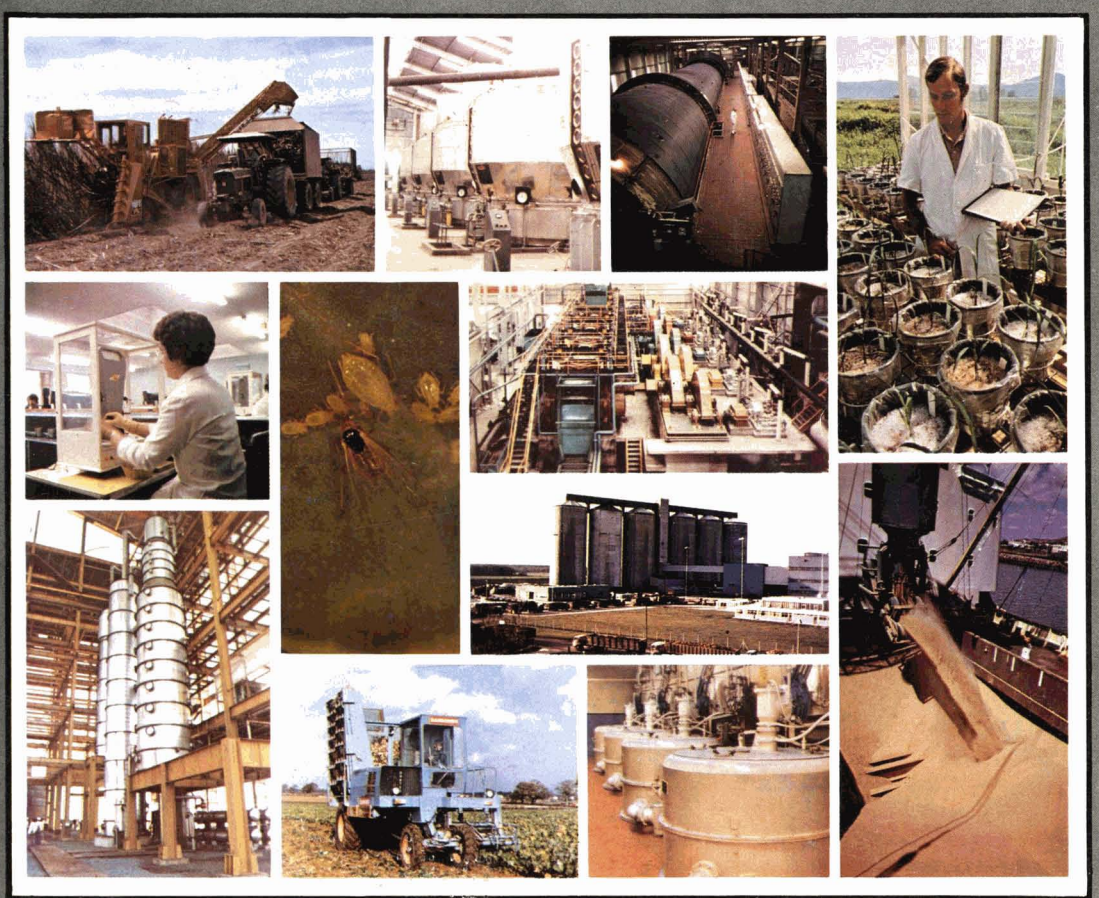
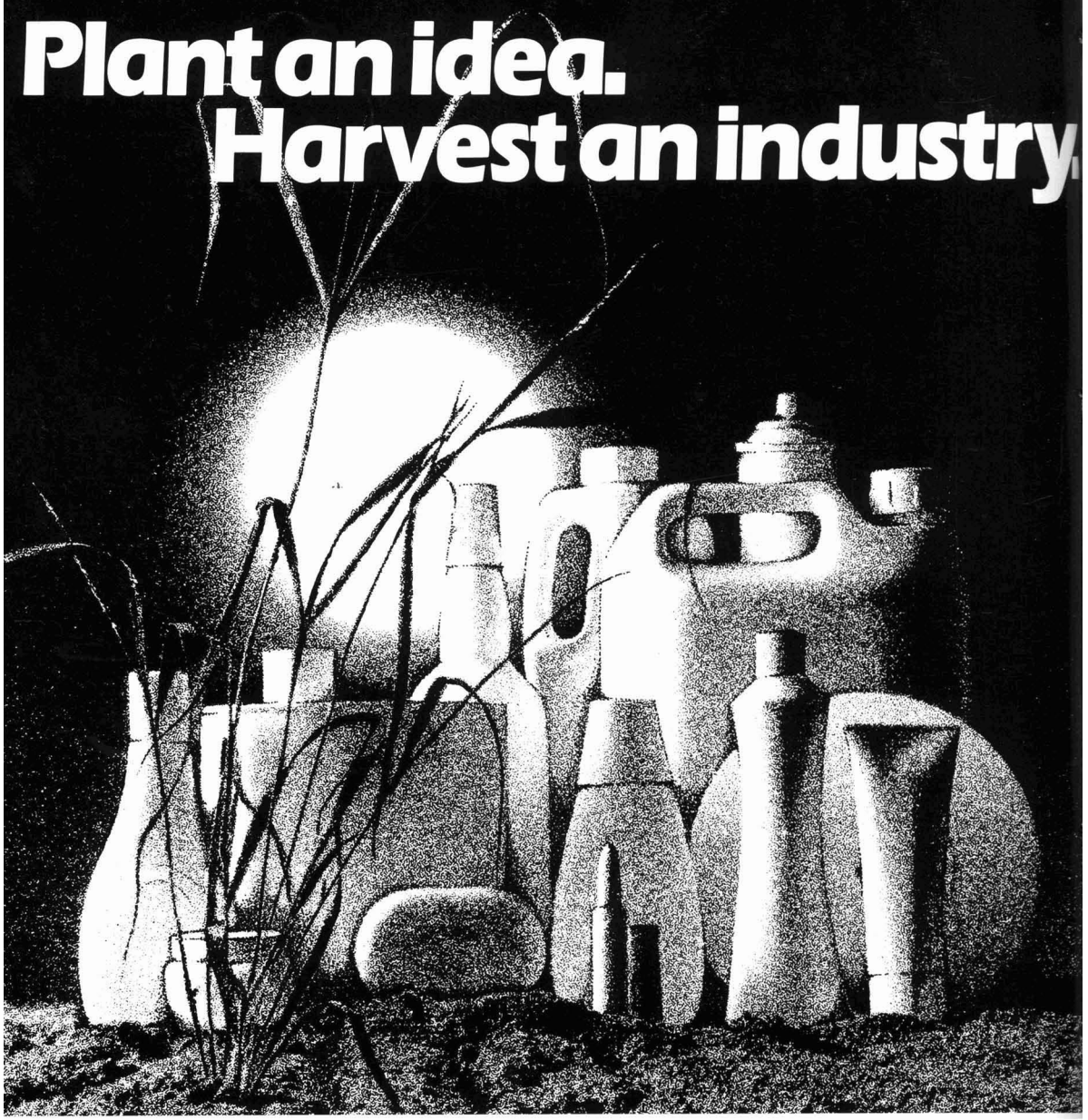
INTERNATIONAL SUGAR JOURNAL

VOLUME LXXXIV
ISSUE No. 1005



SEPTEMBER 1982

Plant an idea. Harvest an industry.



The usual effect of a crisis is to accelerate man's inventiveness. Today's major problems are high cost energy and low commodity prices. Tate and Lyle is the world's largest and most experienced independent sugar corporation and its research and development programmes are concentrated on helping to solve these problems.

Power alcohol derived from sugar is one example of maximising the conversion of the sun's energy into liquid fuel at the same time as providing an alternative use for sugar cane. New chemicals made from sugar could soon replace many more oil-based products such as detergents, plastics and cosmetics.

Tate and Lyle's scientists are working to make agricultural industry more efficient all over the world. Our aim is to add value to agricultural production and to make sure nothing is wasted – we even convert certain effluents into protein for animal foodstuffs.

But adding value can also mean better yields, and that means better agriculture. Tate and Lyle provides expertise, not only in sugar, but in all fields of agriculture and is involved in management and training schemes in many countries. If you need help with your agro-industrial development programme, come and talk to us.

Adding value to agriculture

TATE + LYLE

Tate and Lyle Agribusiness Ltd., Enterprise House, 45 Homesdale Road, Bromley, BR2 9TE, England. Tel: 01-464 6556.

Editor and Manager:
D. LEIGHTON, B.Sc., F.R.S.C.

Assistant Editor:
M. G. Cope, M.I.L., M.T.G.

UK ISSN 0020-8841

Annual Subscription:
£30.00 post free

Single Copies:
£3.00 post free

Airmail charges quoted on request to

The International Sugar Journal Ltd.,
23A Easton Street, High Wycombe,
Bucks., England HP11 1NX

INTERNATIONAL SUGAR JOURNAL

Volume 84
Issue No. 1005

CONTENTS September 1982

Printed by the Wrightsons Group of Companies, London; and published by the Proprietors, The International Sugar Journal Ltd., at 23a Easton Street, High Wycombe, Bucks. Entered at the New York Post Office as Second-Class Matter.
PRINTED IN GREAT BRITAIN.

Published by

The International Sugar Journal Ltd.

23A Easton Street, High Wycombe, Bucks., England HP11 1NX.

Telephone: 0494-29408 *Telex:* 21792 REF 869

Inquiries regarding advertising should be addressed to the above office or to the appropriate representative:

France: MaG-Watt International,
6 rue des Acacias, Vert-le-Grand, 91810 Essonne.
Tel.: (6) 456-00-15.

Holland: G. Arnold Teesing B.V.,
Prof. Tulpstraat 17, 1018 GZ Amsterdam.
Tel.: 020-263615. *Telex:* 13133.

India and South-East Asia:
J.P. Mukherji & Associates Pvt. Ltd.,
P.O. Box 915, Poona, India 411 005.
Tel.: 52696/7 *Cable:* Preproject, Poona.
Telex: 0145-367 JRMASSO.

Italy: International Media Services,
C.P. 87, Via 1° Maggio 16, 20090 Segrate (Milano), Italy.
Tel.: (02) 213 9725/30.

Japan: Shinano International,
Akasaka City Plaza No. 304, 8-1 Akasaka 1-chome, Minato-ku, Tokyo 107.
Tel.: (03) 584-6420.

U.S.A.—Florida and Latin America:
Mr. Mario A. Mascaró,
7321 S.W. 82nd Street, Miami, FL, U.S.A. 33143.
Tel.: (305) 667-1724.

NOTES AND COMMENTS

British Sugar plc take-over

In a deal agreed in early July, S. & W. Berisford bought from Rank Hovis McDougall Ltd. their 10.5% holding in British Sugar plc; with the 40% they had acquired last year it gave them just over 50% of the company's shares. They made a bid of £4.70 per share, which values the company at £282 million, claimed by the British Sugar Board to undervalue it in view of its assets and profitability. The Board also noted, in their advice to shareholders not to sell to Berisford, that as commodity brokers and sugar merchants the take-over bidders brought no relevant expertise to a sugar producing company.

The Board appealed to the European Commission, claiming that Berisford was in breach of an undertaking not to bid for British Sugar while the latter's earlier submission was under consideration by the Commission. This submission had, however, been rejected provisionally by the Commission in May although an appeal was pending. The competition commissioner said he would not block the bid but that a hearing would take place before the European Court on July 29.

On July 22, Berisford sold all its sugar merchanting interests in the UK to Napier Brown, an independent sugar merchant, so that it no longer traded in Tate & Lyle sugar and thereby met a condition of the Monopolies Commission for permission to bid for British Sugar. The latter then withdrew an application they had made to the European Court for an injunction to stop the bid, and the last line of defence appeared to fall on July 29 when the Secretary of State for Trade announced that he would not refer the bid by Berisford to the Monopolies Commission.

Berisford shareholders voted overwhelmingly on July 30 to buy the Rank Hovis McDougall shares in British Sugar, whereupon, with a majority of shares, the offer became unconditional. Berisford is seeking 95% of the total equity; under the rules of the Takeover Panel it must bid for 90% or more, but in any event, with control achieved it is to be seen what management changes the new ownership will bring.

World sugar prices

The improved market tone which had prevailed during the first week of July brought the London Daily Price for raw sugar from £111 on July 1 to £118 on July 7. It had been due largely to an upsurge in demand from the Far East and from traders covering short positions. A reaction occurred and the price fell to £112 on July 9 before renewed buying interest and a report that China was seeking 700,000 tonnes brought the LDP to £128. This was the peak for the month, however since prices started to fall when Licht published their latest estimate of the world sugar balance showing an even higher surplus than before, and reports from the European beet sugar countries indicated another excellent crop.

Reports of sales of Indian white sugar brought down the LDP(W) so that, instead of a premium of £40 over the raw sugar price, the two came closer together and the premium gradually shrank to about £20. More bearish news included a forecast at the start of the new Australian season which put production at a record level, 5% up on the previous season, while the USDA estimated Chinese production as 10% higher than in 1981/82. With confirmation that India had sold a total of 511,000 tonnes of white sugar, the month ended with a LDP of only £103 per tonne and an LDP(W) of £131.

World sugar production, 1981/82

F. O. Licht GmbH have recently published their third estimate of world sugar production[1] for the crops beginning in May 1981/April 1982. A further increase in total production is expected, amounting to 403,000 tonnes more than the second estimate[2] and 9,760,000 tonnes more than the revised figure for 1980/81. The change in the total is the net result of a fall of 1,424,000 tonnes in the beet sugar total, following the disastrous USSR crop failure, and an increase of 1,827,000 tonnes in the cane sugar total, made up of major increases in the estimates for India (600,000 tonnes), Thailand (360,000), China (230,000), Pakistan (217,000), Brazil (200,000), Cuba (200,000) and the Philippines (138,000 tonnes) as well as smaller amendments in other countries.

Philippines sugar industry gloom[3]

The recent US decision to impose import quotas has added to the depression of Philippine sugar producers following low world market prices and restricted ISO quota. Local morale is at a low ebb and many sugar estates are switching to other, more profitable crops. Zero growth is expected in the Negros region which accounts for over 60% of the country's sugar production. The whole-year quota for Philippine exports to the US is expected to be 180,000 tonnes which is a far cry from the average of 550,000 tonnes for 1975-1980; last year, however, exports to the US reached only 189,000 tonnes. The Philippines had hoped to increase this considerably but has been stymied by the quotas.

But what makes the Philippines' sugar outlook even grimmer is the continuing decline in cane production; government officials admit that even if the US did not impose quotas and even if the ISO export tonnages were raised, the Philippines would not be able to sell more because output has been declining anyway. If the downward trend continues, the reduced exports will have a disastrous effect on the balance of payments since sugar has traditionally been the Philippines' top dollar earner. Sugar production has been declining during the past five years, interrupted only last year by a tiny 2% increase in output, from 2,260,000 tonnes in 1980 to 2,310,00 tonnes.

At the root of the country's productivity problem are the pricing and marketing policies of the National Sugar Trading Corporation (Nasutra); many producers have been deliberately keeping production down, or at most constant, because they claim that the government's pricing policies are curtailing the planters' initiative to produce more sugar. They claim that, even if they raise their productivity, the price paid them by Nasutra does not assure reasonable profits. This is a "composite price" derived from the weighted prices of domestic and export sugar. The price for domestic sugar sales (40% of output) is fixed by the Philippines Sugar Commission and, after strong protests from producers, was recently raised

[1] *International Sugar Rpt.*, 1982, **114**, 235-239.
[2] *I.S.J.*, 1982, **84**, 96.
[3] *Financial Times*, May 26, 1982.

from 110 to 165 pesos per picul (10 to 14 cents/lb). Producers have long lobbied for freedom from control so that domestic sugar prices would reach their own level.

The export price depends on world market movements but producers have questioned some of the items subtracted by Nasutra from their final share and are critical of Nasutra's efficiency as a trading company. However, in mid-1980, Nasutra committed half the country's export crop from 1981 to 1984 at an average price of 23.5 cents/lb and this protects producers from today's low world prices. Meanwhile, the Philippines keeps missing its chance of increasing exports under the ISA; last year, only 1,230,000 tonnes was available against its quota under the Agreement of 1,480,000 tonnes and it has declared a shortfall of 310,000 tonnes against its 1982 quota of 1,610,000 tonnes.

Mauritius sugar industry anxiety[4]

The recent slump in sugar prices is merely one of several problems threatening the viability of Mauritius's sugar industry, which appears to be more concerned about domestic policy issues than the state of the world market. Their worries have been heightened by establishment of the left-wing Mouvement Militant Mauricien as the party in government. The sugar industry, by far the island's biggest employer and export earner, figured prominently in the MMM's election manifesto and the new government intends to nationalize two sugar factories and their adjacent estates over the next five years. In addition it has pledged to take over about 8000 ha of cane fields from other estates – one-sixth of the total – and these are to be earmarked for crops other than cane, such as maize, beans and rice, as part of an effort to lower the country's dependence on sugar and to expand local food production.

Another problem is the 23.6% export tax levied on large estates' turnover. The tax started at 5% in the mid-1960's and has risen steadily. According to industry sources, the tax is crippling the sugar industry and will lead to the rapid economic downfall of processing while preventing rational development of agriculture. Without the export tax the industry would have been able to avoid the losses it has suffered for four of the past five years. Tax payments will reach 432 million rupees ($43 million) in 1982 against estimated losses of 270 million rupees ($27 million). The authorities have so far resisted pleas to reduce or abolish the tax, arguing that the industry should improve its productivity.

Indian sugar crop progress

C. Czarnikow Ltd. have reported that, up to the middle of June, white sugar output had reached 8,170,000 tonnes, compared with 5,040,000 tonnes by the closing stage in the 1980/81 season when operations were within 100,000 tonnes of the closing figure[5]. There would now appear to be little difficulty for output in 1981/82 to reach recent forecasts of 8.4 million tonnes of white sugar, equivalent to 9.08 million tonnes, raw value, by the close of the season, which would make India the largest single producer of sugar. Production in 1980/81 totalled some 5,560,000 tonnes, raw value, and the estimated 1981/82 outturn would represent an increase of 63.3%.

This has followed incentives given to the industry by the Indian government in the form of tax reliefs and unremunerative prices for gur and khandsari which have resulted in diversion of cane supplies to the factories. However, credit restrictions have led to problems for the factories, increased taxation on alcohol has reduced molasses offtake and given a disposal problem, and domestic prices have been depressed, as have world market prices. *World Sugar Journal*[6] asks whether India is borrowing from the 1982/83 crop since extension of the crop period (to an expected 170 days against the 104 days of last season) gives a lower recoverable sugar content in cane; it also reduces the time available for the necessary maintenance and factory preparation for the coming crop, and involves difficulties over irrigation of standing cane and loss of a short season crop for the farmers. It is reported that farmers are reducing the area under cane for 1982/83, and *World Sugar Journal* recalls the experience of Cuba in 1969/70 when a huge extended crop was followed by a number of considerably smaller ones.

US sweetener market penetration by HFCS

Mr. Steve Vuilleumier of McKeany-Flavell Co. has recently published[7] that company's estimates of the current penetration of the US sweetener market by high fructose corn syrups and has compared this with the 1981 situation and their estimate of long-term penetration, as follows:

	Sugar		HFCS		HFCS % of market		Long-term penetration expected, %
	1981	1982	1981	1982	1981	1982	
	thousand short tons, dry basis						
Beverages	3658	3150	3271	4125	47	57	90
Baking	2558	2600	850	850	25	25	25
Canning	500	460	680	720	58	61	75
Dairy products	900	920	400	415	31	31	35
Processed foods	450	410	225	265	33	39	40
Confectionery	1926	2000	24	25	1	1	5
Other food and non-food uses	1420	1400	0	0	0	0	
	11412	10940	5450	6400	32	37	

From the table it appears that most markets are approaching theoretical penetration levels with the exception of beverages and for the beverage industry's relative position to increase significantly beyond the 1982 estimate will require approval of higher HFCS levels by major soft drink manufacturers.

The proportion of the second-generation syrup (55% fructose) to first-generation (42% fructose) has been increasing of recent years, largely owing to increase in the production of the former while the latter has increased only slightly or has remained constant. From a ratio of 11:89 (300,000 tons:2,400,000 tons dry basis) in 1978, the estimated levels for 1982 are 50:50 (3,200,000 tons:3,200,000 tons). Approximately 90% of the 55% fructose syrup goes into beverages and, because of accelerated demand for this product in recent years, corn wet millers have expanded production capacities by enlarging facilities or changing their product mixes.

Theoretical capacity for plants operating in 1982 is estimated at about 1,000,000 short tons each, dry basis, of 42% and 55% HFCS. Demand varies with the time of year, however, although, since the 42% product can be stored when demand declines, this alleviates the tight demand-supply position experienced in the third quarter. The 55% fructose syrup is not stored for any length of time, however, and higher approval levels in soft drinks could tighten availability sharply during the critical summer months.

[4] F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 335.
[5] *Sugar Review*, 1982, (1604), 111.
[6] 1982, **4**, (12), 4-5, 26.
[7] *Sweetener News* (McKeany-Flavell Co.), June 7, 1982.

Improved detection of dextrans in cane juice using a capillary flow technique

By P. F. GREENFIELD and G. GERONIMOS
(Department of Chemical Engineering, University of Queensland, St. Lucia, Australia 4067)

Introduction

Greenfield & Geronimos[1-3] have previously reported on the detection of dextrans in cane juice, and on the prediction of viscosity increases to be expected in later stages of processing, using a measurement of relative viscosity. The measurement of the viscosity of filtered mixed juice, before and after treatment with the enzyme dextranase, allows such determinations to be made. With a simple U-tube capillary viscometer as the measuring device, the method is rapid, straightforward, specific for dextran, and inexpensive in terms of both time and chemicals. Using this technique, a mill should, with some experience, be able to determine if viscosity problems attributable to dextran are likely to occur in later processing stages.

The technique seems more suitable than the haze test for routine analyses[2, 4, 5]. Its main drawback lies in its lack of sensitivity at low dextran concentrations. Additionally, the capillary viscometer system is not particularly suited for automating the analyses, if the frequency of sampling were to warrant it.

This paper reports on an extension of the capillary viscometer technique which provides increased sensitivity and the potential for automated and, indeed, on-line detection of dextrans in cane juice.

Theoretical basis

The bases of the analytical method lie in the relationships that exist between the fluid pressure drop through a capillary and the fluid viscosity, and between juice viscosity and dextran concentration. Various authors[6-8] have demonstrated the viability of using viscometry to monitor effluents from gel chromatography columns. Geronimos & Greenfield[1] have developed a number of relationships between juice viscosity and dextran concentration.

For Poiseuille-type flow (i.e. laminar flow) through capillaries, the pressure drop over a fixed length is directly proportional to the viscosity of the fluid[9]:

$$-(\Delta P) = k\,\eta \qquad (1)$$

where k = instrument parameter

$$= (128/\pi)(QI/D^4) \qquad (2)$$

ΔP = pressure drop, Pa

η = solution viscosity, Pa.s

P. F. Greenfield

G. Geronimos

Q = flow rate through capillary, $m^3.sec^{-1}$

I = capillary length, m

D = capillary diameter, m

Clearly, the value of k and, hence, the response of any system measuring pressure drop can be affected by the design of an appropriate capillary (D, I) and in the operation of the device (Q). There will be a trade-off between sensitivity to changes in viscosity and the overall pumping and pressure measurement requirements, i.e. increased sensitivity to changes in viscosity is purchased only at the cost of a higher pressure drop.

For a capillary system of fixed dimensions, the following relationship holds for equivalent flowrates of two Newtonian fluids:

$$\frac{\Delta P_1}{\Delta P_2} = \frac{\eta_1}{\eta_2} \qquad (3)$$

Hence, if the two fluids are respectively a juice solution containing dextran and a dextran-free solution, equation (3) becomes (ignoring, for the moment, the possibility of non-Newtonian effects in the dextran containing solution):

$$\frac{\Delta P}{\Delta P_o} = \frac{\eta}{\eta_o} = \eta r \qquad (4)$$

where η_r = relative viscosity and the subscript $\circ$ refers to a reference dextran-free solution of the same total solids as the dextran-containing solution.

Greenfield & Geronimos[1, 2] have shown that any of the following relationships can be used to describe the effect of dextran concentration on juice, syrup or molasses viscosity:

$$\eta_{sp} = k_{sp}C^{\alpha_{sp}} \qquad (5)$$

$$\eta_r = \exp(k_r C^{\alpha_r}) \qquad (6)$$

$$\eta_{sp} = k_1\,\gamma^{k_2}C^{k_3} \qquad (7)$$

$$\eta_r = \exp(k_4\,\gamma^{k_5}C^{k_6}) \qquad (8)$$

where $\eta_{sp} = \eta_r - 1$ = specific viscosity

C = concentration of dextran, g/decilitre

$k_r, k_{sp}, \alpha_r, \alpha_{sp}$ = parameters which are functions of the average molecular weight of the dextran polymer

1 *I.S.J.* 1978, **80**, 67-72.
2 *ibid.*, 956-961.
3 *Proc. Aust. Soc. Sugar Cane Tech.*, 1979, 151-156.
4 Keniry, Lee & Mahoney: *I.S.J.*, 1969, **71**, 230-233.
5 Richards & Stokie: *ibid.*, 1974, **76**, 103-107.
6 Goedhard & Opschoor: *J. Polymer Sci.*, A-2, 1970, **8**, 1227-1231.
7 Meyerhoff: *Separation Sci.*, 1971, **6**, 239.
8 Ouano: *J. Polymer Sci.*, A-1, 1972, **10**, 2169-2180.
9 Denn: "Process Fluid Mechanics", (Prentice-Hall, New Jersey), 1980.

γ = weight average degree of polymerization
= $\overline{MW}$/(Molecular weight of polymer subunit)
= $\overline{MW}/162$

$k_1 - k_6$ = parameters which are independent of the average molecular weight of the dextran polymer.

Values of the parameters for various dextran polymers and various sugar solutions and juice samples may be found in previous papers[1, 2]. Equations (7) and (8) are more useful in specific cases where the weight average molecular weight of dextran is known, whereas equations (5) and (6) are applicable where the molecular weight is unknown, but can be regarded as being approximately constant. This is a reasonable assumption for many sugar milling applications; the parameters in these equations must then be generated for a particular mill.

Substitution of equations (5) – (8) into equation (4) and subsequent rearrangement leads to the following set of relationships, each of which can be used to determine dextran concentration from a knowledge of the differential pressure drop during capillary flow of a juice solution containing dextran and one of the same solids concentration but dextran-free.

$$C = k'_{sp} \left(\frac{\Delta P}{\Delta P_o} - 1\right)^{\alpha'_{sp}} \quad (9)$$

$$C = k'_r \log_e \left(\frac{\Delta P}{\Delta P_o}\right)^{\alpha'_r} \quad (10)$$

$$C = k'_1 \gamma^{-k_2} \left(\frac{\Delta P}{\Delta P_o} - 1\right)^{k'_3} \quad (11)$$

$$C = k'_4 \gamma^{-k_5} \log_e \left(\frac{\Delta P}{\Delta P_o}\right)^{k'_6} \quad (12)$$

where ′ indicates the inverse of the parameter value specified in the equivalent equation (5) – (8).

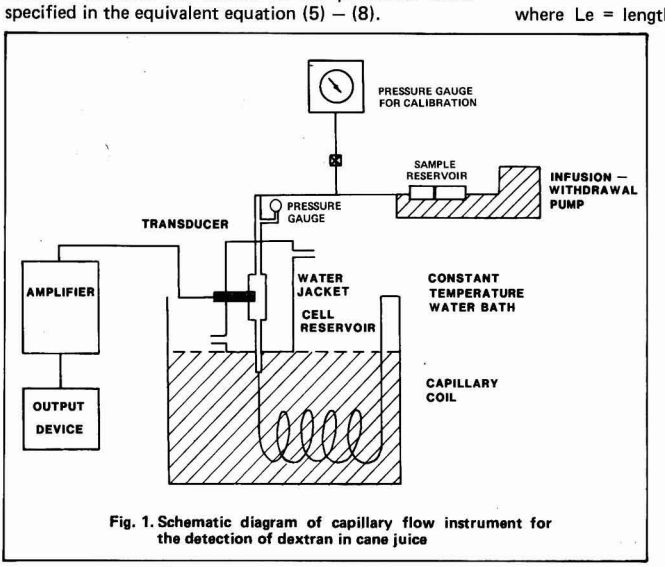


Fig. 1. Schematic diagram of capillary flow instrument for the detection of dextran in cane juice

Instrument design

The design of an instrument to provide the necessary data for evaluating equations (9) – (12) involves four basic components: (i) a juice reservoir, (ii) a pump which will provide a known constant flow independent of head, (iii) a capillary of suitable diameter and length, and (iv) a device for measuring the differential pressure drop.

Within such a scheme as this, various options are possible. While a small positive displacement pump was used in this work, gas displacement of the juice is also possible. To measure the differential pressure drop, two options are suggested. The simpler is to use an appropriate transducer to measure the pressure drop of the juice flowing through the capillary before and after addition of the enzyme dextranase to the juice reservoir. Such a technique was employed in the tests described in the following sections. An alternative, more suited to automated determinations, is to split the juice stream, treat one stream with dextranase, and then directly measure the differential pressure drop of each stream passing through identical capillaries. Aspects of this scheme were also tested and details are reported in a subsequent section.

Certain hydrodynamic constraints may affect the design of such an instrument. The flow must be laminar for equation (1) to hold[6], i.e.

$$Re \ll 2100 \quad (13)$$

where Re = Reynolds number

$$= D\nu\rho/\eta$$

$$= 4Q\rho/\pi D\eta \quad (14)$$

and ρ is the fluid density.

This imposes constraints on the value of Q/D. In addition, there is an entrance region for which equation (1) is unsuitable. It is defined by:

$$\frac{Le}{D} \approx 0.59 + 0.055\ Re \quad (15)$$

where Le = length of tube which is influenced by entrance effects. It is clear that, for the diameters of interest (ca. 1 mm), there should be little problem in ensuring that the entrance region is of negligible length.

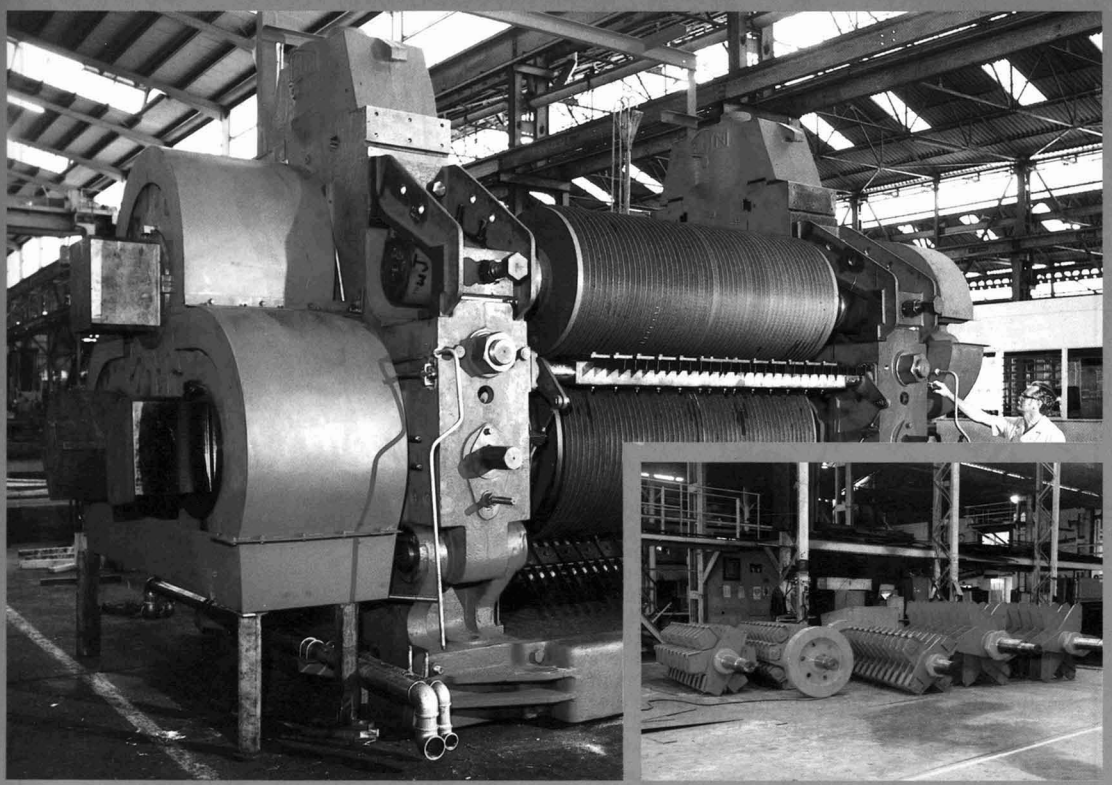
Materials and methods

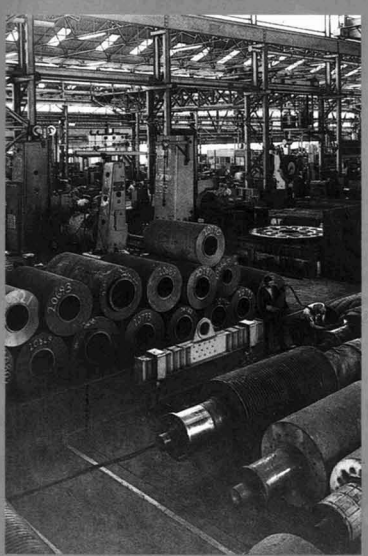
Equipment:

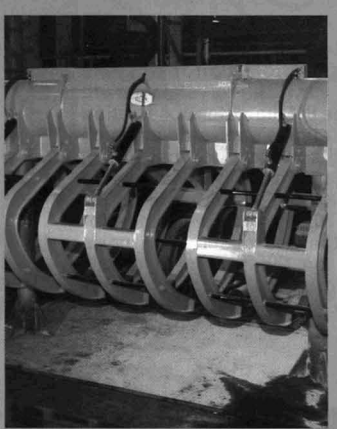
A diagram of the instrument setup is provided in Figure 1. The pressure transducer (Statham Model PG822-15) was inserted just ahead of the capillary. The output from the transducer was amplified (Statham Model SC1000) and sent to a pen recorder. Two other pressure gauges were installed in the system, one to ensure that the maximum allowable pressure on the transducer was not exceeded and the other (Wallace & Tiernan) to test the calibration of the transducer.

A Harvard infusion/withdrawal pump which employed a screw-driven piston was used to pump the juice samples at known, constant flowrates. The capillary tubing was coiled and submerged in a temperature-controlled bath. Capillary tubing of two internal diameters was tested (0.86 mm

WE RECORD OUR SUGAR ACHIEVEMENTS





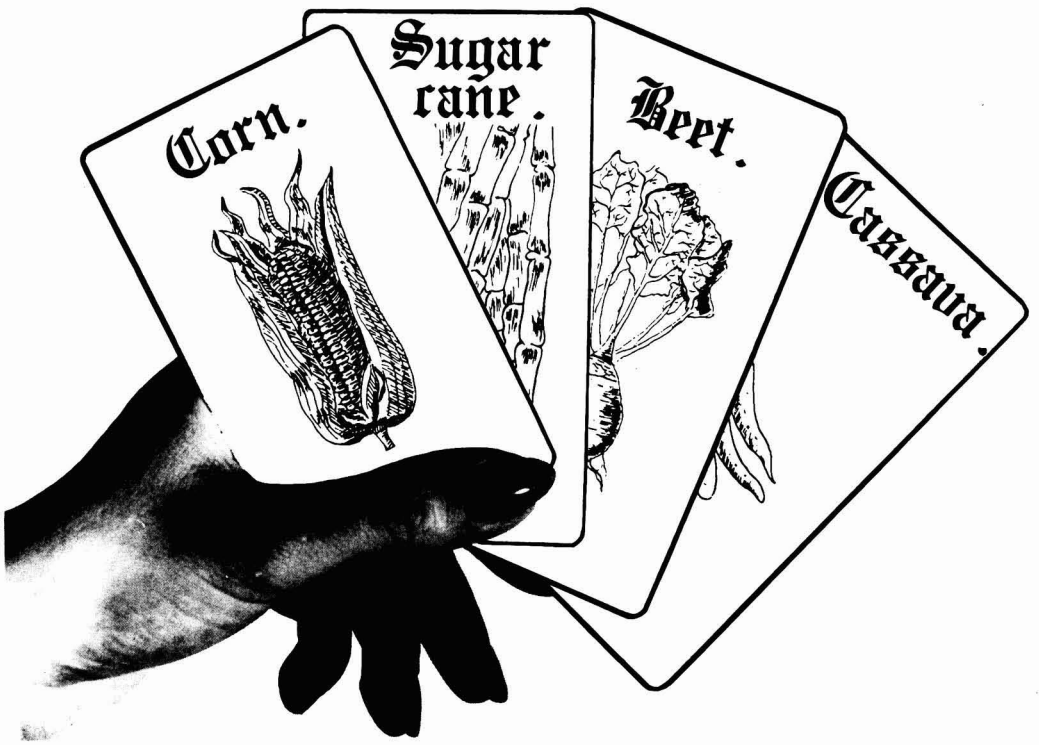


Elgin Engineering Co. Ltd
3 Clydebank Road, Bayhead, Durban 4001
P.O. Box 301, Durban 4000, South Africa
Telephone:
National (031) 251461 International +27 31 251461
Telex 6-22116 SA
Telegrams & Cables 'Panelgin' 'Girders'

A Member of the Murray & Roberts Group M&R

ELGIN

THE BEST HAND.



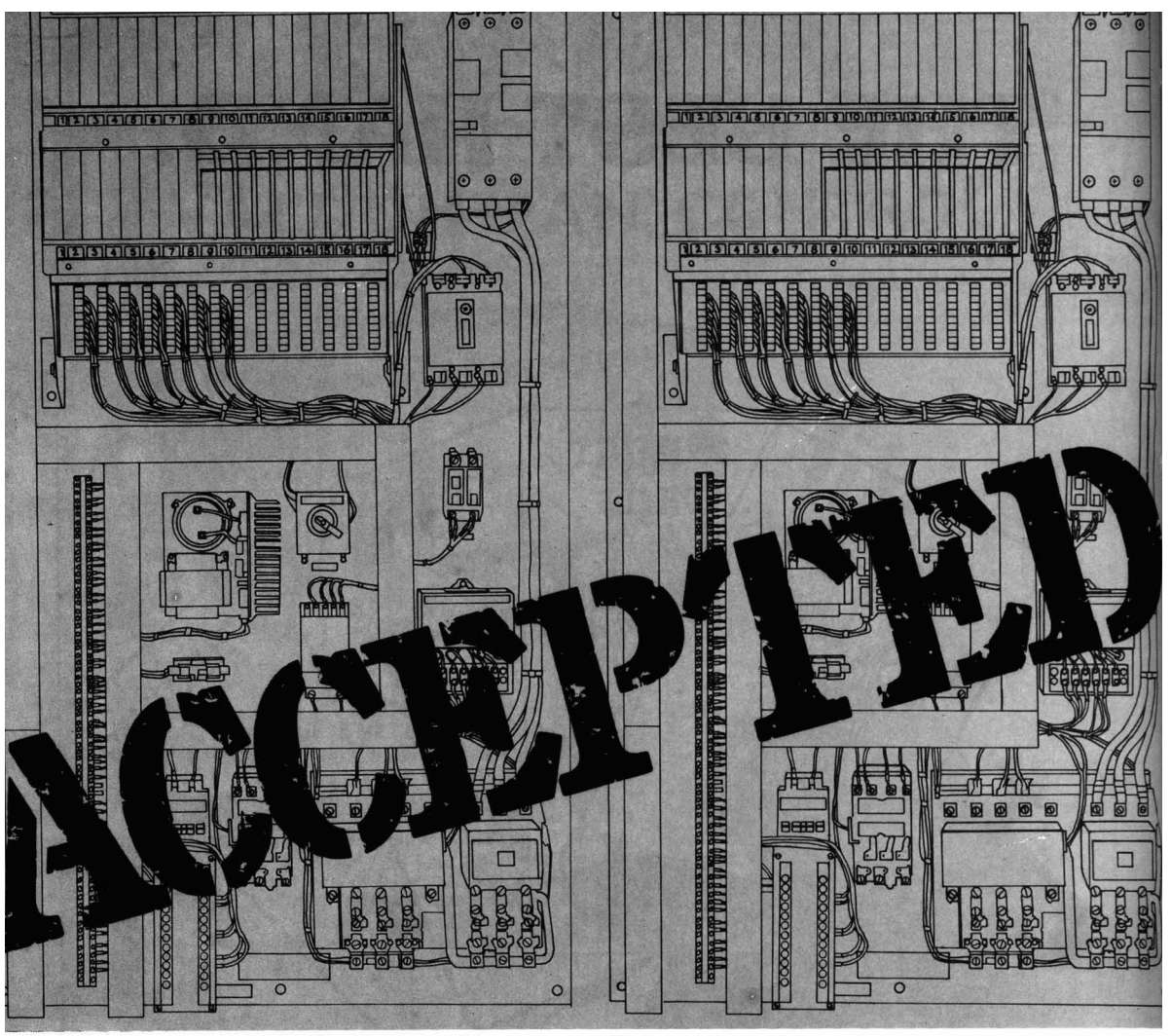
Sugar .. Glucose syrup .. HFCS

Our experience makes us one of the world leaders

abay

A-B-H Engineering division

Rue de Genève, 4, btes 26-28
1140 BRUXELLES (BELGIUM)
Telephone: 02/242.51.51
Telex: 22.328 abay b



Solid State

Installations worldwide have proven the advantage of the solid state control, which is standard with Western States centrifugals.

We introduced it... the sugar industry has accepted it.

Solid state provides higher reliability and reduced maintenance. Indicating lights (LED's) are used to display the state of the circuit, making trouble-shooting easier and more accurate. Programmable controllers have also been supplied.

For more productive sugar processing, get Western States automatic batch centrifugals, and get solid state technology in your controls.

Argentina • Australia • Barbados • Belgium • Brazil • Canada • Chile Colombia • Dominican Republic • Guatemala • Haiti • Honduras • Indonesia Iran • Ireland • Jamaica • Japan • Korea • Malawi • Mexico • Pakistan Panama • Peru • Philippines • South Africa • Swaziland • Taiwan • Thailand Trinidad • USA Mainland and Hawaii • Venezuela.

THE WESTERN STATES MACHINE COMPANY

Hamilton, Ohio 45012 U.S.A.

ROBERTS CENTRIFUGALS

and 1.42 mm) in the initial stages. All the work reported in this paper was carried out on the 0.86 mm tubing. A number of lengths of tubing ranging from 1 m to 3 m were tested. Water from the temperature-controlled bath was circulated through a perspex jacket which surrounded the transducer and the entrance region to the tubing.

Preparation of solutions:

Sucrose solutions were prepared by dissolving the required amount of sucrose in distilled water. Mixed juice and clarified juice samples were obtained from Rocky Point Mill in Queensland. No preparation was required for clarified juice, but mixed juice was centrifuged and filtered prior to testing.

Dextrans of known average molecular weight were dissolved in the solutions of sucrose, mixed juice and clarified juice. Dextrans were obtained from Pharmacia (T500 of weight average molecular weight = 5×10^5; T2000 of weight average molecular weight = 2×10^6) and from Sigma (D5501 of approximate weight average molecular weight = 2×10^7). Particular care was taken to ensure complete solution of the dextrans, especially with the Sigma product. The moisture content of the dextrans was determined by drying to constant weight and corrections to the dissolved concentration made accordingly. The moisture content was found to be approximately 10%.

Measurement of viscosity:

Details of the procedure for measuring independently the viscosity of the sucrose and juice have been provided by Geronimos & Greenfield[2]. A U-tube viscometer was used in these tests.

Experimental test procedure:

The aim of these tests was to determine, using equations (9) – (12), how accurately the differential pressure system could predict the concentration of dextrans in sucrose and juice solutions.

A weighed amount of dextran was added volumetrically to the solution being tested. To half of this solution, an amount of dextranase (Sigma D5884), equivalent to 2 I.U.ml^{-1}, was added. The relatively high concentration of dextranase ensures rapid hydrolysis of the polymer. Independent estimates were made of the viscosity of the reference solution, the solution containing dextran and, after two hours, the hydrolysed solution. Of course, at low dextran concentrations the capillary viscometer technique is unreliable as a means of predicting dextran concentration. The independent viscosity determination, however, provided a check on experimental error and on microbial contamination.

Each of the solutions was pumped through stainless steel capillary tubes of various diameters and lengths at different flowrates, and the pressure drop across the capillary measured by the strain gauge transducer. The pump delivered a constant flow, regardless of head, and was calibrated prior to use. The strain gauge transducer was calibrated against a standard pressure gauge.

The system was thoroughly rinsed with the solution being tested. Care was taken to exclude air from the capillary and sufficient time was allowed for the solution to reach the required temperature.

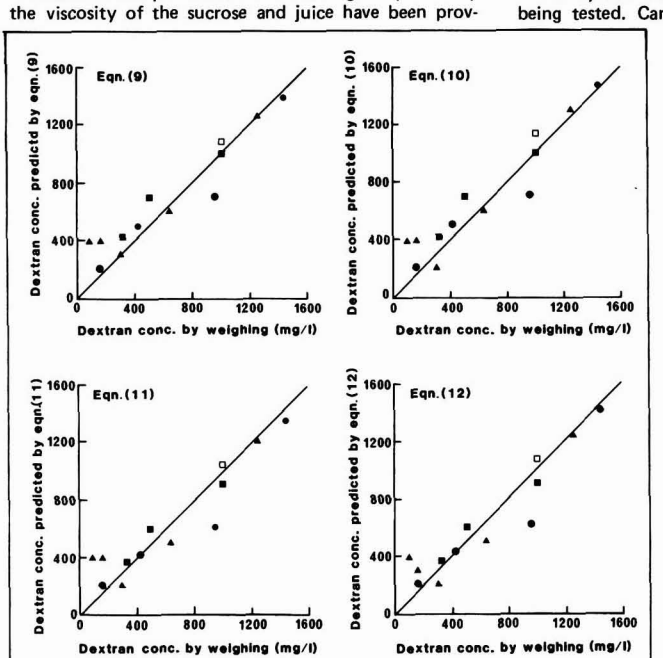


Fig. 2. Determination of dextran concentration by differential pressure drop measurement. ($\overline{Mw} = 2 \times 10^7$; ● . . . . 15% sucrose, l = 2.9m; ▲ . . . . 15% sucrose, l = 1.5m; □ . . . . mixed juice, l = 2.9m; ■ . . . . clarified juice, l = 2.9m)

Immobilized dextranase studies:

If the capillary system is to be used as an automated instrument, it is necessary to split the juice stream and hydrolyse the dextran in one stream, either by the injection of soluble dextranase or by passing the stream over a surface on which the enzyme is immobilized. To test the feasibility of this latter concept, dextranase was immobilized onto porous glass beads using a silanization technique followed by glutaraldehyde coupling of the enzyme.

Following immobilization, the glass beads were thoroughly washed and stored at 4°C. The ability of the system to hydrolyse dextran was tested by following the viscosity change with time of a buffered sucrose-dextran solution which was in contact with immobilized dextranase. The enzyme particles were enclosed in 4 mesh baskets which were attached to a stirrer shaft. Samples were removed from the reactor at various time intervals, placed briefly in a microwave field to denature any enzyme which had become detached from the support, and then the viscosity of the solution was measured with a capillary viscometer.

Results and discussion

Prediction of dextran concentration:

The ability of equations (9) – (12) to predict the concentration of dextran in sucrose solutions, mixed juice and clarified juice is shown by Figure 2, where the predicted value is plotted against the known value. It is apparent that, down to concentrations of around 200 $mg.l^{-1}$ (0.02% w/v), the agreement is good regardless of which predictive equation is used. The results are shown for a dextran with a molecular weight typical of that found in cane juice (ca. 2×10^7). Tests carried out on lower molecular weight dextrans showed similar behaviour although agreement between predicted and measured concentrations was not as good at very low concentrations.

Effect of instrument parameters on sensitivity:

There are various techniques for determining the effect of system parameters, such as capillary diameter and length and sample flowrate, on the sensitivity of the concentration prediction. The most rigorous is to carry out a differential analysis of equations (9) – (12) and then to estimate the error in the concentration by substituting the expected values of and errors in ΔP, ΔP_o, γ, and the various parameters. A more illustrative technique is shown in Figure 3 where the expected pressure drops (ΔP, ΔP_o) are plotted as a function of dextran concentration for various values of the parameter k. The value of k for any particular application is given by equation (2). It does not matter how the variables D, l, Q are adjusted to give a particular value of k as long as the constraints implied by equations (13) – (15) are satisfied.

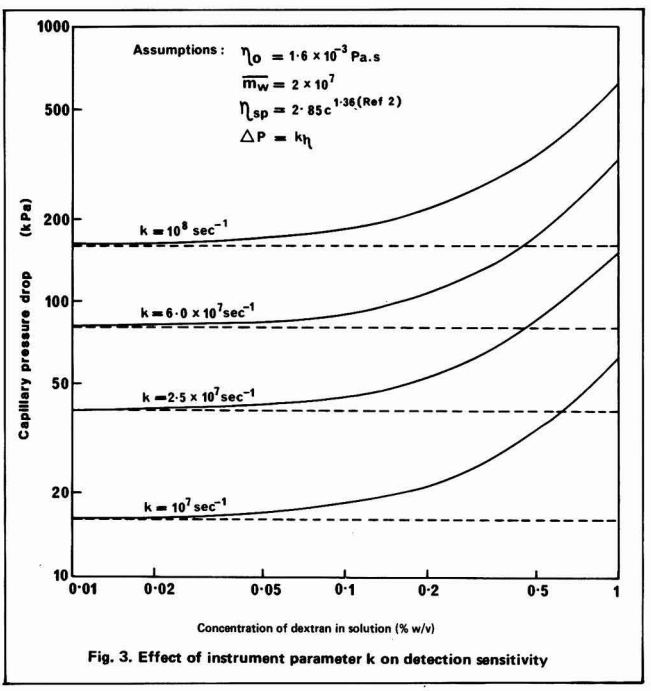


Fig. 3. Effect of instrument parameter k on detection sensitivity

The implications of Figure 3 are straightforward. The sensitivity of the capillary device is improved at higher values of k (i.e. smaller D, larger l, higher values of Q) for a constant absolute error in the pressure transducer and accompanying measuring system. Nothing is gained from operating at high values of k if the error is proportional to output. Of course, the higher values of k imply more expensive pumping equipment.

Non-Newtonian effects:

The relationships described by equations (1) – (2) are valid only for Newtonian fluids and must be modified to account for any pseudoplastic behaviour. Such behaviour is sometimes exhibited by dextran-containing systems. Greenfield & Geronimos[2] have shown that both the average molecular weight of the dextran and the dissolved concentration affect the value of the power law index for those shear rates of interest. The non-Newtonian effects become significant only at the higher dextran concentrations found in syrup and molasses. Greenfield & Geronimos[1] found that, in sucrose solutions for dextran of $\overline{MW} = 2 \times 10^7$, the power law index was always greater than 0.9 at dextran concentrations below 1% w/v. It is expected, therefore, that there should be negligible error introduced by non-Newtonian effects. In a particular mill situation, this can be validated by determining the effect of shear rate on the flow behaviour of the mixed or clarified juice.

Hydrolysis of dextran by immobilized dextranase:

In Figure 4, the results of the batch hydrolysis of dextran, with immobilized dextranase, are plotted. Also shown, for comparative purposes, are two hydrolysis experiments using soluble dextranase. The difference in rates is very noticeable, this being due to mass transfer limitations and steric hindrance of the enzyme action on the polymer when it is immobilized. It was concluded from these tests that, while the use of the immobilized enzyme was possible, its performance was not sufficiently attractive to warrant extended investigation. The use of soluble dextranase is recommended for dextran determination.

Detection of dextran in juice streams:

The use of a simple U-tube viscometer, as described by Greenfield & Geronimos[3], to predict the relative effects of dextran on the viscosity of sugar syrups and molasses has much to recommend it. It is dextran specific, inexpensive and easy to use, particularly for detecting a problem which is usually intermittent. The appropriate parameters for a particular mill may be determined by collecting data over time. Such an approach implies, of course, that the molecular weight distribution does not vary appreciably from case to case.

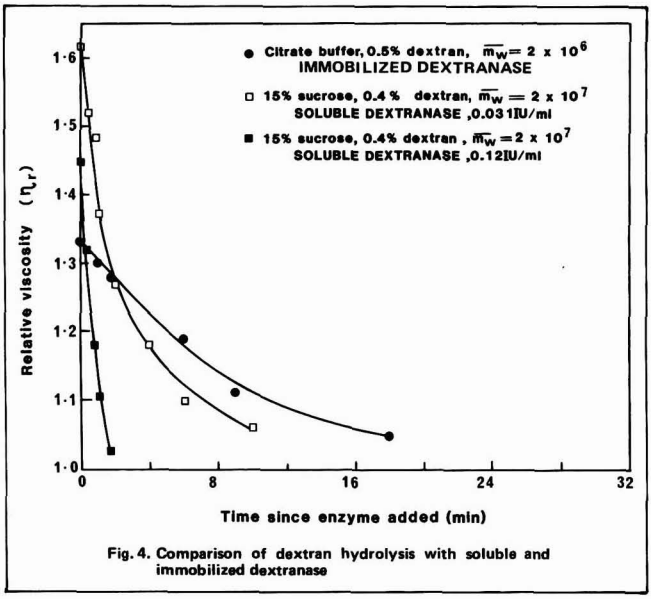


Fig. 4. Comparison of dextran hydrolysis with soluble and immobilized dextranase

From a consideration of the mechanism and the kinetics of dextran formation, this assumption is often reasonable.

Where dextran is a regular problem and where greater sensitivity of detection is required, the use of a differential pressure instrument is recommended. While conceptually very similar to the capillary viscometer method, the technique has considerably greater range and flexibility. Again it is a relatively simple, inexpensive instrument.

The latter instrument lends itself to automated and even on-line analyses. Because dextran is usually an intermittent problem, however, consideration of such an automated system as a routine stream analyser does not appear warranted. If a mill has a continuing dextran problem, then extension of the instrument, described in this paper, to such an application is straightforward.

Acknowledgements

The financial assistance of the Bureau of Sugar Experiment Stations and the Sugar Research Institute is appreciated. The continuing readiness with which Rocky Point Mill supplies juice samples is also greatly appreciated.

Summary

Details are provided of an instrument which will permit the detection of dextrans in cane juice down to relatively low concentrations. The device is based on the differential pressure drop of a solution passing through a capillary with and without dextran present. The enzyme dextranase is used to remove dextran from the sample being tested. Accurate determinations of dextran of MW 2×10^7 were made at concentrations down to 200 $mg.l^{-1}$ in sucrose solutions, filtered mixed juice and clarified juice. The instrument may be used either with discrete batch samples or, with slight modification, in an on-line application. The device is inexpensive, easy to use and appears suitable for use in mills subject to processing problems caused by dextran.

Détection améliorée des dextranes dans le jus de canne par l'emploi d'une technique à écoulement capillaire

Des détails sont fournis au sujet d'un instrument qui permettra la détection des dextranes dans le jus de canne jusqu'à des concentrations relativement faibles. Le dispositif est basé sur la perte de charge différentielle d'une solution qui s'écoule à travers un capillaire en présence et en l'absence de dextrane. L'enzyme dextranase est utilisé pour éliminer le dextrane de l'échantillon à examiner. Des déterminations précises de dextrane de P.M. 2×10^7 ont été effectuées à des concentrations jusqu'à 200 $mg.l^{-1}$ dans des solutions de saccharose, dans le jus mélangé filtré et dans du jus clarifié. L'instrument peut être utilisé avec des échantillons prélevés en discontinu ou, moyennant une petite modification, pour un travail en ligne. L'équipement est bon marché, d'un emploi aisé et il parait approprié pour l'emploi dans des sucreries sujets à des problèmes de fabrication causés par le dextrane.

Verbesserter Nachwies von Dextranen in Rohrsaft mit Hilfe einer Kapillar-Fluß-Technik

Einzelheiten werden von einem Instrument gegeben, das den Nachweis von Dextranen in Rohrsaft bis zu verhältnismäßig geringen Konzentrationen erlaubt. Der Apparat basiert auf dem Differenzdruckverlust zwischen einer Lösung, die mit und ohne Dextran durch eine Kapillare fließt. Das Enzym Dextranase wird benutzt, um das anwesende Dextran aus der Probe zu entfernen. Genaue Bestimmungen wurden mit Dextran von einem Molekulargewicht von 2×10^7 bei Konzentrationen bis hinunter zu 200 mg/l in Zuckerlösungen, gefiltertem Mischsaft und Dünnsaft gemacht. Das Instrument kann entweder für Einzelproben oder mit leichten Änderungen in einer On-line-Anwendung benutzt werden. Das Instrument ist billig, leicht zu benutzen und scheint geeignet für Fabriken zu sein, die Verarbeitungsschwierigkeiten durch Dextran haben.

Detección mejorada de dextranos en jugo de caña *empleando una técnica de flujo capilario*

Se presentan detalles de un instrumento que permitira la detección de dextranos en jugo de caña hasta concentraciones relativamente bajas. El dispositivo se base sobre la caída diferencial de presión de una solución pasando a través de un tubo capilario con y sin la presencia de dextrano. La enzima dextranasa es empleado para eliminar dextrano de una muestra de ensayo. Determinaciones exactas de dextrano de P.M 2×10^7 se hicen para concentraciones hasta 200 $mg.l^{-1}$ en soluciones de sacarosa, jugo mixto filtrado y jugo clarificado. El instrumento puede usarse con muestras discretas o, con modificación menor, en un aplicación "en-linea". El dispositivo es barato, fácil de usar, y parece convenable para uso en azucareras propenso a problemas en proceso causado por dextrano.

Control of sugar beet aphids and virus yellows

By R. A. DUNNING
(Broom's Barn Experimental Station, Higham,
Bury St Edmunds IP28 6NP, England)

Although the black aphid *(Aphis fabae)* has been known as a pest of beet since the nineteenth century, the greater importance of green aphids (mainly *Myzus persicae)* was not recognised until 1935. Work in Belgium and Holland then discovered that the severe yellowing of beet leaves which often developed in the summer was due to a virus, transmitted principally by *Myzus persicae.* Control measures that were developed included the separation of seed and root crops, growing stecklings (first year seed plant) in areas unfavourable to aphids and/or spraying with nicotine. The disease decreased sugar yields in Poland, Sweden, Switzerland and, especially, Belgium, Czechoslovakia, Denmark, England, France, Holland, Hungary, Spain and West Germany. Virus yellows is now the most important disease of sugar beet, or equally important to the leaf spot disease *Cercospora,* in all the above countries, and second only to *Cercospora* in Austria, Greece, Italy and Yugoslavia.

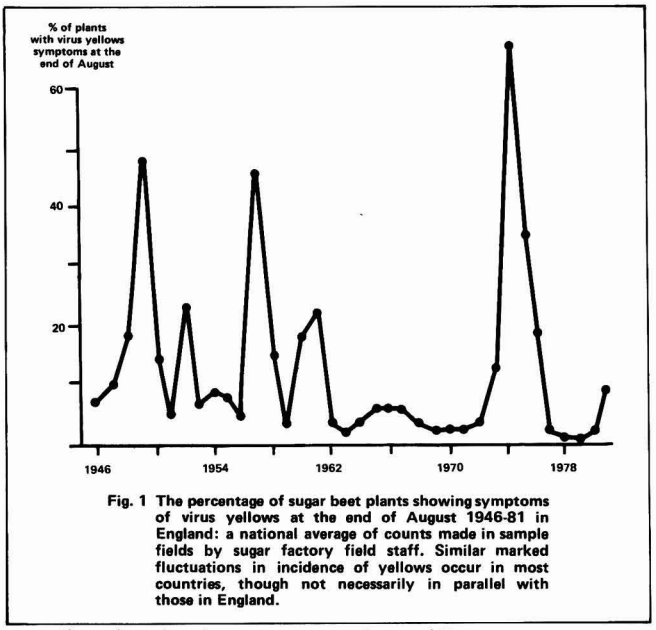


Fig. 1 The percentage of sugar beet plants showing symptoms of virus yellows at the end of August 1946-81 in England: a national average of counts made in sample fields by sugar factory field staff. Similar marked fluctuations in incidence of yellows occur in most countries, though not necessarily in parallel with those in England.

In the 1940's considerable progress was made in studies of *M. persicae,* especially in Denmark and Sweden, and of the virus, especially in England and Holland. A method of controlling the aphid vector was needed; nicotine fumigation, using a drag sheet to ensure a long enough fumigation period, began to be used to control severe black aphid infestations, and was relatively harmless to beneficial insects. It was, however, uneconomical against green aphids and virus yellows. Compounds such as DDT were ineffective, probably because they also controlled beneficial insects; a persistent, systemic aphicide spray was needed to control the aphids and hence decrease virus spread within the fields. The first one, Schradan, was tested in the late 1940's but the breakthrough came with Demeton-S-methyl, which began to be used commercially in the late 1950's.

Because of the very variable incidence of virus yellows from year to year (Fig. 1) and area to area in many countries, general routine spraying of crops could never be justified economically. As a result of international meetings of research workers on the virus yellows problem, held annually in Holland under the auspices of the International Institute for Sugar Beet Research, each country developed a method of advising growers if, and when, spraying was justified. Advice was based on the development of crop infestation by green aphids, related to the stage of crop growth and the number of virus sources locally.

During the 1960's and early 1970's it seemed that spraying when necessary, combined with the still important hygiene measures of separating seed and root crops, destroying fodder beet and mangold clamp remnants by April, etc., ensured that virus yellows caused little damage.

However, in the period 1973 to 1976 many countries suffered severe epidemics and the research effort was intensified. The main cause of the resurgence was probably a series of mild winters but, in addition, *M. persicae* resistant to organophosphorus aphicides began to be found throughout Europe.

Granular formulations of systemic pesticides, mainly carbamates, applied in the seed furrow with the seed began to be used extensively. These fairly broad spectrum pesticides give protection against soil pests (nematodes, and soil insects such as millepedes and symphylids) and foliage pests, especially aphids.

R. A. Dunning

Compounds such as Aldicarb, Carbofuran, Oxamyl, Terbufos and Thiofanox are now used extensively in Belgium, England, France, Holland, Italy and Switzerland.

Granular pesticides applied with the seed can only be used prophylactically, and much effort is currently being devoted to developing improved methods of deciding which fields need treatment, and in which seasons. The treatment is expensive and unnecessary use is uneconomical; furthermore, excessive use is likely to be harmful because it may accelerate the development of resistant aphids.

Despite the extensive use of granular pesticides in some countries, spraying when the aphid population begins to increase on beet plants is still the main method of aphid and yellows control in all countries. Again, a considerable part of research work aims to improve decision making on the need for, and timing of, spraying. Organophosphorus compounds are now used less and are being replaced by carbamate compounds. These are more selective, i.e. they do not harm the beneficial insects that help to control the aphids, and they still kill the organophosphorus-resistant aphids.

The importance of beneficial insects that eat crop pests has long been known; they are especially important in the case of sugar beet aphids. Recent studies have shown that carabid beetles, that live in beet fields and are active when the aphids first arrive in the crop, also help to control aphid numbers. The carabids are probably more important in decreasing subsequent virus spread than are the more familiar ladybirds (Coccinellids), hoverflies (Syrphids) and lacewings (Chrysopids).

Sprays applied to the crop should not harm these beneficial insects. Some studies in the laboratory at Broom's Barn in 1981 showed marked differences in the mortality of carabid beetles *(Pterostichus melanarius)* when exposed in different ways to field-strength spray solutions of several insecticides (Fig. 2). Pirimicarb, as expected, was harmless to the beetles by all three methods of testing but Demeton-S-methyl killed most of the beetles that were dipped in it or fed contaminated food, whilst Deltamethrin was very toxic when the beetles were confined on sprayed soil.

Further studies are needed to determine whether these harmful effects in the laboratory have any importance in the field. In commercial practice, Demeton-S-methyl and Pirimicarb are the most extensively used sugar beet aphicides in Europe. In Belgium Deltamethrin has recently been shown to give good control of virus yellows; however, it seems preferable to use aphicides that kill the aphids but leave the beneficial insects unharmed.

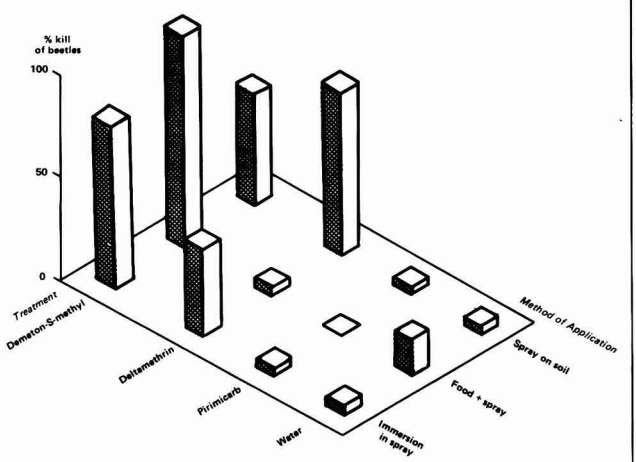


Fig. 2. The percentage of carabid beetles *(Pterostichus melanarius,* the commonest and most voracious of the field-resident predators of sugar-beet aphids in England) killed by three different aphicides, diluted to concentrations commercially recommended for field application, tested in three different ways:
(1) the beetles dipped in the spray for one second,
(2) the beetles supplied with contaminated food (powdered meat moistened with spray), and
(3) the beetles confined on soil previously sprayed at field rate.

Summary

The history of control measures against the green aphid pest of sugar beet is summarized and mention of recent trials of a number of carbamate-type selective aphicides against beneficial insects. Pirimicarb proved harmless to these insects by all three methods of testing.

La lutte contre les pucerons en betteraves et la jaunisse

On résume l'histoire des mesures pour combattre le puceron vert en culture betteravière, en mentionnant d'essais récents pour déterminer la toxicité d'un nombre d'antipucerons selectifs du type carbamate vis à vis des insectes utiles. Pirimicarb s'est montré inoffensif à ces insectes par toutes les trois méthodes d'essai.

Die Bekämpfung der Grünen Pfirsichblattlaus und der Vergilbungskrankheit

Die Geschichte von Massnahmen gegen die Grüne Pfirsichblattlaus im Zuckerrübenbau wird kurz dargestellt, und Versuche in letzter Zeit zur Bestimmung der Toxizität mehrerer selektiver Insektizide der Art Carbamat den nützlichen Insekten gegenüber werden erwähnt. Pirimicarb hat sich schadlos an diesen Insekten bei allen drei Versuchsmethoden gezeigt.

Control de pulgones de la remolacha de azúcar y de la enfermidad viral de amarillez

Se presenta un resumen de la historia de medidas para control del pulgón verde, plaga de remolacha de azúcar, y hace mención de ensayos recientes sobre toxicidad de algunas aficidas selectivas del tipo carbamato contra insectos beneficios. Pirimicarb se demuestra inocuo a éstos por todo de los tres métodos de ensayo.

Application of membrane technology to juice concentration*

By S. E. BICHSEL and A. M. SANDRE
(Research Dept., American Crystal Sugar Company)

Introduction

The primary objective of this study is to determine the technical and economic feasibility of reducing overall energy usage within the basic beet sugar manufacturing process by reducing the weight of water which must be evaporated. It is estimated that approximately 50% of the energy utilized to produce beet sugar and cane raw sugar is consumed in the evaporation of water. Energy requirements necessary for water evaporation in conjunction with the manufacture of beet sugar and cane raw sugar are a result of processing a raw material containing approximately 75% water on a weight basis. The raw cane sugar refiner, by contrast, receives a raw material with water content generally not exceeding 0.30% by weight.

It is apparent that the highest potential for energy reduction in beet sugar and cane raw sugar production is concentration by reverse osmosis (R.O.) of clarified evaporator thin juice ranging from 12 to 14 refractometric dry substance (RDS) to a maximum of 30 RDS prior to multiple-effect evaporation to 60 RDS thick juice. Utilization of R.O. in the refining operation is probably limited to the concentration of sweet water to 30 RDS prior to evaporation and recycling. Several investigations have reported on the feasibility of using low-temperature cellulose acetate membranes to concentrate evaporator thin juice[1-8].

This progress report identifies the key findings with respect to the technical and economic feasibility of high-temperature membrane utilization within the beet sugar industry to reduce factory fuel requirements by an estimated 25%.

Discussion

The underlying principle of R.O. is defined in Figure 1 which relates sucrose concentration to osmotic pressure. Reverse osmosis or concentration of the sugar solution takes place when the osmotic pressure is exceeded by sufficient pressure necessary to overcome the resistance of a semi-permeable membrane. A literature survey concerning the state of the membrane art indicated that the standard cellulose acetate membrane should be compared with several new high-temperature, wide-pH range membranes. A total of 12 membranes including cellulose acetate from several domestic and foreign sources were evaluated on a performance screening basis. A membrane test stand designed and built to test membranes as sheet stock or in small modules was used during the initial screening tests. Analysis of performance data narrowed the selection of membranes for long-term factory testing to a standard cellulose acetate membrane SEPA-97 and two new high-temperature, wide-pH range non-cellulose acetate membranes identified as U.O.P. PA-300 brackish and sea water, and Film Tek FT-30 membranes. Subsequent long-term factory testing indicated that the standard cellulose acetate membrane service life-span and performance characteristics were not adequate in thin juice concentration service at temperatures not exceeding 55°C at pH 9.0. Test data reported in this paper are limited to those obtained using the new high-temperature U.O.P. PA-300 and Film Tek FT-30 membranes.

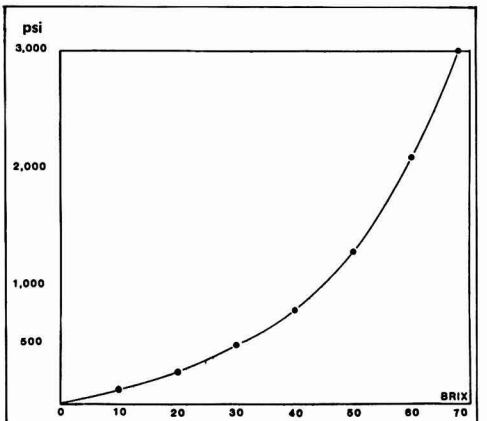


Fig. 1. Osmotic pressures of sucrose/water at 25°C

Figures 2, 3, and 4 indicate the relationship between beet thin juice RDS and flux in gallons per day per square foot of membrane area at temperatures ranging from 25°C to 95°C and a standard operating pressure of 800 psig. These graphs indicate significant thermal compression of the U.O.P. sea water and brackish membrane and marginal compression of the FT-30 membrane at higher temperatures. Examination of the plastic membrane backing material also indicated significant thermal creep and subsequent deformation of the plastic backing material in the commercial low-temperature spiral-wound modules. This deformation physically blocked permeate flow independently of membrane performance.

Figure 5 indicates flux and sugar rejection trends on a one-stage high-temperature module after 800 hours on-line concentration of beet thin juice from approximately 13 RDS to 18 RDS at 95°C and 800 psig. Figure 6 indicates flux, RDS, and concentration-time functions utilizing the U.O.P. 300 sea water membrane to concentrate cane thin juice at 50°C and 800 psig. Sugar rejections exceeded 99% during this short-term run. No significant difference was noted in comparing the concentration of beet or cane thin juice during short term evaluations.

R.O. economic potential

Commercial utilization of R.O. within the beet sugar

* *Paper presented to the 40th Ann. Meeting, Sugar Industry Technologists,* 1981.

1 Baloh: *Sugar J.*, 1976, **39**, (5), 19-25.
2 Bichsel *et al.*: *J. Amer. Soc. Sugar Beet Tech.*, 1970, **16**, 197-206.
3 Idem: *ibid.*, 26-33.
4 Madsen: *I.S.J.*, 1973, **75**, 163-167.
5 Idem: *Zeitsch. Zuckerind.*, 1971, **96**, 612-614.
6 Oulette *et al.*: "Electro Technology Waste Water Treatment and Separation Methods." (Ann Arbor Science, Ann Arbor) 1978.
7 Vane: *Sucr. Belge*, 1977, **96**, 277-282.
8 Wallander: "Treatment of Sugar Solutions by Reverse Osmosis." *Paper presented to Processing Conference, Lund University, Sweden*, 1976.

or cane raw sugar factory is dependent on existing factory energy costs, R.O. operating costs including membrane replacement, the efficiency function of the membrane in terms of gallons of permeate/day/sq. ft., and sugar loss in permeate as a percentage of sugar in juice treated.

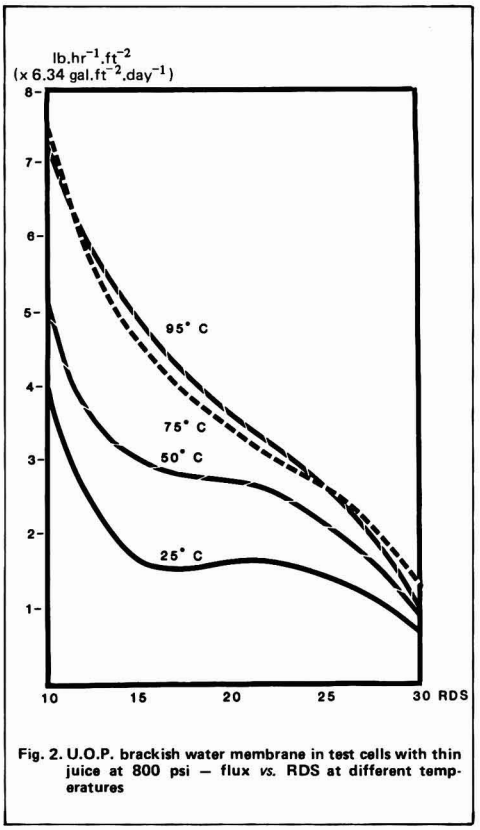


Fig. 2. U.O.P. brackish water membrane in test cells with thin juice at 800 psi — flux *vs.* RDS at different temperatures

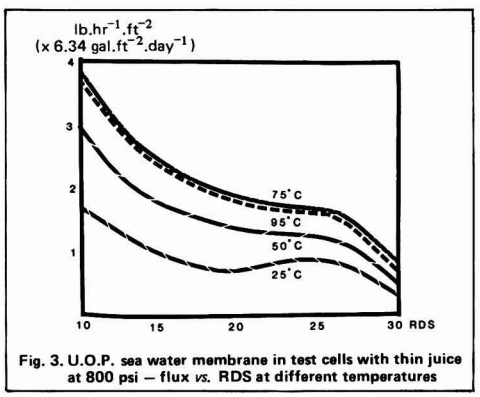


Fig. 3. U.O.P. sea water membrane in test cells with thin juice at 800 psi — flux *vs.* RDS at different temperatures

Comparative economics for different concentration processes have been developed and discussed by R. P. Oulette *et al.*[6]. Cost expressed per 1000 gallons of permeate are estimated at 70 cents using electricity costs at 4 cents/kWh and cellulose acetate membrane service

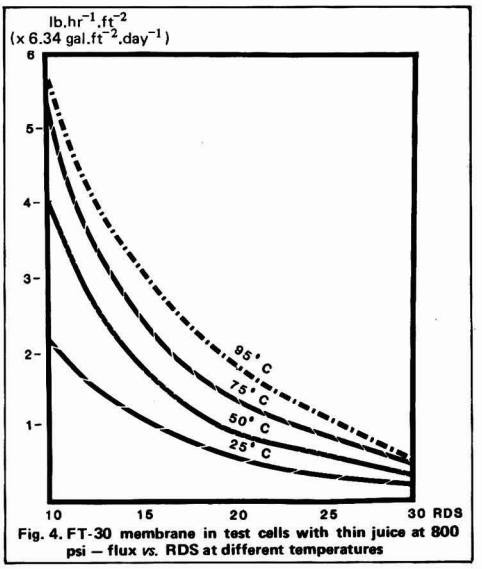


Fig. 4. FT-30 membrane in test cells with thin juice at 800 psi — flux *vs.* RDS at different temperatures

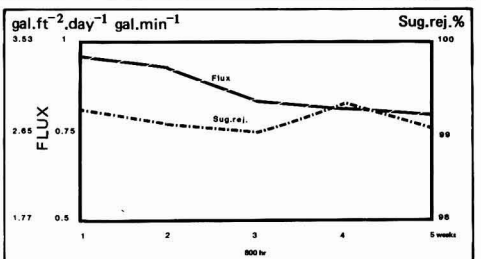


Fig. 5. Performance of the U.O.P. (PA-300) membrane as a function of time (factory on-line testing)

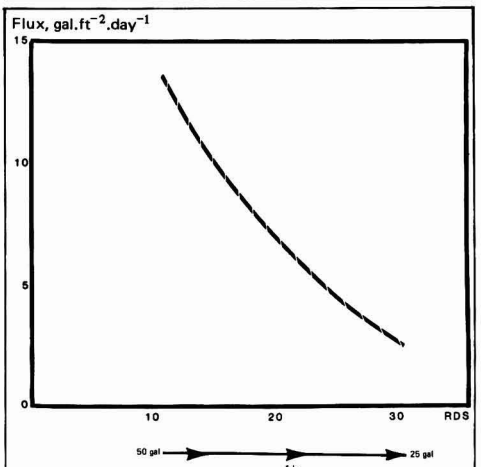


Fig. 6. Cane syrup concentration using U.O.P. seawater (PA-300) membrane in element (68 ft^2) at 50°C — average sugar rejection = 99.9%; salt rejection = 99.5%

life of 2 years. Our estimate of cost per 1000 gallons of permeate from thin juice utilizing the the new higher-cost high-temperature membranes is $1.50, $2.00 and $2.50/1000 gallons of permeate on a three-, two-, and one-year membrane replacement schedule, respectively. These costs compare favourably with evaporation of 1000 gallons of water utilizing standard quintuple-effect evaporators. In this case, 1000 gallons of water may be evaporated for $2.64, $8.98, and $12.78 utilizing North Dakota lignite, No. 6 fuel oil, and natural gas at costs of $1.00, $3.40, and $4.84/million B.Th.U., respectively. The primary impact on potential overall fuel cost savings is apparent. Utilization of "free energy," from bagasse in conjunction with the production of raw cane sugar may negate the economic potential of R.O. use in the raw sugar mill.

Table I determines the simple and basic return on investment at variable R.O. plant capital costs of three different fuel sources identified as: (1) North Dakota lignite coal, (2) No. 6 oil and (3) natural gas, at the costs previously indicated. A, B, and C, refer to membrane and pump service life of three, two, and one year, respectively. Simple R.O.I. is defined as fuel savings credits/year divided by plant capital costs. Basic R.O.I. in brackets is calculated using a 10-year straight-line depreciation schedule and a 50% tax schedule to calculate cash flow which is divided by plant capital cost to determine % after tax R.O.I.

Table I. R.O.I. simple (and basic) for different capital investments

		$0.5 x 10^6	$0.75 x 10^6	10^6
A)	1.	35% (22.49%)	23% (16.66%)	17% (13.75%)
	2.	227% (118.46%)	151% (80.64%)	113% (61.73%)
	3.	342% (176.06%)	228% (119.04%)	171% (90.53%)
B)	1.	20% (14.99%)	13% (11.66%)	9% (9.99%)
	2.	212% (110.96%)	141% (75.64%)	105% (57.98%)
	3.	327% (168.56%)	218% (114.04%)	163% (86.78%)
C)	1.	5% (5.28%)	4% (3.52%)	3% (2.64%)
	2.	197% (103.46%)	131% (70.64%)	98% (54.23%)
	3.	312% (161.06%)	208% (109.04%)	156% (83.03%)

Table II uses the same schedule to determine payback period. Both tables indicate the extreme economic sensitivity to variable energy sources available at significantly different delivered cost/million B.Th.U.

Table II. Payback period in years simple (and basic) for different capital investments (300 W.D.)

		$0.5 x 10^6	$0.75 x 10^6	10^6
A)	1.	2.86 Yrs. (4.5 Yrs.)	4.35 Yrs. (6 Yrs.)	5.88 Yrs. (7.3 Yrs.)
	2.	0.44 " (0.8 ")	0.66 " (1.2 ")	0.88 " (1.6 ")
	3.	0.29 " (0.6 ")	0.44 " (0.8 ")	0.58 " (1.1 ")
B)	1.	5 " (6.7 ")	7.69 " (8.6 ")	11.08 " (10 ")
	2.	0.47 " (0.9 ")	0.71 " (1.3 ")	0.95 " (1.7 ")
	3.	0.31 " (0.6 ")	0.46 " (0.9 ")	0.61 " (1.2 ")
C)	1.	18.94 " (18.9 ")	28.41 " (28.4 ")	37.88 " (37.9 ")
	2.	0.51 " (1.0 ")	0.76 " (1.4 ")	1.02 " (1.8 ")
	3.	0.32 " (0.6 ")	0.48 " (0.9 ")	0.64 " (1.2 ")

Conclusion

New high-temperature membranes appear to have great technical promise with respect to concentration of beet thin juice from 13 to 30 RDS at a cost significantly less than using steam from oil or gas fired boilers. The practical problem of thermal creep within the membrane modules must be solved if the new high-temperature wide pH range membranes are to be used commercially. The new membranes U.O.P. PA-300 sea water and brackish and the Film Tek FT-30 membranes operating at high temperature have the advantage of minimal possibility of bacterial infection within the R.O. module and higher permeate rates/sq. ft. of membrane associated with higher temperatures. Owing to the wider operational pH range possible with the new non-cellulose acetate membranes, more aggressive cleaning agents may be utilized to remove scale or other membrane foulants.

The economic potential of R.O. within the sector of the beet sugar industry utilizing gas and oil energy sources is excellent provided the technical problems associated with high temperature operation are solved in a reasonably cost effective manner. Potential economic advantages with respect to fuel cost savings where low cost North Dakota lignite is used as an energy source are marginal.

Acknowledgement

Funding of this study was provided to the Beet Sugar Development Foundation by the Department of Energy under Contract DE-ACO3-79CS40213. The authors wish to express their gratitude.

Summary

Examination of the use of some new high-temperature membranes for the concentration of beet thin juice indicates considerable potential for cost savings as compared with the use of evaporation. Certain technical problems remain, however, and must be overcome before this potential can be realised on the commercial scale

L'application de la technologie par membrane à la concentration du jus

L'examen de l'emploi de certaines nouvelles membranes résistantes aux températures élevées pour la concentration du jus léger de betterave révèle un potentiel considérable en économies possibles, comparé à l'emploi de l'évaporation. Il reste toutefois certains problèmes techniques et ceux-ci doivent être résolus avant que ce potentiel puisse être réalisé à l'échelle commerciale.

Anwendung der Membran-Technologie für die Saftkonzentrierung

Die Untersuchung der Verwendung einiger Hochtemperatur-Membranen für die Konzentrierung von Rübendünnsaft läßt auf ein beträchtliches Potential von Kosteneinsparungen im Vergleich zur Verdampfung schließen. Bestimmte technische Probleme bleiben jedoch und müssen noch gelöst werden, bevor diese Möglichkeit kommerziell realisiert werden kann.

Aplicación de la tecnología de membranos a la concentración de jugo

Examinación del uso de varios membranos nuevos capaces de operar en temperaturas altas para la concentración de jugo clarificado de remolacha indica potencial notable para ahorros en costos por comparación con el uso de evaporación. Algunas problemas técnicas restan, sin embargo, y tienen que superarse antes de que este potencial puede realizarse en escala comercial.

bosco makes all the difference

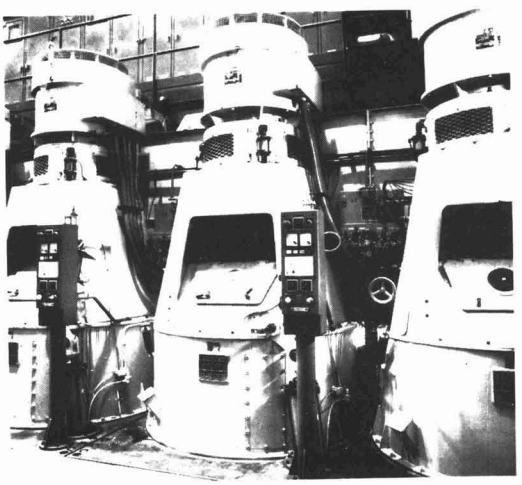
All Bosco sugar centrifugals are designed to reach high hourly outputs and to give the utmost reliability both from a mechanical and an electrical point of view in order to keep investment and operational costs to a minimum.

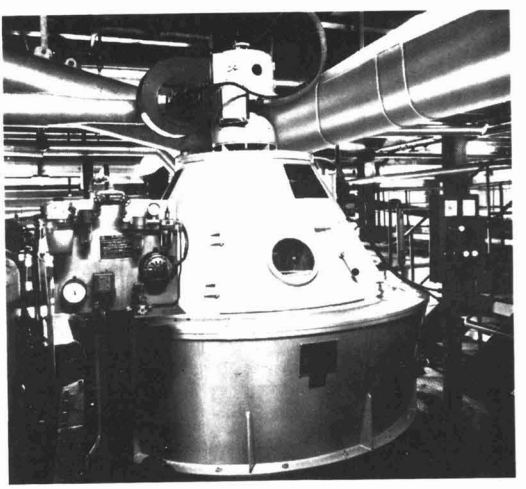
Batch type centrifugals

- high hourly outputs
- high-speed loading and discharging thanks to the use of special devices
- clamping of shaft during discharging phase
- tight shut-off bottom doors
- fully drilled basket in stainless steel with reinforcing rings
- self-supporting structure
- d.c. electric drive
- minimum power consumption

Continuous type centrifugals

- very high outputs more than double those of traditional continuous machines
- pendular suspension, exactly the same as in the batch type machines
- basket of considerable dimensions and weight (about 1 T)
- d.c. electric drive which enables the exact centrifugation speed to be chosen for each product to be handled





bosco

an active presence in the sugar industry

Bosco industrie meccaniche s.p.a. - Terni
Piazzale Bosco, 3 - 05100 Terni - Italy - Telex 660032 - Phone (0744) 55341

SUGAR CANE AGRONOMY

A combination of Tebuthiuron and Diuron for weed control in South African sugar cane. S. K. Coster, J. B. R. Findlay and C. van der Schans. *Proc. 55th Ann. Congr. S. African Sugar Cane Tech.*, 1981, 106-110. Pre- and post-emergence weed control by Bimate (a combination of 25% Tebuthiuron and 50% Diuron) was tested. Best results were obtained with early post-emergence application. No phytotoxicity to plant or ratoon cane was recorded with 4 kg.ha^{-1} Bimate applied to soil containing 8-30% clay or 5 kg.ha^{-1} on soil containing 30-50% clay. The herbicide had no adverse effect on cane sucrose content, and residues of the two component herbicides were below 0.1 ppm in cane juice at all levels of application. Stalk counts and heights were better than in the untreated controls.

Sugar cane for ethanol — should field management practices be modified? I. Variety and seasonal influences. K. E. Cackett and J. J. Rampf. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 149-153. **II. Other agronomic effects.** *Idem ibid.*, 154-160.

I. Studies were undertaken to compare recoverable yields of sucrose and total fermentable sugars for different cane varieties and harvest seasons. Results showed that total fermentable sugars could be satisfactorily estimated from Brix data, that the variety N:Co 376 was the best available variety for both sucrose and ethanol production, and that improved fermentable sugar yields could only be expected from varieties of lower sucrose content than N:Co 376. Variations in the sucrose and total fermentable sugar content throughout the year showed that it would be feasible to start harvesting the cane for ethanol production about two months earlier than the normal start for sugar production.

II. The effects of various agronomic practices on sucrose and total fermentable sugar yields were investigated. It was found that: whereas nitrogen application rates should be reduced for crops harvested during the early part of the season for sugar production, in the case of cane grown for ethanol production high nitrogen levels can be used throughout the year; ripeners increase the total fermentable sugars to a lesser degree than sucrose; post-harvest deterioration has less effect on the total fermentable sugars content than on sucrose; and there is need to determine the optimum topping height for cane quality and the costs of transport and processing, regardless of the final product. It was uneconomical to mill untopped cane for ethanol production, although it was of benefit to top higher for fermentable sugars than for sugar yield in the early part of the season and in mid-season; optimum topping heights were the same late in the season and in flowered cane.

Results of investigations into nozzle distribution pattern with reference to ground application of a sugar cane ripener. J. G. Hardy. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 161-164. — Investigations of cane ripener spraying by knapsack and boom are reported. Recommendations included fitting a boom with flood jet nozzles at 1.6 or 3.0 m spacing, depending on the spray swath desired. The nozzles should face upwards, the maximum recommended swath is 6.0 m and nozzle pressure should be at least 150 kPa (the choice of nozzle size and pressure combination being governed by the operator's walking speed and volume required per ha, which should be within the range 60-120 litres.ha^{-1}). The boom height above the average cane canopy should be about 500 mm. It is important that the equipment is so constructed that the boom can be tilted on hill slopes, under which conditions the spray pressure should be at least 200 kPa in order to minimize variation in nozzle output between the nozzles at the boom extremities.

Nitrogen availability in soils as influenced by organic fertilizers having different C/N ratios. R. A. Wood. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 165-168. — Three soils (a sand, a loamy sand and a clay loam) were treated with fresh or decomposed filter cake, poultry litter or poultry manure having different C:N ratios, and their effects on N availability determined. The results indicated that, even when the C:N ratio is favourable for N mineralization, organic fertilizers may not contribute greatly to the N nutrition of sugar cane at an early stage of crop development, particularly where the soil has a low mineralization capacity; if inorganic N fertilizer were not applied to such soils, a significant delay would probably occur between application of the organic fertilizer and N supply to the plant. It was considered likely that between 40% and 50% of the total N content of decomposed filter cake, applied to soils of high N mineralization potential, would become available to the plant crop. The release of N from 15 tonnes.ha^{-1} of poultry manure was substantial four weeks after application, and equivalent to that obtained by applying 50-100 kg.ha^{-1} N.

The effect of different extraction processes on the nutrient content of filter cake. R. A. Wood. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 177-180. — Samples of filter cake from all the South African and Swaziland sugar factories were analysed for plant nutrients during 1979. The P, Ca, Mg, Zn and Mn contents were found to be much higher on average at factories using cane diffusion than where milling tandems were used. Since a cane producer's allocation of filter cake is based on the amount of cane he delivers to the factory and the average filter cake % cane emanating from the factory, the amount of N in the filter cake allocated to a grower supplying a diffusion factory was only between half and three-quarters of that in filter cake from mill factories. Fly-ash incorporation in filter cake also substantially reduced the N content.

The characteristics of water consumption in sugar cane. IV. Studies on evapotranspiration in ratoon cane under automatic mobile shelter. Y. T. Chang, P. L. Wang and T. P. Yao. *Rpt. Taiwan Sugar Research Inst.*, 1981, (92), 1-8 *(Chinese)*. — An experiment was carried out during the 1980-81 crop year to study the evapotranspiration of ratoon cane under automatic mobile shelters equipped with a non-weighing lysimeter. Evapotranspiration at each growth period was found to undergo the same variation as in autumn-planted cane grown in the same plots one year before. However, the actual evapotranspiration rate per day and the total water consumption of the ratoon cane were higher than for the autumn-planted cane because of the extraordinary dry weather recorded in 1980. The water utilization efficiency of the ratoons was also found to be much lower. It was

concluded that the best water utilization efficiency was not necessarily coincident with the highest total amount of evapotranspiration.

Scope for increased use of herbicides in sugar cane fields. M. L. Agarwal and J. P. S. Malik. *Indian Sugar Crops J.*, 1981, **8**, (2), 7-9. – Some advice is given on chemical weed control, and details are given of nine herbicides together with their performances as determined in trials.

Chemical weed control in sugar cane in India (during the seventies) – a review. S. S. Narwal and D. S. Malik. *Indian Sugar Crops J.*, 1981, **8**, (2), 10-17. – A survey of herbicide application and performance in Indian cane fields is presented together with a concise list of weeds and the States in which they occur. Herbicide effects on cane growth and yield and quality of juice are indicated.

Companion cropping with autumn-planted sugar cane – a critical review. VII. Intercropping of berseem with autumn-planted sugar cane. K. S. Rathi and R. A. Singh. *Indian Sugar Crops J.*, 1981, **8**, (2), 20-22. – Berseem is described as an important fodder crop for the winter season. Results are given of intercropping trials, showing the adverse effect of berseem on cane yield but a total net profit by comparison with cane grown alone.

Ratoon management of sugar cane in Punjab. P. S. Dhillon and N. Singh. *Indian Sugar Crops J.*, 1981, **8**, (2), 23. Recommendations on growing of ratoon crops are given on the basis of investigations conducted at the Sugarcane Research Station, Jullundur.

Respirators protect against harmful effects of agricultural chemicals. E. G. Spry. *Cane Growers' Quarterly Bull.*, 1981, **45**, 14-15. – Three main types of respiratory protection equipment available for use in handling chemicals are described. The most common form is the cartridge–type respirator, and advice is given on when and when not to use it and on its proper care and maintenance. The type of cartridge differs with class of use, and guidance is given on this.

"Boomjets" – a new force in interrow spraying. P. J. McGuire. *Cane Growers' Quarterly Bull.*, 1981, **45**, 17. – A brief description is given of a device which can spray up to 10 rows of cane at a time and treats one hectare in only 10 minutes' spraying time. The heart of the system is a "boomless" nozzle comprising three small flat nozzles and two large off-centre nozzles (which allow a coverage of up to 19.2 m). The "boomjet" is fitted to a vertical steel section, adjustable to a height of over 5 m, which allows crops of all sizes to be sprayed from the correct height above the canopy. Maximum effective coverage is obtainable when the "boomjet" is set 915 mm above the canopy.

GSP – a constant threat. A. A. Matthews. *Cane Growers' Quarterly Bull.*, 1981, **45**, 25-26. – GSP (giant sensitive plant, i.e. *Mimosa invisa)* is a constant threat to crops such as cane, particularly in the wet tropics, and is the only weed listed as a plant pest under the Sugar Experiment Stations Act. During 1980-81 there was a significant increase in the number of new findings of GSP, seedlings having occurred in many instances. The main reasons for the spread are: flooding, which has carried seeds of the weed along streams; the presence of sand (for building work), in which the weed grows readily; and carrying of the seed by farm machinery from infested to non-infested areas. The weed can be controlled by spraying 2,4-D/2,4,5-T (20 g + 20 g a.i. per litre of mixture) at the rate of 3 litres.ha^{-1} ; a wetting agent is recommended.

Parthenium weed found in the Burdekin. Anon. *Cane Growers' Quarterly Bull.*, 1981, **45**, 27. – *Parthenium hysterophorus* is an annual with erect stems found growing to a height of 1.25 m in a block of Q 63 cane ratoons. Spraying with Atrazine or 2,4-D has had only limited success, but control is possible through early ploughing of the cane (all of which has to be harvested and ploughed-out as part of a leaf scald disease control program) and long fallowing of the field. However, future spread of the weed could come about through seed transfer by birds.

Navua sedge – another weed problem? E. G. Spry. *Cane Growers' Quarterly Bull.*, 1981, **45**, 28. – The title weed, *Cyperus aromaticus,* is described as a possible threat to major cane areas in Queensland, having been found in certain factory areas (but not in cane blocks). A native of Africa which has become naturalized in Fiji and a number of Pacific islands, the weed grows on a wide range of soils in areas of high rainfall, preferring damp areas with permanent moisture and low-lying swampy areas. In Fiji, it is regarded as the most serious single weed. The most effective means of control is Roundup sprayed at 2 litres per 200 litres of water; however, this cannot be used in cane, but continued cultivation to bring the roots to the surface will give some control.

Beware of the traps in spreading fertilizer. P. J. Nielsen. *Cane Growers' Quarterly Bull.*, 1981, **45**, 35. – While broadcast surface application of fertilizer by spreader is fast and uses less power and labour than application below the soil, it can lead to a reduction in crop return. It may be of advantage with P and K under certain circumstances (although no comparative trials have been conducted on the two methods), but is not recommended with N. Some advice is given.

Lime on copper-deficient soils can increase "droopy top". T. G. Willcox. *Cane Growers' Quarterly Bull.*, 1981, **45**, 36. – Copper is an essential micro-nutrient for cane growth; where soils have low levels of it, application of lime may cause a copper deficiency and so-called "droopy top". Application of Ca and Mg to remedy deficiencies in these elements should be followed by copper sulphate application (at 40-50 kg.ha^{-1}) where there is a Cu deficiency.

Studies on the cultivation of nitrogen-fixing micro-organisms. I. Isolation of blue-green algae from sugar cane fields and measurement of their nitrogen-fixing activities. Y. T. Chuang, C. M. Huang and W. P. Chen. *Rpt. Taiwan Sugar Research Inst.*, 1981, (92), 29-41 *(Chinese).* – The purpose of the study was to cultivate those N-fixing micro-organisms that could be used as soil inoculant in order to save the expense of N fertilizer in cane fields. Numerous blue-green algae, N-fixing phototrophs, were isolated from soil in cane fields located in central and southern Taiwan. Their N-fixing activity was determined by the acetylene-reduction technique and could reach as high as 1.23 μmoles acetylene per hour per mg dry cell. Results showed that the degree of acetylene reduction fell considerably in the presence of inorganic N (nitrate and ammonium salts) and was about the same whether the reaction was carried out in argon or air, indicating inhibition of atmospheric N fixation by the acetylene. It was also proportional to the reaction time, up to 6 hours. Light was necessary

for N fixation activity, which was also affected by the partial pressures of acetylene and oxygen (being maximum at an oxygen partial pressure of 0.1 atm).

Cane plant nutrition. Anon. *Australian Canegrower,* 1981, **3,** (6), 13-14. — The role played by N, P, K, Ca, Mg, S and trace elements in cane growth is briefly explained, and the importance of combating salinity by good soil drainage and of maintaning soil pH at no lower than 5.5 is discussed. A table shows the quantities of specific nutrients removed by the cane crop at sites in various districts of Queensland.

Helpful hints with herbicides. Anon. *Australian Canegrower,* 1981, **3,** (6), 16. — Factors to be considered in selecting herbicides for specific functions are given and hints for safe use of herbicides and achieving maximum cost effectiveness are listed.

Chemical gives a clean burn. Anon. *Australian Canegrower,* 1981, **3,** (6), 20. — Mention is made of the advantage of treating cane with a desiccant such as Gramoxone as an aid to pre-harvest burning. There is no accumulation of the active constituent (Paraquat) in the soil, and even if the cane is not burnt, treatment with the chemical has been found to permit more rapid and easier harvesting and hence savings in fuel.

Estimating total leaf area of sugar cane using stalk diameter measurements. R. L. Lapitan. *Crystallizer,* 1981, **4,** (2), 13-15. — Experiments were carried out to establish the possibility of a correlation between log stem diameter and log total leaf area for sugar cane. Results for three varieties showed that there was a high linear correlation between the two parameters for the three varieties and for the primary, secondary, tertiary and quaternary tillers up to a crop age of nine months, after which the relationship became an inverse one as a result of an acceleration in the rate of senescence.

Organic fertilizer from cane trash as soil ameliorant. C. S. Abrigo. *Crystallizer,* 1981, **4,** (2), 13, 15. — Since material of high C:N ratio, such as cane trash, applied directly to soil has been found to decompose at the expense of soil N, with the result that the level of available N eventually falls, studies were conducted on treatment of cane trash to convert it to an organic fertilizer before application. Sun drying, grinding and subsequent microbial degradation under controlled conditions of moisture, temperature and C:N ratio over a period of five weeks gave a product which, when added at the rate of 5.5 tonnes.ha^{-1}, significantly increased cane yield from 61 to 78.7 tonnes.ha^{-1}, pol content from 12.80 to 14.1% and juice purity from 81.88 to 88.10. The yield of the 1st ratoon crop was also raised, from 58 to 62.5 tonnes.ha^{-1}.

Benefits of improved drainage in cane growing. Anon. *Australian Sugar J.,* 1981, **73,** 221-222, 224. — Indicators of poor soil drainage are listed, and the advantages and disadvantages of surface and sub-surface drainage discussed. The benefits of mole drains as a cheap and effective method of sub-surface drainage are indicated, and advice is given on maintenance of drainage structures. The positive effects of improved drainage on cane growth are listed.

Erosion control and the drainage unit. L. Hepworth and L. Syphens. *Australian Sugar J.,* 1981, **73,** 225-226, 228. — The authors describe how to control run-off and achieve effective water management on gently sloping cane land by combining erosion control with drainage and irrigation measures.

Cost of production of sugar cane, May 1981. C. M. González T. and C. A. Gargiulo. *Bol. Estac. Exp. Agro-Ind. Obispo Colombres* (Tucumán), 1981, (135), 17 pp *(Spanish).* — Calculations and data are presented on the basis of a 100-ha cane area in Argentina on 90 ha of which cane is grown, the remainder being devoted to roads, buildings, etc. It is assumed that the cane is grown in 60 rows per ha and with a yield of 1 tonne per row. The machinery costs are calculated on a basis of linear depreciation over appropriate periods and include fuel and maintenance costs. Labour costs allow for salary increases, etc., and the bulk of the paper is comprised of tabular data for the calculations.

Sugar cane desiccation. Reduction of trash in cane without burning, mechanically harvested. D. Sandoval. *La Ind. Azuc.,* 1981, **87,** 176-177 *(Spanish).* — Mechanical harvesting of cane had reached almost 50% of the total in Argentina in 1980, and a problem is the high level of trash in the cane, between 8 and 18% (average 10.9%). Burning is practised generally, but at the start of the season the trash does not burn easily and atmospheric humidity is such as to hinder loss of water. Trials were made to assess the action of Paraquat as a desiccant. The average trash content in the trials was reduced from 7.96 to 4.83%, and this raised the value of the cane by 198,000 pesos per ha against a cost of chemical plus application of 90,000 pesos per ha.

Infield drainage systems research and installation at Kekaha Sugar Company. A. C. Fehrman. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 58-63. — About 2000 acres of the lowland cane fields belonging to Kekaha Sugar Co. suffer from moderate to severe problems of drainage and salinity, most of it being formerly marshland near the sea. Various methods have been tried to improve cane yields, but only since 1979 has a concerted effort been made with subsurface drains in conjunction with a program of conversion to drip irrigation, as already used in the company's highland fields. Advantages and disadvantages of tube drains and Agzip drains are indicated; the latter type of drain comprises a strip of perforated, flexible polyethylene with tabs on one side and slits on the other so that it can be formed into a 2-inch tube installed by pulling directly into the ground behind a mole plough while it is simultaneously drawn through a tube-forming machine. Results of comparative experiments showed that trenched-in corrugated tubing gave the best average peak flow, although trenching is more time-consuming and cumbersome than installation with a mole plough. On the basis of results obtained from nearby well-drained fields and from experiments conducted with corrugated tubing 12 years ago, a marked increase in sugar yield per acre could be expected.

Salinity assessment by direct measurement with a four-electrode probe. E. A. Barnes. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 64. — While determination of soil salinity by conventional means is too time-consuming and expensive for the information to be incorporated in management decisions, a direct method based on the measurement of bulk soil electrical conductivity using a 4-electrode probe, has been developed. Measurement is very simple, but assessment of the salinity relies on two empirical calibrations, a technical and a statistical one.

SUGAR CANE MECHANIZATION

The IISR tractor-mounted sugar cane harvester. M. P. Sharma and K. Singh. *Indian Sugar Crops J.*, 1980, **7**, 95-98. — A description is given of a tractor-mounted single-row cane harvester designed and developed at the Indian Institute of Sugarcane Research which can cut 1.5-2.0 ha of cane in 8 hours, placing it in windrows for manual topping and trash removal. The cane is cut near ground level by a three-bladed disc rotating at 600 rpm in an anti-clockwise direction. Development of the machine has been prompted by shortages of labour for manual cutting.

Improved field practices can reduce harvesting costs. C. D. Jones. *Cane Growers' Quarterly Bull.*, 1981, **45**, 29-31. — Advice is given on measures to reduce the costs of cane harvesting; they include care in clearing and preparing land so as to ensure that no timber is left on the ground after planting of the cane; removal of grubber and weeder rake tines that have snapped off; checking and grading of headlands; and care in preparation of cane blocks, to make sure that ground conditions and row widths are suitable.

Planters and planting methods at Davies Hamakua. G. Aganus. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 39-40. — Information is given on the three-pass, open-line system adopted by Davies Hamakua Sugar Co. for planting of setts to overcome the problem of poor cane distribution commonly encountered with the previous system (18-20% blanks).

Planting methods at Oahu Sugar Company. G. W. Freeland. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 41-42. — The sett planting system used in drip- and surface-irrigated fields is described. All gaps of at least 3 ft in a cane line are filled manually 4-6 weeks after planting, although replant cane requirements have been reduced to one-third of what they used to be. Details are given of the quantities of seed cane required. No ratoons are grown for reasons stated.

Planters and planting methods at McBryde Sugar Company. K. A. Smith. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 43-44. — Details are given of the planting system used in drip- and furrow-irrigated fields as well as unirrigated fields, using a fleet of Stubenberg machines. Some open-line planting is being used on a trial basis.

Current methods of soil preparation at Oahu Sugar Company. D. R. Gerbig. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 45-46. — The equipment and methods used for soil preparation in drip- and furrow-irrigated fields are briefly described. A major problem is cloddiness in the drip-irrigated fields, especially with black soils, and attempts are being made to overcome this by using, in sequence, harrows of increasing disc size, followed by a ripener.

Current methods of soil preparation at HC & S Company. C. T. Fisher. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 47-49. — An illustrated description is given of the operations used in soil preparation, with particular mention of the problems arising from the use of drip irrigation, especially with regard to the need for adequate water movement directly after planting.

Soil compaction in sugar cane fields. G. Uehara, R. G. Chase, J. Wakatsuki and P. H. Moore. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 50-53. — Reference is made to experiments to determine the effects of soil compaction. In one, carried out in a vegetable crop, it was found that the adverse effect of soil compaction on root development could be greatly offset by maintaining an adequate quantity of water and nutrients in the root zone at all times, that a subsurface drip irrigation system can withstand moderate soil compaction from field equipment, and that the soil can be cultivated indefinitely without tillage if it is protected from heavy machinery. Similar results were achieved in a lettuce crop, also grown under drip irrigation but on a different soil. A third experiment was carried out in a surface drip-irrigated cane field in which conventional, deep and excavation tillage methods were used. The factors requiring observation are listed, but no results were known by the time of writing of the article.

Tillage effectiveness study at Kekaha Sugar Company. L. Tornbom. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 54-57. — Investigations of tillage and its effectiveness in a field being prepared for cane planting and in fields of growing cane are reported, and the adverse effect of compaction on root growth is discussed. Observations showed that compaction was a problem in 60% of the fields, particularly when tillage was carried out on wet soil, but also mainly where drainage was inadequate. In order to reduce the problem and make better use of tillage equipment (particularly against the background of rising energy costs) it is recommended to till only when the soil is relatively dry and use the equipment in a sequence that will ensure that the work of one implement is not undone by the next operation.

Davies Hamakua short-cane harvest system: field view. R. B. Toledo. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 163-165. — Experiences in mechanical harvesting using chopper-type machines are described. For various reasons, chiefly problems in maintenance of the loading buggy undercarriage and track assembly, difficulties in transport coordination and inability of Ookala factory to handle the dry-cleaned billets without some washing, it was decided to halt further work on chopped cane harvesting and revert to whole-cane, push-rake harvesting systems. Comparison of pol losses in washed and unwashed cane showed that those in the unwashed cane were much higher.

Liliko systems — island of Hawaii. L. Mochida. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 170-171. Details are given of the systems used by the four sugar companies on the island of Hawaii to recover cane left in the field after mechanical harvesting.

Hydraulic crane application in the sugar industry. J. Donlin. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 172-173. — The author discusses the advantages of hydraulic cranes over cable-operated machines used for cane loading in the field and for cane handling in the yard.

CANE PESTS AND DISEASES

Field trials with scale insect predators in eastern Uttar Pradesh (India) for biocontrol of sugar cane scale insect *Melanaspis glomerata* **Green (Hemiptera:Coccidae).** M. P. Misra, A. D. Pawar and R. Samujh. *Indian Sugar Crops J.*, 1981, **8**, (1), 13-14. – Three species of coccinellid predators of the scale insect were released in cane fields: *Pharoscymnus horni, Sticholotis madagassa* and *Lindorus lophanthae;* the first two were released after mass breeding in the laboratory, while the third was directly released in the fields. From the considerable reduction in the numbers of *M. glomerata* and recoveries of *P. horni* and *S. madagassa,* these are regarded as highly promising means of control.

The experimental report on the toxicity of the new anti-coagulant rodenticide Klerat. S. T. Tseng. *Taiwan Sugar,* 1981, **28**, 92-95. – Application of 0.005% Klerat (an ICI formulation) in rice cake bait at 0.3 $kg.ha^{-1}$ in spring-planted cane and ratoons, 0.5 $kg.ha^{-1}$ in autumn-planted cane and 0.25 $kg.ha^{-1}$ in young autumn-planted cane was highly effective in controlling *Rattus* spp. and *Bandicota nemorivaga* in Taiwan. The rodenticide at the above concentration gave as good as or better results than 0.025% Warfarin, so that the risk of accidental poisoning of other animals is reduced. The moderate toxicity and lack of odour of Klerat contributed to good bait acceptance by rats, even those classed as "bait shy".

Sugar cane diseases in the Philippines. T. T. Reyes. *Crystallizer,* 1981, **4**, (1), 6-7, 17-18. – A survey is presented of diseases affecting cane found in the Philippines, with details of the causal organisms, symptoms, control means and cane varieties resistant to each disease.

Trials with nematicides registered for use on sugar cane in South Africa. P. K. Moberly and M. St. J. Clowes. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 92-98. – Nematicide trials were conducted on a number of cane varieties growing in sandy soils of the Fernwood series (containing up to 6% clay) and of the Clansthal series (containing 7-15% clay). Results for plant and 1st, 2nd and 3rd ratoon crops showed that response, in terms of increased expected sugar yield, in the soils of lower clay content was generally double that in the other soils, although the average response in all crops was more than enough to cover the costs of treatment; at current prices a cane yield increase of 5-6 $tonnes.ha^{-1}$ would be necessary to cover the costs of treatment. Temik at 20 $kg.ha^{-1}$ was more effective than Curater 10% G at 30 $kg.ha^{-1}$ and slightly more effective than Vydate L (24%) at 12 $litres.ha^{-1}$; economies could be made by reducing the Temik application rate to 15 $kg.ha^{-1}$ for ratoon crops growing in Clansthal series soils. However, it is suggested that it would be preferable to use a combination of Vydate and a trash blanket rather than burn the cane and use one of the granular nematicides, while frequent irrigation of the sandy soils is likely to produce far greater yields than nematicide treatment of rain-fed cane. Under very dry conditions, application of filter cake in the planting furrow may reduce the positive effects of a granular nematicides, which (in a poor Fernwood series soil) should therefore be applied 2-3 months later, unless the dry conditions persist. In a Clansthal series soil a nematicide is preferred to filter cake. Since it has been found that there is no disadvantage in delaying application of a granular nematicide, before deciding to treat the whole field a grower could apply nematicide to test strips in order to determine whether a response would be likely. There was a statistically significant interaction between variety and response to Temik.

A history of the outbreaks of *Eldana saccharina* **Walker in Natal.** P. R. Atkinson, A. J. M. Carnegie and R. J. Smaill. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 111-115. – The authors trace the spread of the title borer from the initial outbreak in 1970 and indicate the levels of infestation in various factory regions. While the spread appears to be related to drought, there is no evidence that infestation levels have increased in fields infested before drought; however, the insect tends to oviposit in dry leaf matter rather than living tissue, so that the accelerated spread occurring during 1979-80, when South Africa was affected by a very severe drought, could have resulted from the abnormally large amounts of dry matter available. Other possible reasons for the recent outbreak are discussed. An outbreak of the borer between 1939 and 1953 was confined to the Umfolozi region, and it is not known why it did not spread nor why it eventually disappeared.

Combating *Eldana saccharina* **Walker: a progress report.** A. J. M. Carnegie. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 116-119. – The situation regarding the pyralid cane borer, *E. saccharina,* in South Africa and investigations of population monitoring and possible means of control (covering crop management, biological control and chemical control) are discussed. A number of predators have shown promise, whereas there has been lack of evidence of positive effects of insecticides, although chemical control is considered so important that a new program of insecticide trials has been instigated. While borer incidence was apparently unaffected by burning of cane, as opposed to trashing, irrigation, drainage or nematicide applications, the population increased with greater amounts of nitrogen fertilizer applied in trials; however, surveys in commercial cane did not confirm these results, and the trials were to be repeated on a wider range of soil types.

The macro-arthropod community of sugar cane fields and of *Cyperus immensus* **stands.** G. W. Leslie. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 120-126. – As part of a study of predators of *Eldana saccharina* borer, arthropods associated with cane 7-11 months old and with the sedge *C. immensus* were collected at 2-month intervals over a 15-month period in four regions. More arthropods were found on stools of the sedge than on cane (possibly because of agricultural practices in cane fields), although one of the two most abundant taxa (out of twenty found), viz. Formicidae (ants) was found in greater numbers in cane; the other most abundant taxon was Araneida (spiders). These two taxa are considered to include the more important predators of the borer mainly because of their abundance. The greatest numbers were recorded from samples collected in April or June, which could be related to environmental factors.

Introduction of a seed cane improvement scheme in the Central Zululand extension area. A. B. Tucker, T. J. Prince and P. H. Fox. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 139-142. – Information is given on a seed cane improvement scheme introduced in 1980, in which growers were asked to submit their potential seed cane fields to inspection in order to determine if they were free from major diseases and to determine their trueness to type. Surveys revealed that 22 out of 234 fields sampled were affected by ratoon stunting disease, 33 out of 213 fields contained smut (but only half of these had more than 0.5% of the stools affected), 39 were mosaic-infected (13 with more than 0.5% of the stools diseased), and 32% of all the fields of a given individual variety contained more than 0.5% of other varieties (which is the level considered unsatisfactory for seed cane). The value of the scheme in permitting rejection of unsuitable fields was thus demonstrated.

Effect of soil moisture on larval movement of *Melanotus tamsuyensis* Bates. S. A. Hsieh. *Rpt. Taiwan Sugar Research Inst.,* 1981, (92), 19-27 *(Chinese).* – Laboratory experiments and field surveys revealed that the larvae of the wireworm *M. tamsuyensis* were very sensitive to soil moisture, which at 15-20% was optimum for larval activity. Soil moisture had a repellent effect on the larvae at 25% in sandy soil and at 5% in loam and clay soils. The larvae appeared to be more adaptable to a wide range of water content in sandy loam soil, but their activity was very much affected by a reduction in moisture content to below 5%. Field surveys of larval population at different soil levels showed that the greatest concentration (34.8-42.6%) occurred in cane stubble, followed by 29.5-34.5% in the 11-20 cm layer and 13.9-21.3% in the 6-10 cm layer. Density was generally lower in the top 5 cm and 21-30 cm layers. During the June-September rainy season, the larvae in the soil moved upward because of the increase in soil moisture, resulting in greater damage to the underground part of cane plants. By contrast, downward movement was observed during the October-April dry season.

Record of leaf scorch disease of sugar cane caused by *Stagonospora sacchari* (Lo & Ling) in India. S. Kumaraswamy. *Indian Sugar Crops J.,* 1981, **8**, (2), 24-25. – A description is given of the symptoms of the title disease observed on KHS 2045 cane in the Mandya district of Karnataka, where it caused 15-20% leaf damage at a number of sites.

Further spread of the Gurdaspur borer, *Acigona steniella* (Hampson) *(Bissetia steniella* Hampson) (Pyralidae: Lepidoptera) in Haryana. J. Prasad and A. D. Pawar. *Indian Sugar Crops J.,* 1981, **8**, (2), 26. – A brief report is presented on the occurrence of the title borer in various cane areas of Haryana.

Occurrence of sugar cane downy mildew and suggested control measures. F. T. Gargantiel and F. C. Barredo. *Crystallizer,* 1981, **4**, (2), 13, 16. – Trials on control of downy mildew by means of a systemic fungicide, CGA 48-988, are reported. Setts of VMC 67-175, a highly susceptible variety, were immersed for 0, 10 and 60 minutes in concentrations of 125, 200 and 250 g a.i./ 500 litres. In all cases, except dipping (but not prolonged immersion) in the lowest concentration, 100% control was achieved by comparison with an incidence rate of 32.28% in setts dipped only in water. Other possible control measures are also mentioned.

Proper precautions ensure safe use of pesticides. G. C. Wilson. *Cane Growers' Quarterly Bull.,* 1981, **45**, 11-13. Advice is given on safe use and handling of pesticides. Details are given of the degree of oral and dermal toxicity of a large number of chemicals, and symptoms of poisoning by the groups of pesticides commonly used in cane are briefly described. Causes of accidents are summarized.

Comparative virulence of different isolates of sugar cane wilt pathogen *(Fusarium moniliforme* var. *subglutinans* Wollenw. & Reink). K. S. Waraitch. *Indian Sugar,* 1981, **31**, 37-40. – The comparative virulence of eight isolates of the title pathogen obtained from various cane varieties was determined by the plug method of inoculation, on the basis of linear spread of infection, number of nodes crossed as well as type of lesion developed in the internode next to the inoculated one. Results for three years demonstrated differences between the pathogenicities of the isolates and between the reactions of the two susceptible varieties inoculated. The data are tabulated.

Status of smut in Hawaii – a research progress report. J. C. Comstock and S. A. Ferreira. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 75-78. – Tests are reported in which setts were treated with hot water for 20 min at 52°C and then dipped for 20 min in 1000 or 5000 ppm Bayleton (produced by Bayer AG) or CGA-64251 (produced by Ciba-Geigy Corporation). The setts were then planted in plots adjacent to a plot of smut-infected cane. Very little smut developed in the plant crop, which was ratooned at 5 months; at 4 months, the ratoon crop was checked for the degree of infection and a 2nd ratoon crop started, the degree of infection again being determined at 4 months. For each of three varieties, CGA-64251 was generally far more effective than Bayleton in reducing smut incidence, its performance increasing with the higher dosage. In another experiment, it significantly reduced the percentage of infected stalks by comparison with the control, and again performance improved with dosage rate. A new smut inoculation technique is described in which single-eye setts were treated with hot water for 20 min, dipped in 300 ppm Benlate fungicide for 1 min, then incubated for 7-10 days at 28°C. When the shoots were 12-15 cm tall they were inoculated with a total of 0.5 ml of a teliospore suspension in the meristem region, each shoot being injected twice on opposite sides. After overnight incubation, the setts were planted in the field and infection determined 4-5 months later. Distinct differences were found between the reactions of eight varieties to the A and B strains of the pathogen *(Ustilago scitaminea),* while results were comparable to the smut grades obtained with the artificial dip-inoculation technique.

Obtaining fertilized eggs from *Diatraea saccharalis* under laboratory conditions. J. R. Araújo, S. M. S. S. Araújo, P. S. M. Botelho and N. Degaspari. *Brasil Açuc.,* 1981, **98**, 67-73 *(Portuguese).* – Laboratory conditions were varied to determine the most suitable for obtaining eggs of the title borer. In each case 10 females and 15 males were placed in polyethylene tubes 6 inches in diameter and 8.8 inches high, and temperatures were varied in 3° stages from 17° to 32°C, photoperiod in 6 hr stages from 0 to 24 hr, and the concentrations of sugar and honey also varied. Best results were obtained with a photoperiod of 12 hr, temperature of 20°C and a feeding with 5% sugar solution.

CANE BREEDING AND VARIETIES

Some implications of genetic drift for sugar manufacture. B. T. Roach, J. Daniels, N. H. Paton and P. Smith. *Proc. Australian Soc. Sugar Cane Tech.,* 1981, 275-282. While hybridization of *Saccharum officinarum* with *S. spontaneum* has produced highly efficient varieties in terms of sugar yield per ha, *S. spontaneum* does have many characteristics that are undesirable for processing purposes. Existing cane breeding programs aimed principally at maximizing sugar yield are probably increasing the ratio of *S. spontaneum* to *S. officinarum* chromosomes in hybrids, and adverse genetic correlations within the *S. officinarum* genome may be adding to the problem. There is a danger that unless levels of characteristics such as fibre, ash, starch and colorant content are monitored during the evolution of new hybrids, there could be a genetic drift in these characteristics toward unacceptable and eventually uneconomical levels. The authors reject the inevitability of decline in processing quality, and suggest four possible means of preventing long-term decline.

Flowering in sugar cane at different localities in north Queensland. J. S. Pollock. *Proc. Australian Soc. Sugar Cane Tech.,* 1981, 283-286. – The flowering habits of 25 varieties, known to flower sparsely at Meringa Sugar Experiment Station, were observed at six localities. Flowering was more intense and more advanced for most varieties at Walkamin (at an altitude of 580 m) than at the other locations. Seedling germination rates from crosses using female parents from Walkamin were satisfactory. Generally, low pollen viability associated with lower temperatures may limit availability of male parents, but overall seed set and flower availability warranted establishment of a permanent parent collection at Walkamin. Evidence of variety-location interactions for flowering suggests further use of specific locations for flower production in the cross-pollination program.

Cane breeding in Réunion. *Rpt. Centre d'Essai de Recherche et de Formation* (Réunion), 1980, 4-23 *(French).* – In 1980, 1156 crosses (a total of 325 different combinations) were produced between 65 female and 40 male varieties. However, only 210 of these combinations have been successful. The progeny from 159 crosses were sown, 58% of the total coming from hybridization carried out in 1980. H 39/3633, F 156 and R 569 were the females most used for crossing; the corresponding males were R 570, CB 45/6, M 1227/62 and M 907/61. As in previous years, F 146 was among the best seed bearers; CP 48/103 and H 39/3633 were the others. Details are given of the seedlings planted in the nursery and of their parents, and results of varietal trials, mostly concerning ratoon crops, are tabulated and discussed.

Varietal trials in Réunion. *Rpt. Centre d'Essai de Recherche et de Formation* (Réunion), 1980, 34-120 *(French).* – Tabulated results are given of numerous varietal trials conducted at various locations in Réunion

Sugar cane varieties in West Africa. Anon. *IRAT Informations,* 1981, (13), 3-4 *(French).* – It is stated that, for some 20 years, IRAT (the Institute of Tropical Agronomic Research) has been building up collections of cane varieties in most of the French-speaking countries of West Africa; the choice of variety is based, wherever possible, on its performance in major sugar-producing countries. Lists are given of the principal varieties, in order of decreasing importance, in countries of the Western Hemisphere, Asia and Oceania (excluding India), Africa and the Indian Ocean, followed by lists for West African countries. It is shown that five varieties are grown in a number of countries, while five are in decline in several countries because of susceptibility to smut (N:Co 310 appears in both groups) and one because of rust susceptibility; B 46364 and M 3145 have performed better in French-speaking West Africa than elsewhere. It is thus concluded that, although the reputation of a given variety may be a sound basis for preliminary selection, there is still need to test it in the country in which it is introduced.

Biological activity of the gibberellin-like substance in sugar cane +1 leaf blade. K. M. Huang and Y. S. Chang. *Taiwan Sugar,* 1981, **28**, 56-59. – See *I.S.J.,* 1982, **84**, 113.

The pedigree of selected Canal Point (CP) varieties of sugar cane. P. Tai and J. D. Miller. *Proc. Amer. Soc. Sugar Cane Tech.,* 1978, 34-39. – The pedigrees of 17 CP varieties released for commercial production or developed as breeding lines during the last two decades are documented; the information given includes the frequency of transmission of *Saccharum* genetic factors and shows that *S. officinarum* was the major contributor of genetic factors, followed by *S. barberi* and then *S. spontaneum. S. sinense* was transmitted in the pedigrees of seven of the varieties.

Biomass and sucrose production in sugar cane. I. Divergent selection strategies. R. D. Breaux and B. L. Legendre. *Proc. Amer. Soc. Sugar Cane Tech.,* 1978, 156 *(abstract only).* – The yield components desirable in a cane variety to be used for biomass production differ from those in a variety for sugar production; total solids (fibre + Brix) % cane and total solids per ha replace sugar per tonne and sugar per ha. All these yield components were measured in 30 clones each of an F_1, BC_1, BC_2 and two BC_3 progenies of *Saccharum spontaneum* US 56-158 bred to commercial-type sugar cane. The highest mean yield of total solids per ha occurred in the F_1 progeny, but the highest mean yield of sugar per ha occurred in the BC_3 progenies. Back-crossing to commercial varieties resulted in a sharp reduction in yield of cane per ha in the BC_2 progeny and a more gradual reduction in total solids % cane. The yield of sugar per ha increased with the back-cross generation, because the increase in sugar per tonne of cane more than compensated for the loss of cane tonnage. The data show that, if selection pressure for sugar per tonne of cane were removed, it would be possible to select varieties that yield much more biomass than varieties grown commercially for sugar production.

Potential cytogenetic approach in sugar cane breeding. B. S. Gill. *Proc. Amer. Soc. Sugar Cane Tech.,* 1978, 156 *(abstract only).* – Two concepts have recently emerged from the cytogenetic analysis of genome in polyploid plant species. First, the diploid-like chromosome pairing in a polyploid is controlled by a single major gene. In

the absence of this gene, multivalent formation occurs during metaphase I of meiosis. Second, in hybrids involving a polyploid plant (which lacks the chromosome pairing gene) with related genera, intergenomic chromosome pairing also occurs. In wheat, a mutation (possibly a deletion) of the chromosome-pairing gene has been used to transfer genes from genera as far removed as *Agropyron* and rye. There is an urgent need for basic cytogenetic research in sugar cane to elucidate the genetic control of chromosome pairing and explicate its use in intergeneric gene transfers. Some other recent advances in chromosome cytology also need to be explored for possible application in sugar cane breeding.

Biomass and sucrose production in sugar cane. II. Association with yield components. B. L. Legendre and R. D. Breaux. *Proc. Amer. Soc. Sugar Cane Tech.*, 1978, 158 *(abstract only)*. — The relationship between yield components and biomass and sucrose production was studied in 30 clones of an F_1, BC_1, BC_2 and two BC_3 progenies of *Saccharum spontaneum* US 56-158 bred to commercial types of sugar cane. Both total solids (a biomass component) and sugar per ha were highly associated with tonnes of cane per ha for all progeny generations. Sugar per ha was positively associated with sugar per tonne of cane. Total solids was negatively associated with sugar per tonne when all generations were combined; however, there was no association of total solids with sugar per tonne of cane within generations. Total solids was associated with fibre % cane, but, within a progeny generation, sugar per ha was not. In all generations, total solids was associated with sugar per ha and both were associated with tonnes of cane per ha. Despite these associations, the opposite effects that selection for sugar per tonne of cane has on biomass and sugar production require separate breeding programs.

Breeding for and selecting sugar cane genotypes that respond to ripeners. F. A. Martin. *Proc. Amer. Soc. Sugar Cane Tech.*, 1978, 158 *(abstract only)*. — For two consecutive years, 24 experimental sugar cane varieties were tested for response to the chemical ripener Glyphosine. Six weeks after treatment, the effects of Glyphosine on stalk weight, sugar per tonne and sugar per acre were determined. The genotypic variation of response was observed for the three yield components. Of particular interest was the range of the effect on stalk weight (from positive to negative) that was apparently associated with genotypic variation. The fact that crosses which yield high frequencies of positively responding progeny can be identified should make breeding and selection for response to chemical ripeners feasible.

Relation of pollen and pistil characteristics in setting of true seed in sugar cane crosses. S. Nagatomi and P. H. Dunckelman. *Proc. Amer. Soc. Sugar Cane Tech.*, 1978, 159 *(abstract only)*. — A study of the association between seed set in sugar crosses and the condition of the floral organs was made at Houma, Louisiana. A positive correlation was found between breeding generations and the size and variability of pollen grains. The more highly nobilized the generation, the larger and more variable were the pollen grains. Seed set increased exponentially with pollen maturity and was closely associated with anther dehiscence and shedding of pollen in the male parent. Better seed set can be expected in interspecific crosses when 60% or more of the pollen grains of male parents are mature, and the stigma of the female parents are fully extended beyond the glumes. Seed set in intergeneric crosses was apparently influenced by sexual incompatibility rather than by pollen maturity or stigma extension. Specific techniques for making intergeneric crosses are suggested.

Further observations on the selection of potted seedlings. D. W. Thomas. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 143-145. — Results of six experiments indicated that few of the potential selections from single stools would be lost if the apparently least vigorous third of potted seedlings were discarded before being planted in the field. Single stools were established successfully by stalks taken from plants in the pots.

Studies on stalk characters of selected clones in sugar cane. R. S. Sangwan. *Indian Sugar Crops J.*, 1981, 8, (2), 4-6. — Stalk and yield parameters were determined for 18 promising clones selected from the progeny of four biparental crosses, and the results compared with those for Co 1148 and Co 1158 as standard varieties. Details are tabulated.

New method of screening sugar cane cultivars for salt tolerance. L. T. Santo. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 65-67. — Approximately 42,000 acres of sugar cane in Hawaii are irrigated with saline water having an electrical conductivity greater than 0.76 mmhos.cm^{-1}; this level of salinity may increase soil salinity and reduce cane yield if salts are allowed to accumulate in the root zone. However, leaching to remove salts may not always be possible or practical, so that selection of salt-tolerant varieties is necessary in order to obtain optimum yields. Current selection techniques for salt tolerance include a rapid greenhouse screening method known as the salt shock test, in which varying amounts of NaCl are applied to 4-month cane plants growing in soil-filled 1-gal containers followed by daily irrigation sufficient to wet the soil but not to leach it. Visual growth ratings in the range 1-9 are assigned1-2 weeks after treatment. While the method is rapid and simple, it does have disadvantages, the major one being that selection is based on qualitative rather than quantitative growth response data. Experiments were therefore carried out to develop a new method in which pot-grown plants were hand-irrigated with tap water and with water mixed with sea water to obtain a required salinity of 2, 5, 8 and 12 mmhos.cm^{-1}; each of 16 varieties was subjected to the five treatments. The plants were harvested at 4 months of age, i.e. 2 months after treatment, and dry weight and stalk length determined. Large differences were found between stalk length of varieties at the same applied salinity, while inadequate correlation was found between relative stalk length and dry weight. Comparison with the salt shock test results for dry weight showed poor correlation between the two methods, which gave similar results in only a few cases; in one case, very poor growth was observed for a variety which had received a high rating in the salt shock test.

Sugar cane variety update — 1980. T. L. Tew. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.*, 1980, 71-74. — A survey is presented of varieties that have shown promise in the five major regions of Hawaii, and particular mention is made of H 70-144, a high-yielding variety over a wide range of environmental conditions. There is need for rapid replacement of the standard varieties, H 50-7209 and H 59-3775, because of their smut susceptibility.

SUGAR BEET AGRONOMY

Soil erosion. Anon. *Die Zuckerrübe,* 1981, **30,** 148-149 *(German).* — Changes in land management have increased the risks of soil erosion in West Germany, it is stated, and specific factors contributing to the problem are listed, as are means of preventing or at least minimizing it.

Are we still fertilizing correctly? W. C. von Kessel. *Die Zuckerrübe,* 1981, **30,** 150-152 *(German).* — The question of optimum fertilization to effect increased crop yield and quality is considered alongside the economic aspects which may appear to run counter to optimum practices, although it is stressed that economy in use and buying of fertilizers does not necessarily imply lower yields. Sources of nitrogen other than inorganic fertilizers are discussed.

Foliar feeding with complete fertilizers to adjust nutrient concentrations in sugar beet. B. Stahlecker. *Die Zuckerrübe,* 1981, **30,** 162-164 *(German).* — The development of foliar feeding, from application of specific nutrients (e.g. to rectify deficiencies) to application of multi-nutrient sprays, is discussed, with particular mention of Wuxal 12-4-6, a Schering product containing a number of trace elements, N-P-K, vitamin B_1, plant hormone, buffering agents and chelating agents.

Soil separation during sugar beet harvesting with single-row standard machines and multi-row systems. Problems and solutions. S. Gramse. *Die Zuckerrübe,* 1981, **30,** 165-166 *(German).* — Dirt tare removal in new harvesting systems designed for both single- and multi-row machines manufactured by Wilhelm Stoll Maschinenfabrik GmbH is described.

Potassium uptake and distribution in the sugar beet plant with regard to various governing factors. L. C. von Braunschweig. *Die Zuckerrübe,* 1981, **30,** 170-171 *(German).* — The role played by a number of factors in beet K uptake and distribution and the importance of this element to the beet are discussed.

Characterization of water uptake by pelleted sugar beet seed. M. Burba. *Zuckerind.,* 1981, **106,** 592-596 *(German).* — It is shown that water uptake by pelleted beet seed as a function of time at constant temperature can be described by Langmuir's adsorption isotherm. The constants in the modified saturation function (saturation, sorption coefficient and sorption rate) are defined analogously to the Langmuir relation at the interface between the seed and water vapour-saturated air in the initial stage of the sorption process and used to characterize water uptake. The difference in behaviour between two pelleted seeds of extreme coating composition is discussed on the basis of these parameters.

The weed beet — mechanical and chemical control. A. Vigoureux. *Le Betteravier,* 1981, **15,** (155), 9, 12 *(French).* — Devices described for elimination of weed beet include a rotary mower, a system in which a non-selective contact herbicide is transferred from a tank to an applicator roller by means of a polyurethane foam roller, a wick applicator for brushing a Roundup herbicide onto the bolters, and a machine for electrocution of the weed beets.

Green manure — its importance for the structure of beet soils. N. Roussel. *Le Betteravier,* 1981, **15,** (155), 10-11 *(French).* — Types of green manure and the benefits they bring to the soil structure in beet fields are discussed, and advice is given on choice and cultivation of the crop.

The level, results and prospects of sugar beet production in Bulgaria. V. K. Stefanov. *Listy Cukr.,* 1981, **97,** 177-179 *(Czech).* — A survey is presented of beet agronomy in Bulgaria, including details of Bulgarian-bred beet varieties, equipment, plant protection chemicals, and seed and row spacings used.

Rational beet growing in West Germany. H. C. Neitzke. *Listy Cukr.,* 1981, **97,** 181-183 *(Czech).* — A review is given of fungicides used to protect beet seed and of pesticides and herbicides applied with the aim of ensuring a maximum possible recovery of sugar from the crop.

A three-row tractor-drawn digger for sugar beet roots. R. N. S. Yadav and N. S. L. Srivastava. *Indian Sugar Crops J.,* 1980, **7,** 99-102. — A simple digger, comprising duck-foot shovels bolted to the ends of tines, loosens the soil about the beets which are thus pushed upward to be picked up by labourers following behind. Trials with the digger are reported.

Nitrogen mobilization in a loess soil, fallow and planted to sugar beet. I. Feyerabend and C. Winner. *Zuckerind.,* 1981, **106,** 692-699 *(German).* — In 6-year field trials, mineral N was determined as nitrate in degraded loess left fallow and planted to beet. The N in the beets at harvest time and the residual mineral N in the soil were compared with the mineral N in fallow soil and with the increased quantity occurring during the summer months as a result of addition of mobilized N. From the results, it was concluded that, generally, beets take up more N from the soil than is indicated by repeated determination of soil mineral N. The significance of this finding in regard to calculation of fertilizer requirements is discussed.

Agricultural factors affecting beet respiration rates. J. F. T. Oldfield, M. Shore, J. V. Dutton and B. J. Houghton. *Sucr. Belge,* 1981, **100,** 249-255. — A gas chromatographic method for measurement of beet respiration rate in terms of the CO_2 concentration is described, and investigations are reported in which the effects of a number of agronomic factors on respiration rate were determined. In a restricted study on four varieties, no significant differences were found in the rates between three of them, whereas one (Monika) had a far higher respiration rate than the others; however, because of its higher sugar content, losses were about the same as for the other three. Beets of high amino-N contents (resulting from excessive N fertilization or from stunted growth) also had high respiration rates. Topping to different levels affected respiration; at 10°C, under moist conditions, sprouting occurred from leaf buds present in residual crown material, i.e. when the beets had been under-topped, and was accompanied by higher respiration rates than with beets topped normally. Brushing of the beets with a wire brush incorporated in a device developed by the National Institute of Agricult-

ural Engineering in the UK (intended to reduce the amount of leaf buds while leaving more processible crown material than with conventional topping) caused the respiration rate to rise by 20% over 51 days by comparison with conventionally topped beet. While spraying the beets with 12 ppm (w/w) thiabendazole fungicide reduced the respiration rate by 10%, the treatment is considered uneconomical, although work by others has indicated that a lower concentration may still be effective, and would be economical. Respiration has been found to represent the primary source of losses in beet stored for a short period.

Beet must be protected from frost. R. Vanstallen and L. van Steyvoort. *Le Betteravier,* 1981, **15,** (156), 9-12 *(French).* — It is stressed that toward the end of November more than half of the Belgian beet crop is clamped and that the monetary value of this large quantity of beet is such that frost protection is vital. The losses resulting from processing of frosted beet, the best means of protecting clamps and when to cover the beet are indicated with the aid of photographs.

The tare problem. G. Robin. *Le Betteravier,* 1981, **15,** (156), 13-14 *(French).* — The financial penalties for supplying beet having excessive dirt and leaf tare are discussed with the aid of calculations concerning beet samples from a load containing 30% extraneous matter. The advisability of reducing tare is indicated.

Beet research in France 1980. Anon. *Rpt. Inst. Tech. Franç. Betterave Industrielle,* 1980, 333 pp *(French).* A detailed report is presented of beet research conducted by the ITB covering six main areas: spring work (soil preparation, comparative tests on drills and herbicide application), seed (varietal trials, fungicidal protection of seed and bolter problems), chemical weed control, pest and disease control, agronomy (irrigation, nitrogen fertilization, insecticide and herbicide interaction and phytotoxicity to beet, and problems concerning crop rotation), and beet harvesting and cleaning.

The Windcheater. Anon. *British Sugar Beet Rev.,* 1981, **49,** (3), 32. — An illustrated description is given of a prototype self-feed straw "planter" designed and built by a farmer to insert straw in rows between every two rows of beet so as to protect the latter against wind blowing. The straw is fed from a bale and is pressed into the soil to depth of four inches.

How to set up the Matrot 6-row self-propelled harvester. Anon. *British Sugar Beet Rev.,* 1981, **49,** (3), 38-41. Advice is given on steps to take to ensure that the title harvester operates efficiently and economically. The information is given in the form of twelve steps accompanied by close-up photographs of the relevant components.

Sugar beet weeds and pests in perspective. J. Mumford. *British Sugar Beet Rev.,* 1981, **49,** (3), 50-51. — A survey of the most common serious weeds and insects found on 11 farms in two major beet-growing areas of eastern England has shown that by far the commonest weed in both areas was fat hen *(Chenopodium album),* and that aphids (green and black fly) were the chief insect pest; knot grass *(Polygonum aviculare)* and redshank *(P. persicaria)* were major weeds in one but not both areas. An indication is given of the control measures most commonly adopted and of the chemicals used.

Four jobs in one at drilling time. E. Foster. *British Sugar Beet Rev.,* 1981, **49,** (3), 56. — A farm manager has adapted a drill to permit nitrogen, herbicide and insecticide to be sprayed in one operation together with sowing. The fertilizer applied is the crop's total N requirement. No major difficulties have been encountered with the use of a 12-row drill.

Irrigation: the way to better yields and returns. W. Hollowell. *British Sugar Beet Rev.,* 1981, **49,** (3), 61-63. —Despite the benefits of beet irrigation in increasing yields, particularly on very light, easy-drying soils, it was found that in 1980 only 4% of the UK crop was irrigated. The author cites a number of farmers in an examination of the pros and cons of irrigation, and mentions mistakes that farmers make in their use of irrigation.

Seedbed preparation on heavier soils in south Lincolnshire. P. Brettell. *British Sugar Beet Rev.,* 1981, **49,** (3), 65-66. — Advice is given on preparation of seedbeds on soils typified by those in the area of Spalding beet sugar factory and classified as silty clay loam, peaty clay loam and a silt loam. Trials are reported in which various methods of soil treatment were compared.

Relationship of climate and sucrose content of sugar beet roots. W. R. Akeson. *J. Amer. Soc. Sugar Beet Tech.,* 1981, **21,** 27-40. — A study was made of the possible effect of climatic variations on beet sucrose content. Results obtained over a 10-year period in eight areas of the western Great Plains showed that August minimum temperatures and date when the temperature first fell to −4.4°C were the most important factors; when combined with September minimum temperatures and October rainfall, they accounted for 67-94% of the annual variation in sucrose content. September rainfall and October temperatures also had effect. For the correlation between minimum August temperatures and differences in the average sucrose contents between areas, the regression coefficient had a value of 0.93. The differences were established by September 1 and remained constant until harvest in mid-October.

Nitrogen management for sugar beets on Pullman soil with residual nitrate problems. S. R. Winter. *J. Amer. Soc. Sugar Beet Tech.,* 1981, **21,** 41-49. — Pullman clay loam, the predominant sugar beet soil in the Texas High Plains, is of low permeability with almost complete absence of leaching even under irrigation; hence, nitrate N accumulates in the soil if the amounts supplied by fertilization and mineralization exceed the quantities removed by the crops in the rotation. Research was therefore carried out to delineate the N management problem more clearly and determine how to produce high-sucrose beets while maintaining root yield. The results are discussed.

Preplant weed control from Norton EC and FL tank mixtures, 1976-80. E. F. Sullivan, K. A. Haagenson, S. L. Downing and L. O. Britt. *J. Amer. Soc. Sugar Beet Tech.,* 1981, **21,** 74-79. — Test results showed no differences in weed control effectiveness or in tolerance by the beet crop between the two formulations of Nortron — emulsifiable concentrate (EC) and flowable (FL) — when tank-mixed with other herbicides, although more of the active ingredient was required in the tank mixes with the FL than with the EC formulation. The average broadleaf weed control efficiencies were 91% and 89% for the EC and FL tank-mixed formulations, respectively.

BEET PESTS AND DISEASES

The problem of Cercospora control in Greece. T. Strouthopoulou, K. Paskhalide and F. Ioannide. *Hellenic Sugar Ind. Quarterly Bull.*, 1981, (44), 321-339 *(Greek).* — Trials on control of *Cercospora beticola* (leaf spot) conducted in 1971, 1979, and 1980 are reported. While the most effective fungicides up to 1970 were triphenyl tin (TPT) compounds, Benomyl and methyl thiophthanate proved better, but their use was discontinued when resistant strains of the pathogen were discovered on a large scale. In 1977, strains resistant to the TPT compounds were confirmed, although susceptibility to these recurred once their use was suspended. Current chemical control is based on mixtures and alternate sprayings of Maneb with TPT compounds, Carbendazime, Chlorothalonil, Nuarimol and Bitetranol; however, research is continuing in order to find new chemicals to replace those losing their effectiveness and to extend the useful life of fungicides. Varieties bred for resistance to the disease have, in the past, given lower yields than susceptible varieties under disease-free conditions, although some recent resistant varieties look more promising. A combination of fungicidal treatment and varietal resistance could give better control and reduce the frequency of spraying, the costs of which are, nevertheless, comparatively low in relation to the increased return that could result.

Beet virus yellows — biology, losses and control. A. Kovacs. *Ind. Sacc. Ital.*, 1981, **74**, 5-11 *(Italian).* Beet yellows virus and beet mild yellows virus are widespread in Italy, but particularly in the Romagna and Marche regions which are the main seed-producing areas. Attempts have been made to evaluate losses; they are put at 10-40%, according to the method adopted. The biology of the diseases is described and a call made for greater attention to them; at present the yellow colour they cause is considered normal rather than a pathological symptom.

Reduction of *Heterodera schachtii* incidence in sugar beet fields by broadcast and row application of nematicides. R. Thielemann. *Zuckerind.*, 1981, **106**, 445-449 *(German).* — Trials are reported in which DD soil fumigant plus Temik granular nematicide at 0.45 $g.ha^{-1}$ killed 90% of the nematode eggs and larvae, and increased both root and sugar yields. Higher dosages of the nematicide were not justified.

Slugs and their enemies. Anon. *Die Zuckerrübe*, 1981, **30**, 117 *(German).* — Slugs and snails can reduce beet yields in wet years by eating young beet plants up to the 4-leaf stage. Their common enemies are described as the hedgehog and various types of bird. Chemical control is also briefly mentioned.

Pegletta — a Chinese radish as enemy and trap plant. A new means of nematode control. Anon. *Die Zuckerrübe*, 1981, **30**, 120 *(German).* — The new variety of Chinese radish acts on beet nematodes, as do all cruciferae, by secreting a sticky substance from the root system which traps the larvae in the cysts; female nematodes are unable to form further cysts, so that there is no new generation. Trials have shown that up to 75% reduction of the nematode population is possible by this means. Advice is given on when to grow the crop in the rotation and on seedbed preparation.

Nematodes put beet agriculture at risk. Anon. *Die Zuckerrübe*, 1981, **30**, 121 *(German).* — Advice is given on farm practices to avoid the risk of nematode damage to the beet crop and on soil fumigation. Soil sampling for determination of nematode populations is also described.

Powdery mildew and its control. W. Byford. *British Sugar Beet Rev.*, 1981, **49**, (2), 33, 35-36. — Symptoms of powdery mildew are described, varietal susceptibility discussed and recommendations given on spraying with sulphur (found to be superior to fungicides so far tested) for control of the disease.

Rhizoctonia root rot of sugar beet as affected by rate and nitrogen fertilizer carrier. R. J. Hecker and E. G. Ruppel. *J. Amer. Soc. Sugar Beet Tech.*, 1980, **20**, 571-577. — Experiments with three beet varieties, respectively resistant, moderately resistant and susceptible to root rot caused by *Rhizoctonia solani*, showed that the quantity and form of available soil N had no appreciable or consistent effect on intensity of the disease, regardless of whether the beets were inoculated with the pathogen or grown in soil infected with the disease. However, it appeared likely that the disease could be more intense in certain genotypes under N deficiency conditions, so that an adequacy of N is recommended, but not an excessive quantity. Plant population had no effect on root rot incidence.

Evaluation of green peach aphid activity and the occurrence of beet western yellows virus in sugar beet fields. G. Tamaki, L. Fox and P. E. Featherston. *J. Amer. Soc. Sugar Beet Tech.*, 1980, **20**, 578-582. — The activity of the green peach aphid, *Myzus persicae*, and incidence of beet western yellows virus (BMYV) were investigated in seven commercial beet fields ranging from 1 to 17 miles apart. Beets were selectively tagged, and in each field a yellow pan was filled with water to attract and trap the winged aphid. Results showed no correlation between the number of aphid-infested plants or number of aphids trapped in the pans and the number of BWYV-infected beets. However, since it has earlier been found that winged *M. persicae* may alight on a preferred host plant, transfer the virus and then depart, the economic injury levels indicated by the present studies may be misleading, particularly in view of the almost total destruction by a fungus of the aphids that had overwintered in the region in question on a virus-infested host plant, *Cardaria draba.*

Deficiency diseases of beet. R. Vanstallen. *Le Betteravier*, 1981, **15**, (154), 10 *(French).* — Descriptions are given of symptoms and causes of Mg, Mn and B deficiency in beet, and advice is given on how to avoid it and what to do if it occurs.

Control of cercosporiosis in sugar beet crops under 1981 conditions. A. Codrescu and L. Dumitras. *Prod. Veg., Cer. si Plante Tehn.*, 1981, **33**, (5), 14-17 *(Rumanian).* Reference is made to the effects of temperature and relative humidity on *Cercospora beticola* (leaf spot) incidence, and trials with various fungicides conducted in the Brasov region for at least 10 years are mentioned. Recommended measures for 1981 are outlined.

CANE SUGAR MANUFACTURE

Review of performance of sugar factories in 1979. S. Marie-Jeanne. *Rev. Agric. Sucr. Maurice,* 1980, **59,** 201-206. — Average performance figures are given for the Mauritius sugar industry in 1979, with results for 1975-78 given by way of comparison (boiling house performances are given for 1974-78). Although total losses % sugar in cane tend to have increased, overall recovery reduced to 12.5% fibre and a mixed juice purity of 85 has remained generally constant.

Bulk loading of sugar. Anon. *Rev. Agric. Sucr. Maurice,* 1980, **59,** 207-210 *(French).* — Studies and organizational work preceding the establishment of the bulk sugar terminal at Fort William are briefly described and details given of the terminal, which includes two warehouses, each having a capacity of 175,000 tonnes of sugar. Ships of up to 40,000 tonnes can be loaded with sugar by belt conveyor at the rate of 1400 tonnes.hr^{-1}; the sugar falls onto this conveyor through openings in the silo floor. Sugar from road trucks is loaded into one or the other warehouse by two belt conveyors, each of 720 tonnes hourly capacity.

Development of a microprocessor cane tracker for use in South African sugar factories. E. P. East. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 24-27. Details are given of a system for demarcation and identification of individual parcels of cane passing along the cane carriers from the unloading point in the mill yard to the cane sampling installation after the shredder. The scheme, which supersedes a previous hardwired logic cane tracker[1], comprises five main sections: (1) processor, program and memory, (2) cathode ray tube (CRT) controller, (3) keyboard, proximity switch and start/stop switch input controller, (4) sample point information transmitter, and (5) sample point receiver, hatch, bell and sub-sampler controller. Each section relates to one printed circuit board of the plug-in type. Use of an in-circuit emulator permits the microprocessor to be removed and all the hardware to be entirely controlled. The programs are U.V.-erasable. The CRT screen is divided into three sections giving information on consignments and information supplied by the computer or keyed in by the operator. At the sample point, the reference number of the sample being processed is shown as well as the length of consignment as yet unsampled. Six such systems were planned for operation in the 1981/82 season. Their chief advantages over the earlier hard-wire system are indicated.

The effect of the level of extraction on mixed juice purity. G. R. E. Lionnet. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 28-30. — Monthly data from milling tandems at a number of factories were used to plot a graph of cane purity/mixed juice purity *vs.* pol extraction, and a regression coefficient of 0.84 obtained; for similar data relating to cane diffusion, the regression coefficient was 0.59. In laboratory experiments, direct analysis was used for some shredded cane sub-samples, while others were subjected to pressing at varying combinations of time and imbition water to achieve pol extractions ranging from 91 to 98.5. Results were plotted, and a regression coefficient of 0.72 obtained, thus confirming the linearity of the above relationships, although meaningful comparison between mill and diffuser data was not possible because of the greater scatter of the diffusion data. From the findings, a simplistic financial analysis was carried out and the profitability of increasing extraction to 98.5% briefly investigated.

Development of fluid bed combustion applicable to the sugar cane industry. G. W. Hunt. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 31-36. — Design aspects of a two-stage fluidized bed combustion system for burning of e.g. low-grade coal or bagasse are discussed, and the possibility of applying such a system in the sugar industry to provide hot gases or hot air for bagasse drying or steam generation (when fitted to an existing water-tube boiler) is examined.

A progress review of air pollution control in the South African sugar industry from 1972 to 1981. G. N. Allan. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 37-42. — A survey is presented of boiler and smut collector installations in the South African sugar industry. It is stated that only 19 out of 92 boilers have no smut collector, by comparison with 59 out of 113 in 1972. Of the 19, 8 are standby boilers of relatively small capacity, while the remaining 11 are scheduled to be fitted with scrubbers by the 1983 season or with dry collectors by 1984. The irrigated, perforated-plate type of scrubber is the one generally installed, while some factories are equipped with dry, multi-cyclone collectors. Smut dewatering systems are examined, and some problem areas considered, particularly the difficulty of achieving a reduction in smut emission to 400 $mg.m^{-3}$ using the multi-cyclone collectors; however, while an emission level of 700 $mg.m^{-3}$ would mean a collection efficiency of only 86%, this would still be equivalent to a relatively clean boiler chimney and compares with a maximum permitted emission of 800 $mg.m^{-3}$ for existing boilers in Australia (690 $mg.m^{-3}$ for new installations). The overall capital costs of two large scrubber installations are briefly indicated.

A computer program for simulating and evaluating multiple-effect evaporators in the sugar industry. R. G. Hoekstra. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 43-50. — A computer program described can be used to predict evaporator performance under given conditions, calculate the heat surface areas required for a given task or calculate the heat transfer coefficients of the individual effects from plant performance measurements of an operating installation. The program allows for any arrangement of vessels, whether in series or parallel, co- or counter-current, and permits incorporation of any special features. This type of flexibility is achieved by having a short program master segment for each installation plus a large number of common sub-routines for use by any one of the master segments. The program is iterative and operates by solving sets of simultaneous linear equations describing the process relationships. After each iteration, the equation coefficients are updated.

Some data on heat transfer in multiple-effect evaporators. I. A. Smith and L. A. W. Taylor. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 51-55. — From a total of 82 data sets covering heat transfer in a number

[1] Calboutin: *I.S.J.,* 1977, **79,** 23.

of evaporator effects at three factories, the heat transfer coefficient was plotted against Brix, temperature, temperature difference and viscosity, respectively. The influence of temperature difference on heat transfer coefficient could not be deduced. The results highlighted the marked difference in operating conditions between the last effect and all earlier effects as a consequence of the very much greater viscosity in the last effect. The values of the coefficient from the 2nd to the penultimate effect nearly all occurred in the range 1.8-3.5 $kW.m^{-2}.°C^{-1}$, with no pronounced dependence on the number of the effect. It was found that very high last vapour vacuum levels were detrimental to evaporation capacity, and optimum last vapour saturation temperature was in the range 55-60°C. A heating surface distribution whereby the last effect was double the size of the intermediate effects would provide 6% more evaporation than the conventional arrangement in which all tail vessels are equal in heat surface area. Heat transfer coefficient values are given for evaporator sets where this has been achieved by operating existing vessels on vapour in parallel. It is concluded that for series juice feed, the advantage of a lower Brix in the 1st vessel of the pair is offset by the absence of flash in the 2nd vessel.

Large falling-film evaporators and vapour compression. W. Addison. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 56-58. – The concept of film evaporation is briefly explained and advantages and disadvantages of the falling-film evaporator are indicated. A description is given of a falling-film evaporator, developed by the Rosenblad Corporation principally for the paper industry, which is designed to overcome the disadvantage of handling large quantities of material and provide a compact heat transfer surface in the form of a flat, vertical hollow plate. Banks of these elements are produced, with fairly large gaps between adjacent plates and a manifold formed at one corner of the bank, through which heated vapour is introduced into the interior of the bank. Incondensable gases can be vented through a smaller manifold, usually arranged at the opposite corner. The liquid to be evaporated is introduced at the top of the elements through a perforated distributor, flows down the plates and is recycled. As vapour is released sideways at low velocity from between the plates, there is usually no mist-type entrainment, so that separation efficiencies are very high, even with simple equipment. Typically, vapour is removed from the top of the cylindrical body and is available for heating the next effect in the evaporator or for compression. The evaporator is highly suitable for mechanical vapour compression.

Activities of the Training Division of the SMRI – a seventeen year review. H. F. Wiehe. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 59-61. An account is given of the formal training of South African sugar technologists undertaken by the Sugar Milling Research Institute since 1964, and other activities of the Division, including the organization of colloquia and presentation of sugar technology courses for sugar factory senior engineering personnel, are briefly described.

Sealing leaks by the Furmanite process. C. C. Mack and H. Bown. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 62-63. – Experiences in the use of the Furmanite process[1] to seal leaks from crystallizer glands and vacuum pan air leaks at Glendale factory are briefly described and the costs indicated.

Autolab – a progress report. S. King, E. P. East and M. Winship. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 67-70. – The mini-computer system installed by the Sugar Industry Central Board to handle cane analysis data has had a number of modifications made to its programs, mainly in order to make it more foolproof and permit easier retrieval of data. The modifications are briefly described, and information is given on a microprocessor connected to a controller linking the "massmeters" to the central printer; this system permits the cane massmeter department to continue operating should the computer fail. Details are given of the hardware and of the cost benefits of the scheme.

The practical development and application of saccharate liming at the Pongola sugar mill. S. North-Coombes, K. Taylor and K. C. Koster. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 71-74. – Of the three possible calcium saccharate structures resulting from the reaction between milk-of-lime and sugar solution, monocalcium saccharate has been found to be the most soluble, particularly at low temperatures[2]. To ensure its formation, there must be a slight excess of sucrose and the temperature must be below 58°C. After earlier trials with the process had been discontinued at Pongola because of abnormal filter cake losses, saccharate liming was re-introduced for the 1980/81 season. Evaporator syrup of 68°Bx added at a 7:1 ratio to 15°Bé milk-of-lime gave a saccharate solution which could be maintained at pH 11.0 and thereby assure the presence of excess sucrose. Results showed that saccharate liming gave a much lower clear juice turbidity than conventional liming, while the purity drop from mixed juice to clear juice was reduced to 0.17 by comparison with 1.00. No problems were encountered in filtration, after additional filter capacity had been installed, despite the slightly higher mud volumes resulting from saccharate liming. Filter cake losses were 0.33% pol in mixed juice.

A look at tracer testing in the sugar industry. E. E. A. Rouillard. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.*, 1981, 75-78. – A review, with 27 references to the literature, is presented of the use of tracer techniques in sugar factory investigations, with particular regard to recent applications in South Africa. The survey includes determination of residence time distribution in diffusers, clarifiers, evaporators, continuous vacuum pans, crystallizers and a fluidized bed dryer for sugar; flow measurement in diffusers and evaporators; vacuum pan entrainment measurement; and determination of the volume of water in a cooling system.

Optimum velocity for the circulation of juice in clear juice heaters. I. Thermo-technical aspect. A. Valdés D. *Cuba Azúcar*, 1981, (Jan./March), 10-16 *(Spanish)*. Experiments were carried out using a pilot plant heater designed to take account of the effects of variation of scale, and measurements made of heat transfer coefficient and pressure drop for juice flowing at four speeds between 1.5 and 3.2 $m.sec^{-1}$, using a steam pressure of 0.8 $kg.cm^{-2}$. Over the range studied, the effects were linear, the 111% increase in juice velocity producing a 57% rise in heat transfer coefficient and a 235% increase in the hydraulic pressure drop.

[1] *I.S.J.*, 1980, **82**, 122.
[2] Hartmann: *Sugar Tech. Rev.*, 1974, **2**, 213-252.

BEET SUGAR MANUFACTURE

Residence time spectra in sugar industry vessels with reference to sugar losses. T. Baloh. *Zuckerind.*, 1981, **106**, 581-586 *(German)*. — See *I.S.J.*, 1980, **82**, 381.

The use of colour monitoring in beet sugar processing. M. K. Faviell. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 256-273. — Since 1971 all beet sugar factories in Alberta and Manitoba, Canada, have included routine determination of colour of juices, liquors and remelt sugars as part of overall process control. The information is displayed on computer-prepared graphs and visual colour boards, and has proved to be of value in revealing a variety of operational malfunctions and in predicting colour trends. The colour content provides a guide to the relative quality of remelt sugar produced by both batch and continuous centrifugals, reflects the changes in beet quality and has shown the Dorr clarifier, evaporator and melter stations to be areas of significant colour accumulation. A Tate & Lyle Talameter colorimeter measures the colour content at 420 nm and replaced a Fisher electrophotometer because of the latter's inability to allow correlation of the measurements with ICUMSA colour values; the Talameter is a solid-state, single-cell automatic absorptiometer designed specifically for the sugar industry and is simple to operate.

Experience in juice purification at Uvarovo sugar factory. N. I. Gavrina. *Sakhar. Prom.*, 1981, (7), 36-38 *(Russian)*. A new juice purification scheme was introduced at Uvarovo in 1978; its chief feature was a multi-sectioned prelimer in which vertical compartments were linked horizontally by a tube housing a mixer, and carbonatation mud was recycled to each tube. Progressive hot preliming was followed by fractional cold and hot main liming. Tests on the new scheme showed that it gave higher 2nd carbonatation juice purity and lower colour than the previous hot preliming and hot liming system. Even better results were given by adding the recycled mud before the prelimer and lengthening the residence time in the main limer.

Use of spray film phase contact in vacuum pan condensers. R. V. Koren' and G. I. Listopad. *Sakhar. Prom.*, 1981, (7), 47-50 *(Russian)*. — Disadvantages of the co- and counter-current film condenser scheme developed especially for the Soviet sugar industry are discussed and advantages of the system using an annular spray curtain indicated. The incorporation of the features of such a system in a compact condenser is described.

Reagentless prevention of scale formation in sugar factory evaporators. V. S. Malovichko, S. M. Konstantinov, N. M. Onishchenko and D. P. Kolomiets. *Sakhar. Prom.*, 1981, (7), 50-52 *(Russian)*. — Experiments conducted on evaporator scale removal by steam stripping (whereby liquid penetrates the layer of scale when the temperature is reduced, followed by sudden, rapid boiling and breakdown of the scale) are reported. Use of the technique to prevent accumulation of scale has given favourable results.

The reliability of batch centrifugal baskets in the sugar industry. I. H. K. Maushagen and G. Schneider. *Zuckerind.*, 1981, **106**, 673-677 *(German)*. — Non-destructive tests were carried out on 666 batch centrifugal baskets, and 146 of them rejected — 97 because of crack formation (mostly at the screen perforations but in some cases at the circular welds) and 49 because of serious reduction in wall strength as a result of corrosion. Investigations to determine the possible effect of ion exchange processes on the corrosive effect of massecuite revealed that the number of rejected baskets in factories with ion exchange treatment, e.g. the Quentin process and thin juice softening, was more than double the number where these processes were not used; however, it is considered questionable as to whether conclusions could be drawn from this for basket life in a given factory, and care in basket maintenance is considered as important in this respect as is the use of ion exchange. Studies were also made of the rate of growth of cracks and of the residual life of a basket, as well as reduction in the long-term fatigue strength under pulsating stresses as a result of corrosion and erosion at the walls of the screen perforations.

Residence time spectra of stirred vessel cascades. T. Baloh and E. Wittwer. *Zuckerind.*, 1981, **106**, 678-682 *(German)*. — Models of residence time patterns derived for sugar industry vessels equipped with stirrers[1] were applicable only to cascades in which the vessels were of identical size and contained a constant amount of material, whereas in most cases, e.g. multiple-effect evaporators and carbonatation systems, the vessels are of varying sizes and the quantity of material in them varies; even a Brieghel-Müller liming trough, although separated into equal compartments, is characterized by changes in content because of the addition of milk-of-lime and recycled mud/juice at different points. In the present article, solutions are given for differential equations valid for cascades of varying vessel sizes and for constant or varying contents. The equations apply to cascades of up to four tanks, although residence time patterns for any number of tanks can be obtained by analogy.

Technical progress at Koscian sugar factory. J. Hernet. *Gaz. Cukr.*, 1981, **89**, 32-34 *(Polish)*. — Information is given on equipment installed at Koscian factory as part of a modernization program intended to raise the daily beet throughput to 2400 tonnes. The factory was built in 1881-82.

Chemical descaling in a sugar factory. BS descalants. J. Perrot. *Sucr. Franç.*, 1981, **122**, 349-351 *(French)*. The physical properties of BS descalants (based on sulphamic acid with corrosion inhibitors added) are described, their fields of application indicated and their advantages listed. Use of a 5% solution to descale a filter-press is described.

Energy savings in the sugar factory. J. C. Giorgi. *Ind. Alim. Agric.*, 1981, **98**, 591-592 *(French)*. — In a discussion of energy saving in a sugar factory, the author underlines the need to consider the "knock-on" effect of individual measures, whereby a reduction in steam consumption in one process station may lead to the need to modify other processes; hence, investment to modify the boiling station so as to effect steam economies will necessitate complementary investment to improve the evaporative capacity of the evaporator and reduce power consumption. Other areas considered are pulp drying and cossette pre-scalding.

[1] Baloh: *I.S.J.*, 1980, **82**, 381.

LABORATORY STUDIES

United States polarization allowances. J. V. López-Oña. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 23-91. During question time at the end of the symposium entitled "The effects of raw sugar quality on the refining process" held during the 1979 Meeting of SIT[1], representatives of raw sugar producers stated that US refiners were not offering sufficient polarization allowance to encourage improvement in raw sugar quality; the two main objections were to the declining premiums for raw sugars above 96° pol, and the maximum limit of 99° pol for imported raws. The present article attempts to answer the points raised and indicates the reasons for the declining premiums for high-pol raw sugar. The history of events leading to the revision of the pol allowances by the Sugar Institute Inc. in 1928 (on the basis of agreement between refiners and raw sugar producers) is reviewed, and the work carried out by the institute (which constitutes the roots of the present system of allowances) is described. The scientific basis of the system, i.e. the correlation between conversion factors and pol allowances, is surveyed, and a number of aspects of polarization are discussed, including the history of the development of the polarimeter, the pattern of weighted average raw sugar pol from 1908 to 1978 (as reported annually by the New York Sugar Trade Laboratory) and the events that have led to peaks and troughs, and pol allowances set in countries other than the USA.

Hermetically sealed cans for raw sugar sampling. M. K. Faviell. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 92-94. — For some years, samples from raw sugar consignments received by B. C. Sugar in Canada had been placed in cans of 1-lb capacity which were then sealed with press-fit plugs and sent to two laboratories in New York while a parallel sample was examined in the refinery laboratory. Up to four weeks could elapse between sealing of the contents and pol measurement in New York, and occasionally the sample analysed by the refinery laboratory was found to be dry and hard. With introduction of an automatic digital polarimeter at the refinery, it was decided to test the sample cans for air-tightness and possible moisture loss. Twenty samples from the same cargo of raw sugar were analysed in January and again in February of one year, and the average pol found to increase by 0.036, indicating moisture loss. As a result, the cans were replaced with ones that could be hermetically sealed, as recommended at the 1978 Session of ICUMSA[2].

Air oxidation of unburned bone char and granular carbon. V. R. Deitz. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 95-114. — Unregenerated bone char and granular carbon samples from processes at a number of refineries were subjected to temperature-programmed oxidation in an upward air flow of 5000 $cm^3.min^{-1}$, as a continuation of earlier work[3]. Aliquots of known volume of the effluent gases were withdrawn for continuous CO and CO_2 analyses. Results showed that the SIT (spontaneous ignition temperature, i.e. the lowest temperature at which the material will ignite at 1 atm pressure) was independent of the rate of heating under the test conditions; in the case of carbon, attainment of the SIT was accompanied by a sharp rise in CO concentration. Hence, a carbon should be kilned as quickly as possible in order to avoid excessive oxidation. Oxidation of the organic matter adsorbed on the carbon was accompanied by oxidation of the carbon support, which appeared to be possible in the temperature range below the SIT; in the case of new carbon, oxidation was slower than for new bone char. Comparison of oxidation of a new and a service char from the same refinery showed little difference; this was attributed to a low carbon content and adsorption of a relatively small amount of organic matter per cycle as a result of filtration of higher-purity liquors. In the case of carbon, the CO and CO_2 emission rates for new adsorbents in the proximity of the SIT were about the same, and the integrated carbon content in the emissions up to the SIT was only a fraction of the total loss in weight of the sample.

Investigation of the viscosity of sugar refinery products using an ultrasonic viscometer. L. A. Sapronova and V. I. Tuzhilkin. *Sakhar. Prom.*, 1981, (7), 53-55 *(Russian)*. — The relationship between dry solids content and the product (viscosity x density) for massecuite was studied, and linearity established between log (viscosity x density) and supersaturation at constant purity and pressure. Values of the viscosity ratio of massecuite:mother liquor were in close agreement with those established by Ahari *et al.*[4] at 0, 10, 20, 30 and 40% crystal content using an ultrasonic viscometer. On the basis of the experiments, the use of such a viscometer for Brix and supersaturation control in boiling is suggested.

Sucrose crystal elongation. II. F. H. C. Kelly, F. K. Mak and J. Andersen. *Zuckerind.*, 1981, **106**, 688-692. — A detailed study of raw sugar crystals, obtained from Queensland cane sugar factories and exhibiting elongation along the *c*-axis, is reported. The average rate of growth was 29% greater for the basal pinacoid and 28% greater for the back orthodome than for these same faces in normal crystals (although the study revealed no sharp distinction between normal and elongated crystals, but rather a gradual transition from one shape to the other). Sphericity was 7% lower and the orthodomes 28% smaller in area, suggesting a crystallization inhibitor affecting the orthopinacoid and attaching itself to the C-6 hydroxyl group of the sucrose molecule exposed at this face. The inhibitor could be iso-maltose resulting from partial hydrolysis of appropriate oligosaccharides. Scanning electron micrographs of both normal and elongated crystals are reproduced.

Machine for washing plastic boxes and test tubes used in biological control laboratories. J. R. Araújo, S. M. S. S. Araújo and N. Macedo. *Brasil Açuc.*, 1981, **97**, 359-364 *(Portuguese)*. — An account is given of labour-saving equipment used in the cleaning of test tubes and plastic boxes employed in the rearing of parasites of *Diatraea* spp. After removal of gross debris, the tubes and boxes are immersed in a biocide solution for 12 hours and cleaned using motorized brushes before drying and/or sterilization.

---

[1] *I.S.J.*, 1979, **81**, 135.
[2] *Proc. 17th Session ICUMSA*, 1978, 23.
[3] Deitz *et al.*: *I.S.J.*, 1979, **81**, 134.
[4] *ibid.*, 1968, **70**, 71-75.

Characteristics of beet molasses viscosity. K. Wagnerowski. *Gaz. Cukr.*, 1981, **89**, 25-29 *(Polish)*. An empirical formula derived by Wagnerowski & Dabrowski[1] for calculation of the viscosity of pure and impure sugar solutions as a function of Brix and temperature was found by Dabrowski to be valid, with some modification, for measurements using a falling ball viscometer, and by the author of the present article for measurements using a rotating cylinder viscometer. For an "average" molasses, the equation has been modified to take the form

$$\log \eta = (n - 0.0038)\left(\frac{2678}{t + 72.2} - 7.732\right) - 2.717,$$

where η is viscosity, t is temperature and n is a constant.

A mathematical model of the rate of sucrose crystallization in pure solutions. S. Zagrodzki and W. Krysicki. *Gaz. Cukr.*, 1981, **89**, 29-32 *(Polish)*. — Investigations were conducted on sucrose crystallization in pure solution of 1.06 supersaturation at temperatures in the range 20-80°C. Empirical formulae were derived from the results for both stationary and dynamic conditions and then compared with differential equations. On the basis of the findings, the thickness of the boundary layer was calculated as a function of temperature.

Methods for estimating sucrose loss in laboratory storage tests. W. R. Akeson. *J. Amer. Soc. Sugar Beet Tech.*, 1981, **21**, 56-73. — Six methods of estimating losses in stored beets were compared in 22 tests conducted during 1971-77. The best estimate, based on simple linear correlation, was obtained by adding the effects of respiration rate, invert sugar accumulation and raffinose accumulation; it gave a much smaller variability between tests than methods combining the factors with multiple regression equations. Sugar loss correlated best with respiration rate followed by invert sugar accumulation, while raffinose showed little correlation with loss. Direct measurement of sugar loss was the least precise of the methods tested. High correlation was found between respiration rate and invert sugar accumulation, so that addition of invert sugar and raffinose components gave little improvement on respiration rate alone in correlation with direct sugar loss.

Growth of sucrose crystals — a review. A. VanHook. *Sugar Technol. Rev.*, 1981, **8**, 41-79. — The literature of the ten years up to the time of writing of this article on the subject of sucrose crystallization kinetics is reviewed. Outstanding developments in nucleation have been the exoneration of classical nucleation theory in general, considerable interest in secondary nucleation, and the popularity of so-called "amorphous" sugar in some parts of the world. Important advances as regards crystal growth have been made in studies on non-linear growth rates and mechanism, the use of automatic and continuous vacuum pans, crystallizer operation and habit modifications. The need for continued studies, especially on solubility, supersaturation determination, and habit modification and optimization is emphasized. The major obstacle to these is lack of data.

Sterilization of sugar products by irradiation. The effect of gamma-radiation on *Leuconostoc mesenteroides*. J. Lodos and S. Acosta. *Zuckerind.*, 1981, **106**, 816-819. Experiments are reported in which suspensions of *L. mesenteroides* and crusher juice samples were exposed to gamma-rays from a ^{60}Co source, while other crusher juice samples were treated with a 2% commercial formaldehyde solution. Results showed that the effects of irradiation were less marked on the juice than on the suspension samples, indicating an inhibitory effect of juice components. However, irradiation proved more effective than formaldehyde in reducing the microbial counts. While, on the basis of the results, 940 ppm of formaldehyde would be needed to give a 90% reduction in the *L. mesenteroides* concentration, costing $200-300 per 1000 tonnes of cane per day, and the energy required to produce a similar effect by means of heat treatment would cost a similar amount, less than $100 per 1000 tonnes of cane per day would be needed to achieve the same 90% reduction using irradiation (45,000 rd).

Description of quality and tabulation of qualitative analytical data for sugar beet. U. Beiss. *Zuckerind.*, 1981, **106**, 820-821 *(German)*. — For description of beet quality and reporting of experimental results concerning beet, there is need for uniformity in nomenclature and definitions and for standardization in tabulation. The subject is briefly discussed with particular reference to "corrected sugar content", "recoverable sugar" and "yield loss", and two examples are given of standardized tabulation of experimental results.

Study of silicate deposits in the sugar industry. G. Brunet, J. P. Labbe, F. Heitz and J. Montuelle. *Ind. Alim. Agric.*, 1981, **98**, 567-573 *(French)*. — Infra-red spectrometry, X-ray diffraction and atomic absorption were applied to studies of scale deposited on the internal walls of evaporator tubes. The investigations showed that most of the scale was an amorphous potassium-sodium aluminosilicate, so that thermodynamic data for silica or aluminium hydroxide products are not valid. The scale retained its amorphous state throughout the whole campaign in which the studies were carried out; it was already perceptible within 24 hours of evaporating operation. It is considered possible to establish a correlation between the kinetics of deposition and thick juice composition, using plate samples as at Nassandres. The ratio of Al (III) to Si (IV) is the main factor governing scale formation; the concentrations of the two individual components have a lesser effect. Heating of the scale sample caused transformations at about 700°, 950° and 1200°C (at which a leucite matrix was identified); at 1300°C a stable state was created which did not change on cooling.

Sucrocarbonate, a new coagulant in the sugar industry. I. Compressibility of the precipitate after preliming. J. Grabka. *Ind. Alim. Agric.*, 1981, **98**, 575-579 *(French)*. Laboratory measurements were made of the compressibility of coagulates formed during preliming as a result of addition of sucrocarbonate or milk-of-lime. The sucrocarbonate was produced by dissolving 150 g of sugar in 800 g of distilled water, heating to 60-70°C, then adding 50 g of CaO and finally gassing with CO_2 until formation of a dense gelatinous substance having an alkalinity of 2.2-2.4 g CaO/100 ml. The filtration coefficient of the prelimed juice averaged 7.65 after sucrocarbonate treatment and 36 after milk-of-lime addition to give the same final pH. Such a difference cannot be attributed only to the higher total amount of lime (0.6%) in the case of the sucrocarbonate (0.25% for milk-of-lime). Compressibility coefficients had average values of 0.72 for sucrocarbonate and 0.97 for milk-of-lime. Hence, juice coagulates formed when sucrocarbonate is added can be more readily separated by filtration.

[1] *I.S.J.*, 1977, **79**, 206.

Make a safe investment in alcohol. Rely on the greatest Brazilian experience.

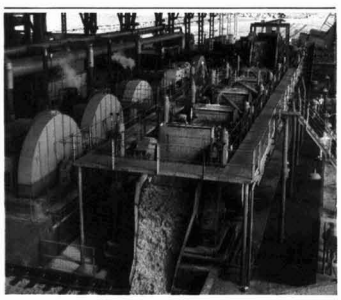
Every six days, Dedini produces a complete alcohol distillery. More than 400 units installed in Brazil, and the company is already exporting turn-key distilleries. Of the 4.5 billion liters alcohol expected for the 82/83 harvest, at least 3.1 billion will be produced by equipments with the Dedini trade mark.

More than 60 years of solid experience in processes and equipments for the sugar industry have made it possible for Dedini to develop the most up-to-date technology for the manufacture of the equipments used by the alcohol industry.

Dedini is a market leader and the most experienced Brazilian firm in this field of activities. They supply crushing mills, steam turbines, speed reducers, boilers, syrup heaters, as well as fully assembled systems for distillation.

Dedini equipments: efficiency and profits

By supplying highly enduring and efficient equipments - which are also of easy maintenance and have a low energy consumption - Dedini assures real profits in alcohol production.



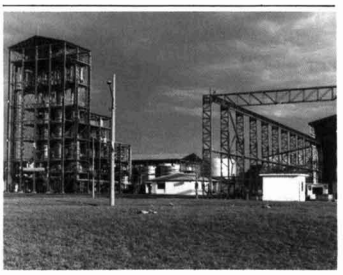
Dedini produces 5 distilleries/month, with a 120 thousand liters/day production capacity.

This is possible owing to the fact that every product is planned in accordance with specific needs and - through manufacture - submitted to the most advanced tests, which comply with Brazilian and international technical standards, such as ABNT, ASTM, SAE, DIN, AFNOR, NEMA, etc.

Mechanical, metallographic, macrographic, chemical exams and dimensional controls are carried out to guarantee an absolutely perfect performance of the equipments.

Exports: a growing capacity

Dedini's services start even before a product is bought, when the company gives advice on the best way to invest the available capital, thus simplifying the arrangements for financing.



Turn-key alcohol distillery delivered to Paraguay in September 1980.

Then, from project to final installation, Dedini supplies equipments or complete distilleries for any and every company or country that might be interested in replacing oil by alcohol-chemistry.

Dedini's capacity also makes it possible to supply turn-key distilleries. Indeed, Paraguay has already imported a unit through this system, pioneer in the history of alcohol industry.

Technical assistance: quickness and safety

Dedini's services do not finish here. They are still present during the project implantation, when specialized technicians supervise assembly. And they go on, with permanent technical assistance, providing spare parts in every country, quickly and efficiently.

Projected, manufactured, installed and assisted by Dedini, the distillery starts producing alcohol and profits.

From the project, through final installation, the client may count on a specialized staff's advice.

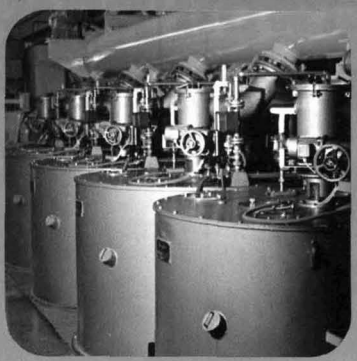
Trust the capacity of the experts in alcohol. Ask for Dedini's advice.

DEDINI

M. DEDINI S.A. METALÚRGICA

Av. Limeira, 222 - Jardim Universitário - Phone: PABX (0194) 34-5455 - CEP 13400 - Piracicaba - SP - Brazil

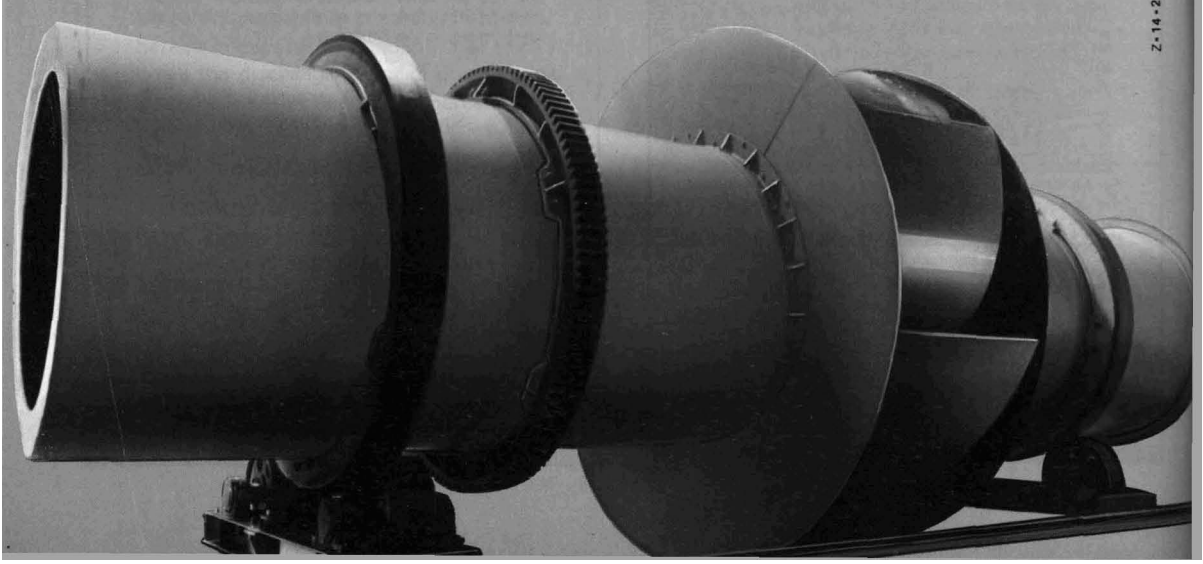
Salzgitter Maschinen und Anlagen AG



Salzgitter Equipment for the Sugar Industry

Beet sugar factories
Cane sugar factories
Sugar refineries
Beet wheels
Beet washers
Beet pulp presses
Rake type classifiers for sewage water
Carbonators
Decanters
Filters
Lime milk preparation
Rake type classifiers for lime milk and raw juice
Heat exchangers (juice heaters)
Evaporators
Vacuum pans with and without agitators
Holding, strike and cooling crystallizers with and without forced cooling
Semi-automatic and fully automatic centrifugals
Continuous centrifugals
Sugar drying and cooling installations
Driers for beet pulp, green fodder and beet leaves
Molasses desugarizing plants
Tanks and vessels
Conveyors of all kinds
Tanks with and without agitators
Dust arresters
Classifiers
Settling tanks
Gears

Salzgitter Maschinen und Anlagen AG
P. O. Box 511640
D-3320 Salzgitter 51
Fed. Rep. of Germany
Phone (5341) 302-1
Telex 954445 smag d



Z-14-2

PATENTS

UNITED STATES

Producing immobilized enzyme compositions. Y. Ishimatsu, S. Shigesada, H. Suzuki, H. Kitagawa and S. Kimura, *assrs.* Denki Kagaku Kogyo K.K., of Tokyo, Japan. **4,205,128.** August 25, 1978; May 27, 1980. Immobilized (glucose isomerase) enzyme compositons are produced by reacting an enzyme or enzyme-containing micro-organism cells with an anion exchange high M.W. substance having a quaternary pyridine ring in the molecule in a weight ratio of enzyme or cells to molecule in the range 1:0.005-1:0.5 (1:0.005-1:0.05), in an aqueous dispersion of pH 5-9 and at 0-30°C. The water content is adjusted from about 25% to about 80% w/w and the reaction product subjected to extrusion moulding at 0-25°C to give an extrudate which is [treated with a cross-linking agent (dialdehyde starch, glutaraldehyde, etc.)], formed into pellets and these dried at 40-80°C for 15 min-20 hr.

Saccharification of glucose raffinate or mother liquors. P. B. R. Poulsen, S. Rugh and B. E. Norman, *assrs.* Novo Industri A/S., of Denmark. **4,206,284.** November 15, 1977; June 3, 1980. — When a first generation HFCS is fractionated by an adsorptive separation technique, the fructose is obtained in relatively pure form and the polysaccharides in the original syrup are concentrated in the glucose fraction. To hydrolyse these polysaccharides and so increase the market value of the glucose fraction, it is (brought to 5-25% solids content and) saccharified by short-term (1-10 hr) batchwise contact with amyloglucosidase enzyme (1-10 AG units per g of syrup solids); if an immobilized enzyme is used the contact time is reduced to <30 min.

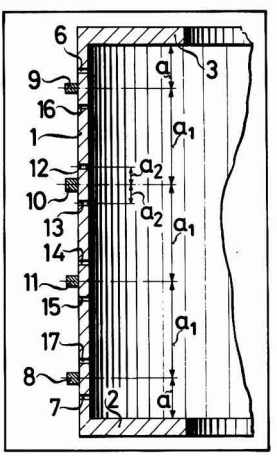
Saccharification of enriched fructose syrups. P. B. R. Poulsen, S. Rugh and B. E. Norman, *assrs.* Novo Industri A/S., of Denmark. **4,206,285.** December 27, 1977; June 3, 1980. — It has been found that, under certain conditions, adsorptive separation of fructose and glucose from a first generation HFCS (see previous patent) yields an almost pure glucose solution and a fructose fraction containing the polysaccharides. In this case it is the fructose fraction (brought to 2-50% solids) which is treated with the amyloglucosidase enzyme to hydrolyse the polysaccharides.

Immobilization of glucose isomerase. I. Ehrenthal and K. E. Miner, *assrs.* Anheuser-Busch Inc., of St. Louis, MO, USA. **4,208,482.** April 23, 1976; June 17, 1980. The enzyme is immobilized by mixing 0.5-1.5 (1) parts by weight of whole microbial cells containing it with 1 part by weight of agar, combining the mixture (at 5-15°C) with an organic solvent [ethyl acetate, butyl acetate, a (3:1) mixture of ethyl acetate and ethylene dichloride], recovering (substantially spherical) discrete particles of agar gel with enzyme-containing cells dispersed through them, and drying these to <15% moisture content.

L-sucrose. W. A. Szarek and J. K. N. Jones, *assrs.* Queen's University at Kingston, of Kingston, Canada. **4,207,413.** April 13, 1978; June 10, 1980. — L-sucrose, the enantiomer of naturally-occurring D-sucrose, does not appear in nature and has been synthesized. It has been found to be sweet and is unlikely to be metabolized in the manner of D-sucrose. 2,3,4,6-Tetra-O-benzyl-α-L-glucopyranosyl chloride is condensed with 1,3,4,6-tetra-O-benzyl-L-fructofuranose and the product catalytically debenzylated.

Centrifugal. H. Houben, of München-Gladbach, Germany, *assr.* Maschinenfabrik Buckau R. Wolf AG. **4,209,341.** August 11, 1978; June 24, 1980.

The drum of a batch centrifugal, suitable for a charge of 1000 kg, is constructed with a side wall 1 connected to lower and upper walls 2,3, the former carrying the web by which it is fastened to the rotating shaft of the machine. Instead of thickening the wall 1 to reinforce it for the large charge, reinforcing rings 8, 9 are shrunk onto the side wall 1 the distance a being between 10 and 15% of the inner diameter of the drum (e.g. 120 mm for a diameter of 1200 mm and a side-wall height of 1050 mm). In this way the wall thickness can be limited to 10 mm against the 12 mm in the central portion and 15-18 mm at the top and bottom of the side-wall necessary for a conventional un-reinforced drum.



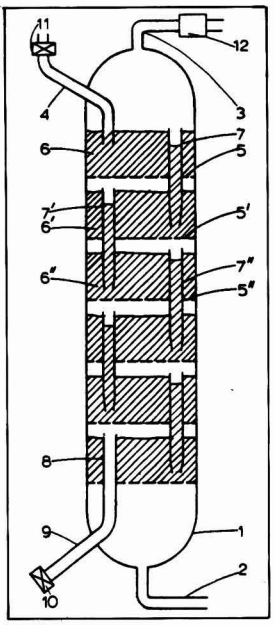
Such a drum is suitable for molasses of low viscosity; if highly viscous molasses is to be separated, additional rings 10 and 11 are provided and drain hole rows 12, 13, 14 and 15 in addition to the rows 6, 7 for low viscosity molasses. If desired, the top and/or bottom walls 3 and 2 may be provided with frustro-conical sections adjacent to the side wall, having angles of 15° upward and 5° downward, respectively, from the horizontal. In this case the reinforcing rings 9 and/or 8, respectively, may be omitted.

Enzymatic conversion process. P. F. A. M. Hendriks, of Geleen, Holland, *assr.* Stamicarbon B.V. **4,209,591.** August 3, 1978; June 24, 1980.

The column reactor 1 is provided with a supply tube 2 for a substrate solution (e.g. glucose) and with an outlet 3 for the discharge of the isomerized product. A supply tube 4 is provided for admission of immobilized (glucose

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 £1.45 each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C., USA 20231 (price 50 cents each).

isomerase) enzyme in granular form or as an aqueous slurry. A number of horizontal sieve trays 5, 5′, 5″, etc. divide the column into compartments in which the upflow of substrate maintains the enzyme in fluidized beds 6, 6′, 6″, etc. The compartments communicate through overflow pipes 7, 7′, 7″, etc. The treated substrate leaving the column through outlet 3 passes through a gas/liquid separator and may additionally be filtered.



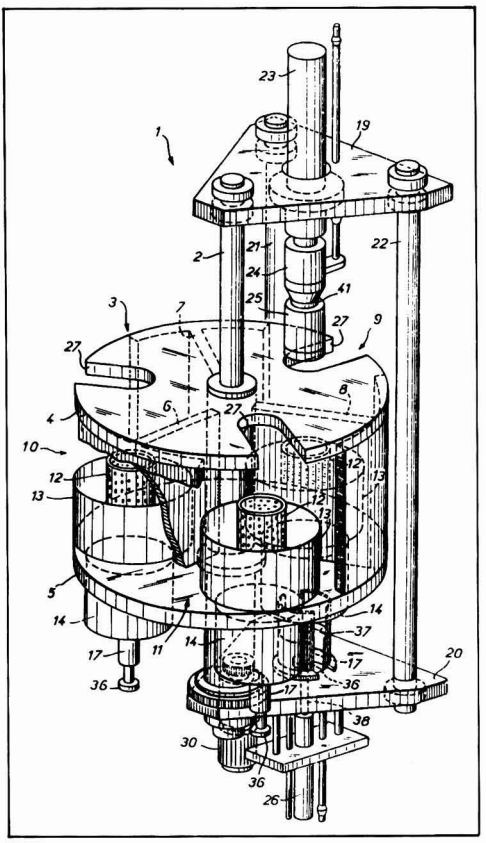
Fresh enzyme is added at intervals as necessary; to do this the flow rate of substrate is increased when the volume of the fluidized beds increases and they overflow through the pipes 7, 7′, 7″, etc. From the bottom compartment the enzyme passes into overflow 8, into pipe 9 and so out through valve 10. Fresh enzyme is then added through tube 4 and the substrate flow reduced to normal, when the enzyme transfer continues and the bed volumes are restored in each compartment.

Cane cultivator. H. Collado, of Palm Springs, FL, USA. **4,211,284.** May 2, 1978; July 8, 1980.

Process and press for extracting juice from a sample of sugar cane. G. Pinette, of Givry, France., *assr.* Pinette-Emidecau S.A. **4,212,241.** November 22, 1978; July 15, 1980.

The press 1 is provided with upper and lower plates 19, 20 linked by posts 2, 21 and 22. Post 2 acts as the axis of rotation for the drum 3 which is formed by upper and lower plates 4, 5 and which is divided into three compartments or work stations 9, 10 and 11 by radial plates 6, 7, 8 welded to the plates 4 and 5. In each work station is located a juice receptacle 13 in which a perforate filter cup 12 is centrally located, while under each station is a hydraulic cylinder 14. The bottom of each cup 12 is movable and attached to an ejector 17 with an enlarged lower section 36.

Above the operating station, shown as 9 in the illustration, is a hydraulic cylinder 23 mounted on plate 19 and having a piston 24 to which is removably attached (e.g. by spring-loaded balls locating in a groove) a ram 25. A cup is filled with finely prepared cane and located under ram 25 in station 9. The cylinder 23 is actuated, whereupon the piston 24 and ram 25 descend through the slot 27 in plate 4 and the ram enters the cup 12 below. A suitable manually-operated or automatic clamping device such as a C-shaped collar is engaged in the groove 41 in ram 25 and holds it firm under plate 4, whereupon the piston 24 is withdrawn.



The drum is then rotated through 120° by a geared motor 30 arranged to locate it so that the pistons and cup are exactly aligned. The hydraulic cylinder 14 is actuated, moving the receptacle and cup upwards against ram 25; pressure is maintained for a chosen time after it reaches its maximum and the juice thereby expressed from the cane to pass out of the cup into the receptacle and from this through an outlet into a sample beaker. The piston 14 then returns to its original position and the drum passes through a further 120° while a subsequent sample is being compressed and then through a third 120° to bring it back to the original position. Here piston 24 is lowered and engages with ram 25, the clamp is removed, a hydraulic unit 26 is engaged with the end 36 of ejector 17 and the bottom of the cup 12 is raised, giving a plug of bagasse held between ejector 17 and ram 25. This is removed manually or automatically, the ejector and cup bottom return and the cup is ready for a new sample of cane.

Swaziland sugar exports[1]

	1981	1980
	tonnes, raw value	
Canada	29,522	0
EEC	123,675	126,711
Indonesia	0	11,390
Malaysia	0	14,233
Morocco	0	29,491
Portugal	15,748	12,200
USA	175,947	111,815
USSR	0	10,702
Other Africa	0	3
	344,892	316,545

High fructose corn syrup production in the EEC[2]. – Production in the economic year July 1980/June 1981 totalled 183,887 tonnes d.s., an increase of 11.98% on the 1979/80 figure of 164,217 tonnes which was itself 18.04% higher than the 139,121 tonnes of the previous year.

Florida 1981/82 sugar crop[3]. – During the 1981/82 season the Florida sugar factories produced 849,181 tonnes, raw value, against the record 1,017,416 tonnes produced in 1980/81. The fall is attributed to a combination of drought and three frosts followed by warm weather which encouraged deterioration. Some cane was left unharvested because the sugar content had fallen below a level which was economical for the cane to be cut and processed.

Colombia sugar production, 1981/82[4]. – In its 1981/82 season Colombia produced its second largest sugar crop, of 1,212,371 tonnes, which compares with the record 1,247,488 tonnes produced in 1980/81.

Peru partial sugar industry recovery[5]. – Peruvian sugar production in 1982 is estimated to reach 650,000 tonnes, raw value, by the US Dept. of Agriculture and will allow Peru to export 50,000 tonnes of sugar in the second half of this year, compared with no exports from the drought-affected 1981 crop. Sugar stocks at the end of 1982 are expected to total about 52,000 tonnes against 92,642 tonnes at the end of 1981. The USDA report also predicts that it could be 1985/86 before Peru's sugar production returns to normal levels.

US sugar import fee[6]. – The interim adjustment mechanism has led to a flat 1 cent/lb reduction in the US sugar import fee; the new rate of 2.4193 cents/lb for raw sugar took effect on July 21.

Guyana sugar problems[7]. – By the end of March Guyana had produced only 49,570 tonnes against its target of 70,800 tonnes; the shortfall is attributed to continuing torrential rain as well as strikes on four out of the ten estates. Unless the weather improves and cane cutters report for work in adequate numbers and on a regular basis, the industry could be faced with serious problems.

US sugar imports, 1982[8]. – Sugar imports by the USA in 1982 are expected to fall from the 5 million tons of 1981 to around 3 million tons, according to estimates by the US Dept. of Agriculture. The major factors leading to the drop are an expected reduction of nearly a million tons in US refined sugar exports, the late 1981 surge in imports in anticipation of duty and fee increases, a prospective decline in domestic use and much smaller inventories by the end of the year.

Chile sugar industry contraction[9]. – The area sown to sugar beet was reduced from 37,700 hectares in 1981 to 21,000 ha in 1982, because of depressed sugar prices. Sugar production is expected to total 120,000 tonnes against 220,000 tonnes in 1981, with domestic consumption remaining constant at about 420,000 tonnes.

Taiwan sugar production 1981/82[10].– Sugar production during the 1981/82 season amounted to 727,500 tonnes, tel quel, almost the same quantity as the 727,700 tonnes produced in 1980/81.

US sugar import quota system legality suit[11]. – The US Court of Customs and Patent Appeals has rejected the appeal by the US Cane Refiners' Association claiming that the current administration policy of imposing import quotas at the same time as import fees is illegal[12].

Zimbabwe sugar exports[13]

	1981	1980
	tonnes, raw value	
Algeria	11,598	12,020
Angola	33	11
Botswana	31,755	36,969
Finland	12,652	68,881
Israel	0	7,160
Portugal	11,598	21,464
Uganda	0	207
USA	68,563	12,758
USSR	0	15,404
Zaire	0	1,476
Other countries	28,027	42,309
	164,226	218,659

Brazil sugar and alcohol production plans[14]. – With the difference between the price of sugar for export and that paid to domestic producers, the Sugar and Alcohol Institute could incur substantial losses on the three million tonnes it is committed to export in the period up to August 1983. Brazil plans to produce 9 million tonnes of sugar and 5200 million litres of alcohol in the crop year June 1982-May 1983, as against 8.45 million tonnes and 4200 million litres, respectively, in 1981/82.

Hawaii sugar factory contraction[15]. – Amfac Inc. has announced a two-year plan to save the ailing Oahu Sugar Co. Amfac plans to reduce the plantation from 18,000 to 13,000 acres and sugar production from 105,000 to 85,000 tonnes/year. There are also plans to install a recovery system for cane trash which can then be used as a source of energy. Amfac officials said they think the plantation could be energy self-sufficient in 1984 at a saving of $700,000-$800,000 a year.

Bolivia sugar exports 1981[16]. – Exports of sugar from Bolivia in 1981 are reported to have totalled 20,375 tonnes, raw value, but destinations are unknown. This is a marked fall from the 107,483 tonnes exported in 1980 and 126,524 tonnes in 1979, in both of which the main recipients were Chile and the USA.

Trinidad sugar industry diversification[17]. – Faced with an expected loss of TT$ 300 million for 1982, the state-owned Caroni (1975) Ltd. plans to seek other sources of revenue. The bagasse utilization plant at Brechin Castle is to be reactivated, distillery operations strengthened and the company is to engage in rice growing, while some 15,000 acres are to be sold for housing. A TT$ 12 million plant is to be built at Ste. Madeleine for producing 60,000 tonnes of granulated sugar per year, almost quadrupling Trinidad's granulated sugar output. If Caroni's raw sugar output continues to decline, whether owing to bad weather (as in 1981 when production was only 90,000 tonnes) or by design, through diversification, the country could eventually cease to be an exporter; this would not be viewed with much dismay, however, because of the claimed loss on exports owing to production cost being twice the income.

1 *I.S.O. Stat. Bull.*, 1982, **41**, (2), 37.
2 *Starch/Stärke*, 1982, **34**, 178.
3 *Sugar y Azúcar*, 1982, **77**, (5), 13-14.
4 *World Sugar J.*, 1982, **4**, (11), 19.
5 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 266-267.
6 C. Czarnikow Ltd., *Sugar Review*, 1982, (1606), 120.
7 *World Sugar J.*, 1982, **4**, (11), 39.
8 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 266.
9 *Bank of London & S. America Review*, 1982, **16**, 96.
10 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 313.
11 C. Czarnikow Ltd., *Sugar Review*, 1982, (1606), 120.
12 *See I.S.J.*, 1982, **84**, 255.
13 *I.S.O. Stat. Bull.*, 1982, **41**, (2), 47.
14 *Public Ledger's Commodity Week*, June 5, 1982.
15 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 281.
16 *I.S.O. Stat. Bull.*, 1982, **41**, (5), 5.
17 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 312.

South Korea sugar imports and exports, 1981[1]

	1981	1980	1979
	tonnes, raw value		
Imports			
Australia	274,500	227,087	185,282
Hong Kong	0	505	0
Philippines	148,517	244,479	184,858
South Africa	63,888	0	17,327
Taiwan	175,815	202,363	196,714
Thailand	96,661	15,417	84,673
USA	0	2	0
	759,381	689,853	668,854
Exports			
Bangladesh	5,271	0	0
Hong Kong	76,590	49,847	58,710
India	24,944	0	0
Indonesia	217,418	94,545	59,907
Japan	1,631	0	0
Kuwait	13,695	0	0
Mexico	0	27,933	0
Nepal	7,227	0	0
Singapore	303	350	1,733
Sri Lanka	57,280	11,550	0
Thailand	0	20,466	0
USA	978	0	1,300
	405,337	204,691	121,650

Congo sugar cane expansion plans[2]. — From a crop of 182,000 tonnes in 1980 and 261,000 tonnes in 1981, cane production is to rise to 448,000 tonnes in 1982, 512,000 tonnes in 1983 and 640,000 tonnes in 1984.

Upper Volta sugar developments[3]. — Among the projects covered by a 20,000 million CFA francs (US $67 million) plan for the development of Upper Volta's industry are one plant for animal feed based on molasses ($672,000) and the sugar complex of Sourcu ($16.8 million).

Panama sugar production, 1981/82[4]. — Sugar production in Panama during 1981/82 is estimated at 202,500 tonnes, raw value, compared with 187,000 tonnes in 1980/81. The preliminary estimate for 1982/83 is 215,000 tonnes, raw value.

Thailand sugar surplus problem[5]. — Sugar cane production for the 1981/82 season is officially estimated at 30 million tonnes against an earlier estimate of 26 million tonnes and the actual 1981/82 crop of 18.6 million tonnes. The crop should yield about 1.9 million tonnes of raw sugar for export in addition to the 700,000 tonnes of white sugar needed to cover domestic requirements. The country's ISA quota is only 1.18 million tonnes, however, and some traders in Bangkok have argued that the surplus is so large that it might be necessary to leave the Agreement in order to surmount the problem. Other traders believe that withdrawal would not solve the problem and that a better approach would be to ask the ISO to relieve Thailand of its quota obligations for the rest of the year.

Ghana sugar industry revival plans[6]. — The two sugar factories in Ghana have been allowed to deteriorate in recent years and sugar production has declined steadily from 13,000 tonnes in 1977/78 to 6000 tonnes in 1981/82. At the same time Ghana has been forced to import sugar, mainly from Brazil and the EEC, at a cost in 1981 of $11,300,000. Cuba is to provide help to revive the country's industry.

Cuba by-products plants[7]. — In 1981 plants were constructed at Central Primero de Enero for the manufacture of bagasse board and at Central Guatemala for the manufacture of torula yeast.

EEC quota for Kenya[8]. — The EEC commission has agreed to reinstate most of the Kenya sugar supply quota from July 1, allowing it to export 4000 tonnes of sugar to the Community at guaranteed prices; the original 5000 tonnes quota had been suspended earlier following failure to supply sugar. No decision was reached in respect of the Congo's 5000-tonnes quota which had been halved, but the Commission would review the situation when production in the next season was known; the Congo expects to produce 32,000 tonnes in 1982/83 against 16,000 tonnes in 1981/82. The Commission is also to examine a request for accession to the ACP protocol by the Ivory Coast which has expanded production markedly in recent years.

Colombia sugar exports[9]

	1981	1980	1979
	tonnes, raw value		
Chile	0	107,309	98,994
China	0	0	24,000
Morocco	0	0	24,800
Portugal	13,130	12,096	72,520
Tunisia	0	0	12,420
USA	151,987	161,049	45,480
USSR	12,096	0	0
	177,213	280,454	278,214

New Spanish sugar factories[10]. — A new beet sugar factory of 6000 tonnes daily slicing capacity is to be built in Andalusia in southern Spain. The exact site has still to be decided but it will be between Cabezas de San Juan and Utrera and operations will commence in 1984. The intention is to re-structure the Andalusian industry while increasing productivity and encouraging beet cultivation; it is expected that the owners, the Ebro Group, will close their existing factory at Los Rosales in Sevilla when the new facility starts production. The ACOR cooperative, which has two factories at Olmedo and Valladolid, is to build a third at Valcabado, near La Baneza[11], with a daily slice of 5000 tonnes, although the project is opposed by existing factories in the region. In Granada province, it is expected that La Vega Granadina and Nuestra Señora del Carmen factories will have to be closed, although the unions concerned have held protest meetings in Madrid in the hope that the decision will be changed.

East Germany sugar production 1981/82[12]. — The 47 sugar factories in East Germany sliced 6.75 million tonnes of beet in the 1981/82 campaign to produce 687,000 tonnes of white sugar, 13,000 tonnes below the planned target. The extraction rate fell to 10.2% white value, because processing was continued until early February 1982.

PERSONAL NOTES

Robert H. Shields, former President of the US Beet Sugar Association in Washington, DC, has been elected Washington area Vice-President of ManExec Inc., a management consulting group that has been particularly active in the sugar and sweetener field. He succeeds the late Lawrence Myers who from 1948 to 1963 headed the US government's sugar program.

Mr. Mervyn Shore, Head of the British Sugar Research Laboratories at Colney, Norwich, has been appointed Director of Research and a member of the company's Operations Committee, from August 1, 1982. He joined the British Sugar Corporation research staff in 1953 and became Head of the Laboratories in 1975. He is Chairman of the European Research Advisory Committee of the World Sugar Research Organization, a member of the Scientific Committee of the C.I.T.S. and a member of the Institut International de Recherches Betteravières.

Mr. Ken Blyth retired on July 9 from the staff of the Queensland Cane Growers' Council which he joined as an office boy in 1932. At 17 he was appointed accountant by the Council in 1933 and held that position until 1939. After war service he entered industry but in 1956 rejoined the Council staff as Administrative Officer and was closely involved with the conversion of the industry from manual to mechanical cutting of cane. He represented the Council at meetings of the ISSCT, Tariff Board, Brisbane Chamber of Commerce, the Sugar Board, etc.

---

1 *I.S.O. Stat. Bull.*, 1982, **41**, (4), 23-24.
2 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 334.
3 *Westway Newsletter*, 1982, (103), 14.
4 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 295.
5 *Public Ledger*, June 5, 1982.
6 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 267.
7 *Cuba Economic News*, 1982, **18**, (128), 11-12.
8 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 278.
9 *I.S.O. Stat. Bull.*, 1982, **41**, (5), 9.
10 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 308.
11 See also *I.S.J.*, 1982, **84**, 95.
12 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 308.

Index to Advertisers

SUGAR BOOKS

Prices given below include insurance, packing and surface mail postage. They are approximate and subject to alteration without notice owing to fluctuations in currency exchange rates. Air mail postage extra will be quoted on request. Terms are strictly cash in advance.

Check your personal library against the list of basic books given below:

MANUFACTURE AND REFINING OF RAW CANE SUGAR (2nd ed.): *Baikow*	(1982)	£81.50
BY-PRODUCTS OF THE CANE SUGAR INDUSTRY (3rd ed.): *Paturau*	(1981)	£38.90
F. O. LICHT'S INTERNATIONAL SUGAR YEARBOOK AND DIRECTORY	(1981)	£30.50
STANDARD FABRICATION PRACTICES FOR CANE SUGAR MILLS: *Delden*	(1981)	£30.30
THE EFFICIENT USE OF STEAM: *Ed. Goodall*	(1980)	£27.35
PROCEEDINGS, FUTURE OF SUGAR CONFERENCE.	(1980)	£45.00
AUSTRALIAN SUGAR YEARBOOK 1982	(1982)	£16.50
SUGAR ANALYSIS: ICUMSA METHODS: *Schneider*	(1979)	£13.55
CANE SUGAR HANDBOOK (10th ed.): *Meade-Chen*	(1977)	£61.50
PHYSICS AND CHEMISTRY OF SUGAR BEET IN SUGAR MANUFACTURE: *Vukov*	(1977)	£44.10
SUGAR CANE PHYSIOLOGY: *Alexander*	(1973)	£60.70
SUGAR BEET NUTRITION: *Draycott*	(1972)	£16.15
HANDBOOK OF CANE SUGAR ENGINEERING: *Hugot*, transl. *Jenkins*	(1972)	£115.05
PROCEEDINGS 15th SESSION ICUMSA	(1970)	£5.50
" 16th " "	(1974)	£7.50
" 17th " "	(1979)	£22.00
ANALYTICAL METHODS USED IN SUGAR REFINING: *Plews*	(1970)	£20.20
SUCROSE CHEMICALS: *Kollonitsch*	(1970)	£6.00
INTRODUCTION TO CANE SUGAR TECHNOLOGY: *Jenkins*	(1966)	£41.90
TECHNOLOGY FOR SUGAR REFINERY WORKERS (3rd ed.): *Lyle*	(1957)	£18.60

SUGAR BOOK DEPARTMENT

International Sugar Journal Ltd.

23a Easton Street, High Wycombe, Bucks., England

Manville offers seven Celite filter aids for one good reason: 99.9% pure sugar.

For over half a century, Celite diatomite filtration of beet and cane sugar liquors has helped produce the brilliantly clear liquor needed for top-quality white sugar. With maximum flow rates over long filter cycles, Celite filtration can also bring about significant economies in cloth, labor, steam, power, and sulfur, while effecting an increased yield from the pans. And regardless of filter design, the inert Celite filter cake separates quickly and completely from the filter elements, so the filter will be ready for the next cycle.

Celite filter aids are available in a variety of diatomite grades ranging in pore size from very fine to large pores. Whichever grades you choose, you can rely on the same consistent quality, supplied promptly to meet your needs.

In addition to Celite diatomite filter aids, Manville also produces other process aids for the sugar industry such as fiber filter aids. All backed by over 50 years of filtration technology, and the largest field force of filtration specialists in the industry.

For more information on how Manville can help clear up your filtration problems, contact:

Manville Great Britain Ltd.
Parkbridge House, The Little Green
Richmond, Surrey TW 9 1QU
Tél.: (01) 948.41.81 - Telex: 928.635

Manville