparison with the control, after 4 hours the fermenting activity fell to below that of the control. However, maintenance of the same high level of fermentation was brought about by feeding additional wort in an amount (50–60%) proportional to the quantity of recycled yeast.

Alkaline pulping of mixed reed and bagasse. T. M. Saleh and A. E. El-Ashmawy. *J. Appl. Chem. Biotech.*, 1978, **28**, (11), 721–726; through *S.I.A.*, 1979, **41**, Abs. 79–1538. – Chopped reed stalks and depithed bagasse were pulped in alkaline media separately and in a 1:1 mixture. Mild cooking conditions (14% alkali, 120°C) gave pulps with better properties than did cooking at 170°C. Replacement of part of the NaOH by Na_2S at 21% sulphidity had almost no effect under these conditions. Pulps prepared from a reed-bagasse mixture had relatively high breaking lengths, approaching those of bagasse pulps, and fair burst factors, intermediate between those of bagasse and reed pulps, while also having high tear factors, unlike pure bagasse pulps, which have inferior tear strengths.

Production of high-quality edible protein from *Candida* yeast grown in continuous culture. G. R. Lawford, A. Kligerman, T. Williams and H. G. Lawford. *Biotech. Bioeng.*, 1979, **21**, (7), 1163–1174; through *S.I.A.*, 1979, **41**, Abs. 79–1558. – Continuous culture of *Candida utilis* Y-900 was carried out under aerobic carbon-limited growth conditions; the medium was based on refinery cane molasses, diluted to reducing sugars concentrations of 1, 1.1 or 2.2% w/v. Effects of dilution rate, insufficient aeration and a trace metal supplement on biomass yield and productivity were studied. The biomass contained approx. 50% protein; tabulated data on its amino-acid composition indicate that it could be used as a protein supplement in cereal-based foods.

L-Lysine from sugar cane molasses. G. Bernal. *ATAC*, 1979, **38**, (1), 56–64 *(Spanish)*. – L-Lysine is a valuable ingredient in animal fodder and could become important in human nutrition. Originally obtained by hydrolysis of casein and gelatine, it was synthesized chemically, but in the late 1950's Pfizer patented a fermentation process, and another was discovered by Kinoshita. Aspects of the possible production of L-lysine in Cuba from cane molasses are discussed.

Introduction of alcohol as motor fuel. A. C. Chatterjee. *Maharashtra Sugar*, 1979, **4**, (12), 31, 33–36. – The question of ethanol manufacture from cane and its use as motor fuel is discussed and references made to studies being conducted in India, including trials on alcohol-powered vehicles.

A note on the digestibility by growing pigs of certain nutrients and energy in maize- or molasses-based diets. J. Ly and P. Lezcano. *Trop. Agric.*, 1980, **57**, (1), 91–94. – The apparent digestibilities of dry matter, organic matter, N, ash and N-free extractives did not differ between diets containing 83.5% maize (as dry matter), 74.4% high-test molasses and 52% raw sugar + 22.5% final molasses. Fat digestibility was negative in the molasses-based diets. The estimated digestible energy contents were 16.4, 14.85 and 14.82 MJ per kg dry matter for the three diets, respectively, in the order given above.

Features of beet pulp storage after intense pressing. A. Ya. Gerbut, V. A. Bondarenko, L. S. Zaets, T. A. Vdovina, L. P. Starushenko and N. V. Raskina. *Sakhar. Prom.*, 1980, (1), 30–33 *(Russian)*. – Investigations of storage of beet pulp pressed to 18–20% dry solids showed that such pulp could not be stored in the open without special pretreatment with preservatives because of the rapid formation of mould and loss of solids as a result of aerobic processes.

The sugar beet as energy plant? E. Reinefeld, F. Wagner and C. Winner. *Zuckerind.*, 1980, **105**, 25–36 *(German)*. – In an examination of the possibility of producing fuel alcohol from beet, it is pointed out that limitations are imposed by the area requirement and availability, by-product disposal and an energy consumption that is greater than the quantity produced. Use of the combined system of vinasse evaporation and distillation would help restrict energy consumption and would allow some steam to be used to generate electricity for sale to the public grid. However, the economics argue against use of beet as raw material in contrast to sugar cane.

Evaluation of different types of antifoams for the production of monocellular proteins. M. Klibansky and M. A. Peña. *Cuba Azúcar*, 1979, (Oct./Dec.), 37–43 *(Spanish)*. – A number of antifoam agents were tested for industrial use in yeast production. The sugar concentration in the medium and the dilution of the agent were factors having a marked influence on their effectiveness, but there were no significant differences between them, all being effective, so that a choice will depend on the economics of use, i.e. dosage required and cost.

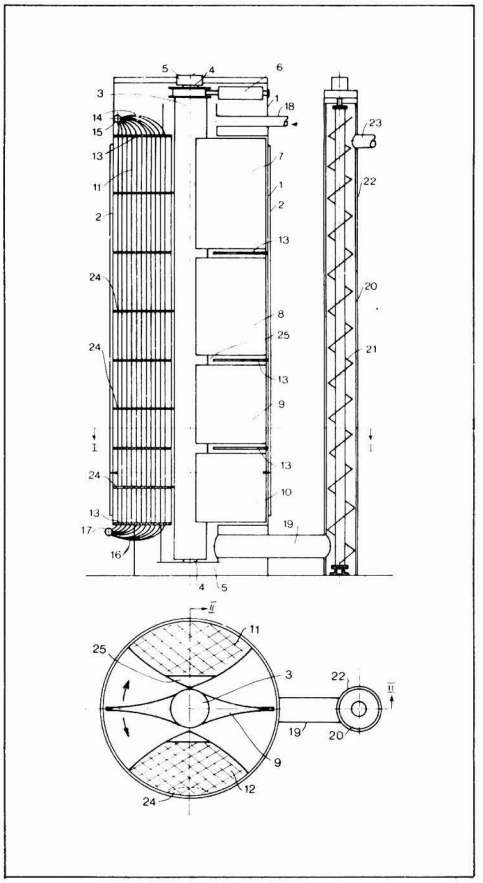
PATENTS

UNITED KINGDOM

Continuous crystallizer. Unice Machine Co., of San Francisco, CA, USA. **1,474,836.** October 24, 1975; May 25, 1977. – See US Patent 4,074,751[1].

Beet harvester. Wilhelm Stoll Maschinenfabrik GmbH, of Lengede, Germany. **1,541,116.** November 25, 1976; February 21, 1979.

Crystallizer. A/S De Danske Sukkerfabrikker, of Copenhagen, Denmark. **1,542,753.** September 28, 1977; March 21, 1979.



The vertical circular cylindrical container 1 is surrounded by an external cooling jacket 2 and contains a shaft 3 mounted with journals 4 in bearings 5. The shaft 3 is caused to move in an oscillating manner by two hydraulic cylinders 6, only one of which is shown. Four axially and radially extending vanes 7, 8, 9 and 10 are welded to diametrically opposite sides of the shaft, the outer edges of the vanes being close to the inside of container 1. The container also houses two bundles of spaced cooling pipes 11, 12 which pass through division plates 13 and are provided with cooling water from manifold 15 through tubes 14 and discharge to manifold 17 through tubes 16. At the base of the container is a pipe 19 which connects to another vertical pipe 20 surrounding a screw conveyor 21 and provided with a heating jacket 22.

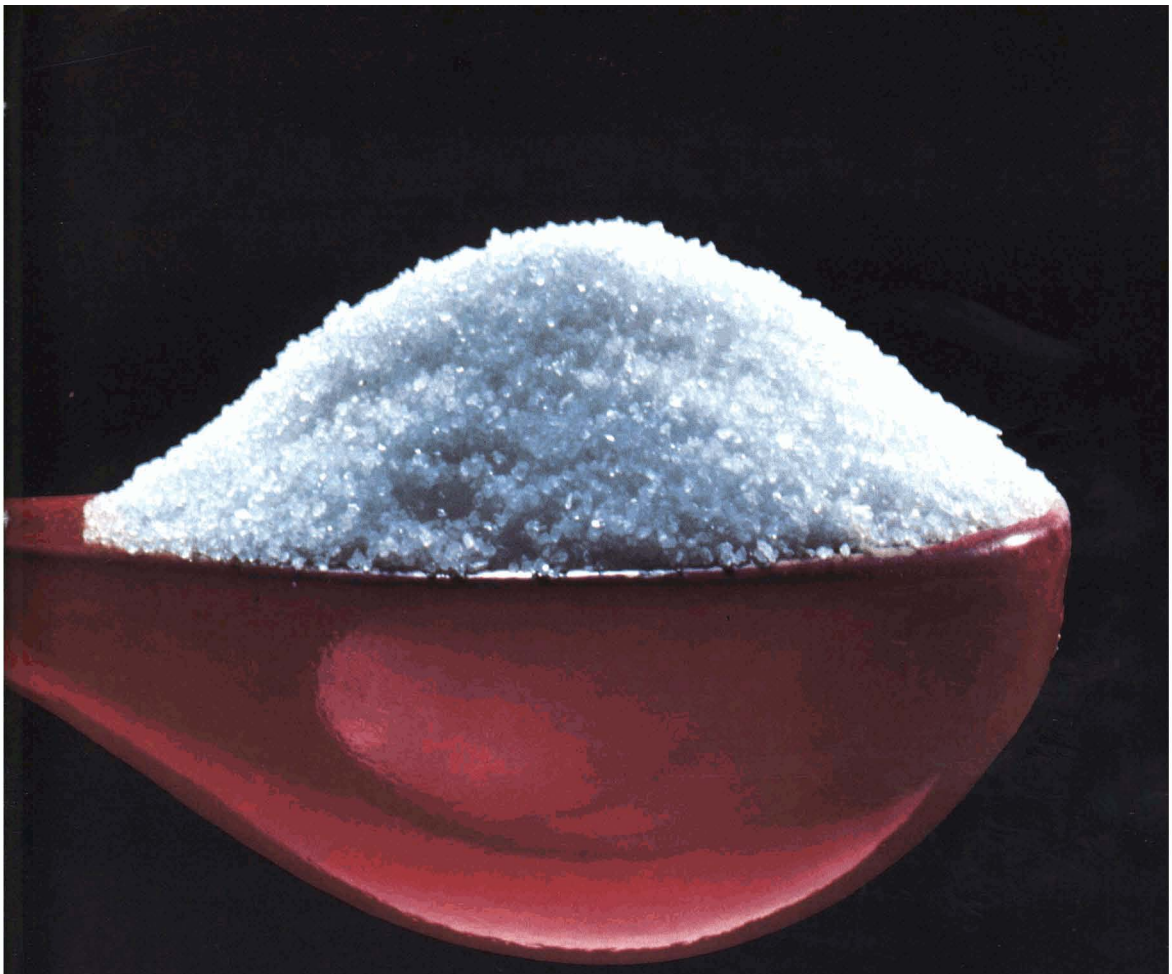
Massecuite is admitted through pipe 18 at the top of container 1 and is directed by the oscillatory movement of the vanes through the cooling tube bundles in a horizontal movement. It descends vertically, passing through openings 24, 25 in alternate division plates 13 to ensure that a zig-zag path is followed for more efficient cooling. At the bottom of the container the massecuite enters pipe 19 and is raised by screw conveyor 21 to the discharge pipe 23, the mother liquor being reheated for centrifugalling by the jacket 22.

Device for indicating the free water content in sugar. Institut Manipulacnich Dopravnich Obalovych a Skladovacevich Systemu, of Praha, Czechoslovakia. **1,534,134.** September 15, 1977; March 28, 1979. The detector consists of a system of two dissimilar electrodes, e.g. of Al and Cu, joined mechanically by a spacer insert and coupled to an amplifier, the output of which is connected to a meter and to an input of a trigger circuit arranged to compare the output with a predetermined threshold value and thereby operate an alarm if the water content of a sugar sample between the electrodes is greater than permitted.

Chloroderivatives of sucrose. Research Corporation, of New York, NY, USA. **1,543,168.** January 8, 1976; March 28, 1979. – Sucrose is reacted with mesitylene sulphonyl chloride and the substituted sucrose separated and reacted with a source of chloride ions (LiCl) after protecting the remaining free OH groups on the sucrose by esterification (with acetic anhydride), thereby yielding α-D-glucopyranosyl-1,6-dichloro-1,6dideoxy-β-D-fructofuranoside. Alternatively this material may be made by chlorinating the 4,6-benzylidene derivative of sucrose. 4,6-Dichloro-4,6-dideoxy-α-D-galactopyranosyl-1,6-dichloro-1,6-dideoxy-β-D-fructofuranoside is prepared by treating 6-chloro-6-deoxy-α-D-glucopyranosyl-1,6-dichloro-1,6-dideoxy-β-D-fructofuranoside with sulphuryl chloride at a temperature -40° to -10° (in an inert solvent in the presence of a base); alternatively, 4,6-dichloro-4,6-dideoxy-α-galactopyranosyl-6-chloro-6-deoxy-β-D-fructofuranoside formed by treatment of sucrose with sulphuryl chloride at a temperature of -40° to -10°C in an inert solvent in the presence of a base) is reacted with an equimolar amount of mesitylene sulphonyl chloride and the mesityl sulphonyl substituent replaced by reaction with a source of chloride ions (LiCl) after protecting free OH groups by esterification (with acetic anhydride).

[1] *I.S.J.*, 1981, **83**, 93.

Copies of specifications of United Kingdom patents can be obtained on application to The Patent Office Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington, Kent, England (price £1.25 each). United States patent specification are obtainable from: The Commissioner of Patents, Washington, D.C., USA 20231 (price 50 cents each).



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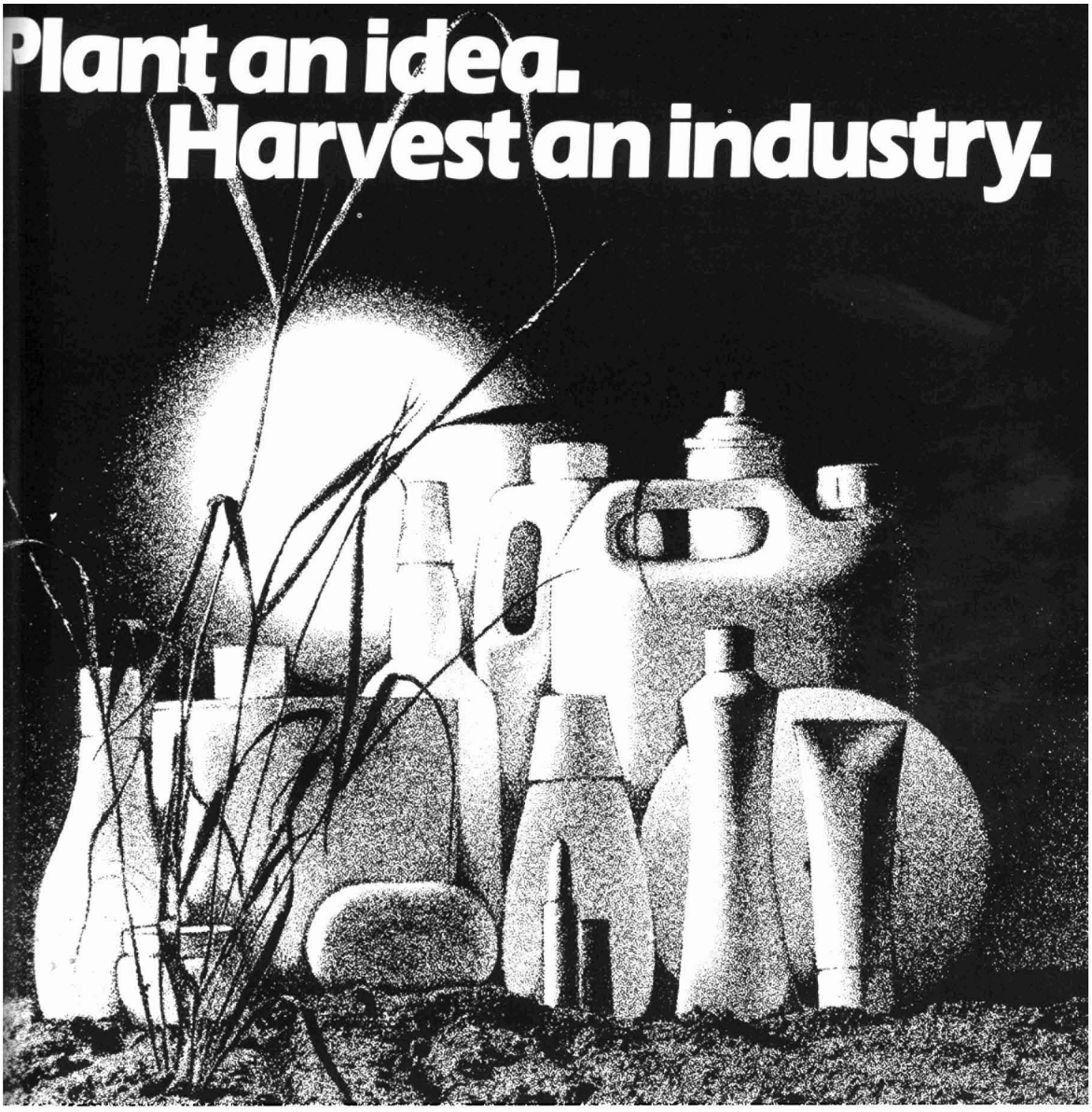

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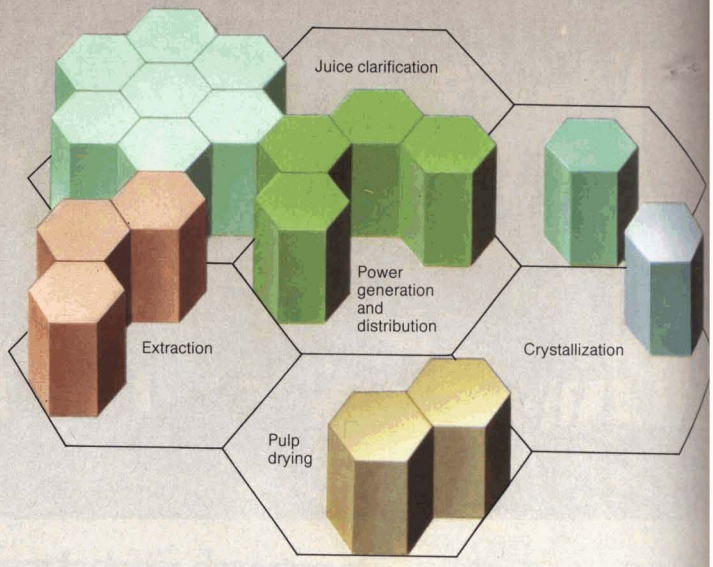

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Recovery of amino acids from raw juice. Pfeifer & Langen KG, of Köln, Germany. **1,543,765.** April 9 1976; April 4, 1979. – See US Patent 4,111,714[1].

Feed system for a continuous centrifugal. Stork-*Werkspoor Sugar B.V., of Hengelo, Holland.* **1,544,497.** August 16, 1976; April 19, 1979. – See US Patent 4,066,547[2].

Beet cleaner for field use. Fives-Cail Babcock, of Paris, France. **1,545,410.** April 27, 1977; May 2, 1979.

Beet harvester topper unit. J. D. Dyson and C. R. Dyson. **1,545,244.** July 8, 1976; May 2, 1979.

Sugar cane treatment. Philagro, of Lyon, France. **1,545,565.** November 17, 1976; May 10, 1979. – The sugar content of cane is increased by application (4–15 weeks before harvest) of an effective amount [1–10 (1–4) kg.ha^{-1}] of a 2-substituted 4-chlorophenoxyacetic acid where the substituent is a formyl or hydroxymethyl radical (formyl) or an ester, amide, or (Na, K, NH_4 or amine) salt of this acid. The acid or derivative is applied in a liquid (water) or solid carrier (containing a surface-active agent and urea).

Production of a dextrose isomerase product by fermentation. Novo Industri A/S, of Bagsvaerd, Denmark. **1,545,766.** July 22, 1975; May 16, 1979. – A facultative, dextrose isomerase-producing micro-organism [(a mutant of) *Bacillus coagulans*] is fermented with a growth-limiting supply of oxygen, while a source of carbon and energy (dextrose, hydrolysed starch or xylose), which represses dextrose isomerase synthesis and is easily converted anaerobically to non-repressing degradation products, is added in a slight excess, but all other nutrients are added in sufficient amounts. Thereafter the dextrose isomerase is recovered.

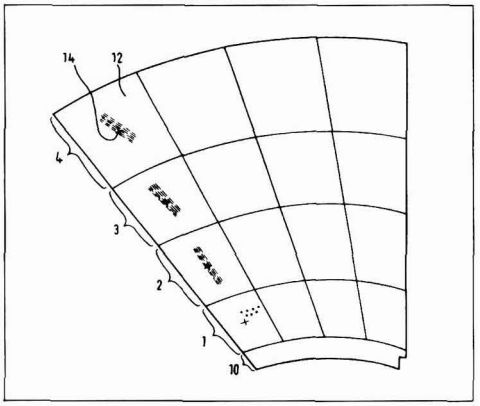
Selective herbicides. E. I. Du Pont de Nemours & Co., of Wilmington, DE, USA. **1,546,228.** August 26, 1976; May 23, 1979. – Undesired vegetation in sugar cane may be prevented or controlled, without injury to the crop, by application of a mixture of 1 part of 1-methyl-3-cyclohexyl-6-dimethylamino-*s*-triazine-2,4-(1H,3H)-dione and 1–8 (4) parts of 3-(3,4-dichlorophenyl)-1,1-dimethyl urea, in the presence of a surface-active agent and/or a solid or liquid diluent.

Process for isomerizing dextrose. Novo Industri A/S, of Bagsvaerd, Denmark. **1,547,223.** March 10, 1976; June 6, 1979. – A [30–55% (40–45%)] dextrose syrup, which contains no added Co^{++} ions and which contains no more than 0.001M Ca^{++} ions (0.000025M Ca^{++}) and no more than 0.01M Mg^{++} (0.0005M Mg^{++}), the molar ratio of Mg:Ca being 5–500 (10), where there is >0.001M Mg^{++} and higher than 5 for ⩽0.001M Mg^{++}, is passed (continuously) through a bed of glutaraldehyde-immobilized dextrose isomerase particles (of >100 μm) derived from *Bacillus coagulans* at a suitable inlet pH [7.8–8.6 (8.0–8.4)], the temperature [60–85°C (60–70°C)] and contact time [<3.5 hr (<2 hr)] being such that the product contains at least 40% w/w of levulose. The process is operated to avoid any significant bitter taste or colour in the product.

Beet diffusion tower. Braunschweigische Maschinenbauanstalt, of Braunschweig, Germany. **1,548,489.** July 4, 1977; July 18, 1979. – See US Patent 4,115,145[3].

Screen for a centrifugal with a frustro-conical basket. Fives-Cail Babcock, of Paris, France. **1,548,523.** September 22, 1977; July 18, 1979.

This screen is comprised of a series of slightly overlapping portions which are identical and which have a non-perforated band at the lower, small-radius edge for fixing it in the basket. Each portion is divided into four bands 1–4, bounded by concentric circles and corresponding to areas having different perforations, while the bands are divided into sectors 12.



The perforations of band 1 are in the form of a small proportion of round holes (providing 5% void area on the total band area) while in the bands 2, 3 and 4 they are in the form of slots, the angle of which changes from band to band, and the perforated or void area increases as a proportion of the total band area. In this way the rate of separation of mother liquor/wash liquid from the sugar in its passage over the screen is more uniform and the passage of the sugar crystals smoother with elimination of imbalances.

Immobilizing enzymes and microbial cells. Kansai Paint Co. Ltd., of Amagashi-shi, and S. Fukui, of Nagaokakyo-shi, Japan. (A) **1,550,151.** June 30, 1976; August 8, 1979. (B) **1,550,465.** June 30, 1976; August 15, 1979. – (A) A suspension of the enzyme(s) (dextrose *isomerase, invertase, α-galactosidase, etc.) or* microbial cells (*Lactobacillus bulgaricus, Aerobacter aerogenes, Bacillus subtilis, Azotobacter vinelandii* or *Proteus vulgaris*) is substantially uniformly mixed with photo-curable resin (a salt of an unsaturated polyester or an unsaturated epoxide having an acid value of 40–200, *an anionic unsaturated acrylic resin, or a cationic* unsaturated acrylic resin) having an average molecular weight in the range 300–30,000 (500–20,000), having two or more photopolymerizable ethylenically unsaturated groups per molecule and having ionic hydrophilic groups, thereafter irradiating the mixture with actinic *radiation (of 250–600 nm wavelength) in the presence* of a reaction additive (an α-carbonyl alcohol, acyloin ether, α-substituted acyloin, polycyclic aromatic compound, azoamide metallic salt, mercaptan, disulphide, halogenide or dyestuff).

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[1] *I.S.J.*, 1981, **83**, 126.
[2] *ibid.*, *30.*
[3] *ibid.*, 126.

(B) The method is as in (A) but the resin used has two or more photopolymerizable unsaturated groups but also non-ionic hydrophilic groups (a polyester made from polyethylene glycol and acrylic or methacrylic acid, a urethanated adduct of the product made from polyisocyanate and polyethylene glycol with 2-hydroxyethyl acrylate or methacrylate, unsaturated cellulose and unsaturated polyamide).

Beet topper. F. Kleine, of Salzkotten, Germany. **1,550,683.** August 16, 1976; August 15, 1979.

Enzymatically isomerizing dextrose to levulose. Novo Industri A/S, of Bagsvaerd, Denmark. **1,551,444.** August 10, 1976; August 30, 1979. – Dextrose is isomerized using an immobilized enzyme as claimed in UK Patent 1,516,704[1], in the presence of not more than 3 ppm of Ca^{++} and (0.0008–0.08M of) at least one soluble food-grade salt of phosphoric acid (Na_3PO_4, Na_2HPO_4, K_2HPO_4 or a hydrate).

Producing immobilized enzymes. Denki Kagaku Kogyo K.K., of Tokyo, Japan. **1,551,518.** March 30, 1977; August 30, 1979. – An enzyme system (e.g. dextrose isomerase) is reacted with a substantially water-insoluble anion exhange resin having a quaternary pyridine ring in the polymer unit, whereby the enzyme and/or enzyme-containing microbial cells are coagulated and immobilized. The product is then (treated with glutaraldehyde or another cross-linking agent and) moulded in an extrusion machine and the moulded pellets dried (at 40–80°C for ¼–20 hr).

Semi-continuous vacuum pan crystallization system. CSR Ltd., of Sydney, NSW, Australia. **1,551,797.** August 24, 1976; August 30, 1979. – See US Patent 4,120,745[2].

Dextrose-isomerizing enzyme. R. J. Reynolds Tobacco Co., of Winston-Salem, NC, USA. **1,551,897.** October 10, 1977; September 5, 1979. – The enzyme is produced by culturing a strain of *Flavobacterium arborescens* (ATCC 4358, NRRL-B 11022 or NRRL-B 11023) in a nutrient medium, and is recovered. It exhibits useful activity at 45°–90°C and pH 6–10.

Dextrose isomerase preservation. Mitsubishi Chemical Industries Ltd., of Tokyo, Japan. (A) **1,552,032.** March 17, 1977; September 5, 1979. (B) **1,553,960.** April 26, 1978; October 17, 1979. – (A) The enzyme solution (or immobilized enzyme on an anion exchange resin) is preserved by adjusting its pH to 9–12 (10–11) [with KOH, NaOH, $Mg(OH)_2$ and/or NH_4OH] with the prior or later addition of at least one of the following compounds: 0.01–2% of *p*-hydroxybenzoic (*n*-butyl) esters, alcohols (ethanol), a sodium, potassium or ammonium salt of a mineral acid (NaCl), 1–10% of the Na or K salt of a polyphosphoric acid (Na tripolyphosphate), more than 0.001% of antibiotics (tetracycline), 0.05–1% of cationic surfactants or 0.1–5% of amphoteric surfactants [dodecyl di(aminoethyl) glycerine], 0.01–2M Na_2CO_3 and/or K_2CO_3 and/or an ammonium compound.

(B) An inactive solid support carries a water-insoluble layer ⩾30 μm (⩾15 μm) thick of a 3-dimensional matrix comprising a polymer or copolymer of an organic compound (of M.W. ⩾450) having 2 or more (2–4) photopolymerizable functional (acryloxy, acryloylamino, methacryloxy or methylacryloylamino) groups. Within this matrix is entrapped a water-swellable or water-soluble hydrophilic organic polymer [polyvinyl pyrrolidone (of MW < 100,000) or polyviny alcohol (having an average degree of polymerization ⩽1000 and degree of saponification ⩽75] while the enzyme is dispersed within the matrix.

Animal fodder supplement. Pacific Kenyon Corporation, of Long Beach, CA, USA. **1,555,908.** October 28, 1976; November 7, 1979. – An animal feed block comprises [45–93% (55–80%)] sugar (provided in the form of molasses) in a solid matrix formed by the reaction resulting from addition to the sugar of a phosphate and/or phosphoric acid (0.5–5% w/w as P_2O_5) and (0.5–5% w/w as oxide of) a hydroxide, oxide and/or salt of a metal (Mg, Al or Ca). The block may also contain (2–30% of) an edible fat or oil, (0.05–1% of) an emulsifying agent, (5–4% protein equivalent of) a nitrogen source (urea, biuret or ammonium phosphate) and (0.5–6% of) starch.

Improving the colour of dried beet pulp. Bayer AG, of Leverkusen, Germany. **1,555,647.** March 2, 1978; November 14, 1979. – Normal beet pulp has a grey colour; this is improved to an attractive golden yellow by treatment with (0.025–0.2%) hydrogen peroxide in an aqueous alkaline suspension (at 50–80°C) (and pH 8–11).

Immobilization of enzymes. Redpath Sugars Ltd., of Montreal, Quebec, Canada. **1,556,398.** May 17, 1978; November 21, 1979. – An enzyme having available mercaptan groups (dextrose isomerase) is reacted with an insoluble (inorganic) support carrier [porous glass beads (of pore size 20–100 nm and area 5–100 $m^2.g^{-1}$)] bearing mercaptan groups such that a disulphide group is produced in a covalent bridge linking the two, the mercaptain group having the formula $HS\text{-}R_2\text{-}O\text{-}G$ where G is the carrier and R_2 is a straight-chain or branched saturated or unsaturated divalent organic radical (of C_1–C_8). The mercaptan groups are attached to the support by treatment of the latter with a mercaptoalcohol $HO\text{-}R_2\text{-}SH$. Mercaptan groups are introduced into the enzyme by treatment with a mixed anhydride $R_3O\text{-}CO\text{-}O\text{-}CO\text{-}R\text{-}SH$ where R_3 is a C_1–C_6 alkyl group and R an alkylene radical $-(CH_2)_n-$ where n = 1–6; this substitutes a H atom attached to an amino group in the enzyme molecule. The enzyme, immobilized on the glass beads, may be used in the form of a column through which a dextrose solution is passed, to convert it to levulose.

Levulose production. A. E. Staley Mfg. Co., of Decatur, IL, USA. **1,563,069.** February 22, 1977; March 19, 1980. – Dextrose is isomerized to levulose employing a fixed bed of an isomerase obtained from an organism of the *Bacillus* genus (*B. coagulans*) which exhibits an enhanced rate of isomerization when the reaction is conducted (a) in the presence of Co^{++} ions and (b) at a temperature >60°C. A refined dextrose syrup (of 45–55% solids content), essentially free of Co^{++} ions (less than 0.00005M) and containing at least 90% monosaccharide [and at least 0.002M (0.003–0.01M) Mg^{++} ions] is passed through the enzyme bed at 55–61°C (58–61°C) and pH 7.0–7.5; the isomerized syrup is recovered while replenishing the bed with fresh syrup and the supply continued until the isomerase activity of the bed is less than 20% (<15%) of its initial activity level [>3000 (>3500) hours].

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[1] *I.S.J.*, 1981, **83**, 62.

[2] *ibid.*, 156.

Sugar Processing Research Inc.

The Board of Directors of the Cane Sugar Refining Research Project Inc. recently voted that the name of the organization be changed to Sugar Processing Research Inc. The organization conducts fundamental and applied research on sugar processing, and is particularly known for its work on the effects of non-sucrose constituents, e.g. polysaccharides, on processing. Sugar Processing Research Inc. (S.P.R.I.), which is funded by some thirty sugar refining and processing companies around the world, will continue operation at the Southern Regional Research Centre of the US Department of Agriculture, New Orleans, LA, where it is housed by U.S.D.A. and works in cooperation with the Department's group on cane sugar refining research. Dr. Margaret A. Clarke, formerly Administrator of C.S.R.R.P.I. Inc., is Director of Sugar Processing Research Inc. Dr. Frank G. Carpenter is Designated Representative of the U.S.D.A. to S.P.R.I. Dr. Carpenter, formerly Director of C.S.R.R.P.I. Inc., is well known for his achievements in sugar refining research, particularly in bone char technology, and was the 1975 recipient of the Sugar Industry Technologists' Crystal Award.

Officers of S.P.R.I. are President Dr. Michael C. Bennett, of Tate and Lyle Ltd., Vice-President Stanley E. George, of British Columbia Sugars, Secretary H. Richard Priester, of Savannah Sugars, and Treasurer Joseph A. Metzler, of Godchaux-Henderson Sugars.

South African sugar crop, 1980/81[1]. — As a result of the drought, cane crushed (14,062,204 tonnes) and sugar production (1,611,146 tonnes, tel quel) during the 1980/81 season were far lower than during the preceding season (18,411,616 tonnes of cane crushed to produce 2,079,379 tonnes of sugar). Pol % cane (13.34) was higher than in 1979/80 and, in spite of a higher fibre content (15.95%) and lower mixed juice purity (84.80), recoverable sugar expressed as ERC % cane was 11.50 against 11.22 for 1979/80. Factory performance was lower than would have been expected from the better cane quality. Extraction was marginally lower at 96.89% *vs.* 96.92% but a low boiling house recovery of 88.17% brought overall recovery down to 85.42%. Average crushing rate fell some 10 t.c.h. to 224.86 t.c.h. Early estimates of the 1981/82 South African sugar crop are in the region of 1,800,000 tonnes, tel quel, a considerable improvement on the 1980/81 outturn but well below the level of around 2 million tonnes produced annually in recent years. With domestic consumption estimated at around 1,200,000 tonnes, raw value, a 1981/82 production of 1.8 million tonnes, tel quel, equivalent to 1,930,000 tonnes, raw value, would leave something more than 700,000 tonnes, raw value, available for export, provided that stocks remain unchanged.

Tate & Lyle in talks on Peru sugar project[2]. — Tate & Lyle is discussing with Peru plans for a sugar producing venture in the Selva region of the Amazon jungle. The plans centre on a turnkey contract under which Tate & Lyle would supply technology and machinery.

Argentina sugar production, 1980[3]. — Statistics published by *La Industria Azucarera* show that there was a substantial increase in the tonnage of cane crushed in 1980 and, though recovery was low, sugar production reached the record of 1,627,000 tonnes, tel quel, of which Tucumán accounted for 961,000 tonnes or 59%. Exports amounted to 489,000 tonnes, the highest level since 1977, the year before the International Sugar Agreement came into operation. The 1980 harvested cane area amounted to 314,100 hectares, against 305,600 ha in 1979 and yielded 16,437,200 tonnes of cane against 11,900,500 tonnes, The 1979 sugar outturn amounted to 1,310,484 tonnes, tel quel, or 11.012% on cane against 9.902% in 1980.

Booker McConnell Ltd. 1980 report. — Of the Engineering Division, Fletcher and Stewart Ltd. suffered from the failure to obtain a major factory contract but unit equipment orders were maintained at an adequate level and included a milling plant for Réunion (the first substantial order in that sugar industry for non-French equipment). An encouraging development was a 20% increase in sales of mill rollers. There has been an increase in enquiries stimulated by higher sugar prices but most major projects are in the public sector in the Third World and tend to be the subject of lengthy negotiations. Booker Agriculture International achieved a satisfactory result in 1980, showing a small improvement over the previous year. Technical services work included important assignments in Senegal, St. Kitts and Nigeria, while major consultancy projects are under way in Sri Lanka, Malaysia, Nigeria, Uganda and Zambia.

Sugar technology training for foreign students in Mauritius

Since 1973 there have been 30 students from outside the country who have successfully followed a course in the School for Industrial Technology of the University of Mauritius, Réduit, leading to a B.Sc. (Hons.) (Sugar Technology) degree. Of these, two have continued, to achieve higher degrees in the United Kingdom. The External Examiners for this undergraduate course have come mainly from the University of Aston, in Birmingham, England, but they have also included Mr. E. C. Vignes of the Sugar Industry Research Institute in Mauritius and Mr. François Langreney, Technical Director, Sucreries de Bourbon, Réunion. Abstracts of the theses presented have been published in the *Revue Agricole et Sucrière de Maurice*.

Training has continued for personnel from the public and private sectors, including some in-service employees, leading to various Certificates in Sugar Analysis, Cane Production and Sugar Manufacture, etc. Eighteen Brazilian engineers, sponsored by Copersucar, were successfully trained in 1977 for a post-graduate Diploma in Sugar Technology, while another foreign student has successfully presented a thesis on a technical and economic study of the use of ion exchange resins in the demineralization and decolorization of sugar products which has led to the award of a M.Phil. degree by the University.

Plans are under way to offer an M.Sc. Course in Sugar Manufacture for foreign students, depending on the demand for it as gauged by the response from a survey. Companies and individuals interested in taking advantage of such a course are urged to write to the Supervisor, Dr. F. G. Carver, at the University of Mauritius.

French sugar production, 1980/81[4]. — Final sugar production in France from the 1980/81 season was 3,910,000 tonnes, white value, down from the record 3,970,000 tonnes of 1979/80. Average beet yield was 48.4 tonnes per hectare, up from 47.8 tonnes previously, but sugar content was lower, averaging 17.1% against 17.6% in 1979/80. The Ministry of Agriculture estimates total French supplies for 1980/81, including imports from ACP countries associated with the EEC and from overseas territories, at 4,740,000 tonnes of which domestic consumption will account for 2,000,000 tonnes and exports to other EEC countries for 300,000 tonnes. This would leave about 2,200,000 tonnes available for export to non-EEC countries, of which 1,500,000 tonnes would be quota sugar.

Indonesia sugar expansion plans[5]. — Indonesia plans to increase the area planted to cane to 259,200 ha by the end of 1984 according to the Finance Minister who added that the increased plantings should bring sugar production to 1.9 million tonnes by the end of 1984 against estimates of between 1.2 and 1.25 million tonnes for the 1980 crop. Plans are in hand to rehabilitate cane sugar factories on the island of Java to increase their milling capacity from the present 67,700 tonnes per day to 113,000 tonnes by the end of 1984. Three new factories are planned for the island of Sumatra and two in South Sulawesi in the same period.

Solids handling exhibition. — The 2nd Solids Handling Exhibition will be held during March 30-April 1, 1982 in Harrogate, England, and will cover all aspects of loose materials handling with more than 120 companies exhibiting equipment. This will include silos, intermediate bulk containers, sack filling and emptying machines, conveyors, dust control equipment, weighing equipment, level controls, valves, discharge aids, complete systems, etc. Information may be obtained from the organizers at Solidex 82, 91-97 High Road, Ickenham, Middlesex UB10 8LB, England.

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1 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 224-225.
2 *The Times*, April 2, 1981.
3 C. Czarnikow Ltd., *Sugar Review*, 1981, (1541), 65-66.
4 *Public Ledger*, February 13, 1981.
5 *Westway Newsletter*, 1981, (88), 13.

Japan sugar imports, 1980[1]

	1980	1979	1978
	tonnes, tel quel		
Australia	768,693	717,930	795,153
Brazil	0	0	21,189
Cuba	289,073	390,438	364,698
Fiji	25,059	10,497	0
Philippines	403,845	287,592	54,836
South Africa	469,775	446,642	497,057
Taiwan	154,109	126,845	163,408
Thailand	154,829	625,249	386,417
Other countries	180	255	294
	2,265,509	2,605,448	2,283,052

Bagasse paper study in Pakistan[2]. —The Punjab Industrial Development Board has signed an agreement with the West German consultant, Zell Plan, to prepare a feasibility study for the establishment of a newsprint factory in the Punjab to use bagasse as raw material. The study will be financed jointly by the Asian Development Bank and the National Development Finance Corporation.

El Salvador sugar production decline[3]. — In the 1979/80 crop year (November — October) El Salvador produced only 183,480 tonnes of sugar compared with 284,323 tonnes in 1978/79 and 293,550 tonnes in 1977/78. After increasing by more than 13% each year from 1970/71 to 1978/79, consumption in 1979/80 declined to 145,908 tonnes, a reduction of 2.32% from the level of the previous year, Exports were down by 74,795 tonnes in 1979/80 from 147,479 tonnes in 1978/79, while stocks declined from 76,962 tonnes at end-October 1979 to 47,975 tonnes a year later.

West Indies sugar production, 1980[4]. — Final figures for sugar production in the West Indies total 828,933 tonnes, raw value, including 135,286 tonnes for Barbados, 275,990 tonnes for Guyana, 268,467 tonnes for Jamaica, 35,609 tonnes for St. Kitts and 113,581 tonnes for Trinidad.

Crystalline levulose plant in the US[5]. —A processing facility to produce crystalline levulose, under construction at Savannah, Illinois, was scheduled to begin producing 10,000 short tons annually when completed in April 1981. This output is relatively low when compared with facilities to produce HFCS but, with a retail price of around US $1.00 a pound, the demand for crystalline levulose is currently limited. It is flavour-enhancing and provides equal or higher sweetness than sugar with fewer calories.

Fiji sugar crop, 1980[6]. — The 1980 sugar crop in Fiji extended into 1981, Labasa mill ceasing to crush on January 9. The total cane crushed amounted to 3,360,275 tonnes and was grown on 67,000 hectares, with an average yield of 50.1 tonnes.ha^{-1}, against an average yield of 65.3 tonnes.ha^{-1} in 1979. Sugar production in 1980 amounted to 396,157 tonnes, tel quel, as against 504,400 tonnes produced from 4,150,000 tonnes of cane in the previous year. A certain amount of crop damage was sustained on passage of a cyclone over the western area of Viti Levu in January but the chances of recovery are good in some areas although 30% of the Lautoka mill's crop was damaged beyond recovery. The revised crop forecast for 1981 is 3,585,000 tonnes of cane grown on 62,921 hectares.

Jamaica sugar problems[7]. — Jamaican sugar industry officials fear production targets for the 1981 crop may not be reached and have made proposals to the Agriculture Minister aimed at stimulating production. Factory breakdowns, low cane deliveries and strikes make it unlikely that the 260,000 tonnes production target for 1981 will be reached. Industry sources fear the island will not be able to meet its EEC quota of 118,300 tonnes, white value, under the Lomé convention since if it does, this could mean availability problems on the local market. It is proposed that money be allocated to buy transport to improve cane haulage to the factories, that work on roads be speeded up and factory efficiency raised.

Zimbabwe sugar exports, 1980[8]. — Exports of sugar from Zimbabwe in 1980 totalled 218,659 tonnes, raw value, of which Finland received 68,881 tonnes, Botswana 36,969 tonnes, the USSR 15,404 tonnes, the USA 12,758 tonnes and Algeria and Portugal each 12,020 tonnes. The total compares with 256,000 tonnes exported in 1979 and 142,100 tonnes in 1978.

USSR sugar imports, 1980[9]

	1980	1979	1978
	tonnes, raw value		
Argentina	12,501	0	12,199
Austria	36,067	0	0
Belgium	54,714	31,389	0
Brazil	465,653	68,969	83,270
Colombia	10,826	0	0
Cuba	2,647,497	3,706,767	3,797,337
Czechoslovakia	10,824	38,973	0
Denmark	0	38,432	0
Dominican Republic	33,449	0	45,923
Finland	19,085	0	0
France	482,562	134,392	25,879
Germany, East	10,826	0	0
Germany, West	263,152	25,224	13,753
Guatemala	15,240	0	12,003
Holland	31,072	0	0
Hungary	75,806	10,837	1,714
Ireland	0	5,787	0
Italy	12,366	0	0
Nicaragua	12,900	0	0
Peru	23,808	0	0
Philippines	332,787	0	0
Poland	3,248	1,516	1,385
Rumania	50,513	6,843	0
El Salvador	26,016	0	0
Swaziland	10,160	0	0
Thailand	139,654	11,176	0
UK	12,504	0	0
Yugoslavia	173,379	0	0
Zimbabwe	14,610	0	0
	4,981,219	4,080 305	3,993,463

Malawi sugar statistics[10]. — Sugar production in Malawi in 1980 amounted to 155,979 tonnes, raw value, against 113,659 tonnes in 1979 and 96,583 tonnes in 1978. Consumption rose to 43,013 tonnes from 40,930 tonnes in 1979 and 39,202 tonnes in 1978 but permitted exports to increase to 99,733 tonnes in 1980 from 72,923 tonnes in the previous year and 56,482 tonnes in the year before that. 1980 exports were 15,974 tonnes to the UK and 83,759 tonnes to the USA and in 1978 had bee 26,126 tonnes and 30,356 tonnes, respectively, to the same destinations, whereas in 1979 Malawi exported 19,015 tonnes to the UK, 49,432 tonnes to the USA and 4,476 tonnes to France.

Chain design and selection film. — Factors to be considered in selecting the right chain for particular conveying, elevating or power transmission needs are outlined in a new film produced by Ewart Chainbelt Co. Ltd. It combines lively commentary, animated diagrams and photography to focus attention on crucial design features with background information to interest users in a wide range of industries including that of sugar. The film emphasises the need for balanced design; the matching of chain type, materials and heat treatment techniques to individual handling needs so as to lengthen chain life by overcoming problems of shear and tensile stress, abrasion, corrosion and wear. The film is available in 16 mm or Fairchild cassette form and enquiries should be made to Ewart at Colombo Street, Derby, England.

Japan HFCS production and prices[11]. — According to industry sources, HFCS production (including HFCS with added sugar) totalled 480,583 tonnes in the period October 1979/September 1980, against 445,627 tonnes in 1978/79 and 381,830 tonnes in 1977/78. HFCS prices remained relatively stable throughout January 1981 at 113.5 yen (US $0.56) per kg at which price some processors could not cover their costs. Producers were not able to raise their prices, however, because of the falling price of sugar.

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1 C. Czarnikow Ltd., *Sugar Review*, 1981, (1534), 36.
2 *Westway Newsletter*, 1981, (88), 14.
3 *World Sugar J.*, 1981, **3**, (9), 32.
4 C. Czarnikow Ltd., *Sugar Review*, 1981, (1542), 70.
5 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 1960.
6 *Fiji Sugar*, 1981, **6**, (1), 6-7.
7 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 161-162.
8 *I.S.O. Stat. Bull.*, 1981, **40**, (3), 99.
9 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, S 140.
10 *I.S.O. Stat. Bull.*, 1981, **40**, (2), 61.
11 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 187.

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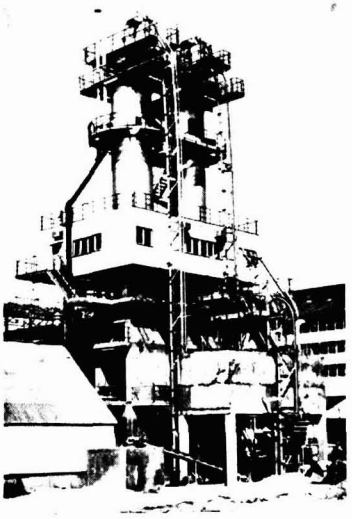

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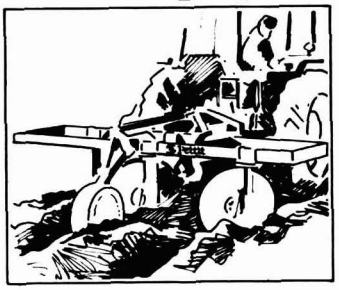

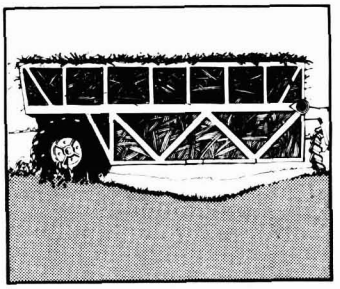

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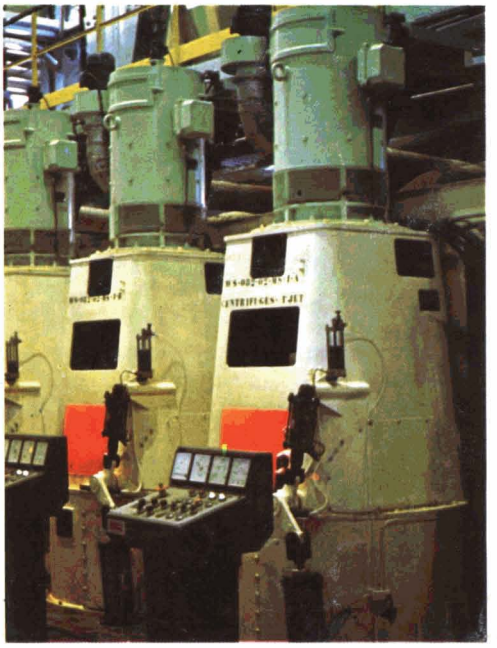

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