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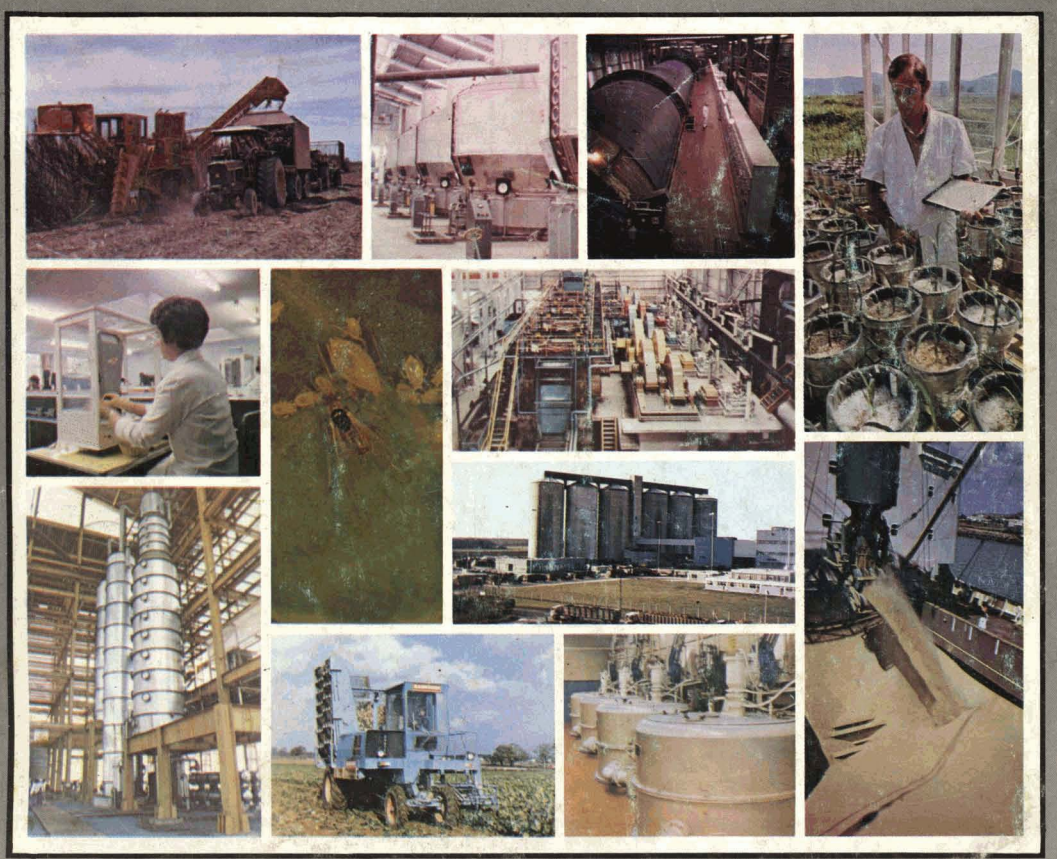
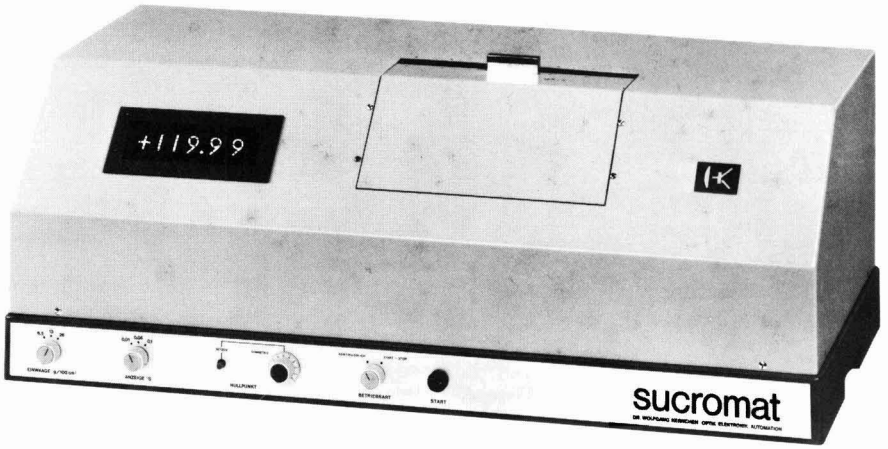


JANUARY 1978



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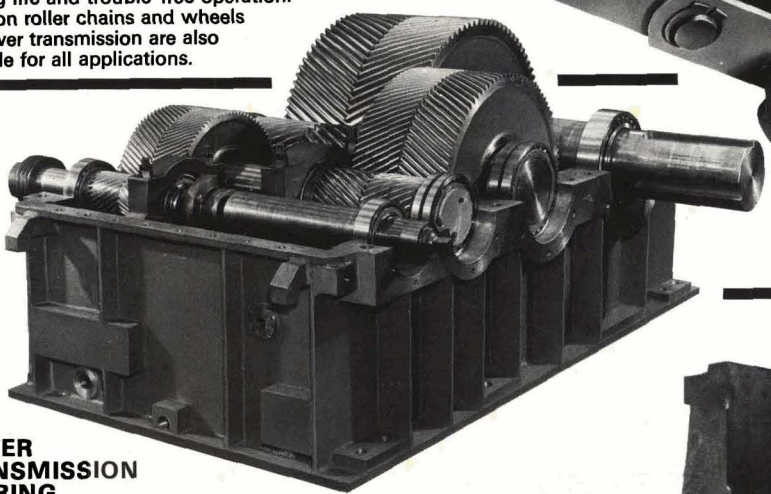

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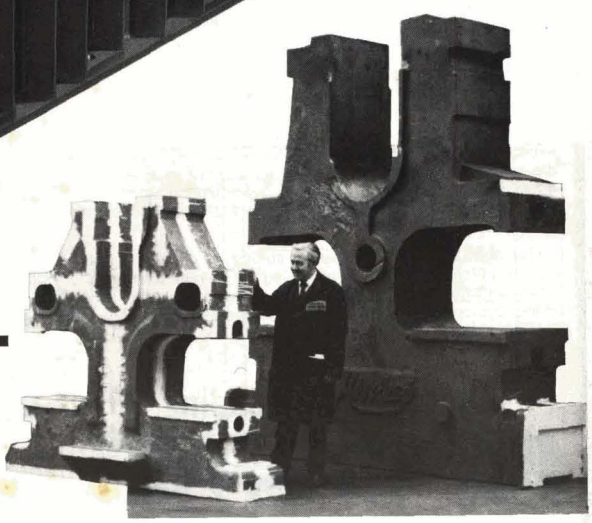

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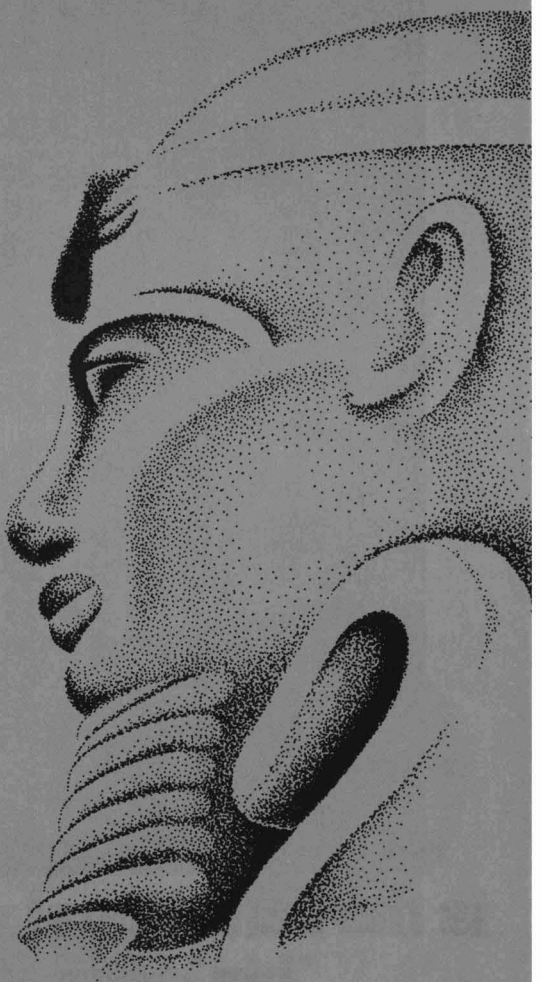
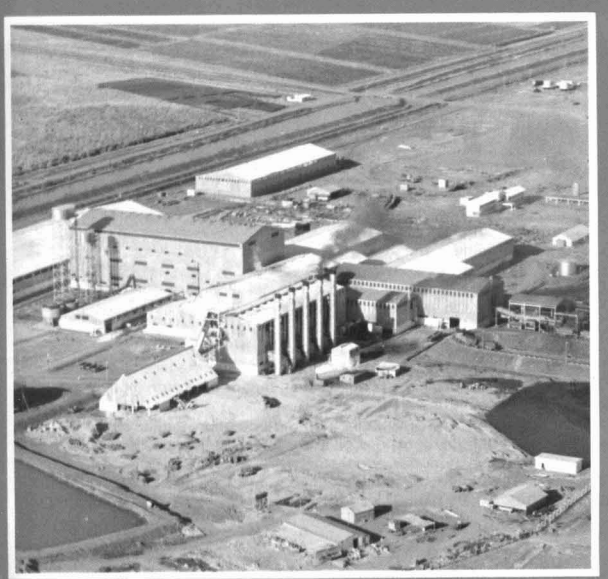


"The food bowl of the Middle East" is how world experts are describing the Sudan. However, to transform the undoubted potential of this vast land into reality requires technical skills, experience and above all stamina and dedication.



Fletcher and Stewart Limited possess just such qualities – qualities which have born fruition in the successful completion of the sugar factory project at Sennar on the banks of the Blue Nile some 300 kms south of Khartoum.

The factory which was supplied and erected against a background of extremely difficult manufacturing, shipping and local construction conditions is further evidence of FS commitment to the developing sugar industry of the world.

FS is now concentrating on the completion of its second turnkey Sudanese factory at Hagar El Asalaya in the White Nile Province which is located approximately 96 kms distant from the Sennar factory.

Although they differ in certain respects, each factory is capable of processing 6500 tons of sugar cane per day and will between them have the capacity to produce 250,000 tons per year of refined sugar.

Things are happening in the Sudan!

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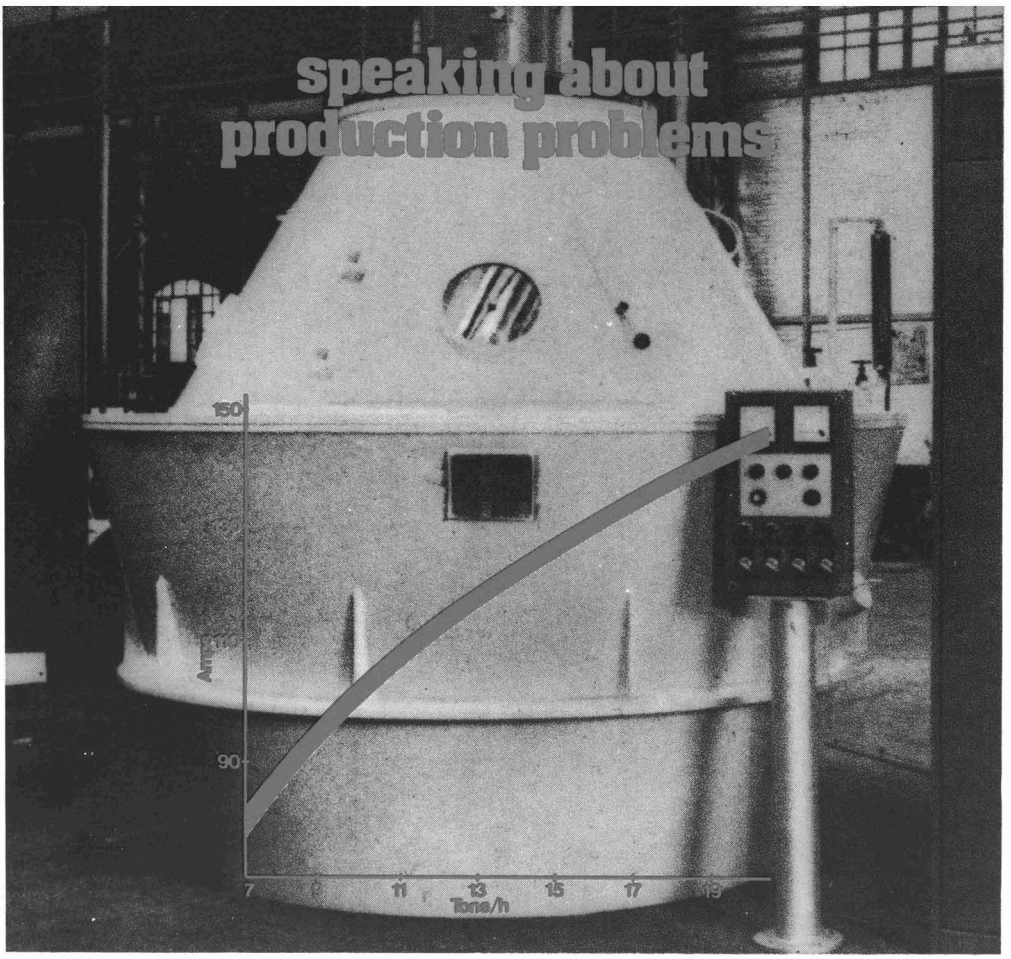

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- massecuite feeding into the basket coaxially with the drive shaft and uniform distribution through a proper device, formed by a cylinder and a cone, which rotates together with the basket.
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Thanks to what above, the "B5" continuous centrifugal guarantees:

- massecuite processing capacities up to 20 Tons/hr, when handling "Low purity" and "intermediate" products.
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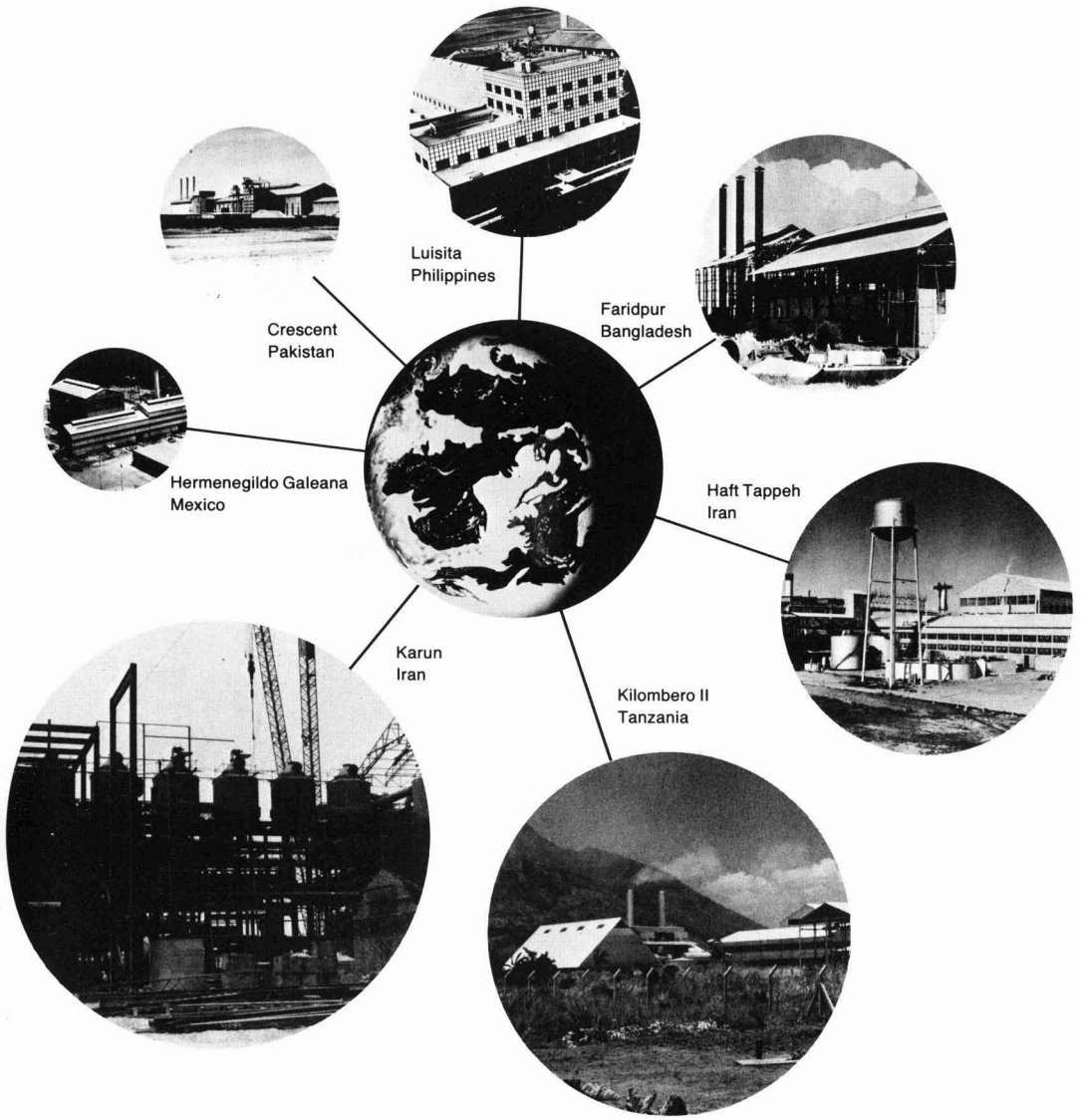
Looking from a satellite



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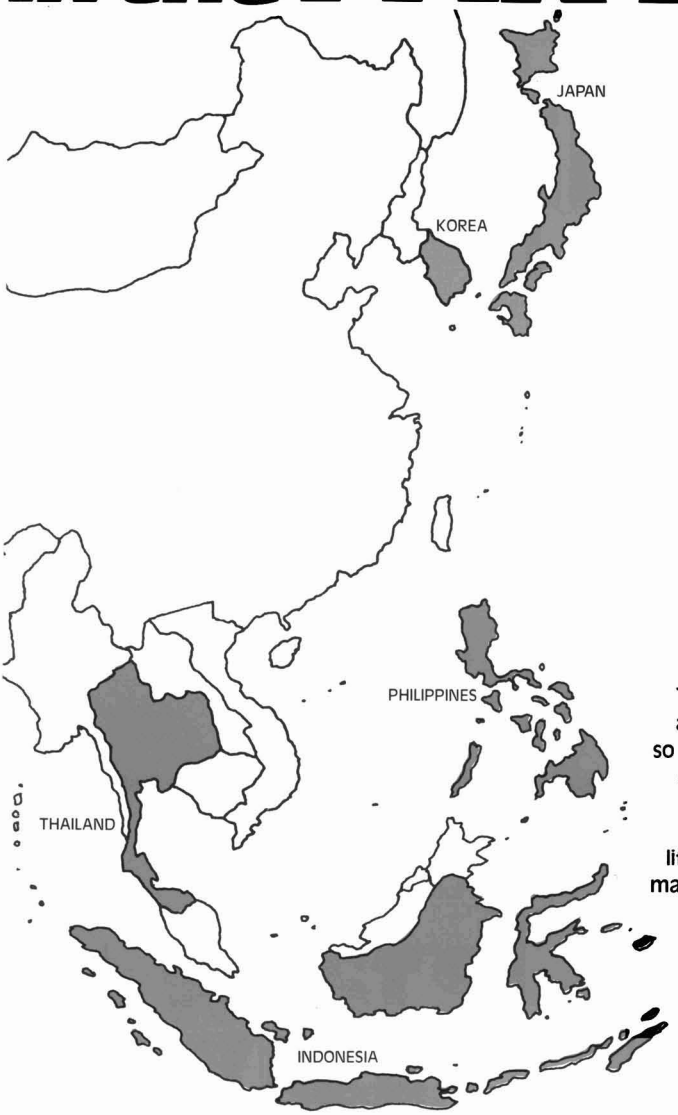

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NOTES AND COMMENTS

International Sugar Journal

Readers will not have to be especially observant to note a number of changes in this issue compared with previous issues of the *International Sugar Journal*. We have changed to a more modern and, we believe, clearer type, have divided our abstracts on agricultural subjects into separate sections, while summaries in French, German and Spanish now appear at the end of our articles instead of next to the Contents page.

The Contents page has been redesigned as has our front cover, and we offer our thanks to those who have provided colour photographs used in the composite illustration of the diverse aspects of the sugar industry and our interests in it; these include the British Sugar Corporation, the Queensland Cane Growers' Council, Ransomes Sims & Jefferies Ltd., Smith/Mirrlees, Toft Bros. Industries Ltd., Western States Machine Co. and Dr. C. Winner of the Institute für Zuckerrübenforschung, Göttingen. We thank also those firms and organizations who lent us photographs which we were unable to use.

Anti-trust action against the New York exchange

The US Department of Justice filed a civil anti-trust suit on 21st October alleging that the New York Coffee and Sugar Exchange restricted price competition in the marketing of sugar by fixing prices of raw and refined sugar at artificial levels affected by the subjective judgments of the Exchange's Quotations Committee which, because it includes officers of two sugar refining companies and three raw sugar merchants, is technically described by the Department as giving rise to collusion.

The following statement was made by the N.Y. Coffee & Sugar Exchange:

"Raw sugar spot prices have been openly published by the exchange for almost 30 years. In fact, publication of spot prices was initiated shortly after World War Two, at least in part, at the suggestion of the United States Department of Agriculture.

"The Justice Department, though recognizing this situation, has now determined that, in its view, the practice should be discontinued.

"The Board of Managers of the exchange does not believe the practice of publishing spot prices violates the law and is now considering its response".

The US sugar economists and brokers B. W. Dyer & Co. commented[1] that the Department was making matters difficult for the US Department of Agriculture and the US State Department as well as the sugar trade. Spot quotations of the Exchange were reviewed recently with public hearings by the C.F.T.C. who were investigating possible methods of improving the reporting system. To discontinue spot quotations would be a disservice to the government and the sugar trade generally, in Dyer's judgment; the levels of quotas and stocks under the new International Sugar Agreement will be based partly on spot prices, the US Farm Act is based on a 13·5 cents per lb domestic spot price, and many commercial raw sugar contracts are based on spot prices.

However, the Board of Managers of the New York Exchange decided on 3rd November to discontinue the practice rather than suffer continued government criticism and a lawsuit while it tries to improve on its methods. As a consequence, the International Sugar Organization ceased to publish its Daily Price which was an average of those on the London and New York markets. On 23rd November the Council decided to use the London Daily Price as its sole basis, the situation being subject to review in January 1978.

World sugar balance, 1976/77

F. O. Licht KG recently published their third estimate of the world sugar balance for the crop year September 1976/August 1977[2], reproduced below, with corresponding data for the two previous crop years.

	1976/77	1975/76	1974/75
Initial stocks	20,567,000	17,472,000	16,036,000
Production	88,256,000	82,756,000	79,600,000
Imports	26,029,000	23,667,000	24,144,000
	134,852,000	123,895,000	119,780,000
Exports	26,322,000	23,400,000	24,674,000
Consumption	83,070,000	79,928,000	77,657,000
Final stocks	25,460,000	20,567,000	17,472,000
" % " consumption	30.65	25.73	22.28

By comparison with his previous estimate in July there is an increase of more than two million tons in the production figure for 1976/77 with a consequent rise in the final stock figure. This may seem surprisingly large for an adjustment after the end of the period from not long before; Licht points out, however, that, because the crop year period ending in August cuts across the actual crop dates of some countries, notably Brazil, South Africa and Australia, especially good results at the start of the 1977/78 season in these countries have had to be taken into account and so have raised the production estimate. Furthermore, in view of Cuban official estimates for the 1976/77 crop, the estimate of production in that country by Licht has been increased by 500,000 tons.

International Sugar Organization

The I.S.O.'s Committee on Rules and Procedure began in November its work of establishing details of a price stabilization fund and its financing, according to a statement by the Executive Director, Mr. E. Jones-Parry. The meetings were to continue for some weeks but the details were to be finalized before the first meeting of the new Council in January 1978, although problems were unlikely in regard to administrative, economic and statistical rules since these should be similar to those under the 1968 Agreement.

The Committee is likely to have drawn on the experience of the International Cocoa and Coffee Organizations regarding the collection of charges on free market trade and verification of stocks. Under the new Agreement, producers are required to build up 40% of the

[1] *News Matter*, 21st October 1977.
[2] *International Sugar Rpt.*, 1977, **109**, (30), 1.

reserve stocks during the first year and will be able to draw 1½ cents/lb for financing of such stocks from the third quarter of 1978. The funds for this will come from a charge of 0·28 cents/lb on sugar traded.

The Council under the 1973 Agreement held what is hoped to be its last meeting near the end of November; the first estimate by the Statistical Committee of world market requirements in 1978 (set at 15,674,000 tonnes, raw value) was considered but will be re-assessed when the Committee reconvenes in January 1978.

The Council will establish quotas and will, for the first time in some years, be able to exert influence on the world supply and demand situation. The work of the Statistical Committee will regain its former importance and, as C. Czarnikow Ltd. comment[1], it will be interesting to see how close a balance the Council will find to exist between supply and demand.

"For our part, we have conducted a preliminary exercise in which we have initially taken notional net import requirements and against this have set out assessments of available supplies, taking into consideration, where appropriate, the full rigours of quota cuts which may be imposed by the International Sugar Council. At first sight this would seem to indicate a surplus of some 100,000 tons, which can hardly be called an excessive quantity, bearing in mind the need to have sugar afloat and the various impediments which there are to international trading. There, is, however, one additional factor which must be taken into consideration. During recent weeks exporting countries which will find themselves severely restricted by the operation of the ISA quota system have managed to sell sugar for shipment during 1977 when under more normal circumstances this would not have taken place until the new year. This, of course, means that importing countries are in many cases establishing corresponding stocks, thus reducing the supplies they will need to import in 1978.

"The quantity of sugar involved in this accelerated shipping arrangement cannot be easily assessed. We believe, however, that it is as much as 900,000 tons. The indicated market surplus next year as it may be ascertained at this stage, even with full quota cuts in operation, would therefore appear to be of the order of 1,000,000 tons. This cannot be heartening to those who hope that the International Sugar Agreement will bring about a rapid price transformation. Nevertheless, there may be some consolation in the fact that in recent years sugar has proved to be much more price elastic than had hitherto been believed. Accordingly consumption might eventually be higher than is at present forecast while low market prices could prove to be a greater disincentive to producers than is currently envisaged."

World sugar prices

During the early part of November considerable selling pressure sent the London Daily Price for raw sugar downwards and it reached the level of £85 per ton, its lowest for almost five years, on the 8th. After three days, however, helped by falling exporters' stocks, rumours of Chinese interest and buying by other importers, the LDP started to recover and rose to £106 per ton by the 1st December.

With less selling pressure for white sugar, the LDP(W) was fairly steady from the level of £102.50 on 1st November but started to rise with the LDP after 9th November and reached £110.00 per ton by the end of the month.

Thailand sugar crisis[2]

The sugar industry in Thailand has advanced remarkably in the past several years and Thailand may be the only cane sugar-producing country whose sugar output has expanded 100% during the past four years (a rate of around 20% growth per year). The total cane crushing capacity in Thailand has increased at a rate of about 40% per year, partly through the expansion of existing factory capacity and partly through the establishment of new factories. While 1976/77 production reached about 2·3 million tonnes, raw value—almost three times that of 1971/72—exports of 1,082,000 tonnes in 1976 have moved Thailand into the top five world sugar exporting nations.

Despite the remarkable progress during the past few years, Thailand's sugar industry is in the midst of crisis. The steep fall in world market prices has resulted in financial difficulties for both the sugar industry and the farm sector. Millers threatened to slash the price they pay sugar cane growers and the Government is stuck with a cumbersome system of price guarantees which threatens to cause it major political embarrassment.

Of 1977's estimated 1,750,000 tonnes of exports, 400,000 tonnes were sold forward at Baht 6000 (US $300) but the remainder fetched on average only Baht 4000 a ton. According to the Thai Trading Corporation the millers' costs are around Baht 4940 (Baht 3540 for cane and Baht 1400 for milling), so, with total sales revenues of Baht 7900 million against costs of Baht 8645 million, the exporters appear to have suffered a substantial loss. Industry production cost figures in Thailand are notoriously subjective, however, and no single set of figures is accepted by millers, growers and Government alike.

It is argued that the new International Sugar Agreement suggests that millers and exporters could hold hope of a return to profitability, and some of these gains may filter down to growers. However, the world-wide oversupply may make it difficult for the new Agreement to raise prices to the specified level. This could mean the Thai sugar industry faced with continued low world market prices and restricted exports under the new ISA. The basic export tonnage allocated to Thailand is 1·2 million tonnes which, under the terms of the ISA, will allow Thailand to export up to 1,020,000 tonnes in each of the next two years, substantially below estimated exports in 1977.

Production in 1978 is expected to decline by more than 15% owing to the most severe drought Thailand has experienced in 15 years. However, despite the anticipated drop in production, the surplus over exports and domestic consumption in 1978 could total about 300,000 tonnes unless farmers cut their sugar cane plantings. The country could be left with a huge stockpile which will be difficult to protect from humid conditions and costly to re-process.

According to reports from Bangkok[3], a group of 23 mills—which accounts for 60% of total Thai sugar production—has signed an agreement with their cane growers which provides for an unchanged cane price of Baht 300 per tonne for the 1978 season and depends on Thailand's becoming a member of the I.S.O. as well as on the ratification of the new Agreement. Those sugar mills which oppose Thailand's membership of the I.S.O. will probably sign a different agreement with their cane growers.

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[1] *Sugar Review*, 1977, (1360), 182.
[2] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (32), 1–3.
[3] *ibid.*, (33), 20.

The FS diffuser (Van Hengel system)

By J. R. FITZGERALD, G. E. SALT and A. VAN HENGEL

Paper presented to the 1975 Meeting, Mauritius Sugar Technologists Society)

Introduction

THE FS diffuser (van Hengel system), from hereon referred to as the FS diffuser, was first conceived in 1968, after, apart from their obvious advantages, a number of disadvantages of the more commonly used diffusers became obvious. In those pioneer days of diffusion the advantages obtained were low costs of installation and maintenance, whilst ensuring a reasonable-to-good extraction without much operational trouble. The main objection was: "it does not put more sugar in the bag", a reference to the fact that there were general indications that the boiling house losses increased as fast as extraction gains[1].

The development of the FS diffuser must be seen against this background. Originally, there was no specific aim to establish a financial or commercial advantage, which only came later, after the Hulett Corporation of South Africa and Fletcher and Stewart Ltd. of Great Britain agreed on terms for world marketing. In 1968 it was nothing but an attempt to evaluate what was good or bad in diffusion and to propose machinery which would clearly display its advantages. It cannot be claimed that the machinery resulting from these attempts is simple and straightforward, but then, neither is the modern airliner.

The FS diffuser in simple terms consists of a series of bagasse transportation and juice spraying systems each not unlike the carriers described as early as 1936 by Tromp[2]. The difference is not in principle, but in the fact that bagasse is dragged over a perforated screen, with the advantage that effective use can be made of the return chain as shown in Fig. 1.

It was never intended that the FS diffuser could comprise one of these units only, but to place in series a number of these units, referred to as cells from hereon, and to design the diffuser in such a way that each cell is of reasonable size and that the juice flow across the cells would establish a gradient in Brix essentially identical to the ones achieved in other well-known makes. A typical multiple cell arrangement is shown in Fig. 2.

The length of the FS diffuser is variable, as the beginning and the end are not characterized by definite equipment like macerators and/or press water rollers. This will, later on, prove to be a great advantage over all other makes.

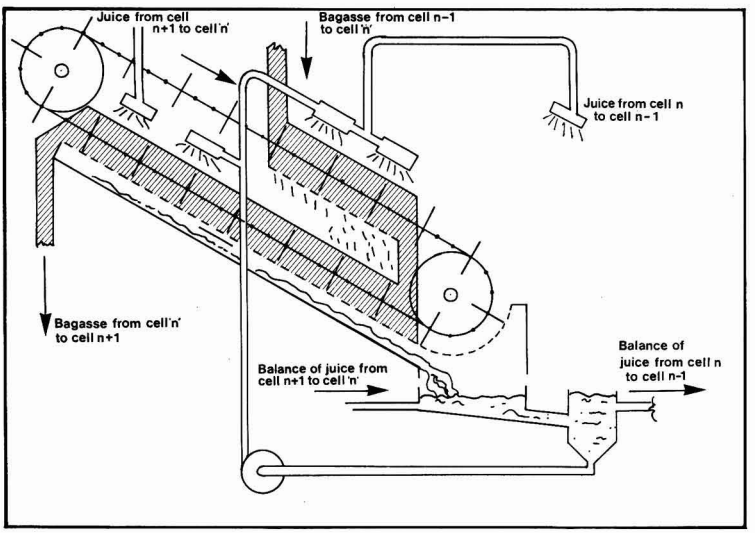

Fig. 1. Schematic layout of *n*th FS diffuser cell

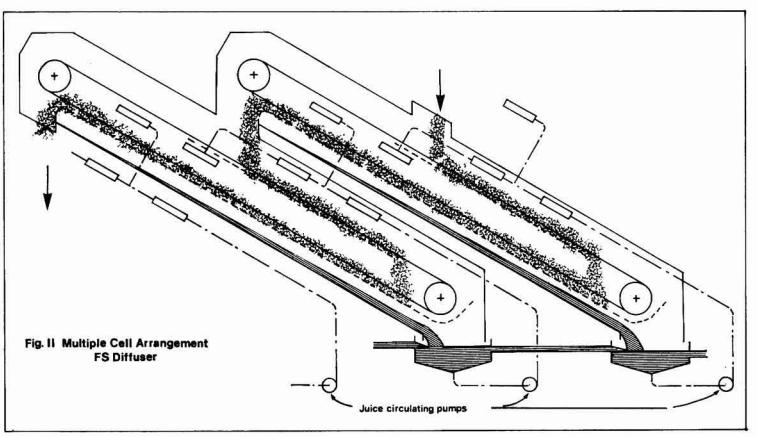

Fig. 2. Multiple cell arrangement

[1] Fitzgerald & Lamusse: *Proc. 15th Congr. I.S.S.C.T.*, 1974, 1486–1498.

[2] "Machinery and Equipment of the Cane Sugar Factory", (Norman Rodger, London), 1936, p. 251.

Dimensions of a FS diffuser

The most important criterion in designing a diffuser is the actual residence time of cane or bagasse, during which pol is to be extracted. From that the speed of the chain, length, width, depth, etc., will follow.

Experience in South Africa, which may vary slightly from that in other countries, has revealed that one cubic metre of bagasse bed in a diffuser contains approximately 80 kg of *dry* fibre. Then, if:

R = residence time in hours
C = tons of cane per hour
f = fibre % cane
W = width of cells in metres
L = length of effective screen area per cell in m
s = bagasse bed velocity in m.min^{-1}
n = number of cells
h = depth of mat in metres, and
d = density of bed in kg fibre per m^3

then:

$$L = 60\,Rs/n \quad \ldots \quad (1)$$

$$W = Cf/6\,sdh$$

and for $d = 80$

$$W = Cf/480\,sh \quad \ldots \quad (2)$$

In Fig. 3 it is shown that it is most unlikely, if not impossible, that the space between rakes is filled up evenly as the cell is inclined at an angle of 30°. An efficiency coefficient of 0·8 must be introduced and (2) will then read:

$$W = Cf/380\,sh \quad \ldots \quad (3)$$

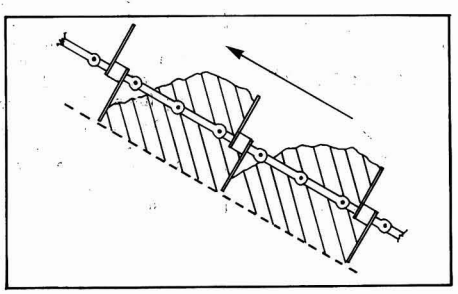

Fig. 3. Average 80% filling rate between rakes

Speed of bagasse in a FS diffuser

It has been found that the sprockets of the bagasse conveying mechanism cannot be smaller than 1·16 m, which allows 12 teeth of 1 foot pitch for a chain with 1 ft links. Smaller diameters will make the distance between top and bottom decks too small, larger diameters will cause unnecessary torque problems. The drive shaft, if operating at 1 r.p.m., will thus cause the velocity of the bed to be:

$\pi \times 1{\cdot}16$ m.min^{-1} = 3·66 m.min^{-1} (= 12 ft.min^{-1})

The average design speed of the drive shaft is indeed about 1 r.p.m., which under the prevailing conditions of torque, creates a mechanical problem of some significance.

Number of cells in a FS diffuser

The minimum number of cells is governed by the approximation to an ideal Brix curve.

The difference, shown in Fig. 4 seems significant, as the stepped graphs for 6 or 11 cell installations follow the general shape of the ideal curve which could be expected from a continuous counter-current design such as a "Saturne" or DDS diffuser under optimum conditions. A low number of cells is mechanically attractive, but cannot, theoretically, be efficient. A large number of cells, e.g. in a BMA, Silver Ring or De Smet diffuser, should likewise be better than a five, six or seven-cell FS diffuser. However, if the theoretical disadvantage of a low number of cells could be offset by preventing juice intermixing and backflow as a result of cellular treatment of the juice, then that theoretical disadvantage could be minimized, nullified or even turned into an advantage. From investigations by Rein[3], it can be concluded that the minimum required number of cells is five, whereas there is no maximum for reasons other than practical considerations.

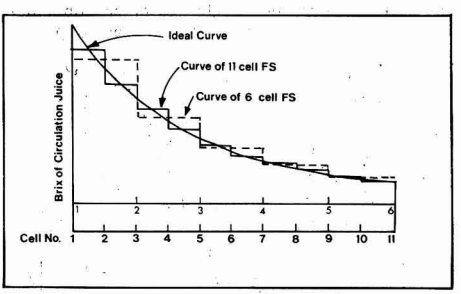

Fig. 4. Comparison of Brix curves

Residence time in a FS diffuser

The residence time required is a function of the efficiency with which the parameters governing the process of "diffusion", in its widest sense, are applied, i.e. temperature, particle size, juice displacement and concentration difference. Rein[3] has recommended that, based on his investigations, the operational conditions in a FS diffuser should require a residence time of 25–30 minutes, which time includes the scalding stage.

Length of bed in a FS diffuser

From the simple geometry of a cell, it becomes quite clear that the total length of the top deck is a function of the length of the bottom deck and the angle of inclination. The longer the bottom deck, the more significant the length of the top deck. If the bottom deck is too short, one may just as well not have a top deck.

Obviously, for a certain angle of inclination the difference in length between the top and bottom deck is constant. Practically it has been found that the effective bed length, shown in Fig. 5 as the sum of a long and a short inclined line, should be 16 metres. The period of

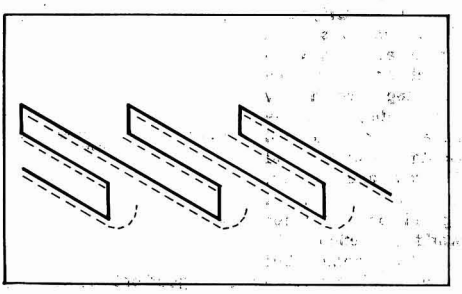

Fig. 5. Diagram showing effective length of bed per cell

[3] *Proc. 15th Congr. I.S.S.C.T.*, 1974, 1523–1537.

falling depicted by vertical lines and a substantial section of the screen at the bottom cannot be regarded as contributing to the effective bed length.

Basic design assumptions for a FS diffuser

In view of the foregoing, the design of a diffuser is now straightforward. For example:

If $R = 0{\cdot}5$ hour retention, $C = 150$ t.c.h., $f = 14\%$ fibre, $n = 5$ cells, $L = 16$ m, and $h = 0{\cdot}6$ m, then $s = Ln/60R = (16 \times 5) / (60 \times 0{\cdot}5)$ m.min^{-1} $= 2{\cdot}66$ m.min^{-1}, which is equivalent to: $2{\cdot}66/3{\cdot}66 = 0{\cdot}73$ r.p.m.

Also, $W = (150 \times 14)/(380 \times 2{\cdot}66 \times 0{\cdot}6) = 3{\cdot}46$ m.

Advantages

The physical properties of the machine have been discussed at some length, mainly in order to be able to evaluate the advantages consciously achieved. Basically these are the elimination of constraints imposed on the "diffusion" process in its adaptation from the beet to cane industries.

Percolation problems

One has always been struck by the ambiguity of the specification made by major diffuser manufacturers that cane preparation should be fine without making fines. In fact, they would like it fine and coarse at the same time. Fine because it will enhance extraction and coarse as percolation problems will be reduced. It is well known that the preheated deposit of fines on top of a finely prepared bed will eventually make this bed impermeable and flooding will occur. This phenomenon can be overcome to some extent by installing bagasse bed disturbing equipment such as the vertical screws used in BMA diffusers in South Africa[4], but the problem can only be completely overcome if the formation of a sealing layer on top of the bed is prevented. This is the very essence of the design of the FS diffuser. It is constructed so that each cell will turn the bagasse mat over twice. Moreover, each cell is placed at an angle and any sprayed juice not percolating through the bed will run down over the top, collect in the boot and drain away. Maximum juice percolation is therefore ensured at all times without any problems.

Fineness of preparation

With the disappearance of the rather indefinable and unmanageable percolation problem, the constraint on cane preparation disappears as well. Therefore, FS recommends the finest possible preparation by any sort of equipment that can rupture plant cells in cane to a percentage as high as 93%.

Thickness of bagasse mat

Each cell has two screens and cells overlap one another to some extent as schematically shown in Fig. 5. As a result there is far more screen area than floor space area in a FS diffuser. Consequently, by comparison with other machines, the layer thickness can be less, irrespective of the residence time allowed for. This layer thickness is set at 0·6 m, which is about half of the bed depth in other diffusers.

Rate of circulation

As a result of optimizing the permeability of a bed of limited thickness, the rate of circulation of juice (kg.m^{-2} of bed area) will be maximum. Rein[5] proved the rate of circulation to be one of the prime factors for good extraction. The amount of juice which passes from cell to cell (or stage to stage) in a conventional diffuser would be totally inadequate to make use of this facility and different juice spray pattern is necessary. The basic set-up as shown in Fig. 6 will explain this. In the

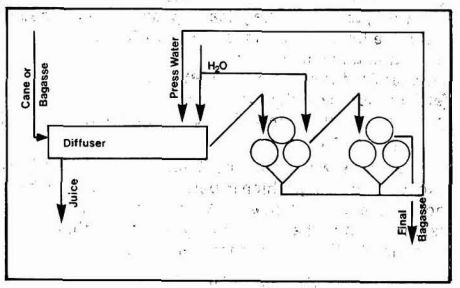

Fig. 6. Basic diffuser layout

diffuser, juice + bagasse out = bagasse in + water; if this model is simplified to some extent, it would be possible to say that, by approximation, the total quantity transferred from cell to cell would be the weight of press water and imbibition water. The imbibition water will be roughly equivalent to the outflow of juice from the diffuser while the press water is that quantity of juice required for the initial wetting of the dry bagasse from the first mill. These two quantities combined would make up the total quantity transfer between cells in case of cane diffusion. In other words, the total transfer from cell to cell will be in the vicinity of 100% on cane. However, the FS diffuser can easily accommodate three

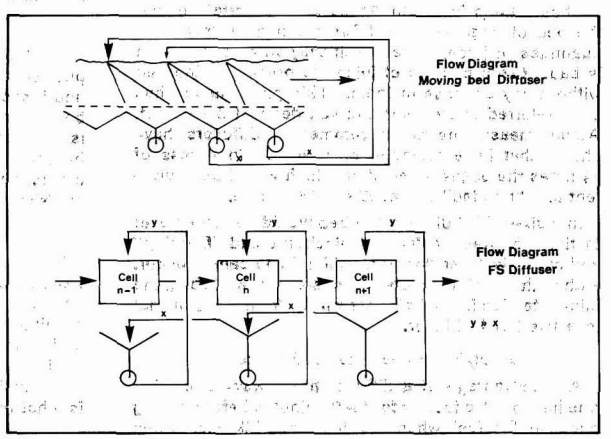

Fig. 7. Flow diagrams of moving bed and FS diffusers

or four times this quantity and the design lends itself very easily to obtain just this advantage. The difference is explained in Fig. 7.

The advantage of the FS system is obvious. The quantity of juice transferred from cell to cell is identical

[4] van der Riet & Renton: *Proc. 45th Congr. S. African Sugar Techn. Assoc.*, 1971, 49–55.
[5] *44th Congr. S. African Sugar Tech. Assoc.*, 1970, 64–70.

and effected by simple overflow. The quantity of circulating juice is limited by practical considerations only.

Press water return

The return of press water to the diffuser system is not as straightforward as shown in Fig. 6. Normally the following equipment is needed for press water treatment:

(*a*) Juice screens to remove solid particles from press water, to enable the juice to pass through a heater.
(*b*) Juice heater to bring the juice to 95°C.
(*c*) Automatic liming device.
(*d*) Clarifier for press water settling.
(*e*) Filtration capacity for muds.
(*f*) Labour for supervision and maintenance of this equipment.

The press water treatment for a FS diffuser is *NIL*, except for heating, which is performed in a mixing heater, not unlike a condenser. As no heat is lost through retention, etc., the juice is only heated to that required to maintain the diffuser temperature.

Retention time of bagasse

If advantages are to be felt, then they must manifest themselves undisputedly. Equal extraction should be obtained in less time than in fixed-bed diffusers. In South Africa, a residence time of 45–60 minutes is accepted for conventional diffusers, whereas the FS diffuser is designed for 25–30 minutes retention time.

Juice retention

It is rather astounding that normally the residence time of bagasse only is taken into account. Surely of more importance is the residence time of juice, or rather the dissolved solids it contains. After all, what happens to pol and non-pol during this period is the key to the riddle of why a higher extraction would not put more sugar in the bag.

Observations in South Africa have ascertained that the bed of bagasse in a diffuser can hold very large quantities of juice, more specifically when percolation is bad. Large pockets of juice are present in the bed without any bagasse in them. This phenomenon has been referred to by Rein[5] and van der Riet & Renton[4]. Actual measurements on commercial diffusers have shown that juice retention may well be in excess of 2½ times the bagasse retention which would be equivalent to a "flooded" bed at 80 kg.m^{-2} of fibre.

In a six-cell FS diffuser the bed would be turned over 11 times between entry and discharge and "flooding" and certainly "over-flooding" will not and cannot occur. Although exact measurements are not available, the juice retention in a FS diffuser will be from ½ to ¼ of that in a fixed-bed diffuser.

Emptying at week-ends or long stops

A disadvantage of a diffuser has always been that one has to run a factory for 50–60 minutes before getting bagasse for fuel when starting up. Likewise when closing down the process will continue to receive juice in limited quantities and the factory must be kept going. Therefore, the practice of leaving the diffuser full was very attractive at first, but has been abandoned in some cases for the reason that residual juice would go "bad"[1]. This disadvantage is approximately halved with the FS diffuser.

Temperature

As a general rule, the rates of temperature-dependent reactions increase by a factor of 2 for every 10°C rise in temperature. With the lower juice retention, high temperatures become less of a constraint and advantage may be taken of its beneficial effect, i.e. high rates of molecular and osmotic diffusion. The only one practical limitation is heat loss from the diffuser installation.

Extension of capacity

If a FS diffuser installation of n cells is increased by one cell, the bagasse capacity and retention time are increased by a factor $(n+1)/n$. If, however, the speed is increased proportionally, the retention time is reduced to the original value, thus increasing the throughput by the same factor $(n+1)/n$.

The layer of bagasse in each cell remains at the same thickness, but must be dragged along $(n+1)/n$ times as fast so that the power will increase by about the same ratio (if anything, slightly lower than proportional as the empty running power remains constant). However, as the r.p.m. of the machine has also been increased proportionally, torque in the drive shaft and tension in the drive chains will remain constant. It is therefore clear that the FS diffuser can be extended by additional cells very easily and is *unique* in this respect.

Materials of construction

The FS diffuser is a repetition of lightly constructed cells, in which normal "off the shelf" components are used for manufacture. Motors, pumps, bearings, sieve plates, chains, etc., are all mass-produced items which are easily obtainable and may be kept in stock. Other parts, such as shafts, sprockets, guttering, etc., can be repaired or replaced by the factory or local engineering firms.

Disadvantages of the FS diffuser

It is virtually impossible to introduce advantages in a system or machinery without introducing some disadvantages as well. A paper about the FS diffuser would therefore be incomplete unless these drawbacks had the same exposure as the advantages.

Compactness of construction

The cells are very compactly built and it takes some physical effort to climb through a cell for maintenance and inspection purposes. On the other hand a lot has been learnt from the Pongola diffuser (Fig. 8), which is the first of its kind, and subsequent diffusers can be built to overcome many of these drawbacks. However, it must be understood that it will never become an easy and simple machine like other makes presently marketed.

Type of bagasse transport

In sugar engineering circles, intercarriers have never been popular pieces of equipment and are often quoted as major causes of breakdown. The FS diffuser is nothing but a series of heavy, complicated intercarriers and thus may not find favour readily in the eyes of engineers. On the other hand, careful design and solid construction will ensure trouble-free operation and this is what is being experienced at Pongola at present.

Power consumption

Bagasse is dragged upward and falls from one cell to the next. This process is repeated a number of times and must require power. The FS diffuser will therefore consume more power for bagasse transport than a conventional diffuser. Also, if one wishes to take advantage of the higher circulation rate of juice per cell, the pumps have to be larger and use more power. Even when taking cognisance of the smaller number of pumps, the total power consumption is still higher than in fixed bed diffusers. The combined extra power in bagasse

transport and pump capacity must be regarded about two to three times as large. This in itself may not be much of a disadvantage as steam is required for process purposes and can as easily pass through a turbo-generator as through a reduction valve, provided the generating capacity is available.

Clarity of draft juice

As a result of the continuous working over of the bed, the bagasse mat cannot, purposely, act as a filter bed and therefore the draft juice is possibly not as clear as from other diffusers. On the other hand, the minimal introduction of lime for pH control maintains the phosphate level as would be found in milled mixed juice. As a result, clarification at Pongola is excellent.

MASS BALANCE

Introduction

Having discussed the physical layout of a FS diffuser and the distinct advantages and disadvantages thus introduced, the operation of the only working installation at Pongola, South Africa, should be investigated in more detail. This installation is designed for 210 t.c.h. in the future, but as a result of the present cane supply, the current throughput is restricted to 170 t.c.h. For the purpose of this paper, the latter throughput is used, as the operational results achieved would otherwise not be representative of the installation considered.

Furthermore, at this stage, the Pongola installation should be described briefly. The cane is discharged from tramtrucks onto a feeder table set at right angles to the 84-in cane carrier. The cane is prepared by one set of very heavy swing knives which rotate against the cane movement and force the cane against a ribbed plate, and for this feature the knives could in fact be described as a semi-shredder[6].

A rubber belt transports the knifed cane to a 84-in modified Searby shredder, after which another rubber belt takes the shredded cane to a heavy 84×44-in four-roller mill. The first mill bagasse enters a seven-cell FS diffuser, each cell having 16 metres of effective screen length, 3 m wide. The very wet discharged bagasse is first dried in an old 34 in × 66 in four-roller mill and finally in a large mill, identical to the first. In South Africa[1] an equivalent milling tandem would consist of not less than seven 38 in × 72 in mills or six or seven 44 in × 84 in mills. The diffuser thus takes the place of not less than 3½ mills of 44 in × 84 in., with an installed value of 3½ × R600,000 = R2,000,000. The estimated installed cost of this and other types of diffuser installations should be R1,000,000.

Table I. Materials balance

In		*tons.hr*$^{-1}$	*Out*		*tons.hr*$^{-1}$
Overall					
Cane		170·00	Final bagasse		51·00
Imbibition water		85·28	Mixed juice ...		199·33
Actual water	74·39		Primary juice	101·49	
Condensates	11·89		Diffuser juice	97·84	
			Evaporation losses		5·95
		255·28			256·28
Note: Neglecting evaporation losses, imbibition becomes: 86·28 — 5·95 = 80·33 equivalent to 35% imbibition on fibre (Appendix 3)					
First Mill					
Cane		170·00	Primary juice		101·41
			First mill bagasse		63·59
		170·00			170·00
Diffuser					
First mill bagasse		68·51	Diffuser bagasse		177·91
Imbibition water		74·39	Diffuser juice		97·84
Condensate ex injector		0·85	Evaporation loss		0·85
Press water (hot)		132·85			
Cold press water	121·81				
Condensate scalding juice heater	4·70				
Condensate press water heater	6·34				
		276·60			276·60
Dewatering Mill					
Diffuser bagasse		177·91	Evaporation loss		3·40
			Dewatering mill press water		78·88
			Dewatering mill bagasse		95·63
		177·91			177·91
Drying Mill					
Dewatering mill bagasse ...		95·63	Evaporation loss		1·70
			Drying mill press water		42·93
			Final bagasse		51·00
		95·63			95·63

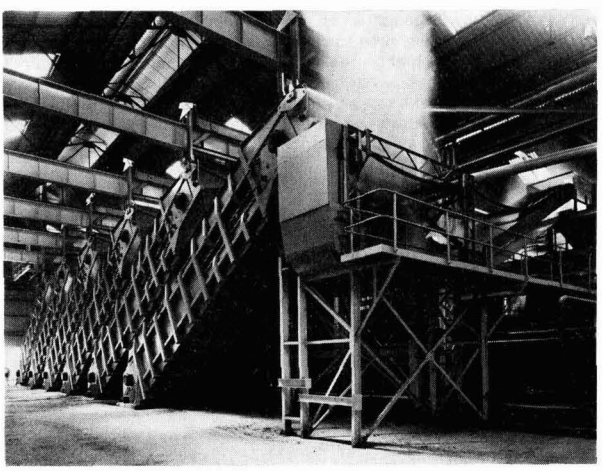

Fig. 8

Material balance

Average conditions of throughput have been assumed for the material balance and Appendices 1 and 2 are included to indicate that these assumptions approximate closely to current operational conditions.

Based on the conditions assumed in Appendix 3, the overall material balance is presented in Table I. In analysing this table, it should be noted that imbibition is not measured directly but estimated via the fibre balance. For this reason, quoted values for imbibition % fibre take into account actual maceration water, heating media condensates and evaporative losses.

In arriving at the overall material balance, it is necessary to conduct a heat balance over the plant in order to estimate the amount of imbibition added in the form of heating media condensates. Assuming that the diffuser and its contents are maintained

[6] Allan: *Comm. S.M.R.I.*, 1973, (98), 19–36.

at an average temperature of 80°C, that the dewatering mills operate in an environment of 60°C and the imbibition is added at 70°C, the total heat requirements amount to 6·99% vapour 1 (at 1·29 bar abs.) on cane. This value corresponds closely with that estimated for other types of diffusers. Heat is added to the system via the scalding juice heater, the direct contact press water heater and cell steam injectors.

A typical cell balance under the conditions assumed is presented in Table II.

Table II. Material balance of cell n

In	*tons.hr*$^{-1}$	*Out*	*tons.hr*$^{-1}$
Bagasse ex cell ($n-1$)	177·91	Bagasse ex cell n	177·91
Overflow ex cell ($n+1$)	57·24	Juice to pump cell n	600·00
Pumped ex cell ($n+1$)	150·00	Overflow to cell (n—1)	57·24
Circulation juice	450·00		
	835·15		835·15

OPERATIONAL RESULTS

Rate of fibre loading

The FS diffuser, originally consisting of five cells to process 150 t.c.h., now comprises seven cells to handle eventually 210 t.c.h. at 14% fibre in cane, or 29·4 tons of fibre per hour. The present throughput is in the vicinity of 24 t.f.h. and the fibre loading thus only 82% of design capacity. As explained, this is largely as a result of a shortage of steam but higher fibre rates are expected when this is rectified. Compared with other diffusers in South Africa, with one notable exception, this fibre loading of 82% of design capacity is not low.

Extraction

The Pongola cane is nearly all grown under conditions of irrigation on flat land and compares favourably with average South African cane. The highest extraction achieved to date, viz. 96·79% over a full week and 97·09% over a day, should therefore be seen in this light. Nevertheless, the results are very encouraging as many operational improvements are still to be achieved. Detailed operational data are supplied in Appendices 1 and 2.

Boiling house results

The boiling house results of Pongola are outstanding and compare very favourably with the rest of the industry, notwithstanding that about 65% of the production is refined sugar which, in itself, would tend to increase boiling house losses. With so many things said against diffusion, it is necessary to emphasize that Pongola has established itself well ahead of any other mill in South Africa in terms of an overall recovery at 87·62% (to date as at 17/8/75), whereas the 89·3% achieved during the week ended 3/8/75, is regarded as an all-time South African record.

The authors of this paper, therefore, claim that the design parameters of the diffuser are such that the high extraction achieved is in fact a contributing factor for recovery of commercial sugar.

Breakdown of plant

During the first year of operation, certain features of the mechanical design, notably the characteristic of the chosen make of drive, became disturbing, causing shutdown of operations far too often. Subsequent replacement drives have improved matters to such an extent that the running of the machine is now regarded as a routine operation and accepted by factory staff as being reliable. Nevertheless, further improvements, all of a simple nature, are envisaged.

Quality of end product

There have been allegations in South Africa that excessive colour extraction by diffusers causes the quality of raws to be inferior. This is not so at Pongola where the refined sugar quality, with no alteration to the refinery, which is more heavily loaded than ever, is given in Table III below:

Table III. Refined sugar quality in Pongola

Season	1972-73	1973-74	1974-75	1975 to date
T.C.H.	150	150	155	170
% diffusion	0	10	85	100
a^*_{420}	67	63	81	50
a^*_{720}	6	9	10	5

Conclusion

The FS diffuser is constructed to overcome certain definite disadvantages in existing commercial cane and/or bagasse diffusers. This has caused a considerable complication of design, although not necessarily an increase in price. Application of the latest technology has definitely led to achieving high extractions in a considerably shortened time of retention for both juice and bagasse. Boiling house results are such that they could be called outstanding. They would certainly belie any accusation of this diffuser being inferior to milling from the point of view of recovery.

The results achieved should satisfy those holding out in favour of straight milling in that this diffuser can:

1. Reduce first cost of installing an extraction plant.
2. Reduce cost of subsequent maintenance.
3. Reduce operating personnel.
4. Improve extraction well above accepted levels of efficiency achieved in milling.
5. Allow the extra extracted sucrose to be recovered "in the bag".
6. Allow for gradual expansion at low cost.

Acknowledgments

Without the diffuser operating well in Pongola, there would have been no paper. The fact that the authors can submit this paper with confidence is largely due to the interest in its development and the diligence and perseverence to make it work by many others, ranging from highly qualified scientists, managers, operators to simple, hardworking labourers who had to dig out tons of bagasse during the first trial runs. To all these, the authors would like to pay tribute and acknowledge their valuable contribution.

Appendix I

Condensed factory report
Week 7/7/1965—12/7/1975

Milling data:	
Tons cane crushed	22·264
Tons cane per hour	174
Tons fibre per hour	24·12
% normal fibre throughput	82
Pol % cane	13·50
Fibre % cane	13·85
%overall time efficiency	76·14
Imbibition % fibre	325
Imbibition % cane	45
Pol extraction, %	96·19
Preparation index	89
Purity first expressed juice	86·88
Purity last expressed juice	65·51
Purity mixed juice	85·41

All figures are arithmetical mean	*In Bagasse/Cane* % *moisture*	% *fibre*	% *Brix*	*Brix extraction* — *Accumulated*	*Per unit*
Shredder	71·28	13·85	15·82	—	—
1st mill	55·62	33·00	11·39	71·83	71·83
Diffuser	84·43	12·90	2·74	82·66	38·48
2nd mill	69·25	27·93	2·82	91·75	52·09
3rd mill	52·49	44·35	2·63	95·22	41·93

Factory data:

Boiling house recovery	92·07	
Overall recovery	88·52	
Purity of final molasses	34·22	
Loss of pol in cake	0·14	as a percentage of pol in cane
Loss of pol in molasses	6·14	
Loss of pol undetermined	1·39	
% refined sugar	64·7	

Appendix II

Condensed factory report
Week 28/7/1975–3/8/1975

Milling data:

Tons cane crushed	22,478
Tons cane per hour	173
Tons fibre per hour	23·35
% nominal fibre throughput	79
Pol % cane	13·71
Fibre % cane	13·47
% overall time efficiency	77·22
Imbibition % fibre	358
Imbibition % cane	48
Pol extraction, %	96·79
Preparation index	90
Purity first expressed juice	87·40
Purity last expressed juice	64·67
Purity mixed juice	84·90

All figures are arithmetical mean	*In Bagasse/Cane* % *moisture*	% *fibre*	% *Brix*	*Brix extraction* — *Accumulated*	*Per unit*
Shredder	71·00	13·47	15·56	—	—
1st mill	55·04	33·79	11·17	71·36	71·36
Diffuser	84·92	12·85	2·24	85·00	47·71
2nd mill	76·03	21·76	2·23	91·06	38·54
3rd mill	51·48	46·10	2·41	95·49	49·07

Factory data:

Boiling house recovery	92·28	
Overall recovery	89·31	
Purity of final molasses	34·27	
Loss of pol in cake	0·14	as a percentage of pol in cane
Loss of pol in molasses	6·20	
Loss of pol undetermined	1·41	
% refined sugar	69·7	

Appendix III

Material balance

Average conditions assumed:

Cane quality

Pol % cane	13·60
Brix % cane	15·70
Fibre % cane	13·50

Throughput

Tons cane per hour	170·00
Imbibition % fibre	350·00

Performance

Pol extraction	96·40
1st mill Brix extraction	71·50

Analyses

Fibre % 1st mill bagasse	33·50
Fibre % diffuser discharge bagasse	12·90
Fibre % 1st dewatering mill	24·00
Fibre % final bagasse	45·00
Residual juice purity	60·00

Evaporation losses

Losses in diffuser	0·5% on cane
Losses in dewatering mill	2·0% on cane
Losses in drying mill	1·0% on cane

Summary

This paper describes reasons why and how a new type of diffuser was designed, leading to a number of substantial advantages. The various disadvantages are discussed, and a material balance is provided together with operational data which permit assessment of the installations' industrial performance, as well as process advantages achieved in practice.

Le diffuseur FS (van Hengel)

Les considérations qui ont conduit à la conception et à la réalisation du diffuseur FS (système van Hengel) sont discutées en faisant référence aux nombreux avantages qui en résultent. Les désavantages du système sont également discutés. Un bilan de matières autour du système ainsi que des données du contrôle chimique permettant de juger des performances industrielles de l'installation sont présentés et les avantages pratique dont on a pu se rendre compte en pratique industrielle sont donnés.

Das FS (van Hengel) Extraktionssystem

Die Verfasser beschreiben warum und wie eine neue Art von Diffusionapparat entwickelt wurde, die zu mehreren wesentlichen Vorteilen geführt hat. Sie diskutieren auch die verschiedene Nachteile, und teilen Details über die Stoffbilanz und die Betriebsdaten mit, mit denen es möglich ist, die Leistung des Systems zu bewerten. In der Praxis erhaltene Verfahrensvorteile werden angegeben.

La sistema de difusión FS (van Hengel)

Este artículo describe razones por que y como se ha diseñado un nuevo tipo de difusor, conduciendo a varios ventajes importantes. Se discuten varios desventajes también, y se provee una balanza de materias, dados operacionales que permiten asesamiento del cumplimiento industrial de la instalación, tanto como ventajes en el proceso que pueden obtenerse en el práctico. □

□ □ □

Tanzania sugar factory[1].—Construction of the new Kagera sugar factory began in October 1977. The factory is expected to be ready in three years' time and will produce 56,000 tons of sugar per year.

US sugar refinery closure[2].—It was announced in November 1977 that Southdown Sugars Inc. had entered into a long-term contract with Supreme Sugar Co. Inc. to refine its raw sugar at Supreme's refinery at Labadieville, Louisiana. Southdown will permanently cease operations of its refinery and adjacent raw sugar factory at Houma, LA, from 10th January 1978. The company will continue to operate its three raw sugar factories at Thibodaux, Vacherie and White Castle.

Indonesian sugar factory expansion[3].—The extension of the Madukismo sugar factory at Jogjakarta in Indonesia has been completed so that in 1978 it will be capable of processing 450,000–500,000 tons of cane during the 6-months milling season to produce 45,000–50,000 tons of sugar. The factory also produces alcohol, averaging about 3 million litres per season. The total area of cane plantations serving the factory is about 6000 hectares.

Fiji bumper crop forecast[4].—Australian Trading Company sources said that the Fiji sugar industry is forecasting an increase of more than 15% in this season's raw sugar output over last year's 296,000 tonnes. Drought in Fiji has hindered planting of next season's cane but has helped increase the sugar content of this season's crop. Fiji has an ambitious sugar expansion plan to reach mill capacity of around 400,000 tons of raws per year eventually and, as a result, even the 75% of targeted plantings completed near the end of November exceeds the 1976 actual level.

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[1] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (32), 14.
[2] *Lamborn Sugar Market Rpt.*, 1977, **55**, 197.
[3] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (32), 15.
[4] *Public Ledger*, 26th November 1977.

Identification and estimation of glucuronic acid in indigenous sugar cane polysaccharide

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Introduction

A HETEROGENEOUS polysaccharide, which is indigenous to sugar cane, has been identified as one of the components responsible for the formation of acid floc in carbonated beverages and acidified syrups[1]. This polysaccharide forms a colloidal solution in water and is present in all sugar cane products. Its component sugars—arabinose, rhamnose, xylose, galactose, mannose and glucose—were recently identified and estimated by Roberts, Godshall, Carpenter & Clarke[2]. Moving boundary electrophoresis of the polysaccharide in a U-tube showed that the colloid carried a negative charge over a wide pH range[1], and it was observed that the charge on the polysaccharide was greater than would be expected on a neutral polysaccharide. This observation led to the suspicion that the polysaccharide contained acidic groups as part of the molecule.

Several references concerning the presence of pectin in sugar cane are found in the older literature[3,4]. Galacturonic acid is an essential component of all pectins, but no galacturonic acid has been found, nor has other concrete evidence been presented to confirm the presence of pectin in sugar cane. Glucuronic acid, however, has been identified in the hemicellulose from bagasse[5]. This paper describes the identification and estimation of glucuronic acid in sugar cane polysaccharide*.

EXPERIMENTAL

Materials

The indigenous sugar cane polysaccharide (ISP) used in this work was obtained from raw cane juice, raw sugar from various sources, and refined sugar.

Isolation of ISP

The ISP from raw cane juice was isolated under conditions designed to eliminate most of the starch and dextran, as described by Roberts, Jackson & Vance[6]. The ISP from sugars was isolated by dialysis. Sugar (100–200 g) was dissolved in 500 cm^3 of water in a regenerated cellulose bag with a molecular weight cut-off of 10,000–12,000. The bag was placed in a glass tube on a rocking dialyser and dialysed against flowing, toluene-saturated, deionized water for 100 hr. The solution remaining in the bag was evaporated under reduced pressure below 60°C to 10–15 cm^3, freeze-dried and weighed.

Methanolysis of polysaccharide

Methanolysis of the polysaccharide was carried out essentially by the procedure of Morell & Link[7]. Between ½ and 1 g of the freeze-dried polysaccharide was placed in 100 cm^3 of absolute methanol containing 5 g dry hydrogen chloride gas. The solution was boiled under reflux for 16 hr. One hundred cm^3 absolute methanol containing 5 g dry hydrogen chloride was added, and the solution was again boiled under reflux for an additional 16 hr. The hydrogen chloride was neutralized by adding freshly prepared silver carbonate. The silver chloride was removed by filtration and the filtrate evaporated under reduced pressure to 10–15 cm^3 followed by freeze-drying.

Base hydrolysis of the methanolysate with barium hydroxide

The residue from the above (less than 1 g) was dissolved in 100 cm^3 water, 1 g barium hydroxide was added, and the solution was boiled under reflux for 16 hr. Barium ions were precipitated by bubbling carbon dioxide through the solution until it was neutral to litmus paper. The barium carbonate was removed by filtration through a 5 mm mat of filter aid. The filtrate was evaporated under reduced pressure to 10–15 cm^3 and freeze-dried.

Gas-liquid chromatographic analysis

A sample (10–20 mg) of the freeze-dried, hydrolysed, methanolysed ISP was silylated by the method of Sweeley *et al.*[8]. The GLC analysis was performed on a Hewlett-Packard model 5750† instrument equipped with a flame ionization detector. The column was a 10 ft stainless steel tube of ⅛ in o.d. packed with 5·8% OV-1 on 60–80 mesh "Chromosorb W". The column was operated isothermally at 200°C with a carrier gas flow of 20 $cm^3.min^{-1}$.

Determination of hexuronic acids

Hexuronic acids were determined by the method of Wardi, Allen & Varma[9]. 10–15 mg of the polysaccharide (freeze-dried dialysate) was dissolved in water and the volume adjusted to 25 cm^3 in a volumetric flask. A 1-cm^3 aliquot of this solution was placed in each of two test tubes. The tubes were cooled in ice-water, and 4 cm^3 of concentrated sulphuric acid was added to each tube. The tubes were placed in boiling water for 20 min, cooled, and 0·2 cm^3 methanol was added to one tube for us as a blank, and 0·2 cm^3 harmine solution (200 mg in 100 cm^3 of methanol) was added to the other tube. The tubes were shaken to mix the solution, and after 30 min to 1 hr the sample containing the harmine was read at 530 nm against the blank to determine colour transmission. The content of hexuronic acid in mg per 100 cm^3 was read from a standard curve prepared from pure glucuronic acid, and the hexuronic acid content in the sample was then calculated.

DISCUSSION OF RESULTS

Methanolysis of ISP

The glycosidic linkages between hexuronic acids and between hexuronic acids and adjacent sugars are re-

* This work was done under a cooperative project with the Southern Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture.

† Names of companies or commercial products are given solely for the purpose of providing specific information; their mention does not imply recommendation or endorsement by the U.S. Department of Agriculture over others not mentioned.

[1] Roberts & Godshall: *Proc. 7th Tech. Session Cane Sugar Refining Research*, 1977, in press.
[2] *I.S.J.*, 1976, **78**, 163–165.
[3] Farnell: *I.S.J.*, 1923, **25**, 248–251, 630–636; 1924, **26**, 480–486.
[4] Brown & Blouin: *Louisiana Expt. Sta. Bull.*, 1907, (91).
[5] Davis & Phillips: *I.S.J.*, 1941, **15**, 241–247.
[6] *Proc. 1st Tech. Session Cane Sugar Refining Research*, 1964, 76–84.
[7] *J. Biol. Chem.*, 1933, **100**, 385–396.
[8] *J. Amer. Chem. Soc.*, 1963, **85**, 2497–2507.
[9] *Anal. Biochem.*, 1971, **57**, 268–273.

sistant to acid hydrolysis and are not broken under the usual conditions employed in hydrolysis of water-soluble polysaccharides. If the conditions are sufficiently stringent to break the glycosidic linkages, the hexuronic acids are usually decarboxylated and thus destroyed.

Methanolysis provides a means of breaking these glycosidic linkages. This procedure yields the glycosides of the sugars and the methyl esters of the hexuronic acid glycosides.

Identification of glucuronic acid in ISP

Gas chromatography of silylated methanolysed ISP, along with a sample of methyl glucuronoside methyl ester prepared from glucuronic acid, showed that the retention time of the methyl glucuronoside methyl ester was identical to that of the methyl β-glucoside peak from the ISP. Therefore, modification of one of these compounds was necessary.

The glycosidic linkage in sugars is stable under alkaline conditions, so the methyl ester group could be removed from the hexuronic acid by alkaline hydrolysis, leaving the glycosidic groups on the sugars and hexuronic acid intact. Fig. 1 shows a schematic representation of methanolysis of ISP and hydrolysis of the resulting methanolysed products. Structure I represents the original ISP. Methanolysis of the ISP yields II, which may be a glucuronic acid unit such as III, whereas IV may be galactose, mannose, or glucose. Structure V may be arabinose. Structures VI, VII, VIII and IX are the base hydrolysis products of II, III, IV and V, respectively. The only change in any of the products resulting from base hydrolysis is the removal of the methyl ester group from the hexuronoside. Removal of the methyl ester group from the hexuronic acid allowed silylation of the carboxyl group to occur in addition to silylation of the hydroxyl groups, thus increasing the molecular weight of the silylated glucuronoside and increasing its retention time over that of methyl β-glucoside.

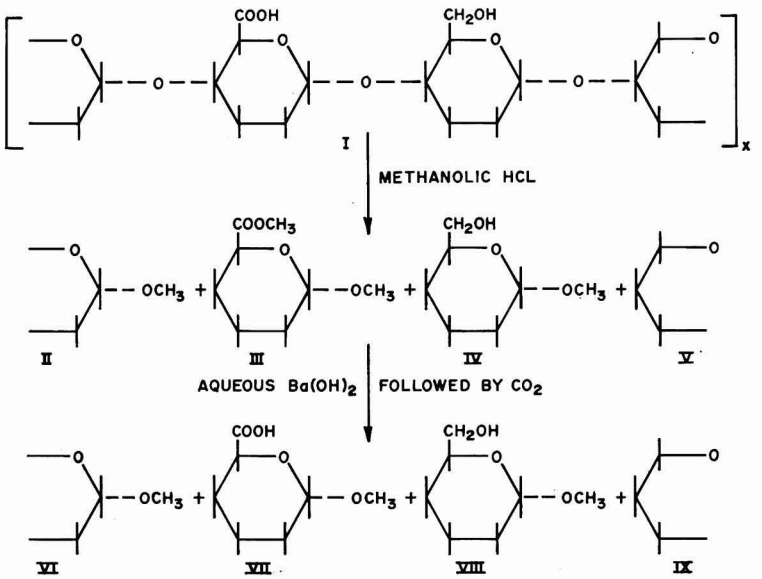

Fig. 1. Schematic representation of methanolysis of polysaccharide and base hydrolysis of methanolysate.

GLC analysis of the silylated, base-hydrolysed, methanolysed ISP showed good separation of the hexuronic acid peak from the methyl β-glucoside. Addition of authentic base-hydrolysed methyl glucuronoside methyl ester enhanced this new peak without distortion, whereas addition of authentic base-hydrolysed galacturonoside methyl ester did not enhance the new peak but rather showed a retention time that allowed good differentiation of the peaks. This procedure permitted a positive identification of glucuronic acid in ISP from raw cane juice, raw sugar, and refined sugar No galacturonic acid was found in any of the samples.

Estimation of glucuronic acid

The glucuronic acid content of ISP isolated from a variety of sugar cane products is shown in Table I.

Table I. Glucuronic acid in sugar cane polysaccharide

Source of polysaccharide	*Weight of sugar dialysed, g*	*Weight of dialysate, g*	*Glucuronic acid, % on weight of dialysate*
Raw juice 1	—	—	8·6
Raw juice 2	—	—	7·8
Raw sugar 1	200	0·4348	3·4
Raw sugar 2	100	0·1162	3·4
Raw sugar 3	100	0·2316	3·4
4th strike	200	0·2550	3·4
2nd strike	200	0·1016	3·0
3rd strike	200	0·1136	3·4
1st strike	200	0·0315	3·1
Refined 1	200	0·0816	3·3
Refined 2	200	0·2865	3·9
Refined 3	200	0·0620	3·3
Refined 4	200	0·0870	2·8
Refined 5	200	0·0600	3·2

An examination of Table I shows that the ISP samples from cane juice had the highest glucuronic acid content. These samples were isolated under conditions which eliminated most of the starch and prevented the formation of dextran. The nondialysable polysaccharide samples from the sugars had glucuronic acid contents that were fairly constant and much lower than the ISP from cane juice. This difference is undoubtedly due to the presence of starch, dextran and other nondialysable constituents such as silica and protein which dilute the ISP. The presence of glucuronic acid groups in ISP accounts for the strong negative charge on this polysaccharide and its readiness to form complexes with protein under acidic conditions.

No galacturonic acid was found in polysaccharide from any sugar cane product, including raw unclarified cane juice. Its absence indicates that sugar cane does not contain pectin and that the similarity of ISP and pectin misled early workers.

Identification and estimation of glucuronic acid

Summary

Glucuronic acid has been identified and estimated in the indigenous polysaccharide from raw cane juice, raw sugar and refined sugar. The glucuronic acid content of the isolated polysaccharide ranges from 3% to 8·5% of polysaccharide dialysate. Galacturonic acid was not found in any of these products, indicating that pectin is not present in sugar cane.

Identification et estimation de l'acide glucuronique dans le polysaccharide de la canne à sucre indigène

L'acide glucuronique a été identifié et estimé dans le polysaccharide indigène du jus brut de canne, du sucre brut et du sucre raffiné. La teneur en acide glucuronique du polysaccharide variait de 3% a 8,5% en poids de dialysat de polysaccharide. Dans aucun des produits on n'a trouvé de l'acide galacturonique, ce qui indique qu'il n'y a pas de pectine dans la canne à sucre.

Identifizierung und Bestimmung von Glucuronsäure in aus Zuckerrohr isoliertem Polysaccharid

Glucuronsäure wurde in Polysaccharid nachgewiesen und quantitativ bestimmt, das aus Rohrrohsaft, Rohzucker und Raffinade isoliert wurde. Der Gehalt des Polysaccharids an Glucuronsäure lag im Bereich von 3 bis 8,5%, bezogen auf das Gewicht des Polysaccharid-Dialysates. Galacturonsäure wurde in keinem der untersuchten Produkte gefunden, womit gezeigt werden konnte, dass Pektin im Zuckerrohr nicht vorkommt.

Identificación y estimación de ácido glucurónico en polisacarido indigeno de caña de azúcar

Acido glucorónico se ha identificado y estimado en el polisacarido indigeno de jugo crudo de caña, azúcar crudo y azúcar refinado. El contenido de ácido glucurónico del polisacarido variaban entre 3% y 8,5% sobre peso del dialisado de polisacarido. No ha encontrado ácido galacturónico en ningún de estos productos, que indica que no hay pectina en caña de azúcar.

The 33rd UK National Sugar Beet Autumn Demonstration, 1977

THE 1977 National Sugar Beet Autumn Demonstration was held at Waddingham, Lincolnshire, on 26th–27th October; the site was the same farm as used for the Spring Demonstration[1]. About 243 hectares are devoted to sugar beet, potatoes, barley, wheat and grass as well as various vegetable crops and rhubarb. The soil ranges from sandy loam to clay loam with varying amounts of stone, and all the fields can be irrigated through underground pipes. Sheep are bred on the farm, and slurry from a 625-sow unit is added to the beet soil to increase fertility and improve soil structure.

As stated before[1], the Autumn and Spring Demonstrations are organized each year by the British Sugar Corporation and the Agricultural Development and Advisory Service under the auspices of the Sugar Beet Research and Education Committee of the Ministry of Agriculture, Fisheries and Food, and is financed through a levy paid by beet growers and processors. The Autumn Demonstration gives farmers the opportunity to see beet harvesters and other equipment in operation, and also features static exhibits.

Of particular importance at the 1977 Demonstration (the first 2-day Autumn Demonstration for 5 years) was assessment of harvester performance on the basis of topping quality, cleaning efficiency and trash removal. Root losses were measured by 8 teams of BSC field staff who followed the harvesters to collect any evidence of over-topping and to gather roots left on the ground. They also used special ploughs to dig row lengths behind the harvesters in order to check for beet left in the ground. Provisional results showed that, generally speaking, those harvesters which performed well as regards cleaning efficiency, trash removal and under-topping, e.g. the Standen "Rapide" 1-row harvester carrying a light-weight topper developed by the National Institute of Agricultural Engineering (Fig. 1) and the Ransomes "Hunter" 2-row harvester (Fig. 2), did not do so well as regards beet losses, while the Moreau 5-row, self-propelled harvester (Fig. 3) achieved the second lowest losses (1·76 tonnes.ha^{-1}) from an allocated harvested area of 8 ha, compared with an allocation of 4 ha for the 2- and 3-row machines. (During the 11 hours' operating period, many machines were able to cover only a small fraction of the allocated area.) The lowest losses were achieved by the French SMC 2-stage, 3-row harvester (Fig. 4) which, however, lifted beet from only 1·23 ha; unfortunately, both this harvester and the SMC 3-stage, 6-row model did not comply with UK safety regulations, so that last-minute modifications had to be made, resulting in some difficulties in operation.

Fig. 1

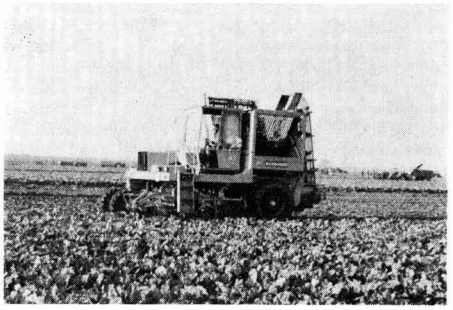

Fig. 2

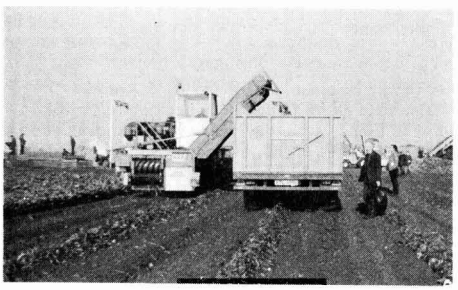

Fig. 3

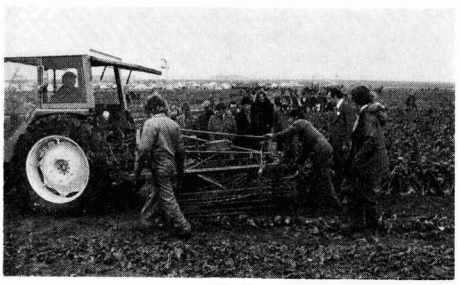

Fig. 4

While 14 of the 21 harvesters entered were multi-row machines, a survey conducted by the British Sugar Corporation in 1976 showed that the beet grown on 72% of the UK crop area was still harvested by 1-row harvesters, although 3-row machines accounted for 18% of the area; 5- and 6-row harvesters were used on 9% of the area, and the crop on the remaining 1% was lifted by 2-row machines.

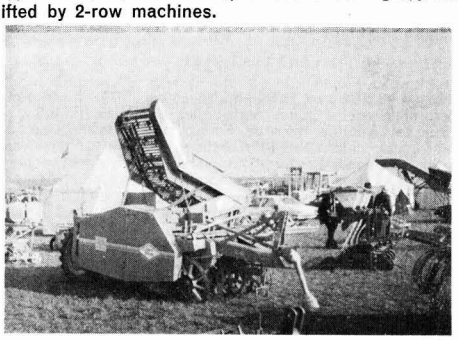

Fig. 5

One interesting model among the static exhibits was the Armer Salmon 3-in-1 harvester which comprises two units attached to the same tractor: a topper unit fixed to the front of the tractor, and a lifter-cleaner-loader attached to the rear (Fig. 5), both units being equipped with independent automatic row finders.

Other machinery demonstrated included cleaner-loaders such as the CTM "Sample Master" shown in Fig. 6, tractor loaders and grabs, trailers, reversible ploughs (of which the largest was the Dowdeswell DP2 7/8/9-furrow plough illustrated in Fig. 7), and the Bonser LS55 fork-lift truck fitted with a 1·3 m^3 beet bucket (Fig. 8) which can handle large quantities of beet quickly with a minimum of damage and is designed for e.g. loading into a cleaner-loader on rough land.

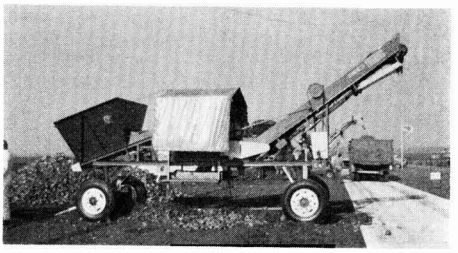

Fig. 6

Fig. 7

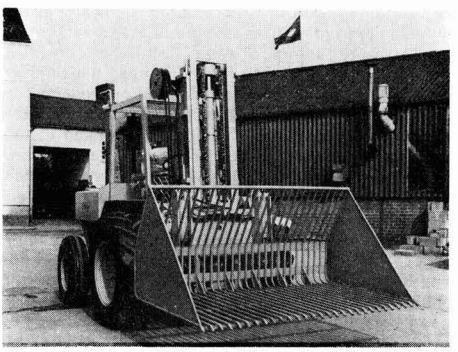

Fig. 8

The static exhibits also included a number of very interesting pieces of equipment other than harvesters, including the Modular Chemical Vehicles crop sprayer (Fig. 9) and the Multilift steel container shown in Fig. 10 alongside a Ransomes "Hunter" harvester. The container is designed to take beet straight from the harvester to the factory. It is hoisted by twin lift cables onto a

hydraulically-operated tipping frame on any truck chassis, and is hauled to the far end of the frame, which then gently drops to its resting position where it is locked. For unloading the empty container onto the ground in the beet field, the operations are in the reverse order; as was clearly demonstrated under field conditions, the whole action is so gentle that the beets suffer negligible damage by jolting.

Fig. 9

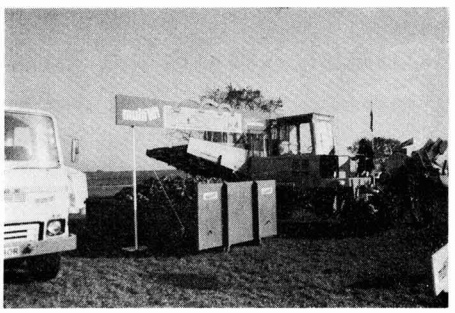

Fig. 10

Special displays housed in marquees were concerned with various aspects of beet agriculture, including the problems confronting beet farmers. Paramount among these is the occurence of weed beet, which are now widespread throughout Northern Europe; a pamphlet produced by the British Sugar Corporation explains the urgency of the problem and points out that the many thousands of seed set by a bolter can remain in the soil for up to 9 years. Since sugar beet varieties are genetically unstable, free pollination in an uncontrolled environment leads to natural degeneration, so that when bolters are pollinated by weed beet, the next generation undergoes dramatic reversion. At present, the only practical solution is cutting of the bolter heads—chemical treatment is more positive but is much slower as well as not completely effective,since not all bolters can be reached by the applicator because of height differences; as a result, chemical treatment must be followed by manual work to ensure complete control.

Considerable losses caused by inefficient topping are also a major problem featured in the display alongside the weed beet problem, while other problems being tackled by workers at Broom's Barn Experimental Station were illustrated on a stand (including the action of beet cyst nematodes, mice and cutworms and the occurrence of virus yellows—fortunately, a disease which did not significantly affect beet during the 1977 crop in the UK). Herbicides and pesticides for use in sugar beet were exhibited as well as fertilizers and applicators. The National Institute of Agricultural Botany and Plant Breeding Institute were represented (the former organization being concerned with performance testing of beet varieties, and the latter with beet breeding) as well as other agricultural organizations presenting advisory and education exhibits. The feeding of beet tops to cattle and sheep featured in a major display presented by the British Sugar Corporation.

A press conference was held by representatives of the British Sugar Corporation, at which some information was given on the 1977 crop, as well as tentative crop result forecasts.

All concerned with the Autumn Demonstration are to be congratulated on the extremely high standard of organization.

Summary

A report is presented of the 33rd Autumn Demonstration held at Waddingham, Lincolnshire, on 26th–27th October 1977. The 2-day event included evaluation of the performances of various beet harvesters and demonstration of the use of other agricultural equipment; a number of static displays were also included.

La 33ème démonstration nationale britannique d'automne de culture betteravière

On présente un rapport concernant la 33ème démonstration d'automne, tenue à Waddingham, Lincolnshire, les 26-27 octobre 1977. Celle réunion, répartie sur deux jours, comprenait l'évaluation des performances de diverses arracheuses de betteraves et la démontration d'autre matériel agricole; elle comprenait également un certain nombre d'expositions statiques.

33. Nationale Herbstvorführung 1977 für den britischen Zuckerrübenanbau

Es wird über die 33. Herbstvorführung berichtet, die am 26. und 27. Oktober 1977 in Waddingham/Lincolnshire stattfand. Auf der zweitägigen Veranstaltung wurde die Leistungsfähigkeit verschiedener Rübenerntemaschinen beurteilt und die Verwendung anderer Ackergeräte demonstriert. Schliesslich wurde eine Reihe von nicht in Betrieb befindlichen Modellen gezeigt.

La 33a demostración nacional del otoño de 1977 de la remolacha azucarera del Reino Unido

Se presenta un informe sobre la 33a demostración del otoño celebrado en Waddingham, Lincolnshire, el 26-27 octubre 1977. La programa ocupaba dos días y incluía evaluación de los cumplimientos de varios cosechadores de remolacha y demostración del uso de otros equipos agrícolas; algunas exhibiciones estáticas incluían también.

□ □ □

Memo statistique 1977.—In November 1977, the Bureau Interprofessionel d'Etudes Statistiques Sucrières (B.I.E.S.), of 42 rue de Lisbonne, Paris 8e, France, published the latest of their regular collections of statistical data for 1976/77 under the title "Memo statistique 1977". This, in the form of a folded long single sheet, provides summarized information on France, the EEC and world sugar matters, the first secti on being the largest, with current and historical data on beet area, sugar balance, production of sugar in Metropolitan France and the number of sugar factories, also classified by size, sugar consumption and indirect usage. EEC quotas, prices, sugar production, beet areas, consumption and imports and exports of individual members are tabulated, as are data on world sugar production by countries and various crop years including the last eleven, consumption development and for individual countries.

SUGAR CANE AGRONOMY

Soil and foliar diagnosis in sugar factory laboratories for determining macro- and micro-nutrients required for sugar cane growth. P. J. M. Rao. *Indian Sugar,* 1977, **26,** 671-685.—The importance of N, P, K, Ca, Mg and S to the cane plant is briefly indicated and recommended times of N-P-K application for the various Indian cane-growing states and areas in those states are tabulated. The importance of micro-nutrients (B, Cl, Cu, Fe, Mn, Mo and Zn) is also described, and details are given of deficiency symptoms in the case of each macro- and micro-nutrient mentioned above. The value of soil and foliar analysis is discussed, and the procedures used at specific sugar factory laboratories in India are described. Practices in other countries are also briefly surveyed.

A new "twist" on plants. A. I. Linedale. *Cane Growers' Quarterly Bull.,* 1977, **40,** 122-123.—A simple means of tying cane into neat bundles for replanting is described with the aid of photographs. Two U-frames shaped like the bottom of a trailer are set on the ground, with two wire slings laid inside them a given distance apart. The plants are cut and laid in the frames until the desired bundle size is reached, after which the slings are attached to the bundler (a piece of steel pipe with appropriate holes at each end for the slings), which is then simply twisted to tighten the slings. The neat bundles can then be easily loaded onto appropriate transport.

Lightning strike in cane. Anon. *Cane Growers' Quarterly Bull.,* 1977, **40,** 123.—Areas of cane which have been struck by lightning are roughly circular and vary in size from a few stools up to an area of 20 m diameter. The most intense damage occurs at the centre and takes the form of shredded leaf blades, dead spindles and, in many cases, death of one or two stools. Leaf sheaths and leaf blades turn purple, and crater-like depressions in the soil may indicate the point of strike. Further from the centre, damage is limited to an occasional dead spindle and a general yellowing of the cane canopy; in these areas, the cane recovers quickly with no measurable loss of yield. In tall canes, stalks at the centre are shattered and killed. The internodes shrink and rot, quickly giving off an extremely unpleasant odour. Side shoots and adventitious roots may be found. Trash may be charred and fires started, but these are usually extinguished by accompanying rain. The general appearance of cane struck by lightning is that of diseased cane.

Application of cement can boost production. C. M. McAleese and E. A. Pembroke. *Cane Growers' Quarterly Bull.,* 1977, **40,** 124-125.—Mention is made of positive results obtained over a number of years by applying calcium silicate (particularly Portland cement) to cane; cane yield has increased sufficiently for the sugar yield to increase as well, despite a fall in sugar content with increasing quantities of silicate. In north Queensland, the recommended rate is 2·5 tonnes.ha^{-1}, while 4 t.ha^{-1} is recommended for the central district. Treatment is not always effective but is governed by soil type, and where there is response to treatment it may not be sufficient to outweigh the costs. (See also Vallance: *I.S.J.,* 1976, **78,** 111.)

Calculators aid better management. C. W. A. Chardon. *Cane Growers' Quarterly Bull.,* 1977, **40,** 128-129.—The author surveys the types of pocket calculators available on the market; he regards them as valuable for the cane farmer in working out various problems, including the application rate of herbicides and fertilizers, and day-to-day farm management problems.

A shower for safety. A. V. Rudd. *Cane Growers' Quarterly Bull.,* 1977, **40,** 133.—A description is given of a shower installed on a road truck used to carry anhydrous ammonia to the field. It is intended for use where parts of the human body come into contact with the chemical, which is a strong irritant and also has a corrosive action.

Gully erosion—a simple way to control it. P. R. Downs. *Cane Growers' Quarterly Bull.,* 1977, **40,** 138-139. Gullies are usually formed where water flow is concentrated by natural depressions or drainage lines; the flow of water carries away soil and the water course becomes more defined and deeper, eventually forming a channel which, once formed, can increase in size rapidly. Erosion can be controlled by a combination of three methods: building a water diversion bank at the top of the gully to steer run-off water away, establishing vegetation on the flow line, and constructing check dams in the gully. The methods are discussed, and advice is given on building of a check dam.

Factors affecting residual herbicides. A. A. Matthews. *Cane Growers' Quarterly Bull.,* 1977, **40,** 142-143. Factors affecting the action of residual herbicides such as 2,4-D, "Trifluralin", "Diuron" and "Bromacil" are examined, viz. soil texture, leaching, plant population, selectivity and soil moisture content. General rules to follow in order to achieve satisfactory results with residual herbicides are listed.

Sea water damage at Bundaberg. J. F. Reimers. *Cane Growers' Quarterly Bull.,* 1977, **40,** 143-144.—The author describes the effect of flooding of 5 ha of cane field by sea water after passage of a cyclone at the time of high tide. Both plant and ratoon cane were affected. In one of two sites selected from the damaged area for examination, 92% of the tops of the 1-m high cane were killed and the stalks were throwing out side shoots; at the other site, only 4% of the tops were dead, while the spindle leaves were green and healthy, but no side shoots were present. Analysis of the sandy alluvial soil at both sites showed that the salt level was severely restrictive to growth. The salt was subsequently leached by rain, and an inspection of the cane one year after flooding revealed no sign of the earlier damage, with both growth and stooling being normal and a good harvest expected. Conclusions to be drawn from the results are discussed.

CANE PESTS AND DISEASES

Borer (*Chilo sacchariphagus* Boj.) injuries to sugar cane in relation to wind breakage. J. W. Williams. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 340-346.—Data obtained in cane fields after the passage of cyclone "Gervaise" on 6th-7th February 1975 are tabulated, showing the extent of borer injuries and cane breakage among three varieties. It was found that the borer *C. sacchariphagus* had not increased wind breakage of the canes, in contrast to a commonly held belief that canes often snap easily at a point where borer damage has occurred and that bored canes suffer most from wind breakage. Observations over a number of years have shown that borers almost invariably attack the soft tops of cane stems, some way below the growing point, in that part of the stem enveloped in green leaf sheaths, i.e. in the growing part. As the stem grows, borer injury is left behind and the injured part is almost immune to further attack, since the susceptible part of the stem has moved upwards. When stem growth is rapid, borer injury is of minimal effect and usually causes no decrease in internodal length or girth, no sprouting of buds at or above the injury point, and no apparent weakening of the stem. On the other hand, when growth is not vigorous, the top is comparatively stationary, no large internodes are formed and the point at which borers are active is not quickly left behind. Borer injury is then of greater importance and may extend through several short internodes, possibly causing sideshooting above the damaged point. This explains why reports of borer damage (*not* infestation) often relate to cane of advanced growth which has been subjected to moisture stress whereas a 100% stem infestation may attract no attention in a field of cane growing vigorously in the major growth period. Hence, the weakening of cane by borer injury is dependent on the field history before the attack as well as on borer incidence. Predominant factors in wind breakage are variety, wind force, stage of cane growth (i.e. height of cane) and wind date; these factors also influence the importance of borer injury relative to wind breakage. However, it is concluded from observations that even when there is an abundance of borer injuries, they do not necessarily have a discernable effect on wind breakage. Moreover, in only a minority of fields is borer injury extensive and severe.

Mechanical and chemical control of the sugar cane scale insect *Melanaspis glomerata* Green. S. V. Rao, S. C. Rao and B. H. K. Rao. *Indian Sugar,* 1977, **26,** 689-693.—Field experiments conducted at three locations in 1975-76 showed that removal of dried leaves from the basal 6 to 8 nodes, i.e. the bottom 4-5 feet of the cane, in July or August when the cane was 6-7 months old reduced the incidence of the scale insect by 69·7-97·7%. Subsequent spraying with 0·1% "Malathion" twice after leaf removal reduced the incidence still further and maintained the crop almost free of the pest throughout the remainder of the season. Treatment also increased sucrose content, juice purity and cane yield without having any adverse effects on the crop. Spraying with "Malathion" had practically no positive effect without leaf removal, and cane yield was almost the same as in untreated controls.

Leaf scald disease found in the Burdekin for the first time. H. L. Boyle. *Cane Growers' Quarterly Bull.,* 1977, **40,** 120-121.—Q 63, a high-yielding but leaf scald-susceptible cane represents more than 70% of the crop in the Burdekin district of Queensland. Late in 1976, leaf scald occurred in the district for the first time, since when it has spread to more than 100 farms. The author describes the two phases of the disease, the chronic stage and acute stage. It is pointed out that susceptible varieties vary in their behaviour once they become infected. Some will show symptoms immediately, while others, of which Q 63 is an example, can become infected but show very few visible symptoms, so that the disease can spread but remain undetected until an environmental factor such as cool, dry weather reveals the symptoms. Once leaf scald occurs in a district, it is impossible to eliminate it in susceptible varieties, so that the only long-term solution is to replace these with resistant varieties of similar or higher productivity. However, in the Burdekin district it may take some years for breeders to produce a resistant variety having the same qualities as Q 63, and in the meantime control measures will be necessary which will minimize spread of the disease in this cane until an alternative variety is developed. Apart from strict attention to farm hygiene, limiting the area under susceptible varieties, planting of disease-free material and ploughing-out of diseased fields after the 2nd ratoon crop, a method has been developed which will destroy the bacteria in plants by soaking 2-eye setts in cold water for up to 48 hours and then in hot water for 3 hours at 50°C. An isolation plot has been established in which treated cane will be planted; progeny of this cane will be planted in larger isolation plots, from which growers will be able to obtain disease-free material. Q 96, a high-yielding but susceptible variety, will be so treated and released in 1979.

Alarming increase in soldier fly damage at Maryborough. J. Wright. *Cane Growers' Quarterly Bull.,* 1977, **40,** 126-127.—Soldier fly incidence in the Maryborough district of Queensland has been increasing at an alarming rate, it is stated. The pest was responsible for 37% of total crop loss throughout the state in 1975, while losses caused by it in 1976 remained at a high level, being estimated at 4500 tonnes. The dramatic increase is viewed simply as a build-up of soldier fly populations in fields untreated with "Dieldrin", mainly on farms that had experienced damage in past years. Although the cost of treatment is high, the author feels that this should not deter farmers from using the only practical means of control. Fields should be treated as soon as they become fallow, and a 3-month period allowed to elapse between spraying and planting, so that older larvae are sufficiently exposed to the chemical. The recommended technique is blanket spraying with 22·5 litres.ha^{-1} followed by immediate incorporation with discs or rotary hoe; ploughing should be carried out soon afterwards—a number of times where larvae are present.

SUGAR BEET AGRONOMY

Late weed control in sugar beet. -. Garburg. *Die Zuckerrübe,* 1977, **26,** (3), 22-23 (*German*).—It is pointed out that, because of their slow early growth, beets offer only moderate competition with weeds, so that a successful stand of beet will depend on freedom from weeds from the 4- to 6-leaf stage up to harvest. However, at the 4- to 6-leaf stage of the beet, the decision must be made on subsequent measures for control of late weeds. Failure to act promptly will allow the weeds to develop to a stage at which they are difficult to destroy, particularly because of the need for underleaf spraying; they will then compete for space, nutrients and light, and will also make the work of harvesters difficult. Details are given of various preparations and methods for late weed control.

Sugar beet quality. H. Coenen. *Die Zuckerrübe,* 1977, **26,** (3), 24-25 (*German*).—The author explains the meaning of beet quality, indicates reasons for its importance and discusses the effect of nitrogen application (as the major factor affecting polarization and yield) with the aid of a table showing the difference in beet quality and yield between 160 and 220 kg.ha^{-1} N. It is shown that the higher N dosage rate in the actual case reported caused a 3-day extension to the campaign, although the white sugar yield from the greater quantity of beet (337,600 tonnes compared with 364,800 t) was 651 tonnes lower and the molasses sugar 1000 tonnes higher than with the lower N rate. Moreover, the steam consumption per 100 kg sugar was greater as a result of the greater beet throughput.

Rotation and humus problems in intensive arable farming. J. Debruck. *Die Zuckerrübe,* 1977, **26,** (3), 26-29 (*German*).—The question of crop rotation, in which residual materials such as beet leaves and stubble from grain crops are incorporated in the soil, is discussed. It is stressed that failure to supplement the residual materials with e.g. organic and mineral fertilizer will lead to a humus deficiency. However, attention is called to the fact that other problems may arise, e.g. where no allowance is made for N released from beet leaves left on the soil surface as a result of decomposition, so that application of N for the ensuing crop may be excessive and lead to a fall in quality or yield. There is also danger from pests such as beet nematodes which may be passed on to subsequent crops such as cruciferae. However, the overriding factor in the choice of rotation is the aim at maximum yields, even where there are other arguments against a particular system. In this respect, the major need is to prevent humus depletion, particularly where no animal manure is available. However, in a 3-crop rotation there is not the same need for green manure as in a 4-crop rotation.

High liquid manure dosage rates are as bad as their reputation. Anon. *Die Zuckerrübe,* 1977, **26,** (3), 32 (*German*).—Since N applied as liquid manure is rarely allowed for in a fertilization programme, liquid manuring may lead to over-dosing of N, with subsequent falls in beet quality. The N in liquid manure may not be immediately available and not always completely demineralized. Moreover, in West Germany liquid manure application may not conform with the laws on environmental protection. The proportions of N, P and K in cattle, pig and poultry manure are indicated.

Effect of drying temperatures and fruit moisture on germination of sugar beet seed. F. W. Snyder, R. J. Patterson and P. Bergdolt. *J. Amer. Soc. Sugar Beet Tech.,* 1976, **19,** 101-105.—Occasionally sugar beet seed must be harvested before it is fully mature and made available for immediate use, so that it is necessary to know the approximate stage of maturity, moisture content and temperature at which the seed can be rapidly and safely dried without impairing germination. Sugar beet fruits were harvested at a range of fruit moisture content and then dried in air at different temperatures, relative humidity of 6-11% and an air flow rate of 3·7 ft.sec^{-1}. Blotter germination was used to detect seed injury. Seed samples from different plants differed in their sensitivity to heat, such sensitivity not being consistently related to the fruit moisture content, although heat injury was inversely related to moisture content at a given temperature. A safe drying temperature is suggested for a range of fruit moisture contents at harvest.

Soil nitrate and the response of sugar beets to fertilizer nitrogen. F. J. Hills and A. Ulrich. *J. Amer. Soc. Sugar Beet Tech.,* 1976, **19,** 118-124.—Field trials were conducted in 1971-74 at 15 locations throughout the beet-growing areas of California to determine N fertilizer requirements for maximum sugar yield. Beet yields to give maximum sugar varied from 27 to 46 tons.acre^{-1}, while N requirements to give these beet yields varied from 0 to 240 lb.acre^{-1}. An average of 16 lb N was found to give a ton increase in beet yield. The N requirement for maximum sugar production can be calculated from *(Ye-Yo)Nfr,* where *Ye* is the expected beet yield based on field history, *Yo* is the beet yield expected without fertilization (as determined from soil nitrate N at the start of the growing season) and *Nfr* is the N requirement per unit beet yield increase from *Yo* to *Ye.*

Competition of annual weeds and sugar beets. S. R. Winter and A. F. Wiese. *J. Amer. Soc. Sugar Beet Tech.,* 1976, **19,** 125-129.—Annual weeds are a major problem in beet growing on the Texas High Plains, the most troublesome being *Kochia scoparia,* pigweed (mostly *Amaranthus retroflexus* and *A. palmeri*) and barnyard grass (*Echinochloa crus-galli*). In 1972 and 1973, some beet plots in areas predominantly infested with pigweed were weeded for 2, 4, 6 or 8 weeks after beet emergence, and the weeds then allowed to emerge and grow until harvest. In other plots, weeds competed initially with the beets for 2, 4, 6 or 8 weeks, after which the plots were kept free of weeds until harvest. It was found in 1972 that late-emerging weeds did not greatly affect beet yield when the plots were kept weed-free for 6 weeks after emergence; on the other hand, in 1973, pigweed allowed to grow and compete with the beets for 8 weeks after beet emergence reduced yield

to 21·3 tons.acre^{-1} by comparison with 25·2 tons.acre^{-1} in plots kept weed-free throughout the year. Control of early weeds within 6 weeks of beet emergence nearly eliminates weed competition for the season and is essential for maximum beet yield; research should be concentrated on development of effective pre-planting and early post-emergence herbicides, it is suggested.

Effect of crown material on yield and quality of sugar beet roots: a grower survey. D. F. Cole and G. J. Seiler. *J. Amer. Soc. Sugar Beet Tech.*, 1976, **19,** 130–137.—A survey was conducted among beet growers in the Red River Valley of North Dakota/Minnesota to determine the effect on beet yield and quality of flailing but not scalping before harvest as in conventional topping. It was found that scalping gave a lower harvested beet sucrose content than flailing (simulated by leaving the leaves intact), possibly because of increase in normal respiration and water uptake by the roots after scalping, while leaf removal stopped photosynthesis and prevented further sucrose storage. Manual removal of the entire crown caused increase in sucrose content and a reduction in nitrate content, conductivity ash and yield by comparison with untopped beets. However, it was found that crown material accounted for 20·5% of the tonnage delivered to the factory. It is calculated thal use of flailing alone would increase the crown material processed by the factory to 24·6% of the total tonnage which, for a factory slicing 5000 tons of beet/day, would mean a 7-day extension to the slicing campaign. Although a reduction in % sucrose extraction would be expected with increase in crown material, it is assumed from the data obtained that the extraction would have to drop by more than 3% to offset the gain in additional sugar extracted from the crown material. Moreover, the respiration rate and hence rotting during storage of flailed beets have been found to be lower than with conventionally topped beets, so that there should not be such rapid drop in extraction or to the same level as with normal beets.

Effects of weather variables on the yields of sugar beets grown in an irrigated rotation for fifty years. S. Dubetz and M. Oosterveld. *J. Amer. Soc. Sugar Beet Tech.*, 1976, **19,** 143–149.—From regression analysis of weather data for Lethbridge Agriculture Research Station, Alberta, Canada, covering the period 1902–1975, an equation has been derived for predicting sugar beet yields in the area, which is semi-arid so that irrigation is essential for the beet crop. Because of this, moisture stress is not a major variable, and temperature was found to be the only variable significantly affecting yields. The standard deviation of the forecast was reduced by incorporating the May and June temperatures of the current year in the equation. Precision of the prediction would probably be further improved if data were incorporated from other sites as well as Lethbridge.

Sugar beet yield and theoretical photosynthesis in the northern Great Plains. E. J. Doering. *J. Amer. Soc. Sugar Beet Tech.*, 1976, **19,** 163–175.—Investigations were conducted on the relative significance of climate and endogenous factors on beet growth early in the season and to evaluate the effect of yearly climatic differences on beet yield and theoretical photosynthesis in the northern Great Plains area of North Dakota, where considerable variation occurs in beet growth from year to year. It was found that both groups of factors influenced the initiation of bulking of the beet root; once the first ton per acre of beet was reached, weekly increases in growth, sugar content and dry matter were relatively high, so that genetic or cultural factors which hasten the bulking initiation would significantly increase beet yield. A method is described by which Dewit's method for calculation of theoretical photosynthesis can be used for comparison of beet growth at different locations and during different years by making allowance for differences in radiation, cloudiness and atmospheric contamination.

How should PRB 200 be used in 1977? L. van Steyvoort. *Le Betteravier,* 1977, **11,** (109), 7 (*French*).—In recent years, application of PRB 200 ("Orthonil") growth regulator to beet has increased yields by the order of 5–8% without any reduction in sugar content (which has even been increased in some cases). The chemical is best applied at the 12–14 leaf stage when 80–90% of the soil is shaded by the leaf canopy; dosage rate is 0·5 litres in 200–400 litres of water per ha. Under these conditions, it is rapidly absorbed by the foliage and will have maximum effect on growth. Practice in Belgium has shown that all varieties grown in that country react favourably to the product whatever the harvest date, although a period of 3 months should elapse between application and harvest. Aphicides can be sprayed together with PRB 200 without any difficulty.

Beet agriculture in Morocco. Anon. *Le Betteravier,* 1977, **11,** (109), 15 (*French*).—A brief survey is presented of beet agriculture in Morocco, where irrigation is of utmost importance for obtaining high beet yields. Since very often beet thinning is carried out too late (either because of winter rains or because of the labour requirements of other important crops such as oranges and cotton), precision drilling of monogerm seed is considered essential. Mention is made of varietal trials which have been conducted for some three years in both irrigated and unirrigated zones and of trials on beet seed production.

Studies on the effect of periodical sowing and harvesting on the yield and quality of sugar beet (*Beta vulgaris* L.). K. S. Parashar and R. P. Sharma. *Indian Sugar,* 1977, **26,** 701–705.—The effect on beet growth, yield and quality of sowing and harvesting dates was studied in field experiments conducted in 1974–1975 and 1975–76 at the Indian Agricultural Research Institute, New Delhi. Maximum beet yield was obtained when sowing was carried out during the last week of October and the crop harvested by the end of April. Sucrose content fell with delay in sowing, while harvesting after 15th March had a positive effect on sucrose content, which was maximum when harvesting was completed in May.

BEET PESTS AND DISEASES

"Benomyl"-tolerant strains of *Cercospora beticola* from Arizona. E. G. Ruppel, L. M. Burtch and A. D. Jenkins. *J. Amer. Soc. Sugar Beet Tech.*, 1976, **19,** 106-107.—Strains of the leaf spot fungus *C.beticola* tolerant to "Benomyl" have been reported from Greece and Texas, while diminished effectiveness of the fungicide against leaf spot has been observed in Arizona. Tests were consequently conducted to determine if "Benomyl"-tolerant strains were present. Infected leaf samples were collected from beet plots which had been sprayed with "Benomyl" or triphenyl tin hydroxide as well as from untreated control plots. The samples were dried, crushed and used to inoculate beets in the greenhouse. When leaf spots developed, sporulation was induced by placing the plants in a humidity chamber. The spores (30 per sample) were cultured on potato-dextrose agar containing "Benomyl", a known "Benomyl"-sensitive isolate of *C.beticola* being included in all plates as a control. All isolates from Arizona grew profusely on the "Benomyl"-amended agar, whereas the sensitive isolate was completely inhibited. In another test, the Arizona isolates had varying degrees of tolerance to the fungicide similar to those isolates from beet grown in Texas which had exhibited tolerance. Hence, discontinuation of the use of "Benomyl" is recommended. Other fungicides such as triphenyl tin hydroxide should effectively control leaf spot, as will growing of resistant varieties.

The effect of "Aldicarb" on growth of sugar beets. R. E. Peckenpaugh and C. C. Blickenstaff. *J. Amer. Soc. Sugar Beet Tech.*, 1976, **19,** 108-111.—In field tests with "Aldicarb" for control of the sugar beet root maggot *Tetanops myopaeformis,* treated plants have often produced denser top growth than untreated plants, even where the latter plants have not been damaged by the maggot or other insects. Greenhouse tests were carried out to determine if the improved plant performance was a result of pest control or whether "Aldicarb" itself stimulated beet growth. Tests in 1973-74 and 1974-75 indicated that any increase in plant growth could be directly attributed only to watering, and that any benefits due to "Aldicarb" would be the result of pest control. It is stressed that, while the damage inflicted by any one species of pest may be insignificant, the total damage caused by a number of pests may be considerable; while minor damage may go unnoticed by growers, application of "Aldicarb" (which has a residual effect lasting 2-3 months) would control a wide range of pests, thus increasing plant growth and yield. The insecticide does not stimulate growth directly, however.

Sugar beet virus yellows in 1976—an attempt to explain its causes. W. Rieckmann. *Die Zuckerrübe,* 1977, **26,** (3), 14-16 (*German*).—The 1976 virus yellows outbreak in West Germany is discussed, with descriptions given of the roles played by the potato peach aphid (*Myzus persicae*) and the black bean aphid (*Aphis fabae*). While the latter pest transmits beta-virus 4, the causal agent of "normal" yellowing, *M.persicae* is a vector of "mild" yellowing which, despite its name, can cause greater yield losses than normal yellowing, although a mixture of both diseases may cause drastic falls in yield. Descriptions are given of the symptoms of both forms of virus yellows, with mention of alternative hosts of the vectors. While most virus yellows is transmitted by *M.persicae*, the beet growth period of 1976 was marked by a reduction in the incidence of this pest by comparison with 1975, while *A.fabae* numbers were greater. However, it is suggested that *M.persicae* caused initial infection of beets, and that A.*fabae* (less prone to migrate to alternative host weeds from beet, to which it is better adapted than is *M.persicae*) spread the infection. Because of the difficulty of establishing accurate numbers of *M.persicae* (it is stated that for every one found, 5-10 will be overlooked), plants preferred by the pest for feeding purposes were used as lures and were sprayed with insecticide after each count to obtain data on weekly arrival flights. *A.fabae* is easily checked by counts on beet leaves. The incubation period of virus yellows is about 3 weeks, but viruses can lie dormant in plants, multiplying only slowly or not at all under adverse conditions (high temperatures and drought). In 1976 preventive spraying was not always successful. A list is given of factors which affect the onset of yellowing. Early drilling reduces the intensity of attack, while beets on the edge of a gap may be more vulnerable, since the vectors are attracted to changes in colour from the normal green of leaf growth such as occurs with gaps. While weak, limp beets are attacked by aphids, the pests do not colonize them as much as they do turgescent beets. Yellow leaves, whether the result of virus infection or nutrient deficiency, attract aphids. K and particularly Mg deficiency causes symptoms similar to virus yellows, so that an ample quantity of these two nutrients in the soil is advisable. Abundant N supplies may mask yellowing, provided the soil moisture content is not impaired (or only very slightly). Reasons for failure of spraying to control yellowing are briefly discussed; it is recommended to spray in the evening (when the chemical will be taken into the plant at a time of increasing turgor pressure and absorbed by the aphid), to provide the plant with ample water, and to consider the use of contact insecticides in dry locations.

Pests occurring at or after emergence, and their control. Anon. *Die Zuckerrübe,* 1977, **26,** (3), 18-19 (*German*).—A list is given of 15 major beet pests, with descriptions of the damage they cause and possible control means.

Snail problems. Anon. *Die Zuckerrübe,* 1977, **26,** (3), 20 (*German*).—Snails and slugs do not cause widespread losses in beet fields, but can damage individual plants. A brief survey is presented of the various types commonly found, and control with grains containing "Mercaptodimethur" is indicated.

CANE SUGAR MANUFACTURE

Industrial satellization of sugar factories—is it possible? J. M. Paturau. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 6-16 (*French*).—The author looks at possible ways in which the sugar factory area (taken as some 8000 ha supporting about 18,000 inhabitants) can be better utilized in Mauritius, rather than have the present situation in which the cane agricultural potential is utilized throughout the year while the sugar factory potential is used for only about 100 days a year. In view of the pressures on land used on the island, it is felt that either the factory should be a satellite of a central national industrial enterprise, or it should be the centre of an industrial undertaking involving not only sugar production but also wide use of waste products such as bagasse and molasses, utilization of workshops to make sugar factory equipment for sale to a central undertaking or even to other countries, cultivation of cane intercrops such as maize and growing of other produce on land not used for cane, breeding of fish and oysters in lagoons, use of basalt (available in pentiful supply in Mauritius cane fields) as building material, and methane and compost production from cattle dung. Increased efficiency in cane growing and in sugar factory water utilization (water being of such great value in Mauritius) are two factors considered in some detail as contributing much to the productivity of a typical sugar factory area.

Is it necessary to abandon mills? M. Rivière. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 79-90 (*French*).—The theory of cane juice extraction by milling is explained in terms of the three operations of cell opening, juice-bagasse separation and solvent extraction. Extraction by a number of mills in a tandem or by a number of stages in a diffuser is treated as a multi-stage counter-current exchange process in which, at each stage, two liquids (juice and imbibition liquor) are mixed together as thoroughly as possible before being separated, so that the efficiency is a product of the two operations. While cane mills are not provided with means for mixing, separation by them is efficient; on the other hand, in diffusion more attention is paid to mixing, while the separation process is purely a case of drainage. In order to quantify the mixing efficiency, the Ponchon-Savarit diagram is used to determine the Murphree criterion. Application of the diagram and the mathematical procedures involved are explained, and evaluation of the performance of the 5-mill tandem at Quartier-Français is used as an example. It is shown that dissatisfaction with cane mills stems from their limitations as mixers—if this aspect of their operation could be substantially improved, there would be need for only three mills in a factory, it is suggested. However, evaluation of the performance of a diffuser by means of the Ponchon-Savarit digaram shows that in a hypothetical case where bagasse entering the diffuser has the same composition as bagasse entering a second mill, five theoretical stages are required in order to give 97% extraction, given a 1st mill extraction of 70%. Where 1st mill extraction was 80%, only two theoretical diffuser stages would be needed, whereas a typical bagasse diffuser contains the equivalent of 7-9 stages. Where a cane diffuser is followed by a mill, an average of 18 theoretical mixing stages is used in practice, indicating an apparent stage efficiency of 0·33%. Hence, diffusers are no better mixers than are mills, while their separation efficiency is lower than that of mills, so that it is not a question of replacing mills with diffusers but rather of looking at ways of improving the mixing efficiency of both types of "exchanger".

Electronic controls for cane carriers. P. Olsen. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 91-95 (*French*).—After a brief mention of the disadvantages of cane carrier speed control by means of a slip coupling, the author describes the Heenan & Froude transistorized system which controls the cane flow to the mills as a function of the cane level in the feed chutes; because of fluctuations in the volume of cane in the chute, the appropriate follower on the central control panel varies the feed to the mills by up to 40%. Reasons for cane volume variations in the feed chute are explained, and the introduction of a second follower to measure the level of cane in the carrier recommended as well as regulating cane feed to the carrier before any variations can affect the mill feed. However, it is stressed that a follower measures only the volume and not the weight; a better control system would allow for variations in density of the cane blanket or would measure weight alone and not volume. The gamma-ray controller, measuring the bagasse density in a Donnelly feed chute and transmitting a signal for carrier speed control, is described as an effective means which operates in a simple manner and is much cheaper than the system described above. Mention is also made of a cutting set of knives (as opposed to leveller knives) installed at Quartier Français which cuts cane from the feed table into 15-cm lengths which then pass to the carrier. The cane is shorter but resembles that in countries using chopper-type harvesters. Three Mauritius factories were to use the system in 1976. A system of leveller knives with a large accumulation box in front of the first of the three sets, and fixed baffles to prevent jamming by feed cane, is illustrated by a diagram. Installed at Bois Rouge, it permits excess cane to pass back into the box in a rolling movement, thus achieving the same effect as the cutting knives mentioned above.

Water pollution control. G. G. Ashe. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 224-226 (+ 5 figs.).—Information is given on the oxidation ditch effluent treatment system used at Umfolozi since 1971, where a cage-type rotor provides oxygen and ensures constant mixing of the effluent with the active organisms in the ditch as well as keeping the effluent moving. The mixed liquid flows from the ditch to a clarifier for solids separation. Official standards set for treated effluent at the factory are a maximum COD of 120 mg.litre^{-1}, a suspended solids content no greater than 25 mg.litre^{-1} and an oil content not exceeding 5 mg.litre^{-1}. Satisfactory results are obtained with the system without the addition of nutrients, a COD value of 50 mg.litre^{-1} and a suspended solids content of 5 mg.litre^{-1} having been achieved on numerous occasions.

Efficient use of water by sugar factories. L. R. Coombes. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 227-237 (*French*).—A water balance is given for a factory having an hourly crushing capacity of 125 tonnes of cane, covering cane washing, imbibition and cooling of mill bearings and turbines, boiler feed water, filter cake sweetening-off, evaporator and pan condensers, crystallizers and other processes where water is used to a limited extent. From the calculations the author estimates the quantity and cost of cold water required where no recycling is used. However, while a closed circuit is of advantage, there are a number of disadvantages, and these are discussed. While water from the cane mills is often cooled together with condensate, there is risk of fouling by algae, although this problem can be overcome by using a unit for the mill water only. Recirculation of water to the condensers necessitates very powerful pumps, which consume much energy. For crystallizers, a closed circuit is desirable in order to prevent accumulation of mud in the cooling elements and to minimize the volume of water to be treated so as to reduce element corrosion. Two possible systems for cooling of water for crystallizers are briefly examined: a completely closed circuit in which the water is passed around the tubes of a heat exchanger, and a scheme in which the water is cooled by fresh river water. Outline descriptions are given of various types of coolers. Problems created by inadequate supplies of condensate to boilers (resulting in excessive fresh water usage) and the need for boiler feed water treatment are discussed, as is the question of waste water disposal where an open cooling circuit is used (cold water being taken from a river upstream and hot water being discharged downstream). The small amount of waste water discharged from a factory using a closed circuit is a major advantage of the system, although it is stressed that even where such effluent is used for irrigation, pre-treatment is necessary. Nevertheless, the amount involved is still far less than the quantity from a factory using an open circuit.

The control of fly ash emission from bagasse-fired boilers. A. B. Ravnö. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 238-246.—Typical boiler fly ash emission rates are given for Australia, South Africa, Taiwan, Florida, Louisiana and Hawaii, and indications are given of the relevant air pollution regulations. While many boilers in the sugar industry are provided with some form of grit arrestor in an effort to reduce erosion of the fan and associated draft plant, the efficiencies of these collectors have proved to be generally too low (20-70%) for pollution reduction. A considerable number of wet and dry collector designs have been tested on a pilot plant scale, and a table is given which summarizes the results obtained. Investigations conducted by the CSR Ltd. on four types each of wet and dry collectors showed that dry collectors appeared to have a maximum bagasse fly ash collection efficiency of 96%, while most wet collectors had efficiencies well above this; over a pressure drop range of 50-150 mm w.g. there was no marked relationship between collection efficiency and pressure drop. While the final choice between wet and dry collectors depends primarily on the required efficiency and the comparative capital and operating costs, there are also a number of factors which should be considered, viz. the materials of construction of the existing fan, ducting and stack; layout considerations and space availability; capacity and power of the existing draft plant; water availability; and the proposed method for handling and disposal of the fly ash. A list is given of collectors installed in South African sugar factories; most of them are wet scrubbers. Major factors which can have a marked effect on collector performance are briefly discussed; they include grit refiring, fly ash disposal and corrosion, particularly by sulphur compounds present in the fuel and by high chloride levels in recycle water where a wet scrubber is used.

Use of steam turbines in the sugar industry. M. G. Damminger. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 259-264 (+ 6 figs.) (*French*).—Applications of steam turbines in a sugar factory as prime movers and as power generators are briefly surveyed, and an example described of a 1600-kW turbo-alternator installed for power generation from a steam input of 70 tonnes.hr^{-1}. Costs are indicated and a diagram presented of the turbine. Turbines as cane mill drives are also described with the aid of illustrations.

Long-tube evaporators in the South African sugar industry. G. N. Allan. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 265-274 (*French*).—The advantages of so-called Kestner and semi-Kestner evaporators (incorrectly named, since the long-tube evaporators described are not climbing-film evaporators) are discussed and the evaporators described with the aid of diagrams. Tabulated data are given relating to long-tube evaporators installed in South African sugar factories, and details are given of entrainment separation, juice retention times and heat transfer rates. While evaporators having tubes 4 and 7 m long have the advantages of large heating surfaces in single tube banks, low juice retention times and simplicity of operation, heat transfer rates have been disappointing; improvements could be brought about, it is suggested, by increasing the temperature differential, increasing tube cleaning efficiency and stabilizing juice flow rate as well as improving juice distribution below the tube bank.

Stainless steel in sugar plants. E. Hale. *S. African Sugar J.,* 1977, **61,** 113-116.—The use of stainless steel tubes, particularly in juice heaters and evaporators, is discussed, and information is given on the heat transfer properties of stainless steel and its basic advantage of reduced fouling by scale (which is easily removed). The problem of stress-corrosion cracking and pitting corrosion of stainless steel tubes is examined, and reference made to investigations at British Sugar Corporation factories. It was found that the chloride content of evaporator juice, although high at up to 1000 ppm, was not the cause, and that the sugar content itself acted as effective corrosion inhibitor. Laboratory and factory investigations showed that boiling out with soda ash solution did not cause corrosion provided the solution was not heavily contaminated with chloride; on the other hand, while dilute HCl is not harmful, particularly during a short period of contact, its combination with impurities in the scale forms a highly noxious liquor which rapidly pits stainless steel. Sulphamic acid was found to be as efficient a cleaning medium as HCl but without the danger of pitting; adoption of a soda ash-sulphamic acid treatment by the BSC has prevented pitting. A brief description is given of welded stainless steel tube manufacture.

Flocculation technology in sugar manufacture. M. C. Bennett. *Rev. Agric. Sucr. Maurice,* 1976, **55,** 275-284.—See *I.S.J.*, 1976, **78,** 315.

BEET SUGAR MANUFACTURE

Modernization of a vertical prelimer. A. E. Golovatyi, V. S. Bondarenko and N. I. Nespryad'ko. *Sakhar. Prom.*, 1977, (4), 43-45 (*Russian*).—Modifications to a vertical preliming vessel are described which were necessitated by non-uniformity of juice alkalinity on leaving the vessel.

Mechanical properties of sugar beet roots. II. Tensile strength. W. Nowicki, P. Kolodziejczyk, P. Banasik and H. Gasiorowski. *Gaz. Cukr.*, 1977, **85**, 32-33 (*Polish*). Investigations of the tensile strength of beet roots are reported. The beet (of variety AJ_3) was found to be completely elastic, the upper limit of elasticity coinciding with maximum tensile strength; Young's modulus was constant and independent of growth conditions and location.

New techniques in the sugar industry. Anon. *Die Lebensmittelind.*, 1977, **24**, 139 (*German*).—Information is given on new techniques developed in Poland. They include: thin juice deliming and decolorization by treatment with ammonium carbonate and active carbon[1,2] followed by ion exchange; vacuum filter cake sweetening-off by sprayed condensate; pre-carbonatation[3]; and a vertical multi-sectioned prelimer for which a number of advantages are claimed, including control of juice pH (which is not possible in the Brieghel-Müller type), reduced floor space requirements, and absence of foam and bacterial infection.

A simplified formulation of the N.P. Silina massecuite viscosity equation. K. Wagnerowski. *Gaz. Cukr.*, 1977, **85**, 49-53 (*Polish*).—Reference is made to the earlier work conducted by Silina and Gromkovskii on massecuite viscosity determination as a function of mother liquor viscosity and massecuite crystal content. The formula of Silina is analysed in detail and calculated values tabulated of the massecuite:mother liquor viscosity ratio (η_c/η_s) as a function of crystal content in the range 5-55% (at 5-unit intervals) and massecuite Brix Bx_c in the range 89-95 at 1° intervals. The formula has been modified so that the viscosity ratio is calculated in terms of only two variables, and takes the form $\log \frac{\eta_c}{\eta_s} = 0{\cdot}0132\ Bx_c \left(\frac{85}{85-Kr} - 1\right)$. Calculated values of the ratio according to the modified formula are tabulated at the same crystal content and massecuite Brix ranges as the values calculated from the original Silina formula. Comparison of curves at the two extreme Brix values (89 and 95°) shows coincidence at the upper limit of validity of the Silina formula (a crystal content of 50% by weight), although differences (up to a maximum of $\pm 3{\cdot}5\%$) were found between the calculated values; they were generally within experimental error, however. The modified formula is considered suitable for use with 2nd and 3rd massecuite calculations.

A new series of barometric condensers. K. Urbaniec and K. Wójcikowski. *Gaz. Cukr.*, 1977, **85**, 55-57 (*Polish*). Details are given of a new type of barometric condenser of Polish design. It has concentric baffles and is available in 10 sizes from 800 to 2800 mm internal diameter.

The effect of solid production wastes at sugar factories on their waste water economies. K. Skalski. *Gaz. Cukr.*, 1977, **85**, 57-60 (*Polish*).—Outlines are given of methods of flume mud and carbonatation mud treatment, with their advantages and disadvantages discussed and general performances compared (in terms of COD and BOD_5 reduction). Apart from the type of equipment and circuits, the author also examines the merits and demerits of various additives such as chlorine compounds and lime.

Mechanical properties of sugar beet roots. III. Relaxation of the sugar beet root. W. Nowicki, P. Kolodziejczyk, P. Banasik and H. Gasiorowski. *Gaz. Cukr.*, 1977, **85**, 61-62 (*Polish*).—Details are given of apparatus used to determine the relaxation (decrease in stress due to internal relaxation under conditions of strain) of samples of beet root sections. A theoretical viscoelastic model of the relaxation process is proposed; comparison of the theoretical curve with one obtained from an empirical equation based on 30 measurements showed close agreement at a 95% confidence level, so that the model is regarded as adequately describing the process.

Applications of the melibiase process in the Steffen process. S. Meguro and H. Konishi. *Sucr. Belge*, 1977, **96**, 111-132.—Details are given of the melibiase process for molasses raffinose hydrolysis as a preliminary step in sugar recovery by the continuous RT saccharate process as used at Kitami in Japan[4]. The enzyme takes the form of mycelia pellets of *Mortierella vinaceae* var. *raffinoseutilyzer* which contains α-galactosidase. Materials balances are calculated for four cases in which a beet sugar factory of 4000 tons beet/day slicing capacity (1) does not use the Steffen process, (2) uses it without discarding any molasses (a hypothetical case), (3) uses it and discards some molasses, and (4) uses both the Steffen and melibiase processes without discarding any molasses. Comparison between (3) and (4) shows that the true purity of the saccharate cake in (4) is 4-6 units higher (at 80-82) than in (3), of which only a 2-unit increase is attributable to the saccharate process, while the rest is a result of the melibiase process, by which the 29-31°Bx molasses is treated for 2-3 hours at pH 5-5·2 and 48-52°C. An evaluation of the economics of the melibiase process shows that it is of advantage where there is a considerable price difference between sugar and molasses, where no molasses is supplied to the factory from outside, or where the campaign is prolonged. At 5·95% molasses yield on beet, it is calculated that case (4) would recover an extra 75·61 tons of sugar daily compared with only 45·65 tons from 5·48% molasses on beet.

The new sugar factory at Krasnystaw. J. Fajst. *Die Lebensmittelind.*, 1977, **24**, 127-128 (*German*).—Details are given of the sugar factory at Krasnystaw in eastern Poland which started operations in 1976 at a daily rated slicing capacity of 5280 tons of beet.

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[1] Zaorska: *I.S.J.*, 1973, **75**, 254.
[2] Zagrodzki & Zaorska: *ibid.*
[3] Zagrodzki: *ibid.*, 139-140.
[4] See also McGinnis: *I.S.J.*, 1976, **78**, 121.

NEW BOOKS

Tate & Lyle Group Research & Development Annual Report 1976. 40 pp; 21×30 cm. (Tate & Lyle Ltd., Group Research & Development, Philip Lyle Memorial Research Laboratory, P.O. Box 68, Reading, Berks., England RG6 2BX.) 1977.

The latest report from Tate & Lyle Group Research & Development gives information on the nature of the work being conducted in various fields, including non-food uses of sucrose and its derivatives; production of microbial polysaccharides and protein; manufacture of non-sucrose sweeteners, principally from the West African plant *Thaumatococcus daniellii*; aspects of biology and agriculture such as photosynthesis processes; enzyme technology; sugar technology (the use of semi-permeable membranes for removal of impurities, carbonatation of refinery liquors, decolorization with resins, measurement of sucrose degradation in refining by means of ^{14}C-labelled sucrose, enzymatically-generated cane juice colorant studies and investigations of the origin, chemical nature and mode of action of oligo- and polysaccharides which interfere with crystallization); and various services which are offered. Mention is made of the formation of a new company, Talres Development Ltd., to produce and market sucrose based chemicals and other speciality products.

Life and the wonders of water. H. F. Clements. 32 pp; 15 × 23 cm. (Harold L. Lyon Arboretum, University of Hawaii, 3860 Manoa Road, Honolulu, Hawaii, USA 96822.) 1976. Price: $5.00.

This, the seventh annual Harold L. Lyon Arboretum lecture, is first concerned with the properties of water and its action on other substances. The bulk of the work is devoted to water utilization by plants and transpiration processes. By far the greater part of the book is concerned with the effect of water on sugar cane and its role in sugar synthesis; the text is accompanied by excellent diagrams of cane leaf sections, as well as beautiful colour photographs of growing cane. The lecture makes very interesting reading for the cane agronomist and will, it is hoped, stress the importance of water for cane growth.

Les principales adventices de la canne à la Réunion. (The major weeds of cane in Réunion). 81 pp; 15 × 21 cm. (Syndicat des Fabricants de Sucre de la Réunion, Centre d'Essai de Recherche et de Formation, Ste.-Clotilde, Réunion 97490.) 1977.

Intended to help the cane farmer combat the weeds in his cane, this excellent book gives descriptions of the major monocotyledons and dicotyledons encountered in Réunion. In each case the description of the weed (of which both the Latin and common names are given) is accompanied by a colour photograph, details also being given of the plant's ecology and distribution on the island as well as chemical control methods. The section on weeds is followed by one on the chief herbicides used in Réunion and a glossary of terms used in the literature on herbicides. The book concludes with a short bibliography and a subject index arranged alphabetically by common names of the weeds. The compilers of the book are to be congratulated on producing such an excellent work which must be invaluable to the cane farmer in Réunion. It could be the pattern for similar books on weeds in other cane-growing countries. The format is highly suited to the type of book, while the printing is very easy to read. While French is the only language used, those of our agronomist readers who have some knowledge of the language would have no difficulty in making out most of the details.

Planalsucar Annual Report 1976. Ed. José A. Gentil C. Sousa. 88 pp; 21 × 28 cm. (Instituto do Açúcar e do Alcool, Rua Boa Morte 1367, Piracicaba, São Paulo, Brazil 13400.) 1977.

The introduction to the 1976 Report of Planalsucar, the Brazilian National Programme for Sugar Cane Research, includes a tribute to the memory of Dr. Gilberto Miller Azzi, who had been General Superintendent of Planalsucar since its inception in 1971 until his death, at an early age, in December 1976[1]. Names are then given of Planalsucar officers and regional staff, followed by details of the cane-growing areas of Brazil, with information on the varieties grown and their importance (in terms of percentages). The bulk of the Report is devoted to the work carried out on the many facets of cane breeding, research and agronomy, colour illustrations being provided on many pages. The text is in both English and Portuguese. As the Coordinator, José A. Gentil C. Sousa, points out in the introduction, "Although much was accomplished (in the year), much still remains to be done to supply the sugar industry in Brazil with the technology needed to reach its full potential". However, it is notable that already the first RB varieties were to be released to farmers in 1977; the best were found in trials to give sugar yields which were greater than that from CB 41-76, used as control. For those readers interested in how Brazil is tackling the problems which so often confront cane-growing countries, this report makes very good reading.

The sugar industry in Ireland. M. Foy. 159 pp; 21 × 31 cm. (The Irish Sugar Co. Ltd., St. Stephen's Green House, Dublin 2, Ireland.) 1976. Price: £4.25.

This history was compiled to mark the fiftieth anniversary of the Irish beet sugar industry, as established by the start-up of Carlow sugar factory in 1926. Well illustrated and beautifully presented, it describes the history and development of the industry and of the Irish Sugar Co. Ltd., created by the Irish Government in 1933 to acquire Carlow factory from the Irish Sugar Manufacturing Co. and establish the three factories at Mallow, Thurles and Tuam (which first operated in 1934). The point is made that the Irish Sugar Co. was the third beet sugar company to be formed in Ireland, the first being the Royal Irish Beet-Root Sugar Co. which built a factory at Mountmellick in the county of Leix in 1851

[1] *I.S.J.*, 1977, **79**, 150.

(although the first beet had been processed on Achill island, off the coast of Mayo, in about 1845); despite the failure of the Mountmellick venture in 1862, in 1885 the Irish Industries Commission decided that Ireland was a suitable beet-growing country. Since its early days, the beet sugar industry in Ireland has progressed by leaps and bounds, turning the country from an importer into a sugar exporter. Moreover, diversification has been on a vast scale, with development (in 1949) of an agricultural machinery industry and limestone quarries, production of "Erin" foods, candle manufacture and fish processing. In 1955 Irish beet harvesters were first sold to overseas customers. The Irish Sugar Co. has a number of associated companies, both in Ireland and in other countries. By 1974 sugar represented only 47% of the company's turnover, although the value of sugar and sugar-containing products exported in 1975 was in excess of £20 million. The book is well produced and lavishly illustrated, and makes very interesting reading as an account of a small but highly efficient sugar company.

Zuckerwirtschaftliches Taschenbuch (Sugar economic pocket book) **1977/78.** K. Dankowski, R. Barth and G. Bruhns. 256 pp; 10 × 15 cm. (Verlag Dr. Albert Bartens, Postf. 380 250, Berlin 38, Germany D-1000.) 1977. Price: DM 27.--.

The latest edition of this well-known pocket book has the same general layout as previous editions, with the first section comprising world, European and West German statistics concerning beet, cane, sugar and molasses, the second section consisting of trade regulations, and the third section containing addresses of international, EEC and West German organizations concerned with sugar, food and/or agriculture, as well as details of West European sugar companies and factories, with information on their capacities and products. The main language used is German, although English and French translations are given of some sections and table headings (a glossary of EEC sugar trade terms is given in all three.). The book contains 69 tables, 6 graphs and 3 maps, and is of great value for those interested in EEC sugar matters. While it is truly a pocket book, the print is highly legible and the pages open out to stay flat for ease of reference.

F. O. Lichts Internationales Zuckerwirtschaftliches Jahr- und Adressbuch (F. O. Licht's International Sugar Economic Yearbook and Directory) **1977.** H. Ahlfeld. 429 + 73 pp; 22 × 30 cm. (F. O. Licht, P.O. Box 1220, Ratzeburg, Germany D-2418.) 1977. Price: DM 80.--.

The latest edition of the Licht Yearbook and Directory has the same layout as past editions and is so well known as to make a full description of the contents almost superfluous. The bulk of the book is, of course, a directory to the beet and cane sugar factories and refineries which make up the world's sugar industry; with most countries, addresses are given of company head offices as well as locations of factories and/or refineries, processing figures given wherever possible and updated to 1975/76 or 1976/77. The information on the West German sugar industry is, as to be expected, in greater detail, while at the other extreme are the socialist countries, for which only factory names are given or, at most, the nearest railway station. Details are also given of international official organizations as well as trading companies and institutes in the individual countries.

There are three articles: "High fructose corn syrup" by E. M. Brook, "The competition between sucrose and isoglucose in the EEC" by W. Grosskopf and E. Schmidt, and "Advances in small-scale sugar processing" by G. B. Hagelberg; these are followed by a general report on sugar machinery manufacturers and factory construction companies. A new item is a survey entitled "Availability of machinery, equipment, chemicals and fertilizer necessary for sugar cane production" by B. J. Cochran and M. Giamalva, which gives addresses of firms from which specific equipment and products are available. Details are given of companies supplying sugar manufacturing equipment and of the equipment itself, and a Buyers' Guide is appended. A 73-page collection of sugar statistics is enclosed in a pocket at the end of the book.

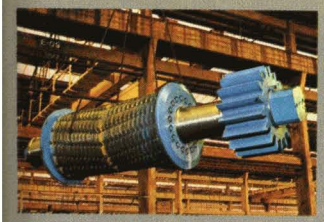
The printing is very clear and the reader wishing to find the type of information contained in the directory would have no difficulty in locating it, particularly in the factory address section, where the names of the countries are printed in large capital letters at the top of the pages. The book is the only collection of such information to be found in a single volume, and as such represents very good value.

Sugar year book 1976. 372 pp; 10 × 14 cm. (International Sugar Organization, 28 Haymarket, London, England SW1Y 4SP.) 1977. Price: £5.00.

The 1976 collection of sugar statistics covers 126 countries (including the EEC as one unit) of which less than half were members of the ISO as at 31st December 1976. This is the 30th issue of the book, and contains details of centrifugal sugar manufacture on a calendar year basis, except where otherwise stated. The data have been supplied by members of the International Sugar Agreement under the rules of the ISA, while governments of non-member countries have supplied the statistics, or these have been extracted from statistical publications or estimated. Wherever possible, the figures are expressed in terms of 96 pol raw sugar, although where such information is available, trade figures are broken down into raw and refined (or plantation white or factory white) sugar. A collection of general statistics towards the end of the book cover sugar imports, exports, consumption, stocks and prices. The tables are neatly laid out and the clear type permits easy reference.

Weed beet. 7 pp; 15 × 21 cm. (British Sugar Corporation Ltd., Central Offices, P.O. Box 26, Oundle Road, Peterborough, England PE2 9QU.) 1977.

This 7-page booklet is devoted to a subject which is of gravest importance to the beet grower in northern Europe, viz. weed beet. It is stressed that, while the problem is not serious in UK fields beet at present, the future of the industry could well be placed in jeopardy by inadequate control of weed beet in the early stages. Recommended control measures are described, both in beet and in other crops, with the aid of colour photographs. The BSC are to be congratulated on producing this booklet, and it is to be hoped that growers pay heed to the advice it contains.



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LABORATORY STUDIES

Introduction to the A1-ETs2-S photocolorimeter. N. N. Neklyudova and G. F. Tyazhelova. *Sakhar. Prom.*, 1977, (4), 46-52 (*Russian*).—The advantages of the title instrument over the KSM colorimeter are discussed, including its greater accuracy. Since it measures optical density at 420 nm and gives a reading in physical units, there is need for conversion to °St, and tables are given of equivalent values for sugar solutions of 49·4-50·6% dry solids in 0·2% intervals having optical densities in the range 0·050-2·00 at 420 nm.

The structure of crystal faces and its relation to growth of sucrose crystals. W. J. Dunning. *Ind. Sacc. Ital.*, 1977, **70,** 15-18 (*Italian*).—The author describes the process involved in sucrose crystal formation, starting from the basis of imperfection in all true crystals, and showing how dislocations occur as screw and edge types, with kinks forming in the steps on the crystal faces under the effect of temperature. The retarding effect of raffinose on the rate of growth of steps is examined, and the effects of regularity and irregularity in step formation are explained, particularly with regard to the spiral formed in the presence of a screw dislocation.

Ion exchange chromatography of carbohydrates. H. Bauer and W. Voelter. *Chromatographia*, 1976, **9,** (9), 433-439; through *Anal. Abs.*, 1977, **32,** Abs. 4C14.—Mixtures of mono- and disaccharides (nmol amounts) are separated, as anionic complexes with H_3BO_3, on a column of a strongly basic ion exchange resin (DA-X4 or DA-X4F) by elution at 50°C with a borate buffer gradient in, e.g., the pH range 8-10·5. The eluted sugars are detected by reaction with orcinol-H_2SO_4 at 100°C, and are determined by spectrophotometry at 420 nm. Monosaccharides (fructose, galactose, xylose and glucose) and disaccharides (sucrose, maltose and lactose) are readily separated.

Study on the quality of lime used in the Alagoas sugar industry during the 1975/76 season. C. G. de Oliveira and A. S. Alves. *Brasil Açuc.*, 1977, **89,** 24-31 (*Portuguese*).—A survey was made of lime samples taken from the stores of 16 sugar factories and analysed for total and available CaO, MgO and SiO_2 content. The available CaO content was generally lower than recommended but better than in 1974/75. The MgO content was good and in some cases less than 2%. SiO_2 was high but the sources of supply indicated that it was difficult to obtain a lime with less than 2% silica. The carbonate content averaged 13·37% in 1975/76 as against an average of 16·07% in 1974/75.

The effect of hydrogen ion concentration on the absorption spectra of factory juices and model solutions. H. Andres, E. Seidelmann and V. Prey. *Zeitsch. Zuckerind.*, 1977, **102,** 133-138, 195-200 (*German*). Absorption spectra of juices from various stages of purification revealed the same pattern in a given pH range, irrespective of origin of the juices or quality. At pH 7 the spectra showed indistinct minima at 240 nm and maxima (also indistinct) at 260–265 nm. At 300–340 nm all juices were represented by a more or less distinct shoulder; from 450 nm the curve in each case followed a path which brought it almost asymptotically towards the abscissa. At a pH in the acid range the extreme values became more distinct than at pH 7 and the shoulders receded. In the alkaline pH range, both minima and maxima flattened to shoulders, while the shoulder at 300–340 nm became more distinct. Difference curves clearly demonstrated the influence of pH in that wavelength range where the basic absorption of the juice underwent marked change. From the agreement between the spectra of raw juice and subsequent products precursors of colorants formed during purification are present in the raw juice. At pH 7 the spectrum of pure hexose solutions after alkaline degradation was similar to that of factory juice, while many other model solutions investigated also had a shoulder at around 300 nm. On the other hand, at lower or higher pH values all model solutions had spectra which differed from those of the natural juices. While the extreme values for factory juices in the acid range occurred at 260–265 nm and flattened to shoulders with transfer to alkaline conditions, the maxima and minima for the model solutions were in different positions, and the effect of pH on the extinction value at the wavelength of the maxima was not the same as with the factory juices.

Chemical control investigations. J. F. R. Rivalland. *Rev. Agric. Sucr. Maurice*, 1976, **55,** 198–209.—A survey showed that weekly performance figures calculated at various Mauritius sugar factories were often subject to wide fluctuations which could not be accounted for during a given week. In other cases, the figures were abnormally steady throughout the entire crop, regardless of unscheduled stoppages or unexpected sugar losses in the factory. Parameters such as boiling house recovery, boiling house efficiency and undetermined losses have gradually lost their quantitative significance and are often regarded as merely of informative value. The author reviews the chemical control methods used and discusses sources of error. By far the greatest source of inaccuracy is the calculation of weight of recoverable sugar based on the volume of individual vessels and using a Brix-density conversion table. Considerable variation hs been found in the density of products from one factory to another, so that it is considered advisable to determine the density of individual products at each factory at the start of the crushing season, and use this value for conversion of volume to weight throughout the remainder of the season. Other possible sources of error are estimation of the weight of sugar left in the bin over the weekend, and determination of the weekly weight of molasses where incorrect taring of the scales may lead to inaccuracies in the weight of sucrose lost to molasses. A proposed modified procedure is described for calculation of performance figures and sugar production which has been tested at three factories.

Analytical differentiation between cane sugar and beet sugar. J. Bricout and J. C. Fontes. *Sugar J.*, 1977, **39,** (10), 31–32.—See *I.S.J.*, 1976, **78,** 28.

BY-PRODUCTS

PEADCO process. J. T. McCloskey and F. Suarez. *Papel,* 1974, **35,** (Feb.), 47-57; through *S.I.A.,* 1977, **39,** Abs. 77-326.—This process for converting bagasse to cellulose consists of: moist depithing; cleaning by flotation; wet depithing with removal of soluble and insoluble impurities; screw conveying under pressure with recycling of expelled liquid to wet depithing; cooking for approx. 11 min at 170-180°C with steam and caustic soda; defibration at >136°C, i.e. before the lignin sets rigid. The functions and apparatus of each stage, particularly the first two, are described, and advantages are indicated. Wet cleaned fibres from the 1st depithing may be stored 10-12 months in bulk, avoiding the health risk of baled storage and the corrosion by lactic acid of the Ritter process. Recycling of liquid from wet depithing for sugar recovery is briefly considered. Some quality parameters of final products in Peru in 1969-73 are shown; they are considered suitable for most applications, but not for soluble cellulose or newsprint.

Supplementation of wood by bagasse. Anon. *Timber and Timber Products,* 1975, (July), 11-14; through *S.I.A.,* 1977, **39,** Abs. 77-327.—Advantages of using bagasse for paper pulp production under South African conditions are pointed out. Aspects briefly discussed are: differences between fibre and pith properties, which make depithing essential; storage methods, the Ritter method being recommended; pulping and bleaching processes; and quality and uses of bagasse pulp.

Morphological and chemical investigations on the pulping of bagasse with neutral sulphite solutions. V. Jacopian, D. Paul and B. Philipp. *Cellulose Chem. Technol.,* 1976, **10,** (2), 177-183; through *S.I.A.,* 1977, **39,** Abs. 77-328.—Semi-chemical pulping of bagasse by means of neutral sulphite resulted in a smaller release of pentosans than did alkaline pulping, while the yield and the lignin content of the residue were similar. This result was confirmed by electron micrographs, which showed only slight destruction of the secondary wall.

Bagasse pulping by the soda-nitrobenzene process. T. M. Saleh, M. H. Fadl, A. E. el-Ashmawy and S. A. el-Meadawy. *J. Appl. Chem. Biotechnol.,* 1976, **26,** 585-589; through *S.I.A.,* 1977, **39,** Abs. 77-329.—The effect of nitrobenzene, which is an excellent lignin oxidant, on the soda pulping of bagasse was studied. Cooking was carried out for up to 60 min at 100, 135 or 170°C using 10, 20 or 25% NaOH on bagasse, with or without 10% nitrobenzene on bagasse. Delignification occurred rapidly during the first 15 min, especially at high temperatures and alkali charges, and afterwards more slowly. Addition of nitrobenzene increased the rate and extent of delignification; it increased the carbohydrate yield, i.e. pulp yield–lignin % bagasse, but it decreased the degree of polymerization. It increased the strength properties of the pulp at the two lower temperatures only, the nitrobenzene pulps prepared at 170°C being inferior in strength to the corresponding soda pulps.

The production of food yeast from vinasse. H. Isik. *Seker,* 1977, **15,** (103), 1-4 (*Turkish*).—Details are given of small-scale trials on *Torulopsis utilis* production from distillery waste by the sulphite oxidation method as a means of reducing effluent disposal problems and simultaneously obtaining a useful product. With ammonium sulphate, ammonium orthophosphate and magnesium sulphate added to the vinasse as inorganic nutrients (4·5, 1·0 and 0·5 g.litre^{-1}, respectively), up to 13·35 g.litre^{-1} dry yeast was obtained under optimum conditions of 9°Bx vinasse concentration, feed rate of 275 cm^3.hr^{-1}, temperature of 30°C and pH of 5·0.

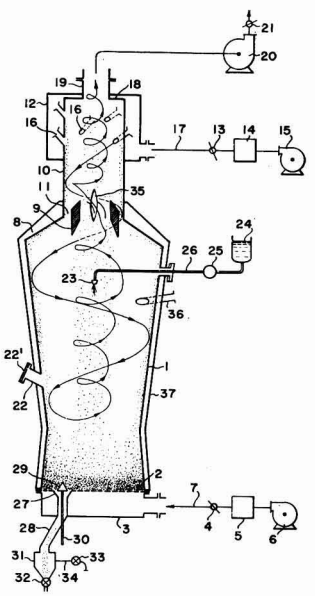
Sugar beet tops silage looks promising. E. Long. *The Furrow,* 1977, (Mar./Apr.), 6-7.—A survey conducted by the British Sugar Corporation in 1975 showed that 74% of the beet tops on farms were ploughed-in, 18% were fed *in situ,* 7% were removed from the fields, but only 1% was ensiled or dried. The main reason put forward for this is that many beets are grown on farms where there are no cattle; on the other hand, where there are cattle, fresh tops are available only from late September to late December, since once frosted they deteriorate rapidly. *In situ* feeding of tops is also limited by lack of fencing and the threat of poaching. One answer to the problem is greater ensilage (particularly in view of the high costs of other fodder materials), and the Norfolk Agricultural Station is investigating the feeding of beet top silage to beef cattle. The tops are stored in clamps which are initially 3 m high but fall to half this within a week. A considerable amount of effluent is produced initially and must be removed. From 10 tonnes of tops about 6 tonnes of silage is made having (in 1975/76) a dry matter content of 18·5-19·3%, a pH of 3·6-3·7 and a crude protein content of 12·5-14·7% on dry matter. Beef cattle fed *ad libitum* on silage plus a medium-concentrate supplementary ration (3·63 kg/day) showed a daily live weight gain of 1·06 kg, compared with 0·90 kg with a low-concentrate ration (2·27 kg/day) and 1·05 kg with a high-concentrate ration (4·99 kg/day). Experience on a private farm is also described, again demonstrating the benefits of feeding beet top silage to beef cattle.

Treatment of concentrated yeast waste. Y. T. Chuang, C. L. Lai and S. L. Sang. *Taiwan Sugar,* 1977, **24,** 268-272.—Laboratory trials are reported in which effluent from a yeast plant was re-utilized for preparation of the culture broth in the factory process, thus replacing about half of the fresh water normally used. Provided the effluent was not used more than once, it had no noticeable adverse effect on yeast growth and quality. The concentrated waste from the re-utilization process was subjected to methane fermentation and the activated sludge process. Under optimum conditions (initial pH 7, temperature of treatment 37-39°C, anaerobic sludge concentration 30% by weight, treatment period 10 days) the BOD was reduced by about 85% to below the officially permitted maximum level of 150 ppm, while 9·5 litres of combustible gas containing 65-70% methane was obtained per litre of waste. The volume of the waste was halved by the treatment.

PATENTS

UNITED KINGDOM

Spray drying of sugar. Asizawa Tekko K.K., of Tokyo, Japan. **1,350,098.** 19th April 1971; 18th April 1974.—The dryer comprises an approximately cylindrical chamber 1 with a smaller diameter separating chamber 10 mounted above it. At the bottom of chamber 1 is a perforated plate 2, the chamber 3 beneath this being provided with hot air from a duct 7 from damper 4, heater 5 and blower 6. Surrounding the upper part of chamber 10 is a jacket 12 also provided with hot air from blower 15 through heater 14, damper 13 and duct 17; this air passes through injection nozzles 16 tangentially into chamber 10. Air is extracted by blower 20 from the discharge duct 19 under the control of damper 21. The chamber 1 is provided with a jacket 37 and suitable heat transfer medium is introduced into this to provide the desired temperature within the dryer.

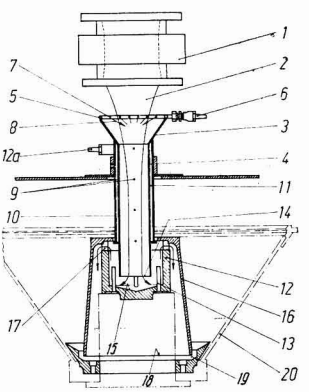


Seed powder of the substance being dried (sugar) is fed in a suitable quantity into the chamber through port 22 and this then closed with cover 22'. The seed is sufficient to give a uniform fluidized bed, 5-30 cm thick, above the perforated plate 2. A minor proportion of the seed is suspended in the chamber. The air from chamber 3 rises through plate 2 and chamber 1, passes through the tube 9 into chamber 10 and so out through duct 19. Secondary air admitted through nozzles 16 passes downwardly with a swirling movement through the annular passage 11 between tube 9 and the wall of chamber 10 and continues down, losing vertical speed until it reaches the fluidized bed when it joins the primary air from chamber 3 and rises through chamber 1. The swirling motion continues, however, and is augmented by the effect of a guide blade 35 within tube 9 so that heavier particles in the air stream are urged toward the walls of the chamber 1. The higher speed in the smaller diameter chamber 10 increases the centrifugal force so that fine particles are also urged toward the wall of this chamber. Feed syrup is brought from reservoir 24 by pump 25 and conduit 26, and is sprayed through nozzle 23. Droplets fall and some reach the fluidized bed where they are dried, while others coalesce with seed particles suspended in the air stream. Others reach the wall of the chamber and dry, but are removed by the stream of solid particles falling down from the separating chamber and higher parts of chamber 1. Yet others are immediately dried by the hot air and pass up into chamber 10. A proportion of the fluidized bed is continuously withdrawn through duct 28, controlled by valve 29, into hopper 31; suitable size material is separated and fines returned to the chamber through port 22.

Animal fodder. Eltsac Feeds Ltd., of London, England. **1,361,266.** 29th December 1972; 24th July 1974.—Calcium in the form of CaO or $Ca(OH)_2$, is reacted with a (heated) sugar-containing product, e.g. molasses, beet pulp or beet tops, in a proportion of more than 8 parts per part of $Ca(OH)_2$, a roughage (e.g. bagasse) is added, and the feed prepared in the form of a meal.

Clarification of sugar juices. A/S De Danske Sukkerfabrikker, of Copenhagen, Denmark. **1,361,674.** 23rd April 1971; 31st July 1974.—See US Patent 3,799,806[1].

Continuous sugar centrifugal. Braunschweigische Maschinenbauanstalt, of Braunschweig, Germany. **1,363,025.** 24th August 1972; 14th August 1974.—Massecuite falls through slide valve 1 as a stream 2 into the funnel-shaped upper part 3 of inlet tube 4. An annular



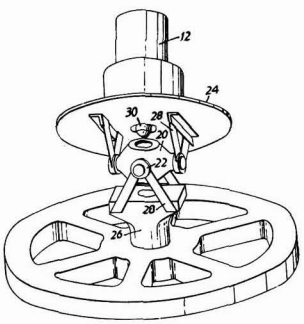
[1] *I.S.J.*, 1975, **77**, 252.

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 95p each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C., USA 20231 (price 50 cents each).

tube 5 with inwardly facing perforations 7 is provided through line 6 with water in jets 8 which thus reach the outer surface of stream 3. Surrounding tube 4 is a jacket 10, provided with steam through feed line 12a; this steam passes through perforations 9 in tube 4 and surround stream 2. This is brought within the distribution cup 12 and is mixed homogeneously with the steam and water by means of the vertical distribution pins 13, and preferably the tube 4 is moveable vertically to adjust the height between its discharge level 14 and the bottom 15 of cup 12, thereby suiting the machine to massecuites of different characteristics. The massecuite overflows from cup 12 to the acceleration cone 16 and so through the gap 19 to the conical basket 20 of the centrifugal.

Citric acid fermentation. Pfizer Inc., of New York, NY, USA. **1,364,094.** 27th October 1971; 21st August 1974.—A citric acid-producing yeast (*Nematospora coryli, Rhodotorula glutinis, Sporobolomyces salmonicolor*) is cultivated under aerobic conditions in an aqueous carbohydrate-containing medium (e.g. a cane molasses broth) (for 3-5 days) until the citric acid content reaches 1 g per litre, after which it is recovered.

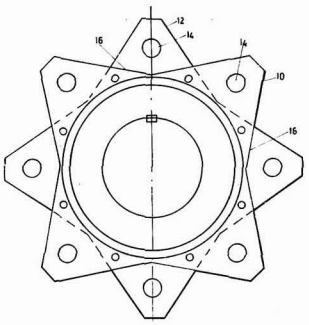
Centrifugal. Fives Lille-Cail, of Paris, France. **1,365,418.** 2nd May 1972; 4th September 1974.—The basket of a batch centrifugal is carried on a hub 26 and connected to the drive shaft 12 by means of universal joint 20. The top of the joint is bored and a rod 30 can be lowered through the centre of shaft 12 to enter the joint and



penetrate to a hole bored in the hub 26. When this is done the basket and shaft are rigidly aligned. The rod is raised during the normal massecuite loading and spinning operations and it is lowered when the sugar separated is to be ploughed out.

Citric acid fermentation. Kyowa Hakko Kogyo Co., of Tokyo, Japan. **1,366,526.** 9th November 1971; 11th September 1974.—Citric acid is produced by (aerobic) culture of *Candida guilliermondii* subsp. *galactosa* No. 610 (ATCC 20296) in an aqueous nutrient medium [at pH 1-9 (6) and at 20-40°C] containing a carbon source, e.g. molasses, a nitrogen source, inorganic salts, and other nutrients, and recovering citric acid or an alkali metal or alkaline earth salt from the resulting liquor.

Cane shredder. Tongaat Sugar (Pty.) Ltd., of Maidstone, Natal, South Africa. **1,367,278.** 17th April 1973; 18th September 1974.—The plates 10, 12 of the shredder are star-shaped and mounted with adjacent plates staggered. The orifices 14 accommodate bars on which the hammers are mounted and these are able to rotate in the recessed portions 16 of the adjacent plates. This



avoids the need for spacer plates and provides greater bearing area to carry the hammer bars. The hammers need not be in very close sideways contact, so reducing wear on the sides, and can be given a rectangular construction which is cheaper than the "club head" type.

Isomerization of glucose to fructose. Standard Brands Inc., of New York, NY, USA. **1,368,511.** 17th February 1972; 25th September 1974.—Part of the glucose in a glucose-containing solution is enzymatically converted to fructose by treatment with glucose-isomerase obtained by treating viable micro-organisms (*Streptomyces* ATCC 21175) with an amount of a toxic agent (ethylenimine, N-methyl-N'-nitro-N-nitrosoguanidine or ultraviolet light) which destroys 95% of the viable micro-organisms, culturing the remaining viable micro-organisms under conditions which promote their growth. The surviving viable micro-organisms produce at least 30% more glucose-isomerase than untreated micro-organisms when cultured under the same conditions [50-75°C (60-70°C) and pH 6-7·5].

Beet and cane diffusion. Granimar AG., of Luxembourg. **1,370,389.** 30th November 1972; 16th October 1974.—Sucrose loss by microbial action during diffusion is reduced when (0·1-1 $cm^3.ton^{-1}$ of beet or cane of) iodo-acetone is added (discontinuously) as an inhibitor of development of thermophilic bacteria. The iodo-acetone may be added to the diffusion water together with (25% by weight of) an emulsifying agent (a non-ionic surface-active agent such as a product of condensation of an alkylene oxide with an alkyl phenol or aliphatic alcohol) and a solvent (an aliphatic alcohol, acetone or propylene glycol). The iodo-acetone may be added with the recycled press water.

Bagasse board manufacture. Formwood Ltd., of Coleford, Glos., England. **1,370,954.** 2nd February 1972; 16th October 1974.—A mouldable mixture of comminuted fibrous ligno-cellulose substance (bagasse) with heat-setting binder is carried from a container by an endless belt conveyor (of low dielectric constant material and provided with a levelling roller) to a discharge point at which it is discharged into a mould. Part of the belt passes between two electrodes or the discharged material may fall under gravity between the electrodes, which are independent of the conveyor and generate a high-frequency electrical field which pre-heats the mixture before it enters the mould, so starting the condensation process.

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TRADE NOTICES

Contracting service for the sugar industry. The Sugar Division, Humphreys & Glasgow Ltd., 22 Carlisle Place, London, England SW1P 1JA.

Humphreys & Glasgow Ltd., international contractors and consultants since 1892, have now set up a Sugar Division which offers a contracting service for sugar, sugar by-products and sucrochemical projects anywhere in the world. The service includes preliminary planning, a comprehensive financing service with multi-national and mixed credit packages for optimum combination of financial and technical resources, engineering designing (using a computer bank where appropriate), procurement of materials and delivery to site, construction, commissioning, personnel training and plant management.

Instruments for the sugar industry. Seres Société d'Etude et de Réalisation d'Equipments Spéciaux, Rue Albert Einstein, Z.I. Aix Les Milles, Les Milles, France 13290.

Seres instrumentation for the sugar industry includes the "Gallois" automatic saccharimeter (known as the "Sacchamatic") which is unaffected by fluctuations in current supply frequency; is insensitive to shock and vibration; provides automatic adjustment to zero of the light intensity to take into account the effect of juice colouring, cell fouling, fall in lamp output and sensitivity drift of the photo-multiplier; offers rapid standardization with a quartz sample (by means of a special measurement tube) without the need for preparation of reference solutions; is insensitive to ambient temperature variations; and has excellent accessibility through use of modular construction. The measurement range is 0-30°S for beet sugar and 0-100°S for cane sugar, with a measurement frequency of about 6 sec.

The "Coup de Sucre" is another Seres instrument and is designed for detection of sudden discharges of sugar into water, e.g. coming from an evaporator. Based on the well-known alpha-naphthol test, the instrument will detect as little as 25 mg of sugar per litre within 15 sec. The sequence of operations is controlled by a transistorized printed circuit electronic controller with integrated circuits, the alpha-naphthol and sulphuric acid reagents being injected every 30 sec, while water is fed at a constant rate.

The Seres purity analyser for pan boiling control continuously measures (by means of a conductivity probe) and records syrup and molasses purity at appropriate points in the pan station. The analyser comprises two cabinets—an upper one housing all the electronic units, and a lower one containing the hydraulic elements. Response time is 6 min, and accuracy is +0·01 unit within the ranges 55-90 or 75-100. The Brix of the sample is automatically adjusted to a value in the range 26–36° by means of a micropump which draws a given quantity of diluent from a tank. Brochures are available which describe the three above-mentioned instruments.

"Micrometer" metering gear pump. Paragon, Division of Micropump Corp., P.O. Box 4001, Concord, CA, USA 94524.

The "Micrometer" metering gear pump from Paragon combines accurate non-pulsing flow and dry lift capabilities at flow rates of 1–500 $cm^3.min^{-1}$ and differential pressures up to 60 psi and system pressures up to 500 psi. Flow is easily metered and proportioned by variation in the pump motor voltage. The absence of shaft seals (because of magnetic coupling) makes the pump suitable for systems where contamination cannot be tolerated. The use of stainless steel, carbon and "Teflon" for wetted parts provides excellent chemical resistance and permits operating temperatures in the range from —100° to +275°F. The pump is only 4½ in long and weighs 15 oz, and is available in a wide range of materials, capacities and motor configurations.

"Vallinox 430" tubes in the sugar industry. Vallourec, Division Corrosion, B.P. 180, Paris Cedex 16, France 75764.

"Vallinox 430" tubes, made of stainless ferritic steel containing 17% chrome and no nickel, have largely replaced carbon steel and copper tubes in sugar factory evaporators because of their corrosion resistance. The tube can be welded to all the standard sizes for use in evaporator or heat exchangers, generally with an outside diameter in the range 30–101·6 mm. The corrosion resistance and mechanical characteristics of the tube normally permit the wall thickness to be kept below 2 mm, the most usual being 1·2–1·5 mm. The tubes are supplied in a heat-treated condition, which gives the welded area the necessary ductile properties for easy expansion into the tube plates, while also restoring the corrosion resistance of the welded area to that of the basic raw material.

"Vallinox 430" tubes have been installed in more than 160 sugar factories. They are used in all types of evaporators, both short- and long-tube types, with rising or falling juice; while they are ideally suited to evaporators, however, they are also of application in raw juice heaters, vacuum pans and various heat exchange equipment. They are equally suitable for beet and cane sugar factories.

No loss of thermal efficiency has been observed when a "Vallinox 430" tube bundle has replaced a carbon steel bundle. Moreover, the reduction in wall thickness made possible by the corrosion resistance of stainless steel means an increase in the internal surface of 2-8%. "Vallinox 430" has greater resistance to erosion than has carbon steel, while the metal can undergo permanent deformation without breaking, a factor of significance as regards the welded area during expansion. The inside bead along the weld does not exceed 0·2 mm.

While "Vallinox 430" has proved its resistance to corrosion by sugar juices, there is need for care to maintain the Cl^- ion content within normal limits so as to avoid the risk of pitting. The most dangerous chlorides result from deliming with ion exchange resins or from vessel cleaning at the end of the campaign. Where HCl is used for tube descaling, a specific inhibitor is absolutely essential. Small deposits of iron, carbon steel or iron oxide on the skin of a stainless steel can also cause corrosion, the risks being particularly high during expansion and during cleaning with a carbon steel scraping tool. "Vallinox 430" is immune to stress corrosion.

PUBLICATIONS RECEIVED

Troughed belt conveyors. Mechanical Handling Engineers' Association, Equitable House, Lyon Rd., Harrow, Middx., England.

A new edition of "Recommended practice for troughed belt conveyors" has been produced by the Mechanical Handling Engineers' Association. It is a design manual and a Code of Practice incorporating the latest standards issued by the British Standards Institute and the International Standards Organization, as well as being based on the experiences of MHEA members involved in the manufacture of conveyors, idlers and conveyor belting. The new manual contains over 120 pages of text, tables and illustrations, together with step-by-step calculations for three examples of complete conveyor specifications. It is available from the Secretary of the MHEA at a cost of $12.00.

Heat exchangers booklet. Transvac Process Equipment Ltd., Stonebroom Industrial Estate, Stonebroom, Derby, England.

A new booklet available from Transvac Process Equipment Ltd. summarizes the relative merits of different types of heat exchangers for a wide range of applications in a number of industries, covering both direct and indirect contact types. Intended as a practical guide to selection of the most suitable units for particular requirements, the booklet presents a wealth of technical data in easily assimilable form, accompanied by simple diagrams, performance graphs and sizing tables based on Transvac's wide experience. A questionnaire is included to ensure that enquirers provide full application data to enable Transvac to specify the most economical and efficient design for each application. Not only does the booklet explain the principle of operation of the heat exchangers, but it also describes the materials and methods of construction.

Packaged air conditioning systems. Fair-Air Ltd., Crowborough, Sussex, England.

Fair-Air Ltd. have issued a new publication describing the concept of purpose-designed packaged air conditioning systems which have the advantage of requiring only a small team of technicians for installation of even a large system, in contrast to a large labour force of skilled engineers required for the site assembly of a comparable plant made up of standard units; this overcomes delays in commissioning and problems associated with the shortage of qualified engineers on remote sites. Each system includes everything except ductwork; controls and instrumentation are designed to the customer's specifications, and the complete unit is tested in operation before despatch. Typical units are illustrated. A list of companies already using Fair-Air equipment includes Tate & Lyle Ltd., while a number of very large systems have been supplied to Middle East countries.

"ChemPruf" lining systems. Atlas Mineral & Chemicals Division, ESB Inc., Export Dept., 1201 Chestnut St., Philadelphia, PA, USA 19107.

Two bulletins available from Atlas give information on "ChemPruf" lining systems which are designed to protect structures from corrosive attack. Bulletin 4-1400 describes the 1400 system, which is made up of vinyl ester resins and glass flake to provide a heavy-duty lining for protection of steel and concrete surfaces against attack by a wide range of corrosive materials including bleach, sodium hypochlorite and sodium hydroxide. System 2200, described in Bulletin 4-2200, is composed of epoxy resins, an inert filler and a fabric reinforcement; this resists inorganic and organic acids as well as salts and NaOH. System 1400 is resistant up to a temperature of 160°F in immersion service and to 180°F in intermittent liquid spillage, splash and fume service; system 2200 is resistant in immersion service up to 180°F, and to 200°F with intermittent spillage, etc. Atlas also manufacture other types of resistant linings covering a broad range of chemical resistance.

Beet drills and fertilizer distributors. Nodet Gougis, Montereau, France 77130.

Literature from Nodet Gougis describes the "Pneumasem II" pneumatic precision drill with adjustable selection which is also provided with an applicator for insecticide micro-granules, which are dropped into the furrow as soon as the seed reaches the furrow bottom. Other leaflets give details of the DP 9 and DP 12 tractor-mounted pneumatic distributors for fertilizers (of 9 and 12 m spreading width and 800 and 1200 litres hopper capacity, respectively), while the tractor-hauled DTP 12 is of far greater hopper capacity (3500/5000 litres) and has a 12 m working width. The DC 602 and DC 452 are centrifugal distributors for granular and powdered fertilizers (of 600 and 450 litres hopper capacity, respectively) which are also described.

Dryers and coolers for industry. Neu Engineering Ltd., Robertson House, 11–17 Leas Rd., Guildford, Surrey, England GU1 4QP.

A 15-page brochure gives details of various types of dryers and coolers (fluidized bed, flash, tunnel, cabinet and apron feed models) which have applications with a number of materials, including powders and granular products, in various industries.

Herbicides and insecticides from Stauffer. Stauffer Chemical Co. of Europe S.A., 25 Rue des Carabiers, Geneva, Switzerland CH-1227.

This is the title of a multi-fold leaflet from Stauffer which gives details of a number of products, among them being "Dyfonate" soil insecticide (based on "Fonofos" organophosphanate) which has proved successful in both beet and cane. The herbicides mentioned for use in beet fields include "Tillam" (which controls annual grasses, sedges, e.g. *Cyperus* spp., and certain broad-leaved weeds), "Ro-Neet" for control of annual grasses and many broad-leaved weeds (often used in a programme with other herbicides to increase the weed spectrum), and "Eptam" for control of various perennial grasses such as *Agropyron repens, Cynodon dactylon* and *Sorghum halepense,* annual grasses, wild oats, *Cyperus* spp. and many broad-leaved weeds. Stauffer also mentions a system ("Herbigation") for herbicide application in irrigation systems.

"Temik". Union Carbide Corporation, 909 Blanco Circle Salinas, CA, USA 93901.

A leaflet from Union Carbide outlines the properties of "Temik", a granular pesticide formed by treating coal chips with a solution of "Aldicarb", which is activated by moisture in the soil and is effective against aphids (thus reducing virus yellows incidence) as well as a number of other pests, effecting a certain measure of control of millepedes, the pygmy beetle and leaf miner.

Agricultural chemicals from Bayer. Bayer AG, Leverkusen, Germany D-5090.

Leaflets from Bayer give information on "Yaltox" (for control of various beet seedling pests), "Metasystox R" and "Metasystox 55" (for control of peach potato aphid and blackfly and hence of beet virus yellows) and "Goltix" pre-emergence herbicide for control of a wide range of annual weeds.

Company name change.—CF&I Engineers Inc. have announced that their name in future is to be Silver Engineering Works Inc.

Lime kiln order from Iran.—West's Pyro Ltd. have announced another lime kiln order from Iran, the second to be received in 1977 from that country. The kiln is a 120 tonnes.day^{-1} Type 5 oil-fired vertical kiln with automatic skip hoist and is intended for the beet sugar factory of Naghshe Djahan Sugar Co., 40 km south of Esfahan. The order, worth £500,000, covers the design, supply, erection supervision and commissioning. The contract also provides for supply of engineering drawings and constructional design information for a limestone handling plant to be built by the client. The order brings to six the number of West's Pyro kilns supplied to Iran, and there are now almost 50 in operation in the world.

New cane transport system company.—Thomson International Co. and The Harold Poole Group announce the creation of a new company, Thomson-Poole Inc., of Thibodaux, LA, USA. The new company will manufacture, market and distribute in the southern US and Mexico the Harold Poole patented cane transport system which works on the basis of transference of weight from the load-carrying unit to a standard tractor.

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

BREVITIES

Syria sugar industry expansion[1].—Beet sugar production in Syria is showing an unexpected increase. The capacity of the sugar industry has risen from 2500 to 6500 tonnes/day with the erection of two factories in the Euphrates region—one at Maskane, on the west bank of Lake Assad, and the other at Ar Raqqa, on the east bank of the Euphrates. Both new factories completed their trial campaign in 1977. A sixth factory, of 4000 tonnes/day slice, is under construction at Thal Salhab, in the Orontes Valley, near Hama. Its first campaign is planned for summer and autumn 1978. A seventh factory at Deir ez Zor, also on the west bank of the Euphrates (as is Maskane), is to be built by 1980 and will have a capacity of 4000 tonnes/day. The beet area for the 1976/77 campaign was increased from 9500 to 13,500 ha, and in addition there is another 4000 ha for Maskane and Ar Raqqa. About 1000 ha in the new Euphrates beet-growing area was planted with monogerm seed. The beet area for the 1977/78 campaign is planned as follows:

Sugar factory	Beet area, ha — Autumn sown	Spring sown	Total	Predicted beet quantity, tons	Predicted yields, tons. ha^{-1}
Homs	3050	1200	4250	120,000	28
Isr Esch Schoghur (Ghab Valley)	3250	1000	4250	120,000	28
Adra (Damascus region)	—	1600	1600	50,000	30
Maskane (Euphrates region)	7500	4500	12,000	300,000	22·5-25
Ar Raqqa (Euphrates region)	7500	4500	12,000	300,000	22·5-25
Thal Salhab (Orontes Valley)	1500	1000	2500	50,000	22·5-25
Total	15,300	9,300	24,600	640,000	26

The sugar beet from autumn-sown seed is of greater importance than from the spring-sown seed, since its sugar content is 2·5–3% greater and the juice is of higher purity. Spring growing of beet is necessary because of the continental climate, particularly in the Euphrates region and in the neighbourhood of Damascus, and because of the need for a prolonged campaign, which normally extends from 10th July to the start of November. It is planned to raise the total beet area to 60,000 ha by 1985; it is intended that sugar production should not only cover domestic requirements but also allow a modest export.

Tate & Lyle consultancy contract for Afghanistan beet sugar factory.—Tate & Lyle Technical Services (TLTS), has won a contract valued at US$2·1 million, for the engineering design and consultancy services for a beet sugar factory in Afghanistan. This is the first overseas contract of this kind that Tate & Lyle has won for a beet sugar project. The services being provided by Tate & Lyle are part of a major project valued at over US$40 million, the implementation of which is being financed by the Kuwait Fund for Arab Economic Development and the Abu Dhabi Fund. The factory is to be constructed at Baghlan for the Afghanistan Government, and will have a capacity for processing 200,000 tons of sugar beet per annum. The contract follows studies carried out by TLTS agriculturalists into the possibilities for expansion of the beet sugar industry in Afghanistan. Existing production and processing operations were assessed and the Baghlan area studied in depth. The TLTS team analysed all relevant available data on soils, climate and water resources and assessed the existing factory capacity. It was established that it should be possible to treble sugar beet production in the Baghlan area and the preliminary design of a new factory capable of handling this level of production was incorporated into the report.

New sugar factory for Cuba[2].—A new sugar factory is to be built in the region of San Cristóbal, Pinar del Río province. Of the cane to be supplied to the factory, 80% will be mechanically harvested. Production of animal fodder from bagasse is planned. Personnel will live in a village which is being built in the vicinity of the factory.

Indonesia sugar imports[3]

	1976	1975	1974
		metric tons	
Belgium/Luxembourg	0	2	8,071
Brazil	0	0	23,275
China	25,976	21,692	0
Cuba	0	5,029	8,248
Czechoslovakia	11,550	6,750	0
India	160,783	34,650	10,549
Korea, South	0	0	5,250
Mozambique	0	0	5,050
Poland	0	5,000	5,237
Taiwan	0	0	5,304
UK	3	8,040	15
Vietnam, North	3,100	0	0
Other countries	141	226	5,907
	201,553	81,389	76,906

□ □ □

British Sugar Corporation capital investment programme.—British Sugar is to invest £70 million on factory improvement over the next two years, it was announced on 11th November 1977. This pushes spending on the expansion and modernization programme past the £110 million mark over a four year period and means that, for the 1979/80 campaign, British Sugar should have achieved one of its major objectives of having the installed capacity to produce 1·25 million tonnes of sugar, more than half of Britain's annual sugar requirements. Work will go ahead on major production capacity increases at Bury St. Edmunds, Wissington, Cantley, and on finishing Newark. Slicing rate at Ipswich, Kidderminster and King's Lynn is to be increased. At Bury almost £10 million is to be spent this year with a further £8 million next year. Installed capacity will be raised from 6300 to 10,000 tonnes a day and work will be completed for the 1979/80 campaign. At Wissington production capacity is also to be expanded to 10,000 tonnes a day. Almost £6½ million is to be spent there in 1978 and 1979. More than £8 million is earmarked for Cantley factory over the next two years to increase production capacity by 1350 tonnes a day, while 1977/78 sees the final instalment of £2 million to complete the massive £25½ million reconstruction of Newark factory where production capacity has been almost quadrupled. Almost £2 million is to be shared by Ipswich, Kidderminster and King's Lynn for processing capacity increases ranging from 250 to 450 tonnes of beet a day. A major investment of £3½ million is to be made at Peterborough factory over the next two years to complete the conversion to white sugar production, and more than £4 million will be spent on storage silos. But the problems of inflation have brought the urgent reconsideration of a wider ranging scheme for Peterborough factory announced earlier in 1977. Within the last few weeks it has been decided that plans for yard reorganization, a new office block and a packeting plant must be shelved. A detailed feasibility study has been made into all aspects of a proposal to rebuild and expand Brigg. The report shows the scheme is not viable, not least because the inflation rate for such capital projects is continuously accelerating. Nevertheless Brigg will continue to play a full and important role in the years ahead.

Soviet sugar industry expansion.—In a brief survey of the history and future prospects of the Soviet sugar industry[4], mention is made of the tenth five-year-plan (covering the period 1976–80), under which it is intended to increase average annual beet purchases by 30% and beet sugar production by 34% by comparison with 1971–75. Under the programme, formulated by the Central Committee of the CPSU and Council of Ministers in 1976, all new sugar factories will have a daily slicing capacity of 6000 tons of beet, and eight such factories will be built in 1976–80. The programme also provides for expansion, reconstruction and re-equipping of existing factories. The task of increasing the total daily beet slicing capacity of the USSR to 249,000 tons in the 1977/78 campaign is described as "not easy", but it is claimed that by the time of writing of the original Soviet report, 82·5 million tons of beet had already arrived at the reception stations, and that the 3·9 million tons of sugar already produced in September-October was 700,000 tonnes up on the figure for the corresponding period of the 1976/77 campaign.

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[1] *Zeitsch. Zuckerind.*, 1977, **102**, 754.
[2] *Die Lebensmittelind.*, 1977, **24**, 402.
[3] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (28), xiv–xv.
[4] *Sakhar. Prom.*, 1977, (11), 5–7.

Süddeutsche Zucker AG Annual Report 1976/77.—After a number of ups and downs the business year 1976/77 was, in the end, a normal year. The extreme high temperatures in the summer months combined with a prolonged dry period did not, after all, have the adverse effects which had been feared. The beet harvest of 5·68 million tons, from a slightly reduced growing area of 115,300 hectares (116,900 ha in 1975/76), did not reach the previous year's volume (6·1 million tons). The area under beet had been reduced in anticipation of the expected sales situation and the renewed assessment of the production levy. Nevertheless, as a result of the increased sugar content of 15·43% (14·10%), sugar produced amounted to 734,000 (709,000) tons. This represents a sugar yield of 6·3 (6·0) tons per hectare which, however, is below the average for the last five years of 6·5 tons of sugar per hectare. In the Plattling factory the beet campaign was preceded by a thick juice campaign in which the thick juice derived from the 1975 beet campaign was processed. The juice was still in good condition after being in storage for more than eight months. The extension of the factory to enable daily processing to be increased to 12,000 tons was completed in time for the campaign. As opposed to recent years, the beet delivered was of good quality and could be cut easily so that after ten days the factory reached a daily production of 12,000 tons for the first time. In the other factories also, no particular technological problems arose in connexion with the beet processing so that all factories were working at normal capacity soon after the commencement of the campaign. The total beet processed by the seven Südzucker factories increased to 58,700 tons per day, an average of 8400 tons per day (7300 in 1975/76). Having regard to the world-wide rising stocks of sugar, a reduction in the growing area was recommended for the business year 1977/78. Sowing began, unusually early, in the first half of March under favourable climatic conditions. Severe late frosts, however, caused considerable damage and made it necessary for some 20% of the area to be ploughed and re-sown. More extensive damage was avoided thanks, in particular, to immediate action on the part of the beet farmers in carrying out the necessary measures and the speedy deliveries of sufficient supplies of seed. Insect pests, above all green-fly, were very prevalent but were combated with good success. A harvest in the region of the previous year's 5·7 million tons is anticipated. Sugar production is also expected to be comparable with that of the previous year.

Cuba 1977/78 crop forecast[1].—The Cuban sugar crop in 1977/78 is estimated to rise to seven million tonnes from 6,485,000 tonnes in 1976/77, a senior Cuban official told Reuters. During calendar year 1977 exports under special arrangements with all socialist countries should reach around 3·3 million tonnes against 3·5 million tonnes in 1976, he added. Domestic consumption is estimated to be unchanged at 500,000 tonnes and exports to the free market at 2·5 million tonnes against 2·1 million tonnes in 1976.

Philippines bulk sugar terminals proposed[2].—Construction of two bulk sugar terminals in Mindanao and Panay and a refined sugar warehouse in Victorias, Negros Occidental, involving a total project cost of 66 million pesos, has been approved by the Government organization which exclusively handles trading and export of sugar. The Mindanao facility, to be set up in Davao, would serve three mills and have a storage capacity of 60,000 tonnes. The Panay terminal would serve six mills and would be connected with the rail system leading to the Iloilo international port; it would also have a storage capacity of 60,000 tons.

Pakistan sugar expansion[3].—Sugar production in Pakistan is expected to reach one million tonnes by 1980 with five new sugar mills scheduled for completion during the next two years, according to Associated Press of Pakistan. Output in 1977 is estimated at about 800,000 tonnes, with domestic consumption put at 650,000 tonnes. This compares with 736,157 tonnes in 1976/77 and 589,458 tonnes in 1975/76.

USSR sugar expansion[4].—The Ukrainian Minister of Food Industries has announced that five new sugar factories are to be constructed in Ternopol, Lvov, Poltava, Khmel'nitskii and Kirovograd during the current five-year plan (1976–80). The factories will each have a daily processing capacity of 6000 tons of beet. In addition, 38 existing factories are to be completely modernized, and the total capacity of the Ukraine sugar industry increased by 36%.

India sugar duty and domestic consumption[5].—It is a feature of the International Sugar Agreement that some of the larger exporters will have to reduce their shipments of sugar substantially if they are to comply with its terms. One such country is India but, owing to circumstances, the constrictions of the Agreement may not be the only factor involved when deciding upon selling policy. In the calendar year 1975 India exported 1,048,000 tons of sugar, raw value, and in the following year exports amounted to 915,000 tons. In 1977, for a variety of reasons, exports have been much lower and figures for January/July show shipments lagging behind the level for the corresponding period of the previous year by some 450,000 tons. With increased production this has led to an expansion of stocks which were up by 641,000 tons at the end of July. There will be little chance to run down stocks in 1978. India's basic export tonnage under the International Sugar Agreement is only 825,000 tons which implies that the quota could eventually be as low as 672,000 tons, with the special arrangement facility bringing the figure up to about 700,000 tons. If stocks are not to continue to grow or production to be restricted it will, therefore, be necessary to take steps to encourage an expansion in domestic consumption. To this end internal excise duties underwent substantial reductions in November 1977. Whether and to what extent this leads to a growth in the use of sugar and whether this will be a real increase or just a switch from non-centrifugal sugars remains to be seen, but certainly there is substantial room for improvement as consumption last year worked out at no more than 6·6 kg per head. India's exchange position has recently undergone a remarkable improvement and there is no longer such an acute urgency to export sugar to secure foreign currency. Accordingly the restraints imposed by the International Sugar Agreement may be less onerous than might appear to be the case at first sight.

Citric acid from sugar in India[6].—Using technical know-how developed by the Regional Research Laboratories in Jammu Tawi, which consistently obtained yields up to 75%, a manufacturing unit is being set up by Andhra Citrates near Hyderabad for production up to 400 tons/annum of citric acid, to begin in mid-1978. For a number of technical reasons sugar is to be used as the raw material rather than cane molasses.

PERSONAL NEWS

We regret to report the death in November 1977 of **Olof Wiklund,** formerly head of research for Svenska Sockerfabriks AB. and a member of our Panel of Referees from its inception to his retirement in 1971. He was a Vice-President of the International Commission for Uniform Methods of Sugar Analysis and had a world reputation for his knowledge and expertise in both theoretical and practical aspects of sugar production from beets, sugar refining and analysis.

Two senior officers of the Bureau of Sugar Experiment Stations retired last year, namely Mr. **D. R. L. Steindl,** former Senior Pathologist, who retired in June, and Mr. **C. G. Hughes,** former Chief Pathologist, who retired in December 1977. Both men have contributed to knowledge of sugar cane diseases and have been very active in the affairs of the Queensland Society of Sugar Cane Technologists and the ISSCT. Both have given more than 40 years of distinguished service to the Australian sugar industry.

The Australian Sugar Producers Association has appointed Mr. **N. F. Dillman** to succeed Mr. **E. T. S. Pearce,** C.M.G., when he retired on 31st December 1977, after 32 years in the post of General Secretary. Mr. Dillman has worked in the Sugar Section of the Departments of Overseas Trade and Primary Industry in Canberra and has also wide experience with primary producer associations in Victoria and Western Australia. Mr. Pearce joined the staff of the A.S.P.A. from University in 1934 and has served continuously, except for a break for war service, playing an important part in negotiations in connexion with the British Commonwealth Sugar Agreement and successive International Agreements. He was active in the formation of the Sugar Research Institute and has participated in the affairs of the Queensland Society of Sugar Cane Technologists for many years.

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[1] *Reuters Sugar Rpt.,* 3rd October 1977.
[2] *Sugar News,* 1977, **53,** 174.
[3] *Reuters Sugar Rpt.,* 12th October 1977.
[4] F. O. Licht, *International Sugar Rpt.,* 1977, **109,** (28), 14.
[5] C. Czarnikow Ltd., *Sugar Review,* 1977, (1363), 196.
[6] *N.S.I. News,* 1977, **13,** (1), 3.

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