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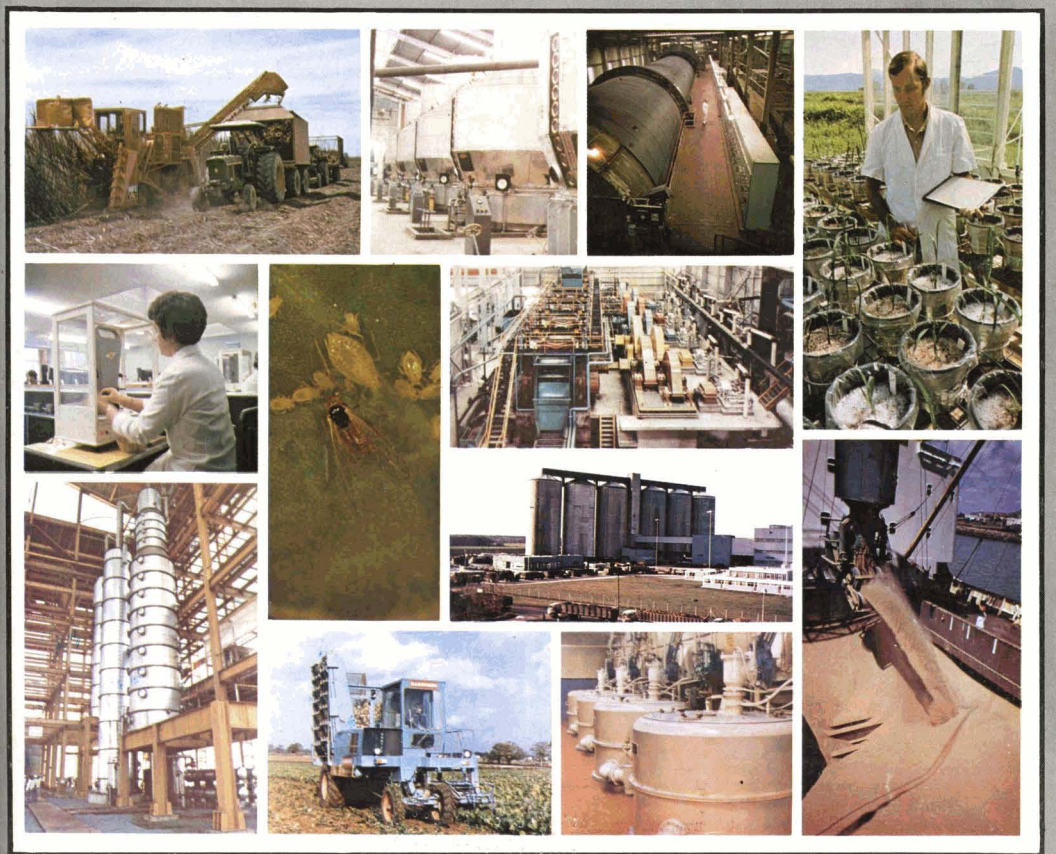

JUNE 1979

RENOLD

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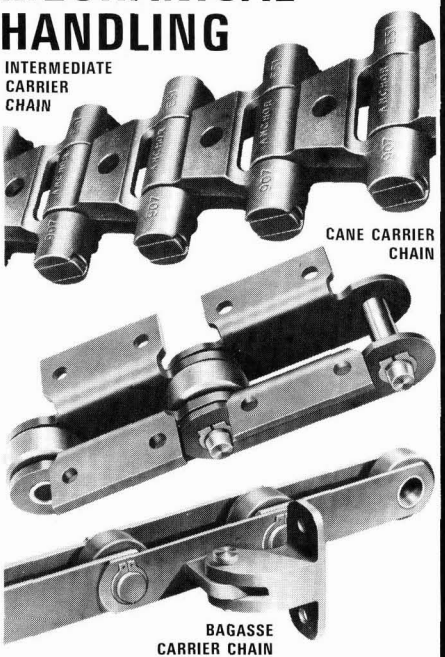

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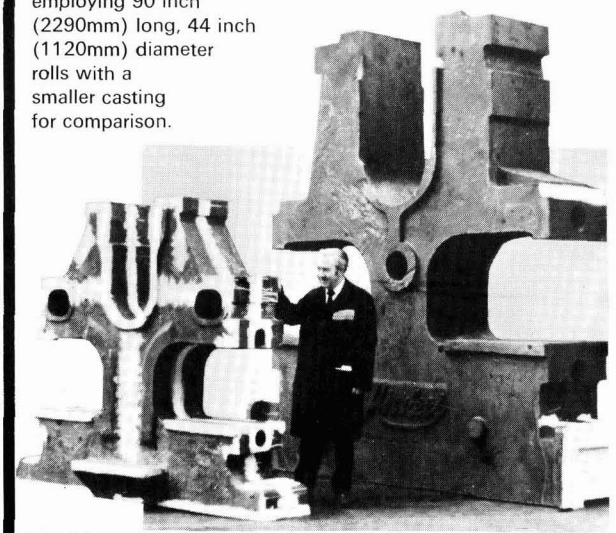
The photograph shows at $13\frac{1}{2}$ tonne headstock casting for a 12 roll tandem employing 90 inch (2290mm) long, 44 inch (1120mm) diameter rolls with a smaller casting for comparison.



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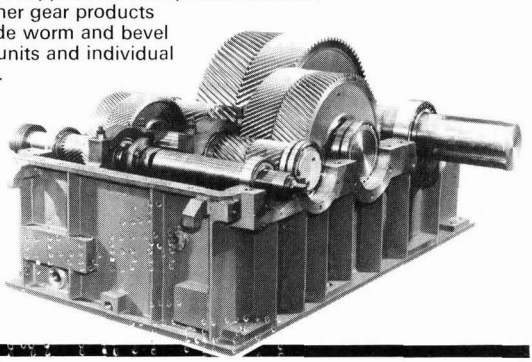

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...more than 2000 high capacity, continuous and batch type Bosco centrifugals, all equipped with d.c. and a.c. motors, can now be found in operation all over the world; machines which contribute to the production activities of many of the most important cane and beet sugar-producing countries and to the industrial growth of many up and coming countries. Our success lies in constant modernization, in line with the most modern manufacturing techniques and technological needs, in the high quality of the material used, in precise and accurate workmanship, in the strict internal checkings and inspections, and in the efficiency of our after-sales assistance and spare parts service.

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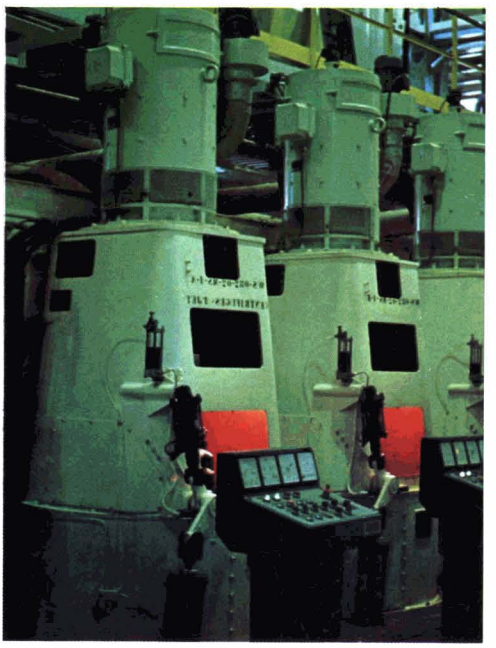
A battery of six Bosco B5 continuous centrifugals for low grade affination and second strike massecuites. KSAR EL KEBIR SUGAR FACTORY (MOROCCO) PROCESSING CAPACITY: 4000 TBD



View of a battery of five Bosco B7 fully automatic batch centrifugals, D.C. driving system, for white sugar. KSAR EL KEBIR SUGAR FACTORY (MOROCCO) PROCESSING CAPACITY: 4000 TBD

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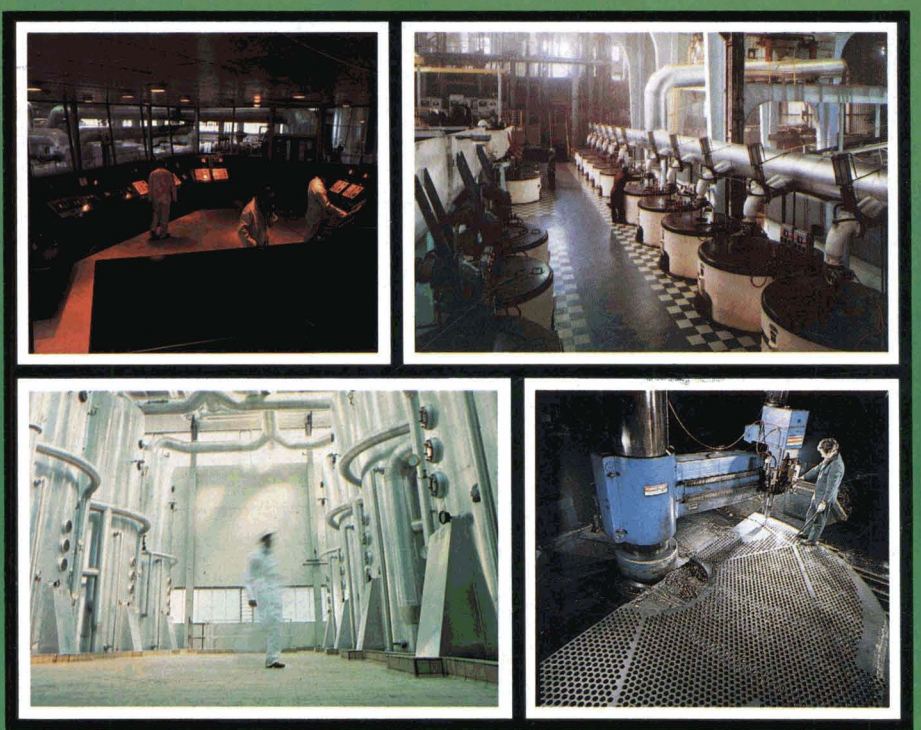

from other designers of several items, notable examples being the SRI Clarifier for which FS holds the worldwide manufacturing licence, the BMA continuous centrifugals and the Jord rotary vacuum filters, each of which enjoys a reputation for its excellence of design and for its particular suitability for the sugar industry.

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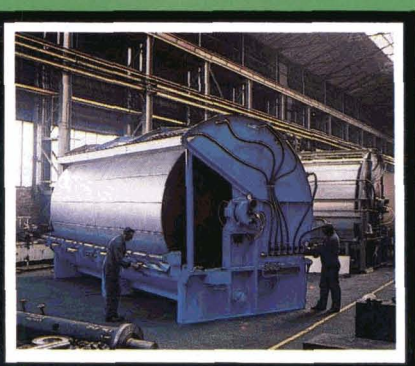

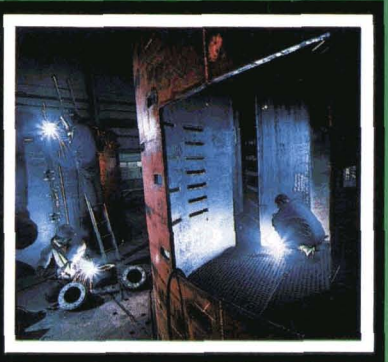

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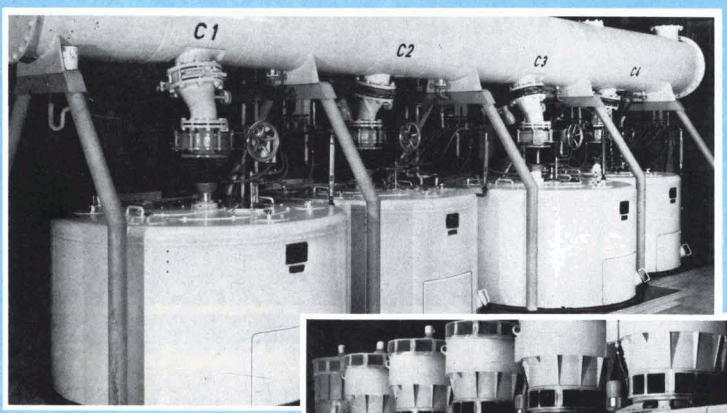

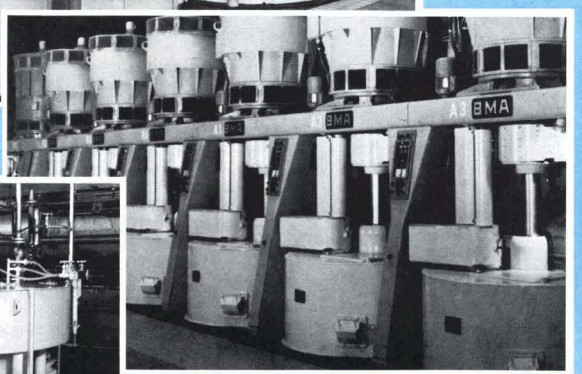

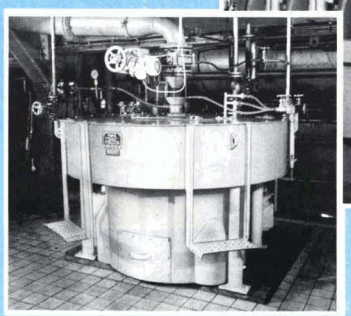

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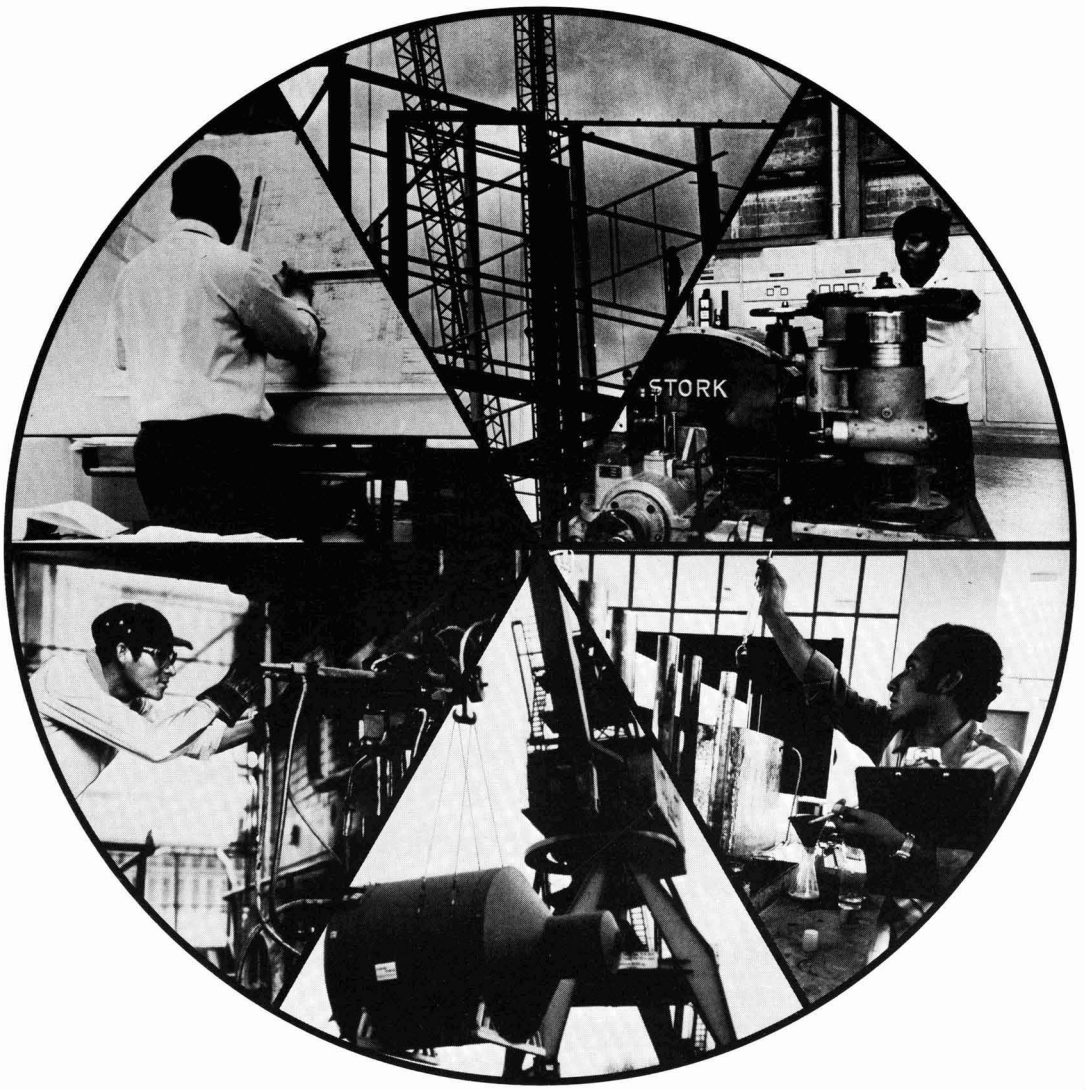

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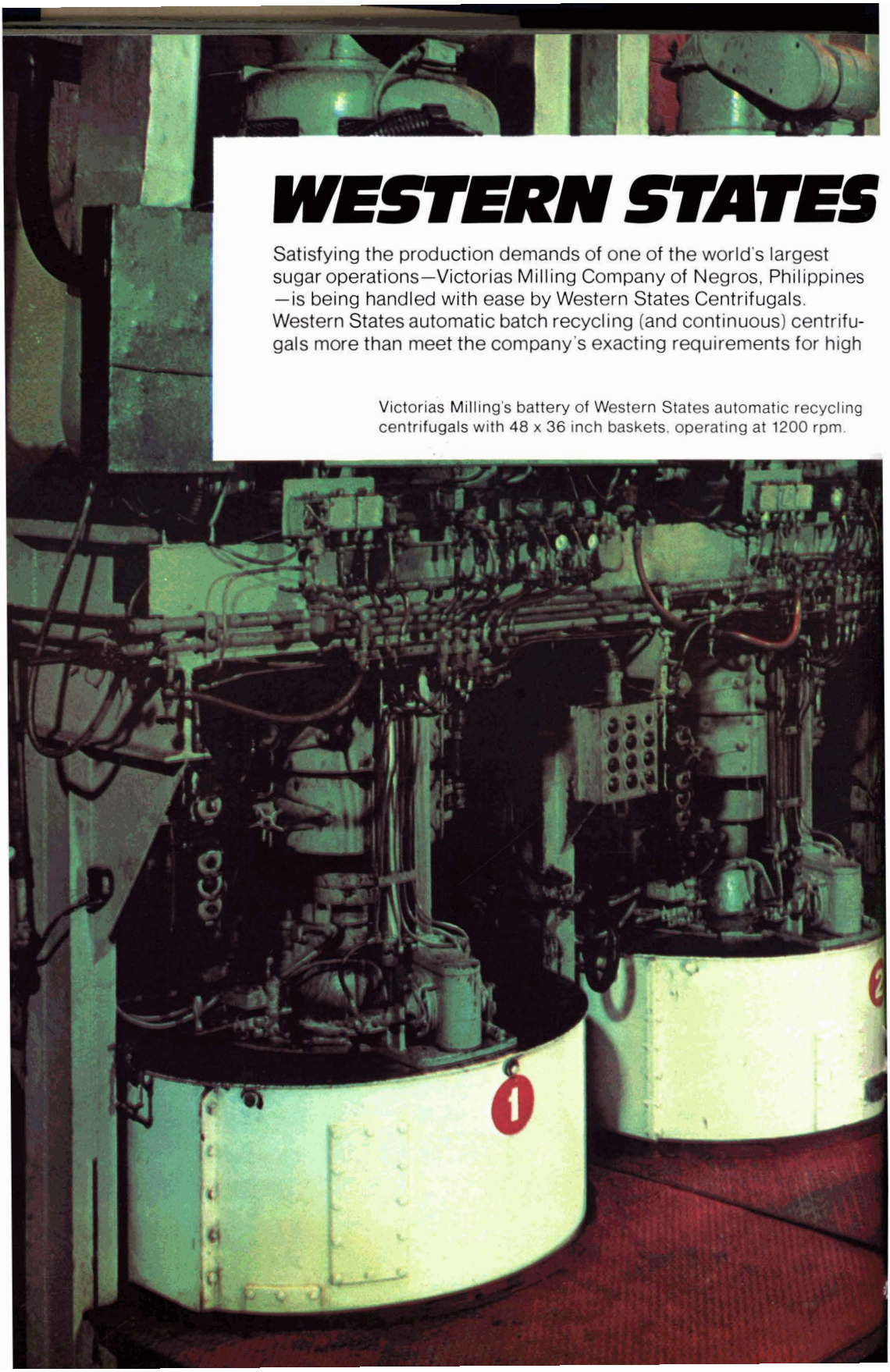
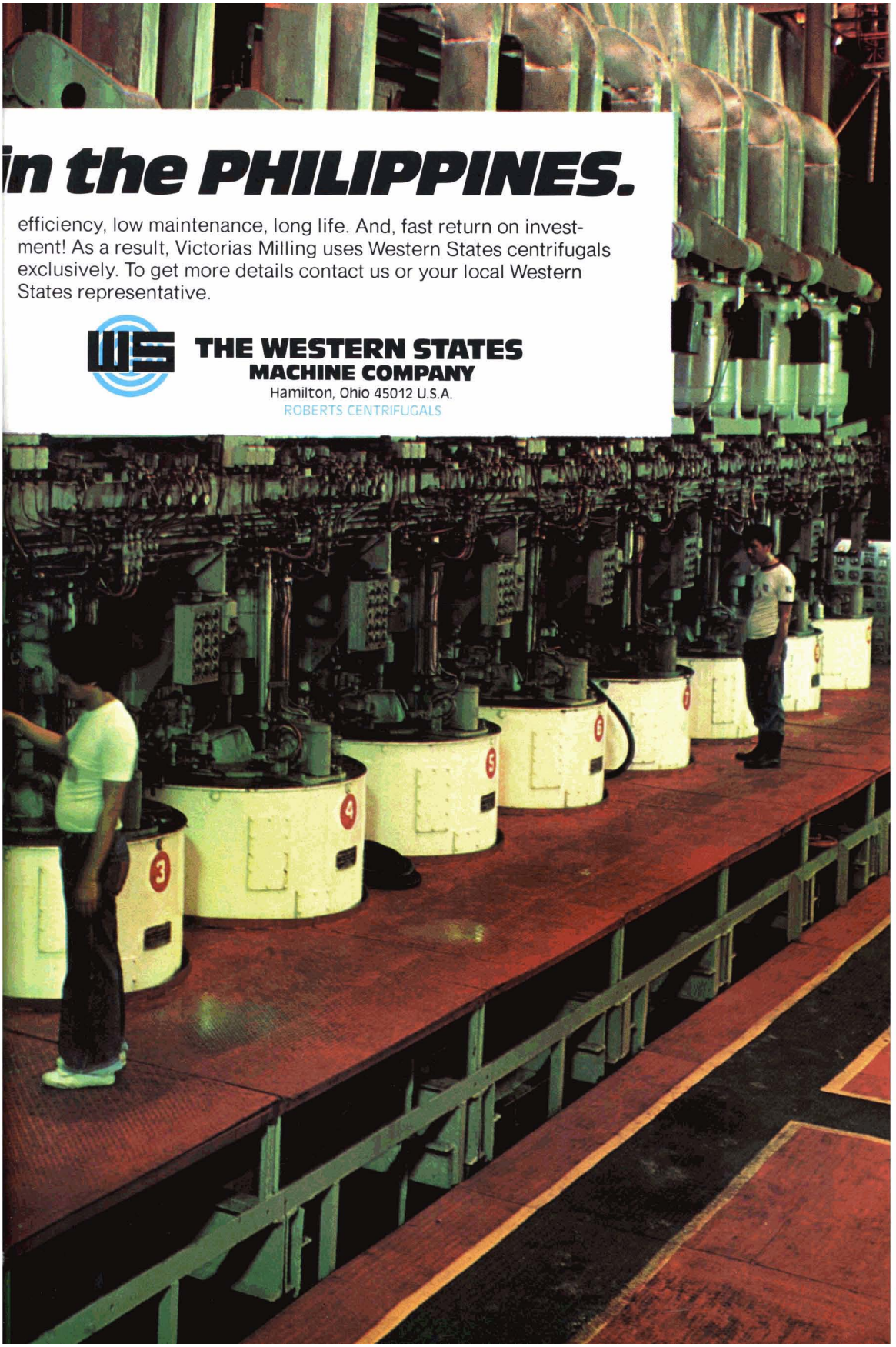


Victorias Milling's battery of Western States automatic recycling centrifugals with 48 x 36 inch baskets, operating at 1200 rpm.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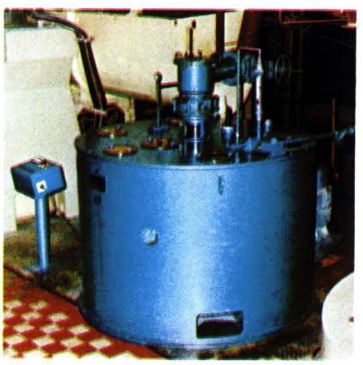

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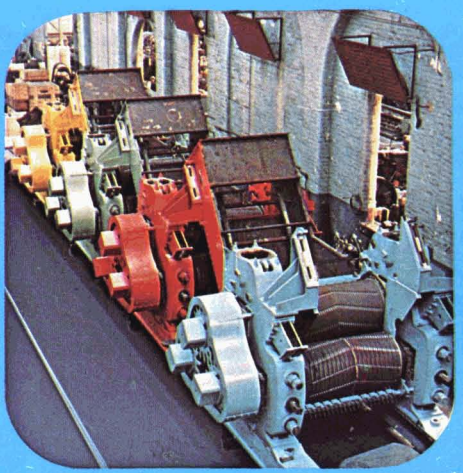

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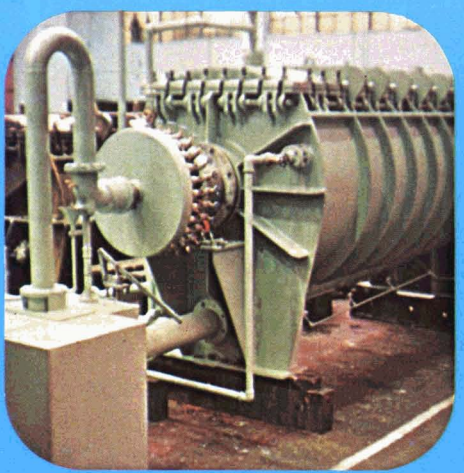

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NOTES AND COMMENTS

Common fund for commodities

The Common Fund for Commodities, for which UNCTAD has worked so hard over the past few years, appears likely finally to come into operation. After three sessions of the full negotiating conference and many other discussions at lower levels it was announced in March that the basic principles had at last been agreed. An interim committee will now be set up to draft the Articles of the Agreement formally setting up the Fund.

It has been agreed that a fund of US $400 million will be established to finance commodity stocks. Of this, $150 million will actually be transferred to the fund by governments while further blocks of $150 million and $100 million will be available on call.

Commodity Agreements which operate stock arrangements are expected to avail themselves of the Fund facilities. They will be expected to deposit with the Fund one third of the money used for stock financing but in return will be permitted to draw on the Fund's resources to the full extent of their requirements. It is argued by those responsible for sponsoring the Fund that the resources of the various individual commodity funds will not all be needed at the same time and there are therefore advantages of scale to be had by establishing a vast common reserve on which the various Agreements may call. There may be some logic in this, but experience has shown that for political and climatic reasons there are occasions when commodity prices move largely in unison.

In addition to the buffer stock fund there will be a so-called "second window" which, with a capital of US $350 million, will engage in activities other than stock management. The full extent of these activities appears not to have been completely spelled out but it is understood that factory and estate management and marketing services will be included, as will also help with diversification programmes.

Though the outlines of the scheme have been settled, many problems still remain. It would seem unlikely that any mishap could occur at this late stage in the proceedings, but there still seem to be differences of opinion as to relative voting strengths and this could cause some delay. In any case the Fund is unlikely to come into operation before the beginning of 1980 at the earliest.

Mauritius sugar crop, 1978[2]

The 1978 sugar cane harvest began on June 2 and ended on December 23. The 21 sugar factories crushed 6,260,483 tonnes of cane, i.e. 141,794 tonnes less than the record figure of 1976. Total sugar output amounted to 665,219 tonnes, tel quel, equivalent to 705,398 tonnes, raw value, which compares with 665,435 tonnes, tel quel, and 704,762 tonnes, raw value, in 1977.

Average cane yield was 78·1 tonnes.ha^{-1}, as against the record figure of 79·1 tonnes.ha^{-1} in 1976. The average sugar extraction was 10·63%, the lowest figure recorded in the post-war period (excluding the cyclone year of 1960) and the sugar yield per hectare amounted to 8·29 tonnes.

World sugar balance, 1978/79

In their 2nd estimate of the world sugar balance for the crop year September 1978/August 1979, reproduced below, F. O. Licht GmbH[3] foresee an additional increase in final stocks 300,000 tonnes higher than they had earlier estimated. They consider that stocks will now reach 32·3 million tonnes, raw value, or about 2½ million tonnes more than in August 1978. Licht set production at 93·2 million tonnes which, while higher than consumption at 90·3 million tonnes, represents an increase of only 900,000 tonnes on 1977/78 whereas consumption is set 3,400,000 tonnes higher than in that year.

The higher production is expected largely in Asia (especially in India), with important increases in Africa and North & Central America; a small increase is expected for Europe and about the same level in Oceania, while a fall in South American sugar production is expected. Consumption increases are expected in all parts of the world but are more significant for Asia, reaching nearly 10%.

(Licht)	1978/79	1977/78	1976/77
	tonnes, raw value		
Initial stocks	29,767,000	24,817,000	20,515,000
Production	93,238,000	92,360,000	88,426,000
Imports	25,475,000	27,784,000	27,490,000
	148,480,000	144,961,000	136,431,000
Exports	25,919,000	28,328,000	28,335,000
Consumption	90,270,000	86,866,000	83,279,000
Final stocks	32,291,000	29,767,000	24,817,000
" " % consumption	35·77	34·27	29·80

World Sugar Journal, on the other hand, while its time basis is different, considering complete crops in the period, irrespective of whether they start in September or later or overlap this month, considers that production will be considerably less than estimated by Licht; the corresponding table below is derived from figures published in the latest issue[4]. Which of the two prove to be the more accurate will become evident in due course.

(WSJ)	1978/79	1977/78	1976/77
	tonnes, raw value		
Initial stocks	24,135,000	18,813,000	16,045,000
Production	91,048,000	92,811,000	87,284,000
Imports	22,000,000	23,997,000	23,568,000
	137,183,000	135,621,000	126,897,000
Exports	22,750,000	25,316,000	24,385,000
Consumption	90,158,000	86,170,000	83,699,000
Final stocks	24,275,000	24,135,000	18,813,000
" " % consumption	26·92	28·00	22·47

The most striking aspect of *World Sugar Journal's* figures is that production is expected to *fall*, rather than rise, leading to a reduction in final stocks and a marked drop in stocks as a proportion of consumption. This sort of drop is a pre-requisite for restoration of the world price of sugar to a level within the ISA range.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1979, (1432), 57.
[2] *Mauritius Sugar News Bull.*, 1978, (12).
[3] *International Sugar Rpt.*, 1979, **111**, 107.
[4] *World Sugar J.*, 1979, **1**, (10), 10.

International Sugar Agreement

The Special Hardship Reserve Committee set up under the ISA examined applications by member countries for additional quotas from the 300,000-tonnes Reserve and in April recommended an allocation of 25,000 tonnes each to Bolivia and El Salvador, one o 55,000 tonnes to Fiji and another of 60,000 tonnes to Panama. A further meeting of the Committee was arranged for July when further applications would be considered.

US sugar loan programme for 1979

The US Department of Agriculture has under consideration a proposal to establish a loan programme for 1979 crop sugar, according to Reuter reports[1]. Such loan programmes have operated for 1977 and 1978 crop sugar. The key unresolved question is the level of the loan rate; the 1978 national average rate was 14·73 cents per lb. An acceptable rate would be 89% of the domestic price objective[2] which, if the objective remained at the current level of 15 cents/lb, would entail a loan rate of about 13 cents.

What USDA officials are aiming for is a low figure so that the CCC (which makes the loans) does not accumulate large amounts of sugar. If adopted, the loan programme would most likely remain in effect until Congress enacts superseding legislation. 1979 crop sugar is already being harvested although it is not covered by any loan programme. Action will depend on whether the ISA is ratified by the Senate, if domestic sugar legislation is enacted and on world sugar market conditions.

EEC farm prices and currencies

The British Minister of Agriculture, Fisheries and Food had vetoed any increases in farm prices for the year beginning July 1, 1979, with the avowed intention of encouraging the limitation of production of those commodities, including sugar, which are in surplus and so produce "butter mountains", "wine lakes", etc. Further meetings of the Council of Ministers to work out adjustments to farm prices under the Common Agricultural Policy had been planned but, with the defeat of the Labour Government and the forcing of a General Election in the UK, the meeting was postponed until May 7-8. The new Conservative Government had not indicated before the election as to what its stance would be in respect of farm prices.

At the earlier meeting, however, it had been agreed that the "green currencies"—the exchange values used to convert EEC prices into national currencies, fixed from year to year to avoid the fluctuations resulting from application of money market exchange rates—would be devalued by 5% for the UK, France and Italy and by 0·3% for Ireland. The changes would apply from April 9 for Ireland and the UK and from July 1 for France and Italy. A further 4% devaluation would apply for the Italian "green lira" as soon as prices had been set for 1979/80.

A further change agreed was that the ecu or European Currency Unit, introduced by the European Monetary System, to which a number of EEC countries belong, would replace the Unit of Account as the Community currency. Amounts expressed in u.a. would be multiplied by a factor of 1·208953 to give the same value in ecu.

World sugar production, 1978/79

F. O. Licht GmbH recently published their third estimate of world sugar production for the crop year May 1978/April 1979[3] and the figures are tabulated elsewhere in this issue. Early estimates suggested that total output might fall by as much as 2·7 million tonnes; Licht now believe that production will reach nearly the same level as in 1977/78, *viz.* 92·9 against 93·5 million tonnes, raw value. The upward revision for Western Europe is attributed to good weather during the last quarter of 1978 while higher beet sugar production figures are projected for the US, Morocco and Japan. Output is expected to decline in Chile and Iran although the latter figure and that of China are highly speculative.

Estimates for Mexico and Brazil have been raised, but Licht put Cuban production at 7·1 million tonnes, substantially below the official estimate of 7·5 million tonnes. The production figure for Peru has also been revised downwards, whereas increases have been noted for Kenya and South Africa. The performance of the Sudan sugar industry is disappointing and actual output, at 179,000 tonnes, is expected to be far below the production target. The estimate for Thailand is still tentative because the effects of five months of drought are not certain, although the crop will undoubtedly be lower than originally forecast. In Australia, too, recent weather conditions have resulted in a reduced estimate, while production in Fiji is now expected to be higher than thought originally.

US sugar legislation

There were signs of a breakthrough in the continuing story of attempts to produce generally acceptable domestic legislation in the US Congress[4]. On April 25 all large cane and beet sugar producers except Hawaii were reported in agreement on compromise proposals which could allow legislation to move ahead. The common ground achieved included the limiting of direct payment to growers to $50,000 in any individual case plus a 0·50 cents/lb direct payment to producers over a 3-year period starting October 1979. The Hawaiians argue that the $50,000 ceiling discriminates against them because of their size.

The compromise plan includes a proposal to match provisions the Administration has agreed to accept—a 15·8 cents/lb price objective in 1979 to be raised by as much as 7% a year in 1980 and 1981, based on production cost increases, plus the half-cent supplement referred to above, plus a 1979 field worker minimum wage of $3.30 per hour.

World sugar prices

Raw sugar values declined considerably during April, the LDP falling from £101 to £93 by April 18, although it had recovered partly during the remainder of the month. There was little business and most sales were to the USA. Encouraging news concerning the likelihood of agreement on US domestic legislation brought about a rise to £97 on April 27 but the LDP fell again to £95 on April 30. The LDP(W) also fell in parallel by almost a cent from 8·44 cents, owing to selling pressure by the EEC, India and Greece.

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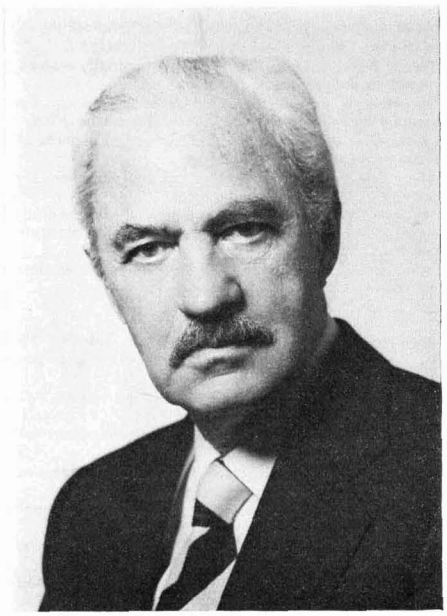
[1] *Public Ledger*, April 14, 1979.
[2] *ibid.*, April 21, 1979.
[3] *International Sugar Rpt.*, 1979, **111**, 161-165.
[4] *Public Ledger*, April 28, 1979.

Commission Internationale Technique de Sucrerie

16th General Assembly, 1979

BETWEEN the 28th May and 1st June 1979, technologists of the world's beet sugar industry gathered in Amsterdam for the 16th General Assembly of the C.I.T.S., under the sponsorship of the two Dutch sugar companies N.V. Centrale Suiker Mij. and Coop Ver. Suiker Unie U.A.



Professor Dr. F. Schneider

The President of the Commission, Prof. Dr. Ferdinand Schneider, sent the following message of greeting to members attending:

"This spring, technologists and scientists from the sugar industries of many countries are happy to visit Holland, and particularly the interesting and venerable city of Amsterdam. At the invitation of the Dutch sugar industry, the Commission Internationale Technique de Sucrerie is holding its 16th General Assembly in Amsterdam from May 28 to June 1.

"The CITS was founded shortly after World War II through the initiative of the unforgettable Professor Dedek, with the support of Raffinerie Tirlemontoise; it was formed out of initially informal meetings of scientists and held its first Assembly in Brussels in 1949. The CITS, which has its headquarters in Brussels, is made up of:

The Scientific Committee, composed of scientists who are active in the CITS and who are elected for specific tasks in the field of sugar technology; the current President is Prof. Dr. F. Schneider of Germany and Switzerland.

The Administrative Committee, representing the patrons of the Commission—sugar factories, refineries and official organizations—which looks after, for example, the financing of the CITS; the current President is Mr. B. Dieden of Sweden.

"The organizational tasks of the CITS are undertaken by a General Secretary; since the inception of the Commission, Dr. J. Henry of Belgium has acted in this role. The main function of the CITS is to act as a discussion forum for members engaged in the area of sugar technology and to sponsor contacts between them. The Scientific Committee has the task of arranging: (1) a General Assembly, every four years, which is a major open discussion on advances in sugar technology based on practice, research and development by the participants (all the papers read, and their discussions, are published in the *Proceedings* of the General Assembly), (2) meetings, in the intervals between the General Assemblies, between members of the Scientific Committee and their associates in the research organizations which permit contact between the scientists and direct exchange of experience by means of colloquia, and (3) discussions by sub-committees of special themes such as "Automatic measuring sensors", etc.

"The main themes chosen for this year's General Assembly are 'Environmental protection' and 'Sugar losses'. More than 30 papers are to be presented with papers on associated subjects. The importance of environmental protection in this year's programme will be demonstrated in the opening speech of the Dutch Minister for Environmental Protection, Dr. Ginjahr. While measures to protect the environment are becoming one of the causes of high costs in the sugar industry, the other main theme, sugar losses, being concerned with the recognition and avoidance of losses, and hence reduction of costs in the sugar industry, is always a central topic of interest in the sugar industry.

"The Dutch Organizing Committee has arranged a fine programme as an extension to the technical sessions, which take place in the International Congress Centre, with interesting functions and activities for the ladies. There is thus every promise of a successful General Assembly".

Registration took place at the Hilton and Marriott hotels on the afternoon of Monday May 28 and on Tuesday morning at the RAI Centre. The first function was a reception at the Vincent van Gogh Rijksmuseum on the evening of May 28 while the Assembly proper began the next morning with an introductory session to which the ladies were invited. After this the ladies were taken on a tour of Amsterdam by boat, with lunch at the Krasnopolsky hotel, while members went into working sessions for the remainder of the day with presentation of papers. In the evening members were able to visit the opera or to attend a Beethoven concert.

On Wednesday May 30, working sessions occupied the morning for members, while ladies were able to go on a visit to Delft, returning after lunch to Amsterdam where the afternoon and evening were free. While the next day's excursion for the ladies was to Keukenhoff, members spent the whole day in working sessions, at

the end of which the Assembly was concluded, while in the evening the ladies joined members for the closing banquet.

On Friday June 1 a series of excursions were arranged for members, who had a choice of sugar factories to visit as well as the opportunity to see the Zuyder Zee, Rotterdam and the delta works, before returning to Amsterdam and thence returning home.

Papers presented at the General Assembly included the following; abstracts will be published in this *Journal* in due course:

Environmental protection

R. de Vletter. Twenty years of waste water control at CSM (1960–1980).

K. C. Pette. Anaerobic waste water treatment at CSM sugar factories.

J. P. Lescure. Purification of sugar factory waters by mesophilic methane fermentation.

F. Zama, C. A. Accorsi and G. Mantovani. Sugar factory waste waters: Physico-chemical and biological parameters for obtaining the quickest purification with minimum energy consumption.

E. Reinefeld, H. P. Hoffmann-Walbeck, A. Pellegrini and J. Wittek. Investigations on activated mud degradation in the treatment of sugar factory waste waters as well as on the constituents difficult to degrade.

N. A. Arkhipovich and V. A. Lagoda. Diagram of reversible water supply in sugar plants.

H. Schiweck, T. Cronewitz and F. Schoppe. The recalcination of carbonatation mud—Trials and results with an experimental plant in the Rain factory of Süddeutsche Zucker-AG.

H. Schiweck, T. Cronewitz and F. Schoppe. The recalcination of carbonatation mud in a high-velocity reaction chamber.

R. F. Madsen. A new method for increasing dry substance in lime sludge.

J. Schaefer, B. C. Huisman, H. Maarse and L. H. de Nie. Composition of emission gases from a pulp dryer.

J. F. T. Oldfield, M. Shore, J. Bailey, R. Parslow and C. W. Harvey. Some constituents of factory pulp dryer exhaust vapour.

J. F. T. Oldfield, M. Shore, R. Parslow, C. W. Harvey and D. Sargent. Formation of volatile fatty acids and carbonyl compounds in pulp drying.

A. Bausier. Utilization of low-level calories for beet pulp drying.

Sugar losses

K. Vukov. Sugar losses associated with beet mechanical damage.

M. Burba. Indication and properties of the sucrose-splitting enzyme in sugar beet.

K. Hangyal. Biochemical sugar losses in stored sugar beet.

J. F. T. Oldfield, M. Shore, J. V. Dutton and H. J. Teague. Assessment and reduction of sugar losses in beet sugar processing.

T. Cronewitz, H. Schiweck and R. Strauss. Microbiological sugar losses in diffusion and their estimation by a cost analysis.

F. Hollaus and L. Wieninger. Experimental investigations on bacterial degradation of sugar in raw and prelimed juices.

G. Pollach and L. Wieninger. Investigations on sucrose loss during preliming.

S. Zagrodzki and H. Zaorska. Decrease of sugar losses as a result of thin juice deionization in alkaline medium.

K. J. Parker. Sugar losses in refinery processes.

T. Baloh. Residence time spectra in sugar industry vessels with regard to sugar losses.

E. Reinefeld, A. Emmerich, N. Fantar and M. Gerlach. Fundamentals for the improvement of molasses exhaustion.

D. Schliephake and K. Austmeyer. Practical aspects of improvement in molasses exhaustion.

F. Heitz. The elimination of glucidic and nitrogenous compounds in the beet sugar factory-refinery.

H. Zaorska. Diminution of sugar losses in molasses and the increase of crystallization rate owing to the decolorization of thin juice.

N. Sendökmen. Relation between the white sugar yield and the chemical composition of sugar beets.

Various

P. Devillers. Proceedings of the "Captors" Sub-Commission.

P. W. van der Poel. Cation and anion balances in juice purification and evaporator stations.

A. Kovarik and R. Osvald. The influence of dextran and dextranase during purification.

W. K. Nielsen, R. F. Madsen and B. W. Olsen. Investigations on colour formation in juices and sugar.

J. Tjebbes and O. S. Malmros. The route of antifoam agents through the sugar factory.

A. Pot, L. C. Giljam, D. Hoks and L. H. de Nie. Developments in applied continuous sugar crystallization.

G. Windal. Application of modern techniques in sugar factory automation.

V. Maurandi and G. Mantovani. Reduction of crystallizable sugar losses—Crystallization of low grade boilings.

Amsterdam—CITS Congress city

MEMBERS are fortunate in having such an attractive city as Amsterdam as the venue for their 16th General Assembly, holding as it does a wealth of attractions for visitors. Some 5½ million come each year, both day-trippers and longer-stay visitors, and tourism is an important factory in the city's economy.

The centre, the Dam Square, is surrounded by tree-lined concentric canals which, by virtue of their half-moon appearance, give this 703-year-old city an atmosphere quite unique among the capitals of Europe.

The canals were dug in the 17th century for the distribution of merchants' goods, and along the banks the wealthy tradesmen and city regents built numerous mansions. Some of these are now open to the public and, particularly along the Singel, Regents, Emperors and Princes canals, the past days of glory and pride, when merchants were as mighty as emperors, can be easily evoked.

Although many of these canals were filled in during the last decade of the 19th century, almost 100 miles of the waterways remain in their original form. And a familiar sight is the glass-topped boat wending its way through the smaller waterways where in bygone eras goods from the East Indies were stored. Amsterdam boasts about 1060 bridges and, like Venice, she is best viewed from her ancient canals.

In the centre of both the city and the canal network stands the Royal Palace, erected in 1650 on 16,000 wooden piles (nowadays concrete is used to provide support in the marshy soil), which served as a Town Hall until Napoleon instructed his brother Louis to take up residence.

Amsterdam's museums exhibit many forms of art. The National Gallery (Rijksmuseum) holds a fine collection of Dutch and Flemish masters dating back to the 12th century as well as French and Spanish works.

The van Gogh museum is devoted mainly to his work and that of his contemporaries such as Gauguin and Toulouse-Lautrec, as well as letters to brother Theo, van Gogh's lifelong financial supporter. The Municipal Museum houses works by modern artists.

During the season, the famous Concertgebouw Orchestra gives performances several times a week at the Concert Hall, situated on the Museumplein, while ballet, opera and operetta can be seen and heard in the Municipal Theatre at Leidseplein. The "Carré" theatre on the river Amstel also holds a short opera season.

Amsterdam boasts several fine shopping areas, the main one being Kalverstraat, near the Dam Square, where the centre stretches via Muntplein (Mint Square, with the Mint Tower) to Rembrandtsplein. Other recommended centres are P. C. Hooftstraat and Van Baerlestraat, while the Beethovenstraat is ideal for those visitors who have the time to get out of the city centre. Shops open from 1-5.30 p.m. on Mondays, 9-5.30 from Tuesdays to Saturdays with late opening until 9 p.m. on Thursdays.

As far as eating out goes, Amsterdam offers a diversity of good national dishes including Hungarian, Spanish, Italian, Austrian, Vietnamese, Moroccan, Greek and Turkish, while the 100 or more Indo-Chinese restaurants are a constant reminder of bygone colonial days. The Dutch cuisine is itself filling and tasty, and is not to be recommended to those with an eye on their waistline. After-dinner entertainment can be found around the Leidseplein and Rembrandtsplein, while film goers can take advantage of the city's 45 cinemas, where

(Photo: courtesy VVV Amsterdam)

Oudezijskolk with the towers of Saint Nicholas church

films are shown in original language with subtitles in Dutch.

But for those who wish to escape from the hustle and bustle, the centre can become an oasis of tranquility. There are many parks—Vondelpark is the largest with flower beds, ponds and gardens dating back to 1875. And in the heart of the city, surrounded by 15th century houses stands the only Presbyterian church. This was reopened by H.M. Queen Elizabeth, the Queen Mother, in 1975, following extensive restoration. Opposite can be found a small Roman Catholic church—a reminder of the 16th century incident when the Austrian Emperor Maximilian was cured of a contagious disease on a pilgrimage to the city. As a result, the Imperial Crown was added to the city's coat of arms, a replica of which can be seen on the Westerchurch Tower.

CITS members were able to explore this unique city during the week-ends before and after the Congress and during the evenings when no function had been arranged.

(Photo: courtesy VVV Amsterdam)

Muntplein (Mint Square) with the Mint Tower, dating from 1620

Sugar in Holland

LIKE his fellows the world over, the Dutchman has a sweet tooth and for centuries this was fed by cane sugar imported into Holland. In Amsterdam alone there were some 60 refineries in operation in 1660 and street and house names still remain which hark back to that period. In the 17th and 18th centuries, Amsterdam was a major sugar trading centre. During the Napoleonic era, with the development of beet sugar production on the Continent to counter the British blockade, many of these refineries were converted to sugar beet processing but without great success.

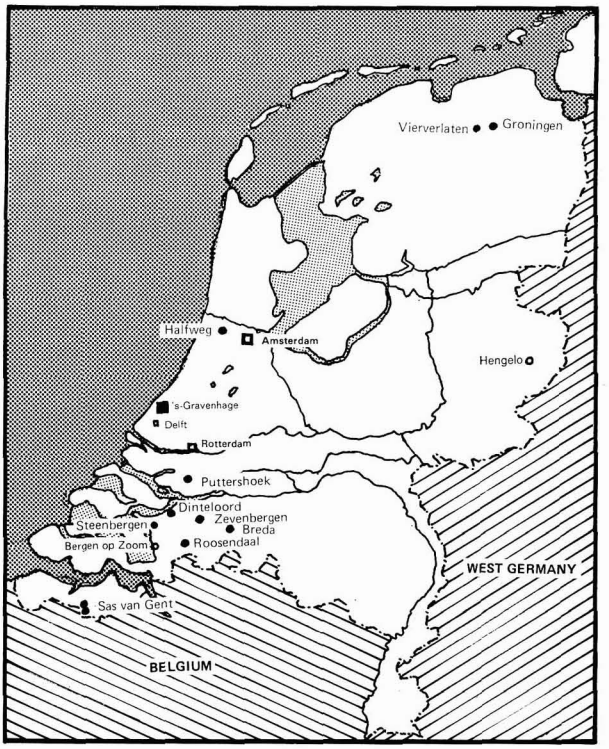
In the second half of the 19th century, however, a great number of beet sugar factories were built, the first privately-owned plant in 1857 and the first cooperative in 1899. By 1900 the industry had become an important branch of Dutch agriculture and the beet area had reached some 36,000 ha, serving 31 factories. Root yield was only 30 tonnes per hectare against about 50 tonnes in modern times, although the sugar content was nearly 16%, little different from today.

In 1917 an association of cooperative factories was formed, while two years later the private companies amalgamated into N.V. Centrale Suiker Maatschappij. Many of the small and unprofitable factories were closed and the processing capacity of the remaining plants increased to handle the beet supply. As a result of the depressed economic conditions from 1929 onwards, however, sugar production declined and, from 266,000 tonnes a year in 1921-30, the average outturn fell to 218,000 tonnes a year in 1931-40.

The Instituut voor Suikerbietenteelt was established in Bergen-op-Zoom in 1930 in order to carry out research into methods of improving the profitability of beet growing and processing. It followed recognition by the industry of the need for more knowledge of the sugar beet and its cultivation in face of the coming threat of

economic crisis, and creation of a Sugar Industry Research Committee in 1924. In the beginning the Instituut paid most attention to the selection of beet varieties suitable for growing under Dutch conditions, to the development of the beet plant, mineral nutrition requirements, and the cause and control of yellows and cyst formation, diseases now known to be due to a virus and the nematode *Heterodera schachtii*, respectively. In 1942 the name was changed to its present title, Instituut voor Rationele Suikerproductie.

Work was interrupted by the Second World War and beet cultivation was also badly affected. After the war, however, new land was reclaimed from the sea and new varieties permitted beet cultivation in soils previously unsuitable. As a consequence the beet area expanded markedly and from some 46,000 ha had reached 134,000 ha by 1978. Much of the emphasis of research by the IRS shifted to the mechanization of soil cultivation, drilling and harvesting of beet, the use of precision seed, at first technical and later genetic monogerm seed, the use of herbicides, machine thinning, drilling to stand and so on—all concerned with the substitution of labour which was becoming ever more scarce.



Nowadays the IRS carries out work on the testing of varieties for yield of tops, roots and sugar, bolting resistance, etc., as well as controlling the quality of seed from the various commercial seed suppliers. Another field of work is the protection of seed against soil-inhabiting insects, fungi and other pests, while others include biological crop protection, fertilizer trials and advice, weed control, crop sampling and forecasting, mechanization, trials with growth-regulating substances and frost protection and storage. Work is still necessary on nematodes and virus diseases, while government regulations on tolerance limits for specific compounds requires monitoring of these in the beet crop. The Instituut carries out research into the utilization of by-products from the beet sugar industry, with animal feeding trials, etc., and also provides an information service for farmers, factory agronomists, the state agricultural advisory service, etc.

Research into factory problems is carried out by the sugar companies themselves. There are now only two sugar producers in Holland, the cooperatives having amalgamated into Suiker Unie B.V. in 1966. The only factory producing raw sugar at the end of the war was closed and the eleven remaining plants have been expanded over the intervening period. Suiker Unie processes over 60% of the Dutch beet crop in its six white sugar factories which include Groningen (8000 tonnes daily slicing capacity), Puttershoek (9500 tonnes), Zevenbergen (6000 tonnes), Roosendaal (5100 tonnes), Sas van Gent (3600 tonnes) and Dinteloord (12,000 tonnes), the last being the largest beet sugar factory in Europe.

CSM operates five white sugar factories including a second at Sas van Gent (also 3600 tonnes), Steenbergen (3200 tonnes), Halfweg (5500 tonnes), Breda (6800 tonnes) and Vierverlaten (8500 tonnes). Transport from farm to factory was formerly by means of barges but in the past thirty years has changed to a system with 65% carried by contractors using large trucks with loads up to 40 tonnes; some 28% is carried by barge or rail from central delivery stations and about 7% delivered direct to the factory by the grower. Farms have grown bigger and, whereas the number of growers averaged 49,900 in 1951-60, with 1·49 ha each of beet area, the number had fallen to 25,750 growers in 1977 and the beet area per grower had risen to 5·03 ha.

In recent years, mainly since 1974, soil profiles have been improved, to give better and deeper rooting of the crop. This has been achieved by deep cultivation, when necessary to a depth of 2 metres, mainly on reclaimed peat subsoils but also on sandy and even silt soils. Clay and silt soils are ploughed before winter and seedbed preparation is by shallow cultivation, while blowing is countered by sowing with winter rye which is killed with herbicide in the spring. Fertilizers are applied according to soil analysis, crop rotation, etc., and pH adjusted if necessary. Growers have a free choice from a national list of approved varieties and genetic monogerm seed is chosen for almost all the area. About three-quarters of the area is drilled by contractors using precision machines, drilling to stand at a row width of 50 cm. Plant population averages 75,000 per hectare.

Herbicides are applied pre-sowing and pre-emergence for control of grasses and broadleaf weeds, while volun-

teer potatoes are a problem. Seed is treated with fungicides and insecticides to control pests, while other chemicals are applied to the furrows and to growing plants, as well as soil fumigants and other compounds for nematode control. The campaign begins about mid-September and is preferably finished by Christmas. Harvesting is mostly by contractors using multi-row machines. A frost warning service operates in November and December so that the grower can take steps to protect his crop. The supplies to the factory are so arranged that storage can be limited to 1-3 days slice.

Of course the Dutch have not concerned themselves only with beet sugar since Napoleonic times. A law was passed in 1870 permitting Dutch nationals to buy land in the then Dutch East Indies and a number of companies were set up to produce cane sugar, expecially in Java. Handelsvereeniging Amsterdam was set up to trade between Holland and its colonies and eventually became probably the largest and best known of the proprietors of sugar estates. Over the years, the application of technology and expertise, and especially the knowledge gained at the famous Proefstation Ost-Java and other research establishments, made the Dutch East Indies sugar industry the foremost in the world. In 1930 sugar production reached about three million tonnes, exported to many countries seeking high quality raw and white sugar. This activity ceased after Indonesian independence but HVA expertise was subsequently employed in Ethiopia and a number of other countries, while Dutch sugar experts have found employment in many other cane and beet sugar industries during the past thirty years.

Machinery for the sugar industry both at home and overseas has been a necessity during this time and the Stork-Werkspoor Sugar Company, having its origins as far back as 1868, has been a major supplier. Located at Hengelo, in the Province of Overijssel, SWS is an operating company in the Engineering Division of VMF-Stork. Not only capable of building and supplying complete cane and beet sugar factories and sugar refineries, the Company offers complete packages from feasibility studies to finance planning, project design and management, selection of suitable plant, control of materials and workmanship, provision of civil engineering, commissioning of plant and training of personnel.

The publishers thank the Instituut voor Rationele Suikerproductie, N.V. Handelsvereeniging Amsterdam and Stork-Werkspoor Sugar B.V. for their help in preparation of this short survey.

Automation and data processing in the sugar factory laboratory

By P. W. van der Poel, N. H. M. de Visser, C. C. Bleijenberg and J. Konings

(N.V. Centrale Suiker Maatschappij, Suikerfabriek "Wittouck", Centraal Laboratorium, Breda, Holland)

Paper presented to the 24th Technical Conference, British Sugar Corporation Ltd., 1978

INTRODUCTION

STUDYING the possibilities of more advanced data processing and laboratory automation, we have to consider:

the tasks of the laboratory,

the developments which are to be expected in the near future, and

the role of the laboratory in factory management.

The factory laboratory is the centre of chemical and technological know-how and, in this function, behaves as a focal point for information and control concerning the state of the process, the sugar losses, the quality of the end products and the use of processing aids.

In the factories of NV Centrale Suiker Mij. the chief chemists are responsible to the production managers who, together with the four or five staff functionaries, are directly responsible to the factory directors. The limits of the fields of responsibility are not sharply defined. The chief chemist has some functions for which he is directly responsible to the factory director.

The factory chemists obtain professional guidance from the Central Laboratory in regard to general and analytical chemistry, chemical technology and, in the last five years, computer programming. The intensive collaboration between the Central Laboratory, the chief control engineer of the company and the factories has formed the base for the success of the system which is to be described. This pattern of collaboration keeps the central development of the programmes and their local applications in equilibrium.

The results are: rationalization of the work of the laboratories, introduction of small computers at the factories, possibility of more advanced data processing at the factories, labour saving, and improved reliability of the figures.

EVALUATION OF THE LABORATORY TASKS

Data processing

The programme of work delegated to the laboratory differs somewhat from factory to factory. Apart from analysing samples, which is a general responsibility of all laboratories, most of them also work on data collection and data processing, which is in line with their function as a centre of know-how and as a focal point for information and control. In CSM we expect that the importance of the laboratories as data processing centres will increase.

Installation of a small computer in the laboratory creates the possibility of presenting the figures in a more useful form without increasing the laboratory staff. We can improve our insight into what happens in the factory and assist in the daily decision-making as well as in the decisions affecting finance. This is one of the reasons why we started our computer applications at the laboratories.

Chemical analysis

The programme of chemical analysis in a factory laboratory is usually based on the requirements of the factory staff. The programme provides sufficient information to enable the local management to follow the process using parameters which have been proved to

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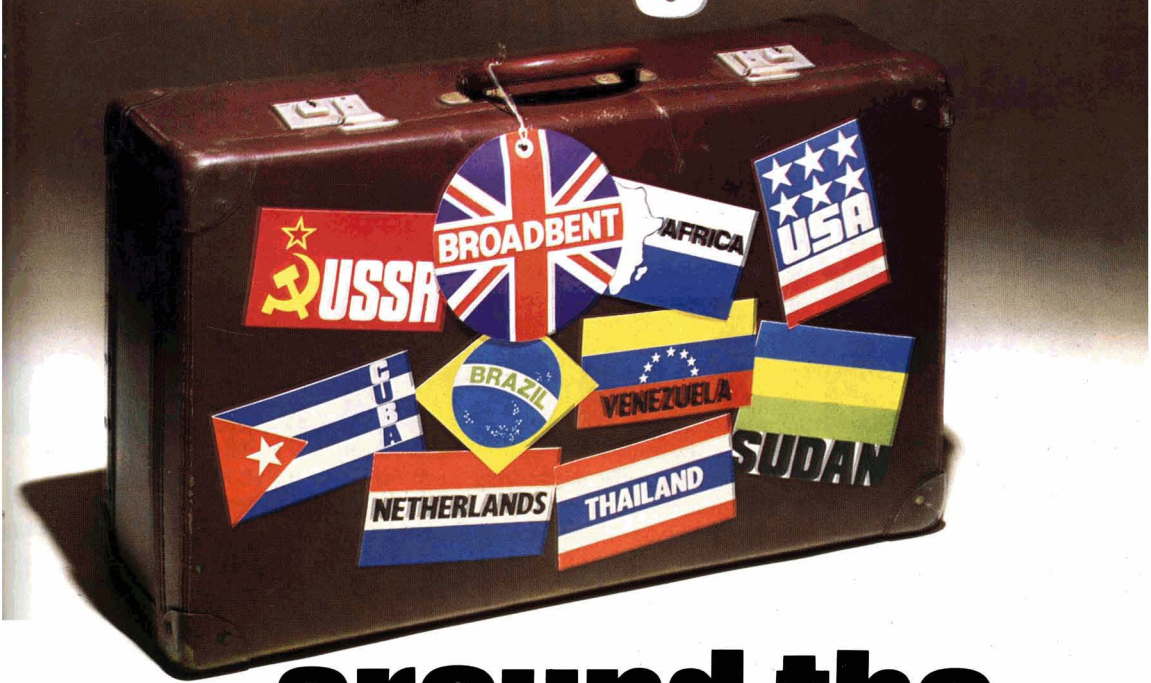

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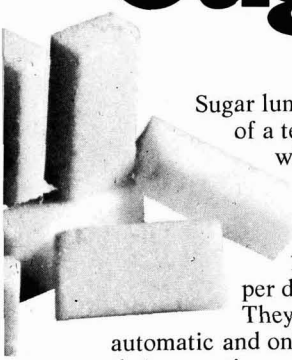
Sugar in lumps. A



Sugar lumps are at present produced throughout the world by means of a technique perfected and modernised by MACHINES CHAMBON, who today offer entirely automatic lines for the moulding and conditioning of sugar lumps of all sizes. The CHAMBON plants mould, dry and put into boxes according to type, 12, 24, 55, 80 or 100 tons* of sugar per day.

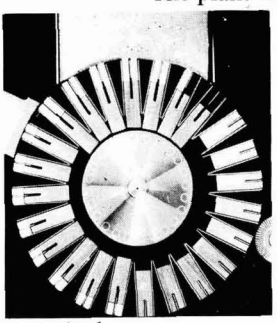
They are strongly built, reliable, completely automatic and only a few people are required to supervise their operation.

PLANT	PRODUCTION/24 h
EMR	12 or 24 t
1 DM	55 t
1 DMH	55 t
3 DM	100 t
4 DM	80 t (hard sugar)

A rotary moulding unit.

The plant is supplied with dry or humid sugar. Suitably mixed so as to be perfectly homogeneous, the sugar is fed evenly into moulds spead out around a rotary drum. The dimensions of these moulds vary according to whether one wishes to produce lumps of sugar of size 3, 4 or 5 or cubes.

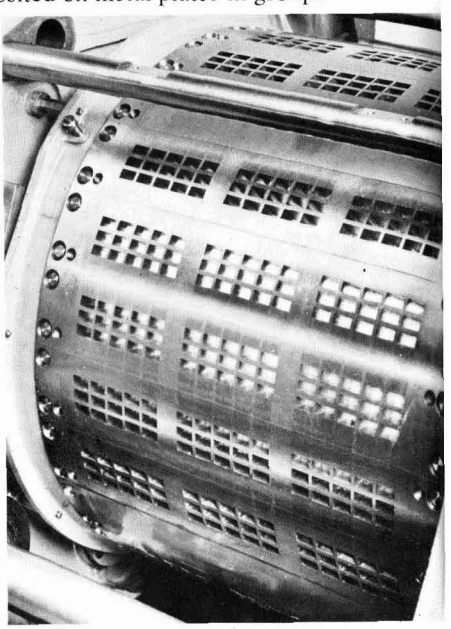
A system of compression by mobile pistons produces lumps perfectly regular in shape and weight and of variable hardness according to the rate of compression.

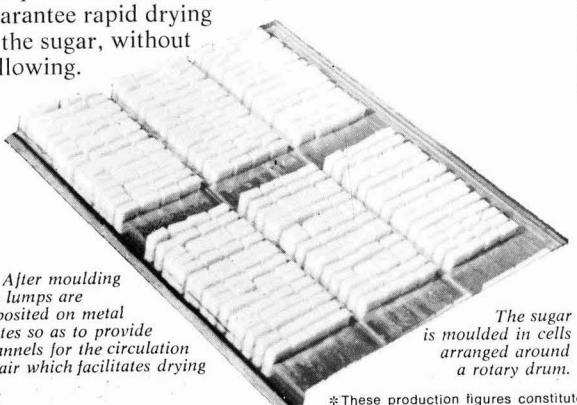


Rapid and perfect drying.

After moulding, the lumps are deposited on metal plates in groups corresponding to one horizontal layer (1/3 kg) of the finished box. The lumps are arranged to provide channels for the circulation of air which facilitates drying.

Driven by an endless chain, the plates are carried into a vertical or horizontal drying unit according to the power of the plant. The relatively low temperature, the good distribution of the air heated by low-pressure steam and the permanent renewal of this air guarantee rapid drying of the sugar, without yellowing.





After moulding the lumps are deposited on metal plates so as to provide channels for the circulation of air which facilitates drying

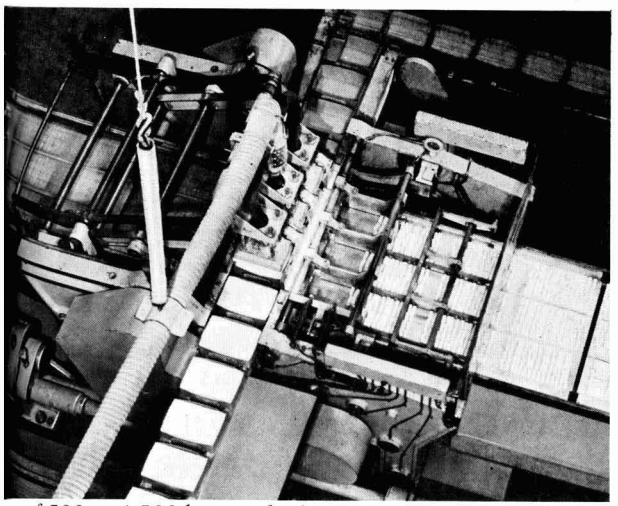
The sugar is moulded in cells arranged around a rotary drum.

*These production figures constitute minimum tonnages guaranteed under normal operating conditio and taking into account the down time for weekly cleaning.

simple product.

Automatic conditioning.

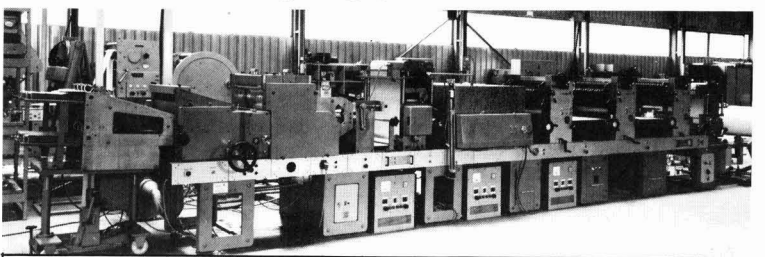
On leaving the drying units, the lumps are gathered and deposited by pneumatic fingers in three successive layers in the boxes, which are formed on a connected machine and automatically supplied to the conditioning line.
The full box is conveyed to the closing machine, which forms and glues the lid of the box.



A well-designed production unit.

A moulding and conditioning unit comprises certain basic inseparable elements synchronised with each other, all the functions of which are automatic, and optional elements (such as the machine for printing and forming the lids or the one-piece boxes, and the machine for parcelling in packets of 5 or 10 boxes).
Entirely automatic, it allows the production of 500 to 4,500 boxes of 1 kg per hour, according to the unit, without any manual intervention.
Four persons are sufficient to supervise all the operations.

To increase production, minimize costs, meet rising charges, while at the same time ensuring the supply of a product of exceptional quality, it is necessary to have automatic equipment, designed and manufactured by specialists. It is therefore not by mere chance that more than 95 % of the world production of lump sugar is carried out on CHAMBON plants. Today, more than 150 CHAMBON plants throughout the world each produce from 12 to 100 tons of moulded and packed sugar per day.



The boxes are printed and formed in a single operation.

CHAMBON

Bergère/Communication

France 6, rue Auguste-Rodin - La Source B.P. 6049 - 45800 Orléans Cédex. Tél. (38) 63.20.74. Télex Chambon 760 763 F
Great Britain Riverside Works, Standish Road Hammersmith - London W.6. 9 AN. Tel. 748.60.86. Telex 261476
U.S.A. 24 North Third Avenue, Highland Park,New Jersey 08904. Tel. (201) 846 8010. Telex 0844445
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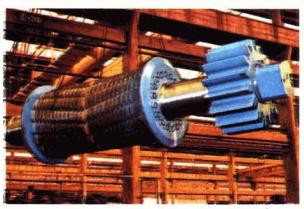
Trapiches Zanini-Farrel 42" x 84" - Usina São Martinho - trapiches con 4 molinos - 8000 TCD - 12% FIBRA

Fator

Solamente quien fabrica el mejor trapiche del mundo puede transformar su ingenio en un moderno central azucarero.



En el ramo azucarero, así como en cualquier otro, un buen equipo es de vital importancia para la obtención de un mejor resultado final. Cada pieza, cada equipo influye en el funcionamiento, pero sucede muy a menudo que un buen equipo no puede alcanzar los resultados deseados, debido a una falta de armonía del conjunto en general.

Es por eso que Zanini no solamente fabrica el mejor trapiche del mundo, como también ejecuta proyectos completos para centrales azucareros. La calidad Zanini está siempre presente, para mejor seguridad del central azucarero y mayor tranquilidad del cliente, desde la fabricación del equipo hasta la indispensable asistencia técnica después de la instalación.

Y esta eficiencia es garantizada por el alto nivel tecnológico conseguido

a través de una asociación que reunió en una única fuente, la experiencia, la tradición y el "know-how" de Zanini y Farrel.

Por lo tanto, cuando Ud. piense en trapiches o en un gran proyecto de producción de azúcar, diríjase a aquel que tenga condiciones de suministrar no sólo el mejor equipo, como también la mejor solución para la coordinación global de su proyecto. Diríjase a Zanini.

TRAPICHES ZANINI-FARREL:

Zanini fabrica trapiches en las siguientes dimensiones (en pulgadas):

30" x 54"	36" x 72"	43" x 90"
30" x 60"	37" x 78"	44" x 96"
34" x 66"	42" x 84"	

pero también puede suministrarlos en tamaños especiales.

GARANTÍA:

Los trapiches Zanini - Farrel ofrecen una garantía total valedera por dos (2) años, contra cualquier defecto de fabricación.

zanini s/a

equipamentos pesados

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Teléfono: (0166) 42.2255
Telex: 0166.315 - ZANI BR
Oficina Central: Avenida Paulista, 460 - 18º andar
01310 São Paulo - SP - Brasil
Teléfono: (011) 285.5122
Telex: 011.22901 - ZANI BR - 011.21550 - ZANI BR

be important for prevention of calamities, avoiding excessive losses of sugar or manufacturing aids, and for keeping the qualities of the end products at the desired level.

Even in cases where these goals are attained, it may be possible to rationalize the programme; for instance, making use of recent developments in on-line measurements which enable us to improve the regularity of the process, which in its turn diminishes the need for frequent analysis.

On the other hand, there are many rather simple determinations such as pH and alkalinity measurements which can be done (and are done) by the plant personnel. Transferring some analytical work to the process stations will often introduce desirable variety in the work of the operators and eliminate communication problems. We do this as routine at the juice purification stations and in the boiler houses.

As far as chemical analysis is concerned, we see the task of the laboratory as concentrating on analyses which require expensive instrumentation and/or skilled labour. Possibly there will be a move in future, away from doing analyses, to maintenance and control of on-line instruments analogous to developments in, for instance, modern oil refineries.

Summarizing, we conclude that a laboratory automation programme has to allow for the following trends:

More advanced data processing is (or will become) desirable.

Simple analyses can often be done by plant personnel.

More on-line analyses combined with computer control diminish or eliminate the need for frequent sampling at random.

The laboratory staff has to make available for supervision and maintenance of on-line analyses.

The programme of analysis has to be focused on the demand for a sharter optimization.

Labour costs are already very high and still increasing.

Seasonal labour of the level needed for the laboratory is not always available.

Computer hardware and peripherals are becoming cheaper and cheaper.

Computer software packages are becoming available to decrease the programming efforts.

CHOICE OF THE SYSTEM

The analytical package

With the trends mentioned above in mind, we decided to automate and rationalize the determinations for sugar content, dry substance content, and colour. With little additional cost or maintenance we could introduce into the line determinations of conductivity ash and pH.

The system adopted would allow K and Na determinations by adding a flame photometer to the equipment.

We have planned for the determination of invert sugar which, up until now, has not been taken into the automatic line.

The sample preparations are done by hand but rationalized as much as possible. Complete automation of this step does not pay at the moment. The analyses of the liquid samples or solutions are completely automated. The analyses which were in the analytical programme at longer intervals were rationalized as much as possible but without automatic connexions of the instruments to the computer.

The readings of these instruments are done by the systems operator who has an alternative hand input system. The calculations are done by the computer and the figures are processed automatically to shift-, daily and weekly reports.

The computer

When we decided to automate the factory laboratories we had no experience available of programming of process computers and no computer installations were available at the factories.

We decided to keep the installation as simple and cheap as possible with a computer big enough to fulfil its task without reserves. The demands were:

(*a*) presence of at least input/output (1·0) facilities to correspond with the system,

(*b*) easy programming by the Central Laboratory staff without the aid of computer specialists,

(*c*) size of the memory + peripherals sufficient to process the already existing programmes (after reprogramming), and

(*d*) peripherals for data collection programme saving, and plotting of the results.

The system did not need to be fast and, while interrupt levels are desirable, they are not strictly necessary, while internal timing is also not absolutely necessary. Nowadays there are a lot of cheap mini-computers on the market, which fulfil these requirements but, about five years ago, the Wang 720 machine was one of the few which met our demands.

LITERATURE

Data processing

The pioneering work in this field has been done by the staff of the British Sugar Corporation.

Withers, Bass & Branch developed a mathematical model which included almost the whole process[1].

Phipps and associates developed a budgetary control system, which calculates for nineteen process parameters the financial influence of a deviation from a target[2].

Higgins developed a programme for the calculation and presentation of evaporator heat balances[3].

Hallbeck, Hartman & Storz devised an optimization model for a diffuser, which could be programmed on a small computer system[4].

Karren published a paper on the applications of a small computer system at the British Columbia Sugar Refinery, which has already been implemented in the Canadian beet sugar factories[5].

The data processing systems at the Austrian factories of Enns[6] and Tulln have also to be mentioned in this summary.

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[1] *Paper presented to the 19th Tech. Conf., British Sugar Corp.*, 1968; *I.S.J.*, 1968, **70**, 344.

[2] *Paper presented to the 21st Tech. Conf., British Sugar Corp.*, 1972; *I.S.J.*, 1973, **75**, 255.

[3] *Paper presented to the 20th Tech. Conf., British Sugar Corp.*, 1970; *I.S.J.*, 1971, **73**, 22.

[4] *Paper presented to the 17th Gen. Meeting Amer. Soc. Sugar Beet Tech.*, 1972.

[5] *Proc. 36th Ann. Meeting Sugar Ind. Tech.*, 1977, 166-188.

[6] Rudolf & Steinbauer: *Zucker*, 1976, **29**, 362-367.

Laboratory automation

Parallel to the laboratory automation at CSM was the development in automation and computerization of the Pfeifer and Langen laboratory activities at Weveling-hofen, Germany.

Recently, Kettlewell & Maylott of C & H Crockett refinery in California, published their work on laboratory automation. Automatic lines were installed for apparent purity, colour in solution, invert sugar, pH, screening analyses and volume weight determinations.

The instruments are connected to the refinery's process computer. The system produces shift-, daily and 10-day period reports while the running figures are made visible on monitors at six locations in the refinery[7].

Further we mention the automated factory laboratory in the Strakosch factory, at Enns[8], which is constructed according to the same philosophy as the CSM's laboratories.

INVENTORY OF CSM's COMPUTER PROGRAMMES

Our computer programmes are focused on the questions which arise in daily practice. We tried to find answers to these questions with relatively small programmes which relate to parts of the process.

Without aiming at complete factory models, which are too complicated for our systems and for our small staff, we tried to estimate the influence of as many parameters as necessary to come to a decision. These models permit decision-making using knowledge currently available and basing of decisions more on figures and less on opinions.

Contradictory opinions, which can be difficult to evaluate in a discussion, can be complementary to each other when they are placed within the frame of an adequate mathematical model.

Some of our programmes were developed on Honeywell Bull time-sharing and later reprogrammed for the Wang 720. Most of them were written directly for the Wang machine.

We now have programmes for:

All the calculations at Central Laboratory as well as at the factory laboratories,

Boiling house material balances[9],

Evaporator heat balances,

Optimization of diffusers[10],

Conversion of lactic acid figures to financial losses[11]

Daily inventory and sugar balances, and

Shift reports and daily and weekly reports from the automated laboratories.

In development are programmes for the C.O.D. balances of the waste water systems.

The programmes were not very expensive from a point of view of programming costs. The returns were:

Increased capacities of the pan houses.

Savings in fuel.

Aids in investment decisions.

Optimization of the extraction losses.

A better view of what happens in the factory.

A better view of the possibilities and problems of computer control.

These programmes were the precursors of the automated factory laboratories; in fact they were the "eye openers" which enabled us to enlarge the span of the work of the Central Laboratory and the factory laboratories without increasing the staff.

THE AUTOMATED FACTORY LABORATORIES

The automation of the factory laboratories was achieved within the following constraints:

The optimal solution of an automation programme depends on the local situation. For each factory a combination of standard procedures and programmes has to be developed which approaches the optimum.

Stepwise introduction is necessary to keep the training programme in equilibrium with the changes in the methods of working.

Development work during the operation should be possible. This requires a maximal flexibility in the development phase.

After each step, the profitability of the next has to be estimated.

Data processing by means of mathematical models of parts of the process should be possible.

Changes of principle in the analytical procedures from those of the classical hand analyses are undesirable.

The system should have a hand input to do the calculations for analyses which are not in the automatic line. The figures have to be plotted on the shift reports and kept in the memory for further data processing.

The programming of the computer should be easy to learn.

Pay-back time of the whole equipment should be less than five years.

Description of the system

Fig. 1 is a schematic diagram of the sample flows of the system and of the electrical connexions.

The automatic line is a combination of normal laboratory instruments: automatic polarimeter, colorimeter, electronic balance for density measurements, pH meters, conductivity meter and, on some occasions, a flame photometer.

The instruments are connected with the computer which reads them out and makes the calculations. The transport of the liquid samples to the measuring instruments is by peristaltic pumps, which are hard wire-programmed.

The computer programme starts analysis procedures. The preparation of the samples into the solutions which are analysed is rationalized as much as possible but not completely automated. Complete automation of the proportioning, the disintegration and dilution of the samples would require a lot of investment, which does not pay because of the relatively small number of samples which have to be treated.

During the preparation of the solutions we divide each sample into three sub-samples; one only is diluted, for determination of dry substance ash and pH, one (for

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[7] *Proc. 36th Ann. Meeting Sugar Ind. Tech.*, 1977, 159-165.
[8] Steinbauer: *Paper presented at the Summer Meeting, Austrian Sugar Tech. Assoc.*, 1977.
[9] van der Poel *et al.*: *Zucker*, 1975, **28**, 122-131.
[10] Blok & van der Poel: *Proc. 15th Gen. Meeting C.I.T.S.*, 1975, 75-90.
[11] van der Poel *et al.*: *Zucker*, 1975, **28**, 295-298.

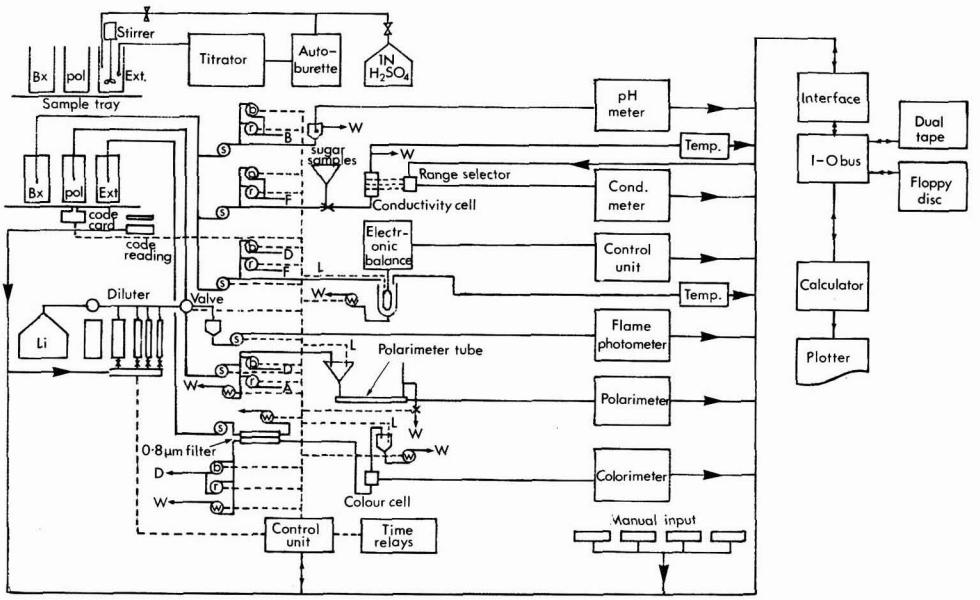

Fig. 1. Sample flows: *Key:* A acetic acid; B buffer; b blank pump; D distilled water; Ext extinction; F formalin; L level control; r rinse pump; s sample pump; W waste; w waste pump.

sugar by polarization) is defecated with lead acetate and filtered (this solution can also be used for determinations of potassium and sodium), and the third sample is titrated in the automatic line for the colour measurement at pH 7 and filtered.

The sub-samples are collected in plastic cups and placed together in one sample tray. The sample trays are positioned on the sampler table, which has a capacity for twenty trays. Code cards are fitted under the sample trays for identification of the samples by the computer.

A complete cycle of analyses takes 2-2½ minutes, so that we can analyse 20-25 samples per hour. Per shift we analyse 75 to 100 samples.

The automatic system, together with the analyses which are not automated, is operated by two persons only, one of whom is trained.

For the sake of simplicity we give more detailed description on the basis of the flow of the three separate sub-samples.

The flow of the sub-sample for Brix, pH and ash measurement is given in Fig. 2. The system has three peristaltic pumps for the transport of the liquid samples to the measuring instruments. The syrups and massecuites are diluted 1 to 5 to a range between 10 and 20° Brix by a proportional balance. Cossettes are extracted in a blender according to the usual procedure.

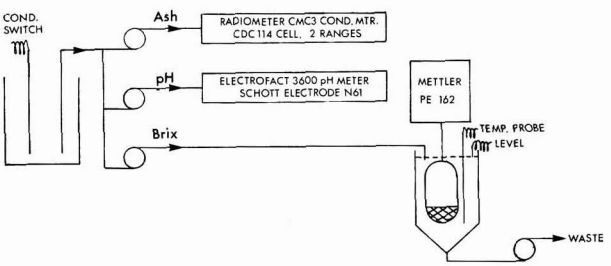

Fig. 2. Flow diagram, sub-sample 1 (Temperature measurement, reading adjusted to 5°Bx in the calculator programme)

The flow of the sub-sample for polarization and occasionally sodium and potassium analysis is given in Fig. 3.

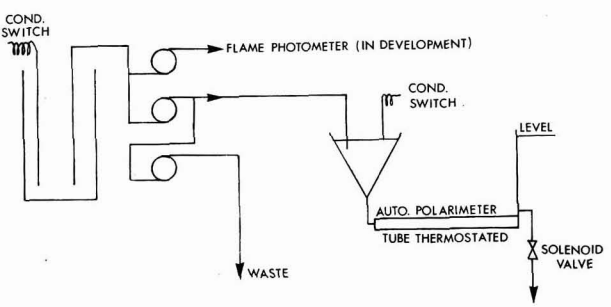

Fig. 3. Flow diagram, sub-sample 2 (Defecated off-line)

Fig. 4 shows the automatic treatment of the sub-sample for colour measurement. This treatment begins on the sample tray prior to the sample entering the pump suction. At this point the pH is adjusted to 7. For filtration, part of the sample is forced through a membrane filter. The filter surface is cleaned by the part of the sample which is not filtered. Membrane changes depend on the contamination of the samples with suspended insoluble material. The frequences vary between once a day at the beginning of the campaign and once a shift at the end of the campaign.

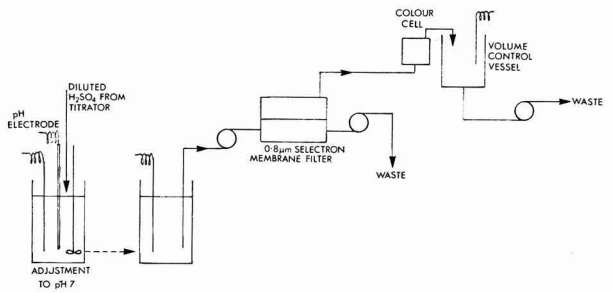

Fig. 4. Flow diagram, sub-sample 3 (Colour measured in a 1 or 2 cm colorimeter cell using a 420 nm filter of band width 10 nm)

The amount of liquid necessary to displace the previous sample has to be estimated experimentally. This amount is measured and controlled by volume. The volume in the small measuring container behind the colorimeter can be controlled by adjustment of the level, as indicated by a conductivity probe.

If a sample tray has less than three sub-samples (for instance, cossettes have only sub-samples for polarization), the computer starts only the line of analyses for which a sub-sample is present. The programmes for analyses and calculations are initiated by the computer on the information from the code cards and from the conductivity probes, which indicate the presence of a sub-sample.

Fig. 5 shows the logic diagram for the control of the system.

Apart from the pumps for the analysis, each line has separate pumps for blanks and rinsing liquids (formaldehyde and diluted acetic acid).

Table I gives statistical analysis of the repeatability of the analyses (10 analyses from the same mother liquid).

Table I. Repeatability (10 thick juice analyses)

Parameter	*Mean*	*Standard deviation*
Brix	58·37	0.020
App. purity	90·81	0·027
pH	8·87	0·003
Ash, g/100 Bx	2·80	0·007
Colour, 420 nm.cm^{-1}/100 Bx	1·33	0·012

The zero drift of the instruments is checked by a blank programme.

The blanks are compared with the blanks from the previous cycle by the computer. If the deviations exceed the programmed limits, the system stops and an alarm and message are given.

PROGRESS AT FACTORIES, MAINTENANCE AND TRAINING

Halfweg

The system was developed at this factory. This first system was under the supervision of one of the members of the Central Laboratory's staff who saw to the final trouble-shooting, the training of the operators and who is now in charge of the training programmes for the system operators as well as of the maintenance of the systems. The installation at Halfweg dates from 1973.

Vierverlaten

The system in Vierverlaten was constructed on a basis of the experience at Halfweg and has been in operation since 1974. The initial training of the operators was done during the first weeks of the campaign.

Breda

This system has been in use since 1975. The system operates in the inter-campaign for the analyses of the liquid sugar plant.

Sas van Gent

This system has been in operation since 1976. Owing to reconstruction of the juice purification station, this factory had to build a new laboratory, and the opportunity was taken to combine it with the control room. In this laboratory the data processing is also carried out for the factory of Steenbergen, which has the same director.

In the Sas van Gent installation we did not provide automatic connexions between the computer and the instruments. The instruments are read out by the operator, who keys in the figures by hand to the computer.

Advanced training and maintenance

The training of the operators before the campaign is under the supervision of the Central Laboratory, and is combined with maintenance of the installations. New operators are trained during the off-season.

The supervision of the four installations and the training of the operators takes about 20% of the time of one analytical chemist.

DEVELOPMENT OF THE DATA PROCESSING SYSTEM

During the five years in which the automatic laboratories have been in use, we have developed, together with the factory chemists, a data processing and information system.

This system started with the shift reports, the daily reports, the weekly reports, and the daily inventory. Before we started with the automatic laboratories, we already had the daily inventory and the weekly averages on Honeywell Bull time-sharing.

The data processing has developed in the past five years to an information system, which includes calculations connected with fuel usage, supervision of the usage of manufacturing aids, and the supervision of the boiling house material balances.

Much attention is paid to the presentation of the figures. There is availability for plotting 10 parameters, which can be chosen at will.

The calculations are uniform as well as the filing into

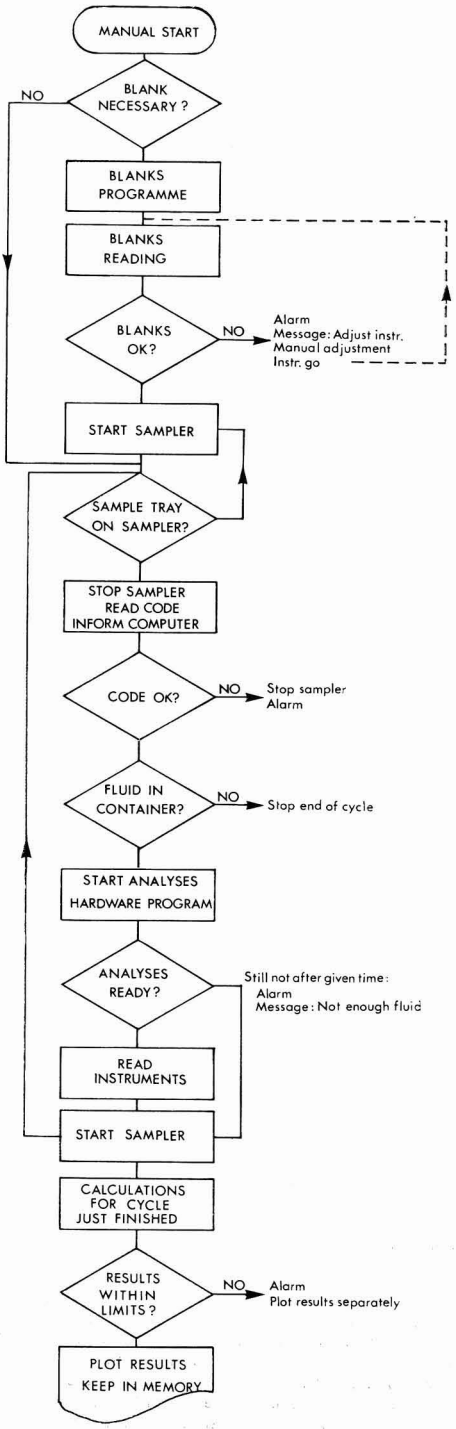

Fig. 5. Automatic laboratory logic diagram

the computer memory. The presentation of the figures for the daily factory reports depends on local demands, but the presentation of the weekly report is uniform for the whole company. Each factory produces its part of the weekly report at its own computer installation. The reports are combined at the Central Laboratory.

Summary

The tasks and responsibilities of sugar factory laboratories are evaluated. The conception of the automatic laboratories in the CSM Company is based upon these tasks and developments which are to be expected in the near future. Data processing, maintenance of on-line analysers, and analyses made by plant personnel are expected to increase in importance.

A description of the system which has been developed at CSM is presented.

Automation et traitement de données au laboratoire de contrôle

Les objectifs et les responsabilités des laboratoires de sucrerie sont définis. La conception des laboratoires automatiques de la CSM est basée sur ces objectifs et ces développements auxquels on peut s'attendre dans un proche avenir. On peur prévoir que le traitement de données, l'entretien des analyseurs en ligne et les analyses par le personnel des chantiers gagneront en importance. On présente une description du système dévelopé à la CSM.

Automation und Datenverarbeitung im Zuckerfabrikslaboratorium

Die Aufgabenbereiche und Verantwortlichkeiten von Zuckerfabrikslaboratorien werden beschrieben. Die Konzeption der automatischen Zuckerfabrikslaboratorien der CSM basiert auf diesen Aufgaben und den Entwicklungen, die in naher Zukunft zu erwarten sind. Datenverarbeitung, Bereitstellung von on-line-Analysatoren und vom Fabrikpersonal durchgeführte Analysen werden an Bedeutung gewinnen. Eine Beschreibung des bei der CSM entwickelten Systems wird gegeben.

Automación y tratamiento de dados en el laboratorio azucarero

Las tareas y responsibilidades de los laboratorios de fábricas de azúcar se evaluan. La concepción de laboratorios automáticos en la Sociedad CSM se base sobre estas tareas y desarrollos que se preverán en el futuro próximo. La importancia del tratamiento de dados, mantenimiento de analizadores tipo "en-línea" y análisis hecho por personal de la planta, se preve aumentarse. Se presenta una descripción de la sistema que se ha desarrollado por la CSM.

New Chinese sugar factories.—The New China News Agency reported that Southern China's Kwangsi Province put eight new sugar mills into operation last year, bringing its annual cane sugar production to well over 400,000 tonnes[1]. The agency said that Kwangsi is one of China's major sugar producing areas, with 65 sugar factories having been built in the region since 1949. Four further factories, each with an annual capacity of 9000 tonnes, are being completed in Heilungkiang Province[2].

[1] *Westway Newsletter*, 1979, (64), 13.
[2] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 141.

SUGAR CANE AGRONOMY

A review of chemical ripening of sugar cane with "Ethrel" in Southern Africa. H. Rostron. *Proc. 16th Congr. ISSCT,* 1977, 1605-1617.—A large number of replicated field experiments have been carried out over five years in which "Ethrel" (2-chloroethyl phosphonic acid) was applied to irrigated cane foliage between 2 and 6 months before harvest. Results were not successful when "Ethrel" was applied at the end of the milling season, but considerable and consistent improvements were obtained when spraying 5-6 months earlier. Despite large reductions in leaf area and net CO_2 uptake per stalk, cane yield was not reduced even when sampling continued for six months after spraying with a high rate of 6 litres.ha^{-1}. The treatment therefore resulted in a large and profitable increase in sugar yield between 0·8 and 2·4 tonnes.ha^{-1}. "Ethrel" ripened all varieties tested, some being more responsive than others to low rates of application. Multiple applications increased the yield response and extended it to at least 26 weeks. They also prevented a loss of sucrose under conditions of severe moisture stress.

"Ethrel" as an early season cane ripener in Rhodesia. C. P. M. Sweet. *Proc. 16th Congr. ISSCT,* 1977, 1619-1629.—Eight replicated and ten whole-field trials were conducted over three years at Triangle Sugar Estate with 2 litres.ha^{-1} of "Ethrel" (48% m.v.) applied aerially about 8 weeks before harvesting at 12 months of age. The average response was 1·2 tonnes estimated recoverable sugar per ha in the replicated trials and 1·8 tonnes in the field trials. Cane yield was barely affected but the sucrose % cane improved by about 1·0. Maximum response was obtained at 6-8 weeks after spraying and would probably have held to 12 weeks. The greatest response was with lower purities and so with earlier harvesting. The topping point of the cane was raised by 15-30 cm and the upper internodes were shortened. The upper leaves dried off to give better burns, allowing more definable topping and less trash.

Chemical ripener studies with "Polaris" in sugar cane in North-East Brazil. G. M. Azzi, A. S. Alves and A. Kumar. *Proc. 16th Congr. ISSCT,* 1977, 1653-1669. Application of 4 kg.ha^{-1} of "Polaris" to two varieties at 10-12 months of age produced a favourable response which varied over the period 4-8 weeks after application. Co 331 cane gave an increase in pol % cane up to 39% higher than the untreated control, while CB 45-3 gave an increase of 7-19%.

Flowering of sugar cane at Coimbatore. S. Singh. *Proc. 16th Congr. ISSCT,* 1977, 1671-1682.—Experiments were conducted at the Sugarcane Breeding Institute, Coimbatore, to investigate different aspects of flowering of cane. The inductive photoperiod (12-12½ hr) occurred between July 7 and August 21 and floral initiation in a variety planted in November-March occurred almost at the same time, while initiation was delayed in April-May planted cane. Flowering following the photoperiodic stimulus appeared to be faster and stronger in early-season flowering varieties, initiation occurring 20-25 days earlier than in late-flowering varieties. Differences in inflorescence emergence among varieties were mainly due to differences in floral initiation time. The minimum stage of "ripeness to flower" differed with varieties. With late-flowering varieties, cutting of the leaf spindle at any time between the second and third week of August prevented flowering almost completely, while in early-flowering varieties it could be checked totally only when the leaf spindle was removed repeatedly at 4-5 day intervals from July 20 to August 12.

Sugar cane glycosidases. A new bound invertase from leaf sheaths. F. E. Prado, M. A. Vattuone and A. R. Sampietro. *Proc. 16th Congr. ISSCT,* 1977, 1683-1691.—A β-fructofuranosidase from sugar cane leaf sheaths was partially purified by precipitation with $(NH_4)_2SO_4$, and half the protein of the concentrated extract removed by $Ca_3(PO_4)_2$ gel, followed by filtration on Sephadex G-100. The enzyme was collected in the void volume of the column. It is particulate and partially precipitable by ultracentrifugation at 105,000 *g* and excluded from Sephadex G-150. It is inhibited by Mn^{++}. Some kinetic parameters were determined and on the basis of values for the km, optimum pH, tissue localization and inhibition by excess of substrate, the enzyme was shown to differ from previously reported invertases. It is thought to be localized in the cell wall and to be related to a feeding process of leaf sheath tissues rather than to the translocation of sucrose.

Field trials with "Polaris" as a sugar cane ripener. II. The effect on cane yield and sugar yield. Y. C. Pan and Y. P. Lee. *Proc. 16th Congr. ISSCT,* 1977, 1693-1699.—"Polaris" has been found to be effective in increasing the sucrose content at harvest of 12-months old N:Co 310 sugar cane in both plant cane and ratoons treated 4 or 8 weeks before harvest. The decrease in cane yield was not statistically significant. The best sugar yields were obtained with foliar application of "Polaris" at the rate of 4·48 kg.ha^{-1} four weeks before harvest in plant cane (5% more than the control) and in ratoon cane (11% more than the control).

Effect of "Polaris" application on the juice quality of sugar cane in the decline phase of the maturity curve. A. S. Alves, G. M. Azzi and A. Kumar. *Proc. 16th Congr. ISSCT,* 1977, 1713-1720.—"Polaris" was applied to cane in the decline phase of the maturity curve, i.e. late in the season when the cane had passed its peak maturity. The results showed that juice quality was improved and deterioration prevented, best results being given when the application was six weeks before harvest.

Effects of aerial spraying with "Polaris" on sucrose enhancement, growth and yield of sugar cane. P. C. Yang and F. W. Ho. *Proc. 16th Congr. ISSCT,* 1977, 1701-1711.—Tests were made of the effects of "Polaris" sprayed from the air under unfavourable ripening conditions. Test areas varied from 5 to 20 ha and included eight major varieties. After application of 4·5 kg.ha^{-1} in 60 litres of water, Brix, growth rate and ratoon

regrowth were measured in the field and Brix, pol % cane, purity, available sugar % cane were obtained from cane and crusher juice samples. "Polaris" produced a fairly consistent positive response and enhanced cane quality by comparison with untreated control plots. Growth rate decreased by 0·22-2·56% but Brix and sugar % cane were higher, resulting in an additional sugar yield of 0·7 tonnes.ha^{-1}. No detrimental effect on ratoon regrowth was observed.

Ripening of sugar cane, irrigated in furrows, assessed on analyses of the 8-10 internodes, sugar cane pol and sugar production. E. J. de A. Leme and R. Scardua. *Proc. 16th Congr. ISSCT,* 1977, 1721-1732.—In a randomized block design with split plots, cane planted in March 1975 was grown with various levels of furrow irrigation and 9-stalk samples cut every two weeks from March to August 1976. The 8-10 internodes were separated and their moisture, sucrose and reducing sugars measured, other parameters recorded being sample weight and pol % cane. The results were subjected to statistical analysis and it was concluded that there was a moisture decrease between the 12th and 17th months from planting, moisture levels being lower in the irrigated cane. Pol % cane and sucrose:reducing sugars ratio increased with the age of the cane, there being no significant differences between irrigated and unirrigated cane. Sugar production depended on the 8-10 internode moisture and on the sucrose:r.s. ratio and, for all treatments, higher values were found in the irrigated cane.

Minimum threshold temperature for sugar cane growth. O. O. S. Bacchi and J. A. G. C. Sousa. *Proc. 16th Congr. ISSCT,* 1977, 1733-1741.—A method is proposed for estimation of the minimum temperature for sugar cane development, using the degree-day concept. Determinations made with the variety CB 41-76 under irrigated and unirrigated conditions show that, for this variety, the values are 18-19°C and 19-20°C, respectively.

Prolonged chemical ripening of sugar cane following multiple applications of "Ethrel". H. Rostron. *Proc. 16th Congr. ISSCT,* 1977, 1743-1753.—"Ethrel", at 2 litres.ha^{-1}, was applied to small plots of irrigated N:Co 376 cane in February, April, February and April, and February, April and June 1976, and the results monitored over a period of 26 weeks. The dry mass of young leaves was reduced up to 47% but the cane mass was unaffected and substantial and prolonged improvements in sucrose % cane and juice purity resulted in large gains in recoverable sugar per stalk. Two applications were more effective than one, and three were more effective than two although the effects of the successive treatments were not additive. During a period of prolonged moisture stress at the end of the experiment, multiple "Ethrel" applications prevented a loss of sucrose which occurred in unsprayed cane and cane sprayed only once; this effect may have been due to more efficient use of soil moisture in the cane which had a smaller leaf area.

The effects of time of harvest on the partitioning of dry matter in three sugar cane varieties grown in contrasting environments. M. H. R. Julien and P Delaveau. *Proc. 16th Congr. ISSCT,* 1977, 1755-1770 Dry matter content and its components (sucrose, fibr and reducing sugars) were followed during 16 weeks up to harvest at 64 weeks for cane of three varieties grown in four environments (differing in temperature, % sunshine, rainfall and photoperiod), the experiments being repeated for three different dates of harvest. For a given variety and date of harvest, partitioning of dry matter was not influenced by the environment but it was influenced by both date of harvest and variety. Increases in sucrose % fresh weight of cane have been explained by an increase in dry matter, partitioning in favour of sucrose and conversion of reducing sugars to sucrose; there was no evidence of a desiccation effect. The varieties also showed marked differences in ripening behaviour, while the effect of age in influencing ripening was negligible.

Age, time of harvest and environment as factors influencing differences in yield between flowering and vegetative canes. M. H. R. Julien, P. Delaveau, G. C. Soopramanien and J. F. Martiné. *Proc. 16th Congr. ISSCT,* 1977, 1771-1790.—Growth, yield, dry matter and its partitioning (as pol, Brix and fibre) were compared in naturally flowering (CF), naturally vegetative (CV) and photoperiodically-induced flowering cane (Vp) of three ages grown in two environments. Time of harvest was found to be the most important factor affecting differences in yield between flowering and vegetative shoots, environment also playing an important role while the effect of the age of the crop is negligible. Differences at the time of anthesis were primarily attributed to an increased rate of development in flowering shoots which is associated with floral development. Differences at subsequent harvest dates were related to the development of side shoots on the flowering cane. The proportional mean of CF and CV canes had similar sugar yield to Vp cane early in the season but lower yields later. This was primarily due to slow growth rate of the CV cane from the time that anthesis would normally have occurred to final harvest. During this period CV cane accumulated similar amounts of dry matter and sucrose as Vp cane at Réduit but lower amounts at Belle Rive. This difference between the two environments has been related to the rate of development of side shoots, which had lower numbers of leaves, leaf area and leaf area ratio at Belle Rive where it is cooler, with lower incoming radiation than at Réduit.

Testing ripeners: Problems and prospects. M. H. R. Julien. *Proc. 16th Congr. ISSCT,* 1977, 1791-1809.—Experimental methods and results obtained in five trials on cane ripeners in Mauritius are described as an illustration of the problems in their interpretation. Variation of fresh weight per plot was the main problem encountered but could be reduced by expressing results on a fresh weight per cane basis. Determination of sucrose content showed less variability but different sampling methods were best for different varieties. Greatest benefit comes from a true increase in sucrose rather than an apparent increase due to cane desiccation, so that pol % dry matter is the best measure. Poor regrowth of ratoon cane can occur and is not variety-related but may be due to reduction of water shoots or, in one trial, to a shorter interval between application and harvest or application at a later stage of floral development. Other possible factors may be concentration and use of a low-drift substance "Nalco-trol".

Recommendations are made for the experimental design of industrial trials.

Varietal effects on juice quality following mechanical harvesting. J. D. Miller, B. R. Eiland, G. J. Gascho and J. E. Clayton. *Proc. 16th Congr. ISSCT,* 1977, 1811–1823.—Samples of five cane varieties (CI 41-223, CP 63-588, CP 65-357, CP 68-1026 and CP 68-1067) were cut with a chopper harvester about 16 hours after being burned and were milled 3, 8, 14, 27, 51 and 75 hours after harvesting. Brix increased up to 51 hours in roughly the same proportion that water was lost from the cut samples. Between 51 and 75 hours, Brix, sucrose and sugar per tonne of cane all decreased. Purity and pH decreased after 27 hours but there was no difference in pH among varieties, although these differed in titratable acidity, CP 63-588 and CP 68-1067 having the lowest values. There was little difference in titratable acidity among sampling times, with only the 3-hour sample being lower than the 75-hour sample. Dextrans increased markedly after 27 hours, the lowest levels occurring in CP 68-1067 (although CP 65-357 had lower levels up to 27 hours). Of the five varieties, CP 68-1026 and CP 68-1067 were outstanding in keeping quality, with no loss of sugar per tonne of cane, the smallest purity drop and the smallest increase in dextran.

Influence of fertility levels on nitrate reductase activity and its significance for sugar yield. E. L. Rosario and K. Sooksathan. *Proc. 16th Congr. ISSCT,* 1977, 1825–1841.—Nitrate reductase activity (NRA) increased with increasing fertilizer levels and decreased with advancing plant age. It is highest at 6 months after planting or two months after the final application of fertilizer N. Based on endogenous NRA at 6 months, the relative ranking of varieties was: Co 785 > Phil 56626 > Phil 62120 > F 156 > CAC 5711. The rate of induction was influenced by the amount of nutrients received by the plant; with a lag phase of about 1 hour, maximum NRA was recorded at 6, 5 and 3 hours in plants receiving 0, 200-100-400 and 400-200-800 kg.ha^{-1} of fertilizer, respectively. Positive correlations were established between NRA and cane tonnage and sugar yield, although there was a negative correlation with sugar per tonne of cane. A significant correlation was observed between NRA and top visible dewlap leaf N, varieties with higher leaf N giving higher NRA values. The possible use of these relationships in determining fertilizer requirements is discussed.

Influence of fertility level on yield determining physiomorphological characteristics of some sugar cane varieties. E. L. Rosario, N. Chantha and M. B. Lopez. *Proc. 16th Congr. ISSCT,* 1977, 1865–1884.—Leaf area index (LAI) development was of paramount importance in cane yield formation. Fertilizer application influenced LAI mainly through leaf elongation and increase in leaf area per plant. At a high fertilizer level, leaf elongation was found to exert a negative influence on cane yield because of severe restriction in stalk number. The P content per unit leaf area assumed considerable importance at high fertilizer levels in terms of its effect on both cane yield and quality. High levels of fertilizer did not affect cane quality provided a balanced application rate of N-P-K was maintained.

Chemical constituents of the sugar cane apex associated with floral evocation. Z. A. Menshawi. *Proc. 16th Congr. ISSCT,* 1977, 1885–1901.—The chemical status of the cane apex during definite phases of the flowering process was traced, comparisons being made between a flowering (69B4) and non-flowering (69B24) variety, both of which are progenies of the same cross. Floral evocation was accompanied by increases in apical P, Zn, Mn and Mg levels, while variations in the amounts of K and Ca were not similarly obvious. Accumulation of the floral stimulus in the cane apex was accompanied by an increase in the content of specific proteinogenic amino-acids and amides, notably in their free forms.

The effect of nitrogen, phosphorus and potassium fertilization and irrigation on nitrogenase activity and yield of sugar cane. Preliminary note. A. P. Ruschel, J. Orlando and E. Zambello. *Proc. 16th Congr. ISSCT,* 1977, 1903–1911.—Nitrogenase activity, as measured by the acetylene reduction technique, of sugar cane root segments sampled 6, 9, 12 and 15 months after planting, was determined in order to study the effect of N, P and K in irrigated and non-irrigated experiments. N additions appeared to decrease nitrogenase activity in irrigated plants whilst P and K levels had no effect. Nitrogenase activity in irrigated cane differed from that in non-irrigated cane during mid-winter and mid-summer for the different N, P and K levels studied. It increased in roots of 12 and 15 months-old cane. Sugar production was increased by irrigation, which effect was similar to the first level of N, P or K plus its nutrient combination.

Aerobic and anaerobic nitrogen-fixing bacteria on sugar cane roots. A. P. Ruschel, J. Orlando, E. Zambello and Y. Henis. *Proc. 16th Congr. ISSCT,* 1977, 1923–1929.—Populations of N-fixers, including non-spore-forming and spore-forming aerobic and anaerobic bacteria, and the nitrogenase activity of cane roots were studied; nitrogenase activity was observed in roots at different soil depths (40, 80 and 120 cm) at normal and low pO_2 atmospheres. Of the isolates, 40% showed nitrogenase activity, more than two-fifths of these showing high nitrogenase activity. A greater number of N-fixing sporulating-type aerobic bacteria were found than of anaerobic, and it seems that the latter have higher nitrogenase activity than aerobes.

Guttation in the sugar cane plant. T. T. Yang and C. T. Chen. *Proc. 16th Congr. ISSCT,* 1977, 1937–1940. Guttation is the exudation of drops of fluid which occurs at the edges of green leaves. A fine structure of hydathodes—structures for discharge of water from the interior of the leaf to its surface—was found in cane consisting of a small short tracheid extending to the intercellular space and directly connected to the main leaf xylem. Guttation brings about a water flow which may be an important process for continuous absorption and transportation of water and nutrients from roots to shoots in a saturated condition, especially for shorter plants. Soil moisture content is very closely related to guttation, which is sharply decreased at soil water content under 40% of field water holding capacity. Top rootless buds guttate while the attached cuttings are immersed in water. The possibility of guttation as a visible indicator for practical use in agronomy is discussed.


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SUGAR BEET AGRONOMY

Tests on the importance of the nutrient supply for sugar beet quality. II. Nitrogen and potassium. K. Bürcky, U. Beiss, C. Winner, L. Drath and H. Schiweck. *Zuckerind.*, 1978, **103,** 190-200 (*German*).—An investigation into the effects of N and K dosage rate on beet quality is reported. Sand pot culture was used, each pot containing 40 kg of sandy soil of known nutrient content at pH 6·2. The basic nutrient mixture was applied in four stages: one-third of the total as a starter (beet emergence taking place on April 30), one-third applied in mid-May, one sixth at the end of May and the remainder at the start of June. N and K were also applied in increased doses which were multiples of the proportions in the basic mixture, and the effects are shown in graph form. Increase in the N application rate caused a fall in sugar content and in the load-bearing strength of the beets (breakage of the beets at a load less than 600 newtons indicated difficulties in processing and brittle cossettes), while the marc content and amino-N and Na contents rose. While a high K dosage rate caused a slight increase in sugar content, this was accompanied by a noticeable rise in the K content. Doubling the Na dosage rate gave the highest corrected sugar content in the test.

Errors in sugar beet agriculture prevent proper use of reserves. W. C. von Kessel. *Die Zuckerrübe,* 1978, **27,** (2), 11-13 (*German*).—The author discusses various aspects of beet agriculture where faulty practices or incorrect decisions can lead to a fall in crop profitability. The article covers fertilization, pest and disease control, the question of whether to plough-up beets and resow (reference being made to panic measures which may incur greater losses than if a more rational approach were made), weed control costs, harvest losses and optimum provision and use of equipment.

Weed control in sugar beet on light soils. F. Maykuhs. *Die Zuckerrübe,* 1978, **27,** (2), 14-15 (*German*).—On light soils, which are frequently deficient in humus, sugar beets offer little competition with weeds. A few days of sunshine are sufficient to dry the soil crust and impair both beet germination and herbicide activity through the absence of moisture, so that light sprinkler irrigation is needed (heavy sprinkling causes muddiness, compaction and erosion) in conjunction with herbicide application. Advice is given on pre- and post-emergence treatments, and brief mention is made of problem weeds for which specific herbicides are recommended.

Control of grasses and weeds. Anon. *Die Zuckerrübe,* 1978, **27,** (2), 20-21 (*German*).—Pre- and post-emergence herbicides and their mixtures, their recommended quantities, remarks on their capabilities and advice on their application are given in tabular form.

New techniques in beet agriculture. G. Spee. *Die Zuckerrübe,* 1978, **27,** (2), 28-29 (*German*).—Problems associated with beet seedbed preparation and drilling are briefly examined, and the sowing of rye to combat wind erosion[1] and thus help to give a good stand of beet recommended. Advice is given on spraying to kill the rye before beet seed drilling, and a description is given of a drill having a special device for cutting into firm soil which enables the drill to run smoothly and provides for optimum placement of the seed. The costs of the rye technique and of the drill are discussed.

"Goltix"—a new beet herbicide. G. Becker. *Die Zuckerrübe,* 1978, **27,** (2), 31 (*German*).—Information is given on "Goltix", which is suitable as a pre-sowing, pre- or post-emergence herbicide in beet; recommended application rates for specific circumstances are given.

The sugar industry and sugar beet agriculture in Austria. C. Nuh and G. Onat. *Seker,* 1977, **27,** (105), 1-18 (*Turkish*).—A survey is presented of sugar beet agriculture in Austria, with a brief outline of the sugar industry organization.

Physical and economic comparisons of different irrigation methods with regard to sugar beet yield. N. Vanli and S. Kaimoglu. *Seker,* 1977, **27,** (105), 19-35 (*Turkish*).—Comparison was made between the effects of sprinkler, strip, furrow and flood irrigation in a randomized block design with six replications. Overhead irrigation was better than the surface methods in terms of root, leaf and sugar yield, and was slightly better on average than strip irrigation as regards beet sugar content, while also consuming less water than the other methods.

Inter-seed spacing. R. Vanstallen. *Le Betteravier,* 1978, **12,** (118), 12A (*French*).—A table is presented which gives the number of seed clusters per ha and the beet population per ha at emergence levels of 45, 50, 55, 60, 65 and 70% corresponding to inter-seed spacings of 10, 13, 15, 17, 18 and 20 cm. For each plant population an indication is given of whether it is considered too low, too high or optimum.

Mixed crops could boost protein yields. E. Long. *The Furrow,* 1978, (March/April), 10-11.—Among trials conducted at Reading University in England on mixed cropping was one (carried out in 1977) in which spring barley was sown alongside sugar beet in March at beet spacings to give 50,000, 75,000 and 100,000 plants per ha. In contrast to the normal size of roots at the end of September where beets were grown without intercrops, those grown close to barley were stunted.

Drainage in reverse irrigated from below. G. Hanslip. *The Furrow,* 1978, (March/April), 20-21.—A farmer, Mr. S. Rice, who grows various root crops (including sugar beet) on a 120-ha farm in Cambridgeshire, England, uses a subsurface irrigation system to keep the soil moist in spring and summer and thus supplement the overhead irrigation which is needed during dry periods. He makes use of clay tile drains placed just above the subsoil about 20 m apart, and controls the water level in the drainage dykes so as to allow water

[1] Palmer *et al.*: *I.S.J.*, 1978, **80,** 207.

to flow back up the drains and be utilized by deep-rooted plants or sucked up into the dry soil by capillary action. In the winter, water has to be pumped from the dykes to a nearby river, whereas in the summer, water is continuously syphoned from the river into the dykes to provide sufficient head for the water to flow up the drains. This also provides a reservoir for overhead irrigation. The beet crop is protected from winds by mustard sown between the rows (although this is too small to have much effect in a poor growing season) and by straw "planted" in every 10th row; this has increased beet yield by 1-2 tonnes.acre^{-1} by comparison with unprotected beet.

When should you sow the beet crop? J. Webb and K. Jaggard. *British Sugar Beet Rev.*, 1978, **46,** (1), 7-8. Work conducted at Broom's Barn Experimental Station in the period 1963-75 on the effect of sowing date on beet yield is reviewed. Trials in 1976 and 1977 showed that a reduction in yield after sowing in late February-early March was probably a result of extensive bolting; it has been estimated that a 1% drop in yield takes place for every 4% of plants which bolt. Moreover, there is also the risk that bolters in early-sown crops will produce viable seeds that survive several years in the soil and germinate as weeds in subsequent crops. Hence, research at Broom's Barn is intended to establish how seed lots will tolerate different types of spring weather without risk of bolting and to predict how many days suitable for drilling are available when there will be no fall in yield as a result of sowing too early or too late. For maximum yield, sowing should start as soon as possible after mid-March and be completed by early April, varieties should have good bolting resistance, seed should be spaced so as to give a harvestable root population of at least 75,000 per ha, and seeds and fertilizers should be kept apart in both time and distance.

Soil factors affecting seedbed cultivations for sugar beet. G. Spoor. *British Sugar Beet Rev.*, 1978, **46,** (1), 13-17.—Factors to be considered in seedbed preparation with a view to rapid establishment of an evenly spaced optimum number of plants are discussed. It is emphasized that the aim should be to produce soil conditions in autumn which, with the help of winter weathering, will be suitable for spring drilling without the need for much additional treatment. Uniform, free-draining, coarse rather than fine tilths are advisable, with fairly level soil surfaces, in order to allow uniform weathering and drying to acceptable moisture contents below the surface layer. Spring cultivation should be minimal, being limited to shallow work within the weathered material so as to avoid excessive moisture loss and introduction o raw, unweathered soil into the seedbed. Passes by tractor should also be minimized in order to prevent compaction and a soil density which could be greater than before the autumn cultivation.

Crop establishment on heavy soils. A progress report. K. Thompson. *British Sugar Beet Rev.*, 1978, **46,** (1), 18-19.—Following problems with seedling establishment in heavy soils, a study was initiated of various methods of seedbed preparation. Results of the preliminary investigations showed that chisel ploughing was not as suitable as mouldboard ploughing, that autumn/winter seedbeds (if possible to prepare) were better than spring seedbeds in terms of emergence after two passes with a Dutch harrow. While use of Dutch harrows tended to result in the earliest and most uniform emergence and highest plant populations, they could not produce a sufficient depth of tilth; as a result, there was little levelling effect, creating difficulty with subsequent band spraying and tractor hoeing. On the other hand, use of Dutch harrows as a final operation considerably improved seedbeds produced by other implements. Power and spring-tined harrows brought much unweathered soil to the surface.

The advantages of mechanical gapping. G. Brown. *British Sugar Beet Rev.*, 1978, **46,** (1), 29.—Mention is made of use of a gapper to thin beets at the four-leaf stage after drilling to a seed spacing of 10 cm when unfavourable weather in the spring causes slow, uneven emergence.

Pelleting Britain's sugar beet seed. D. Charlesworth. *British Sugar Beet Rev.*, 1978, **46,** (1), 37.—Information is given on beet seed pelleting at the King's Lynn and Wisbech factories of Germain's (U.K.) Ltd.

Weed beet: spring work. W. Perowne and P. Longden. *British Sugar Beet Rev.*, 1978, **46,** (1), 44-45.—A random survey of 900 beet fields representing some 2·5% of the UK beet crop was carried out in May-June and July-August 1977; it revealed that 15% of the fields were infested to some extent with weed beet (defined as "any beet plants which are out of position"), northern areas being less affected than southern areas where up to 34% of the fields were infested. While production of viable seeds by bolters was reported from 15% of the fields examined, only one in every four farmers took any action. Many of the weed beets were found in subsequent crops such as potatoes and peas, in which control is difficult. Trials have given variable results, suggesting that varieties differ from year to year and from site to site in the proportion and types of bolters they produce. Advice to farmers drilling on a severely infested site includes seedbed preparation in early March when the soil temperature is 3-5°C, followed by a 4-6 week waiting period (perhaps with an intermediate light harrowing) in which to allow weed beets to germinate. Light scratching of the soil will show when nearly all the germinating seeds have produced seedlings. The beet should then be drilled and the entire field sprayed with "Paraquat". Some 90% of weed beets which appear after crop emergence (usually in circles around the spot at which the original bolter shed seed) can be destroyed by hoeing, while "Trifluralin" incorporated in the soil during hoeing may help control later germinating weed beets.

Post-emergence herbicides—points to bear in mind. W. Bray. *British Sugar Beet Rev.*, 1978, **46,** (1), 47-48.—The points to consider in deciding on which post-emergence herbicide to use and when to apply it are listed as: previous experience, expected weeds to be controlled, soil type, herbicides which can be used in sequence with the one selected, weeds present and their growth stage, crop growth stage and its condition, and factors associated with the mechanics of spraying. A table gives some recommended post-emergence treatments together with acceptable pre-drilling and pre-emergence herbicides and the minimum beet growth stage at which the post-emergence herbicide can be applied.

CANE SUGAR MANUFACTURE

The development of cane wash water treatment systems in Hawaii. L. Engel. *Sugar y Azúcar,* 1978, **73,** (1), 28-35.—Details are given of the system used at Honokaa to treat cane cleaning effluent and boiler ash water[1]. Among equipment used is a Dorr-Oliver 60-foot diameter "Cabletorq" clarifier, in which the power from the drive head is applied to a torque arm travelling above the sludge level where drag is minimum. Cables connected to this arm pull a rake arm and allow it to find its own efficient working level without operator assistance. A special dual-axis hinge on the rake arm allows it to move with a universal joint type of action whenever there is excessive sludge accumulation, while the blades of the rake ride up and back in a motion which keeps them parallel with their original raking position at any lift angle. Retention time in the clarifier is about 75 minutes, with mud density averaging 15% but attaining as much as 30-35% solids. A similar primary waste water treatment system has been installed at Laupahoehoe.

Colour and ash levels in process streams at three factories producing raw, sulphitation white and high pol raw sugars. J. F. Silva and F. Zarpelon. *Proc. 16th Congr. ISSCT,* 1977, 2787-2796.—Colour and ash were measured in process streams in three factories; two of these produced both raw and sulphitation white sugar with hot liming for the former and sulphiting followed by hot liming for the latter. In one factory a three-boiling system was employed with remelting of *C*-sugar (and addition of the remelt to syrup) and use of *B*-sugar as footing for the A-strike; in the second factory a two-boiling system was used with the low-grade sugar used as footing for the high-grade boiling. In the third factory a two-boiling system was used as above but the *A*-sugar was washed with water and steam in the centrifugals to produce a high-pol raw. There was some colour removal during clarification but no significant change in evaporation. Colour and ash levels increase during crystallization, the amount varying with the boiling system and characteristics of the station operation. Use of *B*-sugar instead of *C*-sugar as footing for *A*-massecuite substantially improves the quality of the commercial sugar and remelting of *C*-sugar is indicated as desirable.

Syrup clarification for improving sugar quality and yield. M. C. Bennett, J. R. Elvin, H. W. B. Heineman, P. R. Pottage and J. T. Rundell. *Proc. 16th Congr. ISSCT,* 1977, 2797-2810.—A new process involving the clarification of raw syrup to remove impurities such as insoluble matter, gums and process-generated colorants is described together with the process improvements achieved from full-scale operation. These improvements are most marked when a mill-white sugar is being made. The process[2] involves the addition of lime and phosphoric acid or sodium phosphate in a reaction-aeration vessel, addition of "Talodura" flocculant and separation of the aerated scum.

Measuring methods for control of crystallization in massecuites of high purity. G. R. Moller, E. Knovl and R. F. Madsen. *Proc. 16th Congr. ISSCT,* 1977, 2811-2818.—A description is given of two different methods for control of crystallization in high-purity massecuites. The first employs a consistency transmitter based on measurement of pressure pulses produced by a body rotating in the massecuite, while the other is a successor to the conventional conductivity measurement system using an impedance measurement in the radio-frequency region.

Recent experience in the use of a single-tray clarifier for manufacturing white sugar by the sulphitation process. M. Mochtar. *Proc. 16th Congr. ISSCT,* 1977, 2819-2828.—Trials were made with a pilot-scale Eis clarifier and subsequently full-scale trials were made comparing the clarification of sulphited cane juice in a SRI-type clarifier with a new "RapiDorr" and an old "Multifeed" Dorr clarifier. Both the single-tray clarifiers, when used with appropriate quantities (1·5-2·0 ppm) of "Separan AP-73 Premium" flocculant, gave better results than the multi-tray units in respect of pH drop, temperature drop, inversion, colour increase, turbidity and lime content. While the juice from different compartments of a multi-tray clarifier might vary, that from a single-tray unit is usually more uniform.

Improving sugar for better nutrition. Fortification with vitamin A on a national scale. E. Portela, G. Arroyave and J. Aguilar. *Proc. 16th Congr. ISSCT,* 1977, 2847-2858.—Because of severe and widespread vitamin A deficiency, the Governments of Costa Rica, Guatemala, Honduras and Panama have passed laws requiring the fortification of consumption sugar with the vitamin. This is added at the centrifugals. Surveys are to be made to evaluate the effectiveness of the measure.

Kinetics of the sedimentation process of cane juice. A. C. Raha. *Proc. 16th Congr. ISSCT,* 1977, 2859-2872. Examination of the settling rates of a large number of sulphited cane juices showed that they fell into four categories defined by variation in settling rate and final mud volume. The characteristics are described and related to the nature of the flocs present and, in one case, to the silica content of the juice.

Effect of sugar factory location on average hauling distance of harvested cane. C. M. R. Draijer. *Proc. 16th Congr. ISSCT,* 1977, 2873-2886.—While location of a factory in the exact centre of a circular or rectangular cane area may minimize total cane haulage where the yields are uniform throughout, other factors may supervene, such as e.g. the depth and cost of factory foundations at different sites. Where yield is not homogeneous, location near the high-yielding part of the cane area may reduce haulage, and where the area is not regular, the average haulage from individual sections must be known to identify the most economical location for the factory.

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[1] See also Merle: *I.S.J.,* 1978, **80,** 374.

[2] UK Patent 1,397,927; US Patent 3,926,662; *I.S.J.,* 1978, **80,** 89; 1979, **81,** 28.

A mathematical method is set out for such calculation and the results presented in formulae and tables, with an explanation of application of the method.

The mode of action and the effects obtained by the use of surface-active agents in the boiling process. J. Lodos and I. Díaz. *Proc. 16th Congr. ISSCT,* 1977, 2887-2895.—Experiments when boiling in two adjacent identical pans showed that, of two surface-active agents, only one reduced the final molasses viscosity at concentrations up to 24 $g.m^{-3}$ while boiling time was reduced but not significantly. In further trials with four agents, only one reduced the viscosity by up to 11% at 48 $g.m^{-3}$. Two agents gave higher heat transfer coefficients and laboratory trials showed that the rate of evaporation was improved by a third agent. The reduced boiling time results in less sugar loss and greater volumetric efficiency which, in the case of one agent, "Espumol C", can reach 30%.

Action of some bactericides on raw sugar cane juice. H. G. Ayala, D. Bravo L., A. Delfini and C. A. Gargiulo. *Proc. 16th Congr. ISSCT,* 1977, 2909-2922. Freshly extracted cane juice was placed in 7 sterilized flasks, one as a control and with bactericides added to each of the others. The flask contents were homogenized and subdivided into samples which were maintained at 30°C and taken for analysis immediately and at intervals of 2 hours. The analyses included Brix, pol, apparent purity, reducing sugars by the Lane & Eynon method, pH and titratable acidity. The results are recorded in tabular and graph form and indicated that best results were obtained using an unspecified chlorinated organic compound at a dosage of about 1000 ppm.

Juice composition and its influence on scaling formation. N. A. da Glória and E. da Silva. *Proc. 16th Congr. ISSCT,* 1977, 2923-2936.—Scale formation and clarified juice, syrup and molasses analyses were correlated with the amount and type of lime used for clarification at a sulphitation white sugar factory in Brazil. From the results, which are tabulated, it is concluded that dolomitic lime does not give favourable results in respect of the amount of scaling and it also increases the MgO content of the juice syrup and molasses. A high sulphate content in clarified juice, with a relatively low Ca content, tended to increase the sulphate content of syrup and molasses. Best results were obtained when hydrated lime was used for neutralization.

A study of core sampling and direct analysis of sugar cane. A. C. Sturion. *Proc. 16th Congr. ISSCT,* 1977, 2937-2950.—When using a horizontal core sampler it was found that at least 15 cores were needed to give a representative sample of the load at the beginning and end of the season but 10 were adequate in the middle. Three cores were better than a single core but gave variable results owing to the heterogeneity of the load. The larger numbers of cores increase the work involved in sampling and sample preparation for analysis, however. The hydraulic press method is more rapid and gives less variation in analytical results than the cold digestion method, but for its application it is necessary to transform pol % press juice to pol % absolute juice by applying a correction coefficient according to the fibre % cane. The same method determines indirectly the fibre % cane through the weight of press cake without loss of precision.

Various constituents of sugar cane juice affecting settling in the sulphitation process under Indian conditions. S. C. Sharma. *Proc. 16th Congr. ISSCT,* 1977, 2951-2969.—The effect of various non-sugars present in cane juice, such as phosphates, gums, starch, soluble silica, nitrogenous non-sugars and tannins, has been studied in relation to settling behaviour. A clarification procedure which has been useful in overcoming the difficult settling characteristics of certain juices and causing these to settle properly and smoothly has been developed and tested with success. It involves use of a high initial juice temperature, heavy dosing of lime at the pre-liming stage and also at the simultaneous liming and sulphitation stages.

Effects of increasing quantities of trash on sugar cane milling. F. A. Fogliata, H. G. Ayala, A. Delfini and D. Bravo L. *Proc. 16th Congr. ISSCT,* 1977, 2971-2981.—The effects of milling cane containing up to 20% of trash were studied by a series of experiments. The most noteworthy effects were a decrease in the quantity of juice extracted and an increase in the amount of bagasse as the trash content rose, but there was also a serious reduction in juice quality expressed as pol % juice, purity and rendement resulting from the treatment corresponding to 4% of trash. The pol % cane, pol % bagasse and Java ratio decreased with increased trash. The Java ratio is inversely related to fibre % cane and bagasse % cane and directly related to juice extracted. A further harmful effect is the extra power required for milling with increased quantities of trash.

Pilot plant tests on applying decolorization processes together with defecation for white sugar manufacture. C. S. Lee. *Proc. 16th Congr. ISSCT,* 1977, 2983-2996.—The carbonatation process for mill white sugar produces large quantities of highly alkaline filter cake which is difficult to dispose of while the process also has disadvantages as regards control and labour requirement. Tests were made on a number of treatments of juice which was merely limed and settled, as in raw sugar manufacture; these included variation of carbonatation plus sulphitation and sulphitation alone, with and without additional treatment with activated carbon. Best results were obtained when the juice from the clarifier, at 100°C and pH 6·4, was cooled to 55°C, limed to pH 11·0, sulphited to pH 10·4, filtered, about 300 ppm of phosphoric acid added to pH 9·8, followed by sulphitation to pH 6·5, addition of 0·5% of activated carbon on weight of sugar, filtration, evaporation and boiling to sugar. Colour removal between juice and syrup was 97·22% and the process gave white sugar of as good quality as the carbonatation process but at lower cost.

Computer simulation studies of juice flow models in the continuous carbonatator and sulphitator. C. H. Chen, Y. C. Cheng and J. F. Tong. *Proc. 16th Congr. ISSCT,* 1977, 2997-3009.—A computer simulation method can be used to study the juice flow pattern in continuous carbonatation and sulphitation or other bubble-type gas-liquid reactors. This simulation method is based on a macroscopic lumped-population balance concept. After the model of residence time distribution functions [differential equations of $F(\theta)$ and $E(\theta)$] is

built, the numerical method of Runge-Kutta-Gill is applied to solve the differential equations. According to the results of this simulation, a circulation pump is suitable for modifying the degree of mixing of a liquid of high viscosity and a gas at a low rate of flow, and the location of the baffle is, in most cases, not important.

The clarification of the juice from unburned and burned canes. A. A. Delgado. *Proc. 16th Congr. ISSCT,* 1977, 3023-3030.—Juices from unburned cane, cane cut immediately after burning, and cane burned and left standing in the field were clarified by the simple sulphitation-defecation process. After boiling for two minutes the juices were left to stand in graduated cylinders for settling. This procedure was repeated six times, at two-day intervals after burning, and the experiment carried out three times during the 1971/72 harvesting season. The results show that the clarification process used works well for purification of juice from all three categories of cane if they are processed up to two days after burning and harvesting. Beyond this interval the juices become more difficult to clarify and this may affect the later sugar processing operations. Simple sulphitation-defecation is moderately efficient for the clarification of juice from unburned cane or cane burned and cut immediately, but it does not succeed if burned cane is left standing in the field for longer than two days before harvesting.

Desugarization of cane molasses by the Finnsugar chromatographic separation process. H. Hongisto and H. Heikkilä. *Proc. 16th Congr. ISSCT,* 1977, 3031-3038. The Finnsugar process for beet molasses[1] can be applied to cane molasses, but more comprehensive pretreatment is necessary, consisting of phosphate precipitation and centrifugal clarification as well as deliming in ion exchange softening columns. By means of the process, involving chromatographic separation on a column of ion exchange resin, 50-75% of the sucrose content may be recovered as crystal sugar, while, if desired, the products can include invert syrups or liquid sugars.

Clarification of *C*-melt by centrifuging and flotation improves boiling house recovery and crystal colour of commercial sugars. N. L. C. Suzor. *Proc. 16th Congr. ISSCT,* 1977, 3069-3081.—Recirculation of 10-15% of the non-sugars of *C*-massecuite in the form of remelted *C*-sugar reduces the quality of raw syrup. This recirculation was reduced at Honokaa Sugar Co. during the last two months of the 1976 season by clarifying all the *C*-melt by a combination of centrifugation, phosphodefecation and aeration-flotation in the presence of 5-10 ppm of an anionic polymer additive, and separation of the clarified melt in a 30-minute retention clarifier. Average colour removal was 34% (measurement at 420 nm and pH 7·0) and conductivity ash removal averaged 14% (with a peak of 27% when a purity increase of 4 units was achieved). *A*- and *B*-massecuite exhaustion was improved by 4% and 2%, respectively, while there was a 5% decrease in the pol lost in final molasses and 16% reduction in crystal colour. Raw syrup treated in the same manner showed reductions of 19-26% in colour, 28-61% in turbidity and 10-20% in ash content. A material balance indicates that the additional recovery obtained with *C*-melt clarification is increased 4-8 times when syrup is clarfied.

Purification of juice at Santa Lydia sugar mill. Liming—heating. J. C. Gaiofatto and A. T. Sobrinho. *Proc. 16th Congr. ISSCT,* 1977, 3083-3097.—Cane received at Usina Santa Lydia is 70% mechanically harvested and not washed so that the mixed juice contains sand and clay. The clarification system includes settling to remove sand, weighing, preheating, sulphitation, liming, heating and sedimentation. A new system has been introduced to permit automation and a minimum retention time, with uniformity of pH and temperature in juice sent to the clarifier. The juice is limed with a slurry at 8-9°Bé made up in clarified juice and using 1·6 kg of 68% CaO per tonne of cane. A three-compartment mixing tank is employed with baffles whereby the juice and lime slurry pass in alternate directions before overflowing into the next compartment. pH is controlled automatically and a large capacity pump recirculates the juice twice before final heating and settling. Two sets of heaters each consisting of three units in line are employed with hydraulically or pneumatically operated valves whereby each set is used alternately to heat the limed juice from 55° to 105°C and, at 6-hourly intervals, to heat mixed juice from the mill before it is sent to the sulphitation column. The mixed juice, being acid, facilitates cleaning of scale deposited in the heaters from the limed juice. The system has reduced maintenance costs, wear and labour costs and increased cleanliness and uniformity of pH, sulphitation and temperature.

Preliminary experiences with a continuous pan boiling *C*-massecuite. W. S. Graham and D. J. Radford. *Proc. 16th Congr. ISSCT,* 1977, 3099-3112.—A 64 m³ continuous Fives-Cail Babcock vacuum pan was installed at Tongaat and was intended to boil all the *C*-massecuite. Its capacity did not reach expectations, however, but was markedly improved by steam injection under the calandria and by bringing the feed plus admixed steam nearer the centre of the pan. Originally, control of feed was based on measurement of supersaturation at three points, and this took a long time to reach a steady state and was also unstable, being badly affected by a change in the Brix of the *B*-molasses feed. Electrodes were fitted to every compartment and individual feed valves for each, which greatly improved control and eliminated the need for operator attention under normal boiling conditions. The *C*-massecuite produced had a larger spread of crystal size but the proportion of very small grain was no greater than with boiling in batch pans. Exhaustion was similar to that attained previously in batch pans.

Honiron "Hi-Extractor". P. Triviz. *Mem. II Conv. Nac. Tecn. Azuc. Mexico,* 1972, 193-203; through *S.I.A.,* 1978, **40,** Abs. 78-254.—The "Hi-Extractor" and its operation are described, 2-stage operation of the system and conversion of a milling tandem to it are outlined and the simplicity of maintenance is emphasized.

Use of reactive dolomitic lime during the 1971-1972 season at factories in Mexico. J. M. Zuazua N. *Mem. II Conv. Nac. Tecn. Azuc. Mexico,* 1972, 187-192; through *S.I.A.,* 1978, **40,** Abs. 78-257.—Results obtained at Plan de Ayala and Navolato factories were similar to those obtained using MgO in Hawaii: lower purity and yield of molasses, higher sugar yield and less scaling of evaporators.

[1] Hongisto: *I.S.J.,* 1977, **79,** 100-104, 131-134.

BEET SUGAR MANUFACTURE

Control of a continuous diffuser from an on-line refractometer. G. Windal. *Sucr. Franç.*, 1978, **119,** 145-147 (*French*).—Mention is made of the favourable results obtained in tests on automatic control of the water:cossette ratio in a De Smet diffuser from refractometric Brix measurements, adjustment being made automatically for those parameters which cause variation in the ratio and hence influence sugar extraction from the cossettes. A trace sample is reproduced.

Preliminary work on application of the assisted management system. G. Windal. *Sucr. Franç.*, 1978, **119,** 153-155 (*French*).—Preliminary tests on the system previously described[1], involving *A*-massecuite boiling at Villenoy, are briefly discussed. A chart section showing the level in the standard liquor tank is reproduced. Results obtained were favourable, with good sequence of operations and reduction in level fluctuations.

Formulation of processing instructions for sugar factory boiling houses in which all the thick juice is boiled. J. Buriánek and M. Kmínek. *Listy Cukr.*, 1978, **94,** 32-41 (*Czech*).—Algorithms and computerized processing schemes are presented for two Czechoslovakian factories in which the only feedstock for the boiling house is the factory's own thick juice, none being introduced from other factories. Statistical evaluation of given parameters has been used to establish optimum values for off-line control based on three variables: sugar yield, ratio of sugar content in high-purity massecuites to that in intermediate massecuites, and the ratio between 2nd and 3rd liquor quantities.

Some problems with the water economy at Brodek sugar factory. V. Lochman. *Listy Cukr.*, 1978, **94,** 41-48 (*Czech*).—Details are given of the schemes used for fresh water supply and process water recycling at Brodek factory whereby water consumption and waste water quantity are kept to minimum levels.

Determination of the optimum flocculation point in preliming and first carbonatation. F. A. Baczek and V. M. Jesic. *Seker*, 1977, **27,** (105), 36-37 (*Turkish*).—See *I.S.J.*, 1975, **77,** 217.

Thoughts on the spectrophotometric determination of the optimum flocculation point in juice purification. N. Sendökmen and O. C. Akyar. *Seker*, 1977, **27,** (105), 38-40 (*Turkish*).—The method described in the article by Baczek & Jesic[2] is criticized on various grounds. Because of the wide range of optimum pH values found (10·6-11·6) at which colloid precipitation is maximum, transmittancy should be measured at greater frequency for the purposes of accuracy. However, the range is far greater than cited in the literature (10·8-11·2), and the authors of the present article have observed optimum values above 11·2; investigation of a greater number of samples is therefore thought necessary. Should the pH in preliming slightly exceed the optimum, this is not considered important, and in the original article a rise in pH from 11·2 to 11·5 is shown to be accompanied by only a negligible change in transmittancy. Insufficient importance was attached to the questions of whether mud was recycled or the liming progressive or not. Distortion of the results could occur in 1st carbonatation juice settling as a consequence of adsorption of some colour by the "Separan" and $CaCO_3$ particles. The method is considered difficult to use in practice because of considerable fluctuation in the temperature effect on pH; the authors of the present article have found 1st carbonatation juice pH varying from 0·06 to 0·40 for every 10°C.

Plate-type settlers and their potential applications. S. Bednarski. *Gaz. Cukr.*, 1977, **85,** 274-276; 1978, **86,** 7-8 (*Polish*).—The designs of various plate-type settlers are described and their potential use in the sugar industry for water and juice treatment briefly discussed.

Mechanized handling of limestone. J. Wolański and M. Trepka. *Gaz. Cukr.*, 1978, **86,** 8-11 (*Polish*).—Details are given of the system at Szczecin sugar factory for unloading of limestone from rail trucks and feeding it to the storage site and thence to the kiln.

Choosing starting and finishing dates for the sugar campaign. G. Sobczyk. *Gaz. Cukr.*, 1978, **86,** 11-14 (*Polish*).—Average values of root and leaf weights and sugar content are given for specific dates and ranges of dates after August 31 in Poland during the period 1971-76. The author then calculates the losses and gains resulting from variation in the beet campaign starting and finishing dates. Where it is a question of a long campaign, it is considered best to start lifting early in September before the beet are fully ripe. While this will give a greater sugar yield than is obtained with later harvesting, the root yield will be lower, although so too will be the sugar production costs, so that the monetary advantages will far outweigh the disadvantages.

The new evaporator effect of 3200 m² heating surface at Platy sugar factory. P. Christodoulou. *Sucr. Belge*, 1978, **97,** 79-90 (*French*).—See *I.S.J.*, 1977, **79,** 232.

The sugar beet system. A theoretical model for a new approach. M. G. Koukios. *Hellenic Sugar Ind. Quarterly Bull.*, 1978, (32), 3-66 (*Greek*).—The sugar beet and its agro-industrial handling are examined from the viewpoint of the total biomass yield. Four main phases occur where there is separation of intermediate and waste products: (1) harvesting, which separates the tops from the roots, (2) diffusion, which separates the juice and pulp, (3) clarification, which separates juice and mud, and (4) boiling, where sugar and molasses are separated. The waste products, representing 57·5% of the total biomass, are of considerable value for use as feed-stock in production of chemicals as well as for use as fuel, fodder, etc. Hence, the statistical investigation

[1] Giorgi & Windal: *I.S.J.*, 1978, **80,** 376.
[2] *Zucker*, 1974, **27,** 475-476; *I.S.J.*, 1975, **77,** 217.

carried out by the author offers a new approach to beet processing in which attention is paid not only to the production of sugar but also to optimum separation and use of the by-products.

Industrial tests on a new design of progressive counter-current prelimer. L. P. Reva, V. V. Pyshnyak and M. I. Zhenchuk. *Sakhar. Prom.*, 1978, (4), 24-28 (*Russian*).—A new patented prelimer is described which comprises a tower separated horizontally into six sections by five baffles slightly sloping towards the central hollow rotary shaft. Each baffle extends over almost the complete cross-section but not quite; at its free end is a vertical wall, extending half-way to the baffle above, which ensures that none of the fresh juice escapes contact with treated juice of higher alkalinity. The walls are alternately on the left and right of the baffle, creating a zigzag pattern for the vertical juice flow. At the central shaft and midway between each pair of baffles is a rotating unit made up of two lower solid half-discs and two upper half-rings, with twelve curved paddles in a catherine wheel arrangement sandwiched between the upper and lower sections; these units help draw the juice of higher alkalinity from the section immediately above and also function as mixers. The fresh juice, fed laterally at the bottom of the tower, flows up until it reaches the top section which is provided with a mixer for juice and milk-of-lime fed through a port in the top section. ($CaCO_3$ in the form of filter cake is also fed into the tower at slightly below the midway point.) Some of the treated juice is discharged from the top section, while the remainder is allowed to flow through the sections against the flow of untreated juice. A rotary paddle with chains attached to it is located at the bottom of the tower to prevent mud settling. Test data are tabulated, showing that, in terms of colloid content, lime salts and purity, the prelimer performed better than a Brieghel-Müller prelimer.

Raw juice carbonatation with separation of preliming mud containing no calcium carbonate. V. M. Priimak *et al. Sakhar. Prom.*, 1978, (4), 29-31 (*Russian*). Laboratory tests of a juice purification scheme in which preliming was followed by centrifuging to remove the mud showed that the sedimentation and filtration properties of 1st carbonatation juice were better by comparison with conventional carbonatation (where 1st carbonatation juice was recycled at 100% on predefecation juice), the colour content of 1st and 2nd carbonatation and thick juice was lower and 2nd carbonatation lime salts and colloids content also lower. When low-quality beets were processed, the effectiveness of the new system was even more pronounced. Lime consumption was also lower with the new method, for which optimum conditions were established.

Use of polyelectrolytes in processing frozen and thawed beets. A. A. Ivanyuk. N. S. D'yachenko, V. G. Tsygura, R. G. Zhizhina and V. A. Kanibolotskii. *Sakhar. Prom.*, 1978, (4), 31-34 (*Russian*).—Laboratory and factory trials of 1st carbonatation juice treatment with flocculants [0·1% solutions of partially hydrolysed polyacrylamide (PAA) and carboxymethyl cellulose (CMC)] showed that both accelerated juice settling and improved the filtration properties of the mud, although the effects were achieved with only 0·001% PAA in contrast to 0·1% CMC on weight of beet; however, CMC has the advantage of being more readily soluble and easier to dose. The results were obtained with juice from poor-quality beets, and it is recommended to establish optimum dosage rates as a function of beet quality.

Use of ion exchange resins for 2nd carbonatation juice purification. V. P. Meleshko, T. A. Klochkova, M. M. Mit'kova, A. Yu. Gadzhiev and A. S. Korol'kov. *Sakhar. Prom.*, 1978, (4), 34-37 (*Russian*).—Ion exchange treatment of 2nd carbonatation juice with KU-2 cation exchange resin in Na^+ form followed by KU-2-8 and AV-17-8 resins in H^+ and OH^- forms, respectively, was tested on both laboratory and factory scale. The treated juice was evaporated and the thick juice purity, colour content and pH compared with those of thick juice which had not been treated by ion exchange. The results demonstrated the effectiveness of ion exchange treatment in raising purity and reducing colour. Moreover, it increased sugar recovery and reduced molasses sugar, purity and yield (the last-named parameter by up to 80%).

Centralized control and telecommunications for technological processing. B. A. Eremenko, O. D. Kurilenko, N. A. Shut and E. I. Murashko. *Sakhar. Prom.*, 1978, (4), 40-43 (*Russian*).—Details are given of the central control scheme used at Zhabinka sugar factory, which includes remote control of process parameters as well as a loudspeaker and telecommunications system linked to all factory sections. Advantages of the system, which has permitted attainment of a high efficiency, are indicated.

Modernization of vacuum filters at Turbovsk sugar factory. V. R. Maevskii and V. M. Semenisova. *Sakhar. Prom.*, 1978, (4), 44-45 (*Russian*).—Modifications to Soviet BOU-40 vacuum filters are described. The alterations led to a 150% increase in throughput at a reduced filter cake loss of 0·10% by weight of beet.

Modernization of B-40 vacuum filters in the form of moving belt vacuum filters at Korenovsk sugar factory. N. G. Lila *et al. Sakhar. Prom.*, 1978, (4), 45-48 (*Russian*).—Details are given of the creation of moving belt filters out of conventional B-40 filters, whereby the filter cake loss was reduced by 0·03% absolute on beet weight and the throughput increased by 40-60% by comparison with the original filters.

Determination of the juice retention time in a beet sugar factory evaporator. B. A. Matvienko, N. Yu. Tobilevich and V. A. Ardashev. *Sakhar. Prom.*, 1978, (4), 53-58 (*Russian*).—Investigations are reported on determination of juice retention time in evaporator effects using lithium chloride as tracer.

Note on evaporator tube corrosion. Anon. *Sucr. Maghrébine*, 1977, (21-22), 27-31 (*French*).—Case histories from five Moroccan factories are reported, in which the state of evaporator tubes over a number of campaigns is indicated and causes of corrosion investigated. Recommendations are given on means of preventing corrosion.

BMA centrifugals. Anon. *BMA Information*, 1977, (16), 32-36.—Details are given of BMA batch and continuous centrifugals and of the baskets available for use in them.

SUGAR REFINING

The effect of raw sugar components on refinery filtration. E. Whayman and T. W. Meredith. *Proc. 16th Congr. ISSCT,* 1977, 2581-2585.—Flocculants, dextran, cane starch and corn starch fractions have been added to raw sugar melts used in laboratory-simulated carbonatation and phosphatation-flotation refinery clarification. Filtration tests on the resultant liquors indicate that flocculant residues from cane juice clarification should cause no problems in either refinery process. Amylopectin has been shown to upset the coagulation of phosphatation scums, while sugar from deteriorated cane seems to present more refining problems than those due to the dextran content alone.

Beverage floc and cane sugar. M. A. Clarke, E. J. Roberts, M. A. Godshall and F. G. Carpenter. *Proc. 16th Congr. ISSCT,* 1977, 2587-2598.—See *I.S.J.,* 1978, **80,** 197-202.

Melt phosphatation and sugar quality. M. Matic, F. M. Runggas and G. S. Shephard. *Proc. 16th Congr. ISSCT,* 1977, 2657-2665.—A number of raw sugars, containing various amounts of impurities, were subjected to melt phosphatation under standardized conditions and the resulting clarified liquors were analysed and their filtrability constants determined. The amount of the impurities removed (colour, gums, starch) was a virtually constant percentage so that the quality of the clarified liquor is directly proportional to the melt quality. The efficiency of impurity removal can be increased by addition of cationic surfactants but at a substantial additional cost. Provided the correct air:solids ratio is maintained, turbidity-free liquor may be obtained without addition of flotation agents; however, the concentration of residual calcium phosphate in clarified liquor will depend on the amount of starch present in the raw sugar.

Sugar refining research and development in South Africa. Anon. *Ann. Rpt. Sugar Milling Research Inst.,* 1977, 13-14.

Application of flocculants in the carbonatation process: In experiments on the use of flocculants for refinery liquor carbonatation, addition of flocculant 30 or 45 minutes after seeding with $CaCO_3$ crystals was found to be optimum with regard to colour and filtrability. The efficiencies of certain specific flocculants were determined at various dosage rates. At 50-100 ppm, the flocculants caused a considerable increase in foaming; to prevent this, addition was made to the carbonatated liquor immediately before filtration. Initial results showed that this gave a reasonable increase in colour removal, but starch and gum removal was not affected. No change in filtrability was observed with "Superfloc" flocculants, whereas it fell significantly with "Floccotan C" and "Floccotan D". Best overall results at 100 ppm had been given by flocculants in the "Superfloc" series and "Floccotan D".

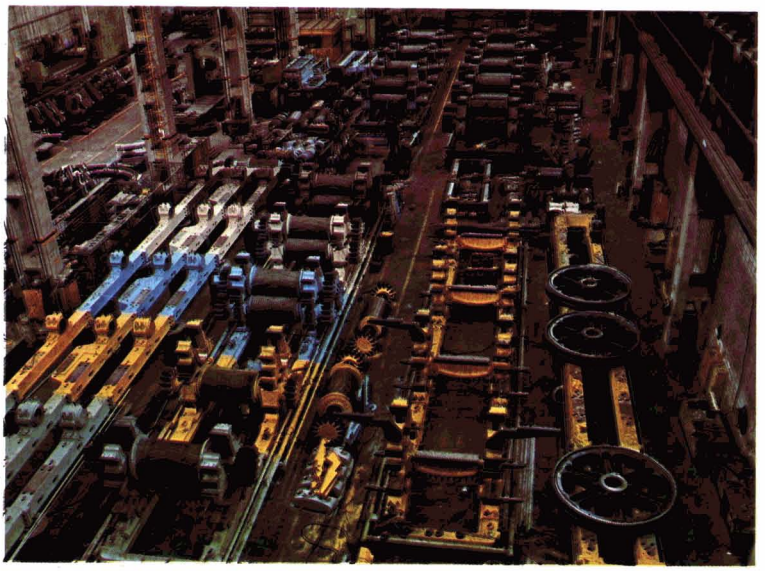
Elimination of acid floc: The conditions necessary to inhibit flocculation in phosphated refined sugar liquor of 60°Bx were determined by filtration of sugar solutions at various temperatures through membranes and filter aids. It was found that the larger the membrane pore size the greater was the amount of floc formed and the lower the filtration temperature required to eliminate it. Solutions filtered through membranes of 0·45 μ pore size remained floc-negative even at 80°C, whereas all solutions filtered at or below 50°C were floc-negative, irrespective of their initial turbidities, with membrane pore sizes of up to 1·2 μ. Raw sugars were rendered floc-negative when passed through filter aid at temperatures of or below 65°C; at higher temperatures, the quantity of floc formed was considerably reduced, the filter aid efficiencies being in the order "Celite 505">kieselguhr 33063>"Celite 535". Efficiency was enhanced by increasing filter cake thickness. Similar results were observed after laboratory melt phosphatation and with refined sugars. "Celite 505" was efficient up to 70°C. "Celite Filter-Cel", a very fine grain filter aid, rendered all phosphated and refined sugars floc-negative, even at 80°C, but the flow rate of a 60°Bx solution through it was 4-5 times lower than through "Celite 505".

Refining with granular carbon: fixed beds or moving beds? E. Krauss Perdomo. *Mem. II Conv. Nac. Tecn. Azuc. Mexico,* 1972, 205-218; through *S.I.A.,* 1978, **40,** Abs. 78-274.—In 1971, La Providencia refinery changed over from a moving-bed system to a fixed-bed one; the systems are described with diagrams and compared. The old system used four 30-ft cisterns each with upward liquor flow at 8 ft.hr^{-1} and slugging of a 1-ft layer of carbon every 8-13 hr; the new one uses eight 20-ft cisterns each with downward liquor flow at 4 ft.hr^{-1} and complete emptying for regeneration every 18-22 hr. The new system gives clear syrup without polishing filtration, owing to back-washing before operation of each cistern, whereas the old system required filter aid to remove fine carbon particles from syrup. The new system is easier to control and permits flow variation, and also does not generate conglomerates of granules; its loss of carbon is 35% lower than with moving beds.

Method of calculation for determining the usage of carbon in contact filtration operation. A. Curbelo S. *Centro Azúcar,* 1977, **4,** (1), 29-37 (*Spanish*).—The paper aims to establish a method for determining carbon consumption which can be applied industrially to any refinery using contact filtration. The method is based on the determination of the equilibrium isotherms for the different changes in the colour of treated liquors, within the normal working ranges. The isotherms are a function of the time for adsorbent and liquor to come to substantial equilibrium. Laboratory and factory-scale tests, made at Central George Washington, were used to study the influence of variables in order to choose the best values and working conditions and, based on the results attained and statistical analysis, the method is proposed.

Tienen. Anon. *Sucr. Belge,* 1978, **97,** 120-134 (*French/English*).—An illustrated description is given of the sugar refinery of Raffinerie Tirlemontoise S.A. of Tienen, Belgium, with a diagram relating the refinery to the adjacent beet sugar factory and a process flow-sheet.

EVERY STAGE OF SUGAR PRODUCTION REQUIRES THE BEST SOLUTION. DEDINI.



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NEW BOOKS

Australian sugar '79. Anon. 16 pp; 20·5×20·5 cm. (CSR Ltd., G.P.O. Box 1630, Sydney, Australia 2001.) 1979.

This booklet is the latest edition of an annual publication for schools, designed as an educational aid and free of charge to Australian students and teachers. It provides a colourful and interesting introduction to many aspects of cane growing and sugar production in Australia, emphasizing the skill needed by the people involved in this important industry.

De Nederlandse Suikerindustrie. 64 pp; 21×15 cm. (Suikerstichting Nederland, Postbus 7498, Amsterdam, Holland.) 1979.

This small booklet has been produced for distribution (to those who read Dutch) at the 1979 meeting of the C.I.T.S. in Amsterdam. It is in six sections describing the history of sugar, the role of the sugar beet in agriculture, EEC and world sugar politics, sugar manufacture, the sugar industry and the environment, and sugar as a foodstuff.

1879 HVA 1979. 112 pp; 18·3×25 cm. (HVA Group of Companies, Nieuwe Zijds Voorburgwal 162, Amsterdam, Holland.) 1979.

This well-illustrated book is a record of the activities of the HVA Group to mark its Centenary. Originally founded as a trading company between Holland and the then Dutch East Indies, HVA (Handels Vereeniging Amsterdam or Amsterdam Trading Company) handled imports for and shipped the produce of estates in Java, Sumatra, etc. Low coffee and sugar prices in the economic depression of the 1880's prevented some estates from repaying loans advanced, so that by 1892 HVA had taken over five coffee estates and a sugar factory. Subsequently the company became interested in large-scale agriculture, clearing waste land and planting it with cane, coffee, cassava and sisal. The general trading interests were sold in 1910 and HVA turned also to rubber and palm oil production, so that by 1928 HVA owned 35 estates with a variety of crops, including sugar plantations producing some 400,000 tonnes of sugar per year.

The crisis years from 1930 on effectively stopped expansion and difficulties continued up to World War II. The HVA estates were occupied by the Japanese from March 1942 and many HVA employees, European and Indonesian, died in the period up to liberation in 1945. Further destruction to estates occurred in the military actions between the end of the war and Indonesian independence in 1949, while nationalization of Dutch-owned property in 1957 brought to an end the near 80 years of HVA's work in the country.

A new chapter began in 1951 when the company began cane cultivation in Ethiopia, employing its expertise of many years in establishment of three estates. After the political changes of 1974 a majority shareholding was taken by the Ethiopian Government in 1975 and the company deprived of all income from the vast investments made in the previous 25 years. Compensation from Indonesia for lost assets is to be paid during 1979-2003 and doubtless settlement of compensation promised by Ethiopia in 1975 will be forthcoming ultimately.

HVA has now turned its attention and energies to tropical and sub-tropical lands where much remains to be done to improve living standards, and is associated with government-owned sugar factories and estates in various African countries as well as pioneering palm oil industries in Brazil and Surinam. Instead of again becoming an estate proprietor it has reverted to a trading company, but now trading in the knowledge and experience gained over the years since 1879.

The South African sugar year book, 1977-1978 edition. 198 pp; 21·5×28 cm. (The South African Sugar Journal, P.O. Box 1209, Durban, Natal, South Africa.) 1978. Price: R6.00.

This reference book to the sugar industry of South Africa contains, as in past editions, a number of interesting articles on various aspects of sugar in that country, including a current assessment of the Eldana borer problem, new varieties, Experiment Station activities, etc. There then appear reports of the South African Sugar Association, the Cane Growers' Association, Sugar Millers' Association, Sugar Technologists' Association and the Sugar Milling Research Institute, while the 53rd Annual Review of the milling season in Southern Africa (South Africa, Swaziland, Malawi and Mozambique, for 1977/78) is presented by J. P. Lamusse, with a wealth of detail in text and tables.

A reference section gives details of the structure of the industry with the various organizations and their members and staffs. The sugar milling companies of South Africa are recorded with details of their Boards of Directors, senior staff, factory equipment, etc., and corresponding information, where available, presented for enterprises in a number of countries neighbouring South Africa, including Angola, Kenya, Malawi, Mauritius, Mozambique, Réunion, Rhodesia, Somalia, Swaziland, Tanzania, Uganda, Zaire and Zambia. The final section of this attractive and well-printed volume is devoted to statistics of cane crushed, sugar production, crop data, prices, consumption, etc. and to mill and sugar company office address and telephone numbers.

Sugar: Science and technology. Ed. G. G. Birch and K. J. Parker. 475 pp; 14×22 cm. (Applied Science Publishers Ltd., Rippleside Commercial Estate, Barking, Essex, England.) 1979. Price: £32.00.

An industry-university cooperation symposium was held at the University of Reading under this title in April 1978 and the present volume records the 22 papers presented during the five sessions, with the ensuing discussions, together with a list of contributors and an introduction by Mr. E. Rolfe, Principal of the UK National College of Food Technology. A number of the papers are concerned with technology and will be abstracted in our pages in due course, while others are concerned with dextrose and other carbohydrates both as sweeteners and as chemical raw materials, and yet others are concerned with dietary and medical aspects of carbohydrate sweeteners, including sugar.

Las investigaciones cañeras en el Instituto de Investigaciones de la Caña de Azúcar. M. Anderez V. 9 pp; 20·5×27 cm. (Instituto de Investigaciones de la Caña de Azúcar, Academia de Ciencias de Cuba, La Habana, Cuba.) 1973.

A report is presented on the range of studies carried out by the Cuban Sugar Cane Institute in the late 1960's and early 1970's. These have been concerned with agronomy (row spacing, planting depth, weed control, etc.), soils and fertilizers, plant protection (pest and disease control) and cane breeding and cytogenetic studies.

Abstracts of publications (1912-1978). S. Krishna and R. B. Gaddagimath. 208 pp; 20×28·5 cm. (Sugarcane Breeding Institute, Coimbatore, Tamil Nadu, India 641 007.) 1978.

At the time of the Golden Jubilee of the Institute in 1962, a bibliography was prepared of papers published by members of the staff during the previous 50 years. It included 354 abstracts while, in the 16 following years, a further 251 papers were published by staff members. Consequently this new volume has been produced which updates the original work to 1978. The abstracts are classified by main subjects and sub-headings within these; they are then listed in chronological order and give the author's name and initials, paper title, journal reference and abstract. An author index is provided.

Queensland Canegrowers Annual Report 1979. 36 pp; 20·5×27·5 cm. (Queensland Cane Growers' Council, G.P.O. Box 1032, Brisbane, Queensland, Australia 4001.) 1979.

This beautifully printed report, with many full colour illustrations, records the activities of the QCGC in 1978 but also provides much information on the sugar industry of Australia. The history of the establishment of the McKinnon inquiry into Australian domestic sugar price and supply is recorded with an account of the submissions presented. The economic position of cane growers is set out with an analysis of the progressive decline in incomes and increase in costs. The effects of the International Sugar Agreement are described and notes presented on other export marketing developments. Statistics of sugar production and prices, and cane assignments are tabulated, as well as other aspects of the Queensland sugar scene. The work of the Bureau of Sugar Experiment Stations is summarized, and an account given of world developments in the use of sugar cane products for fuel and other alcohol manufacture. A description is given of the 1978 crop in both Queensland and New South Wales, as well as information on the various organizations with which cane growers in Australia are concerned.

Conmonitorio, Campaña 1975-76. 131 pp; 19·5×27·5 cm. (Centro de Investigación y Mejoramiento de la Caña de Azúcar, Casilla 2731, Santa Cruz de la Sierra, Bolivia.) 1977.

This well-printed book is a report by the Director, Ing. Agr. Guillermo Kenning Voss, to the Agricultural Sub-Commission of CNECA which is responsible for the Bolivian Sugar Cane Research Centre, CIMCA. The work carried out in 1975/76 is described under sections entitled: production of seedcane; immediate conservation and recovery programmes; pest and disease control; introduction of improved varieties; and cultivation techniques and use of fertilizers, herbicides, etc., while a separate appendix on meteorology provides data on rainfall, temperatures, relative humidities, etc. in tabular and graph form. A number of the reports include summaries of theses, etc., prepared by the Centre's staff members on various research topics and the overall impression given by the report is that of an efficiently run research station which is providing a most useful service to the Bolivian sugar industry.

Pequeno dicionário açucareiro da lingua portugesa. M. P. S. B. Gonçalves. 16 pp; 21·5×30·5 cm. (Depto. de Informática, Instituto do Açúcar e do Alcool, C.P. 420, Rio de Janeiro, Brazil.) 1978.

This small dictionary of Portuguese sugar terms, prepared by the Librarian of the Brazilian Sugar Institute, is in the form of stencilled sheets bound together and includes 198 Portuguese words or phrases, together with their definitions and ranging from "Açúcar" to "Zona metaestável". It will be very useful to newcomers entering the Brazilian sugar industry, no doubt the readership for which it is intended.

Pequeno dicionário de pragas e doenças de cana-de-açúcar Inglês-Português. M.P.S.B.Gonçalves. 12 pp; 21·5×30·5 cm. (Depto. de Informática, Instituto do Açúcar e do Alcool, C.P. 420, Rio de Janeiro, Brazil.) 1978.

This publication, in the same format as that mentioned above, is a small dictionary of cane pests and diseases, in which the latter, recorded in English and in alphabetical order, are provided with the Portuguese equivalent and, in some cases, with more. A total of 199 terms are included.

Bibliografia: Variedades de cana-de-açúcar. M. P. S. B. Gonçalves. 23 pp; 21·5×30·5 cm. (Depto. de Informática, Instituto do Açúcar e do Alcool, C.P. 420, Rio de Janeiro, Brazil.) 1978.

No less than 452 references to the literature are included in this bibliography on sugar cane varieties compiled by the Librarian of the Brazilian Sugar Institute. They include books—one dating from 1888—research station reports and articles in journals, but the classification system is rather confusing since, while most are recorded by the name of the author, others are listed by the key word of the title.

Bibliografia: Alcool. M. P. S. B. Gonçalves. 47 pp; 21·5×30·5 cm. (Instituto do Açúcar e do Alcool, C.P. 420, Rio de Janeiro, Brazil.) 1978.

With the effort devoted to the production of alcohol from sugar cane materials in Brazil, it is not surprising that the Librarian of the Institute of Sugar and Alcohol should have prepared this massive bibliography for the use of the technologists concerned. It includes 831 references to the literature, mostly in alphabetical order by the author's name but additionally by a key word from the title of the publication. Fortunately a very useful index is provided by subject which refers back to the number of the paper, book or report listed.

LABORATORY STUDIES

Modern trends in sugar analysis. J. Dobrzycki. *Gaz. Cukr.*, 1978, **86**, 1-4 (*Polish*).—A survey (with 45 references to the literature) is presented of modern methods for determining dry solids, sucrose, invert sugar, raffinose (and other sugars), ash, colour and non-sugars in sugar factory products and for white sugar evaluation.

Technique for the determination of turbidity in sugar products. A. Rodríguez, M. V. Peña, E. L. Ramos and J. A. Cremata. *Proc. 16th Congr. ISSCT*, 1977, 3011-3022.—Gel filtration chromatography has been applied to the comparative determination of colloid content in cane sugar factory products using "Sephadex G-200" as fractionating medium. Stability of colloid fractions to sucrose, glycerine and sorbitol solutions as eluants has been tested and 14% sucrose solution is recommended as eluant. Positive deviations from linearity are reported if distilled water is used as eluant. The time stability of colloid fractions protected with 14% sucrose solutions was tested and absorbency readings remained constant for at least an hour after elution. A 0·01 standard deviation (absorbency units) and 1·8% coefficient of variation was found which was judged a good repeatability. A formula is proposed for calculating the turbidity index. It is concluded that the proposed technique fulfils the requirements of a routine control method for the comparative determination of colloid content of cane sugar products.

Preparation of cane samples for analysis by the hydraulic press. J. F. G. Pereira. *Proc. 16th Congr. ISSCT*, 1977, 3039-3045.—Samples of cane were split into two and the subsamples disintegrated using two kinds of ensilage cutter. The Preparation Index of the disintegrated cane was measured by adding portions to a flask containing water and shaking for 10 minutes, and to a digester, also for 10 minutes, and determining the ratio of the pol extracted in the flask to that extracted in the digester. The values obtained showed that the two ensilage cutters gave different degrees of preparation and so give different results when the prepared cane is used for cane analysis, with a 500 g sample of prepared cane subjected to a pressure of 245 kg.cm^{-2} for 1·0 minutes. Thus the conditions of use of the cutters must be modified so as to give a Preparation Index adequate for hydraulic press analysis.

Inorganic constituents of white crystal sugar. N. A. da Glória, A. O. Jacintho and R. F. Santos. *Proc. 16th Congr. ISSCT*, 1977, 3047-3056.—A survey is presented of analyses for Ca, Mg, Na, K, Si, P and S in samples of white crystal sugar of three types ("standard", "superior" and "special") produced by seven factories in the Centre-South area of Brazil. In general, the ash constituents were lower in the superior sugar than the standard and lower still in the special sugar. Of the elements studied, S was present in the highest quantity (325-352 ppm) and Ca predominated among the cations (44-97 ppm). It is considered that more efficient control in sulphitation and liming would give reduced ash content in the white sugars.

Electrochemical rapid determination of invert sugar in sugar solutions. E. Krause, F. Tödt and W. Mauch. *Proc. 16th Congr. ISSCT*, 1977, 3057-3068.—A new method for determining reducing saccharides is described which is based on the periodate oxidation of invert sugar during short reaction times, whereby the periodate consumption is measured voltametrically. Details of the technique and of the instrument are given. Results using the method with samples of press juice and molasses were compared with those using the Luff-Schoorl copper reduction method; conformity was significant, reaching 99% in the case of clarified molasses.

Probabilities for premium, penalty and acceptance of raw sugar colours. A further report on testing for raw sugar quality. J. V. López-Oña. *Sugar y Azúcar*, 1978, **73**, (1), 20-24.—By means of a standard normal curve, the author calculates the probabilities of premium, penalty and acceptance with regard to raw sugar colour content for a number of countries (and Florida) which supply raw sugar to US refiners. The procedure for determining raw sugar colour is also described. It is suggested that raw sugar colour data obtained by the New York Sugar Trade Laboratory for 1977 (covering 30 countries and 4 states) should be supplied to refiners, who would thus have an opportunity to decide if the findings applied to the majority of the raw sugar producers supplying the US market, and that agricultural and processing factors common to producers of low-colour and high-colour raw sugar should be surveyed in order to establish the major causes of high colour contents.

Laboratory research and development in South Africa. Anon. *Ann. Rpt. Sugar Milling Research Inst.*, 1977.

Comparison of pol in juice with sucrose (determined by) GLC: Comparison of juice pol with sucrose determined by gas-liquid chromatography at three factories (6-12 samples per factory) showed that GLC gave slightly lower values at two of the factories. However, more analyses are thought necessary before definite conclusions can be drawn.

Testing of two new instruments: A "Refractomat" digital refractometer, calibrated to give a Brix reading accurate to two decimal places in the range 0-30°Bx, compared favourably with a Bausch & Lomb refractometer. Since the "Refractomat" operates on the principle of measurement based on angle of reflected light (as opposed to transmitted light with conventional refractometers) which involves only the surface of the solution, suspended matter should not interfere with the measurements. It was found that the instrument showed no significant distinction between the Brix of filtered and unfiltered final molasses solution, clarity of the solution had no effect on reproducibility, and repeatability was good. Since operator reading error is excluded and the Brix of unfiltered samples can be read directly, the instrument is considered highly suitable for rapid, accurate Brix measurement. On the other hand, a "Reductomat", based on an electrochemical method of reducing sugars

determination, proved to be unsuitable for use with cane final molasses, apparently because of interference by substances in the molasses.

GLC analysis of sucrose, glucose and fructose: Because of difficulties in maintaining a high accuracy over a long period with open tubular columns, packed columns of 3 mm diameter were used for GLC determination of the sugars, recoveries of which ranged from 96·3 to 106·8% for levulose, 96·6 to 105·6% for dextrose and 99·0 to 100·1% for sucrose in three mixtures of known sugars quantities. In the method used, the monosaccharides are converted to their oximes at 75°C and subsequent silylation is done with trimethylsilylimidazole at below 10°C. Silylation at low temperature is completed in 2 hours. Trehalose is used as internal standard.

Exhaustion of final molasses: In a study to determine the effect of viscosity on exhaustion, molasses sub-samples were boiled down in a special small pan to viscosities ranging from 1000 to 6000 poise at 40°C. Baker's sugar was then added, the molasses equilibrated at selected temperatures for 48 hours, then filtered and analysed. Maximum exhaustion was obtained at 2000 poise at 40°C, no further drop in purity occurring with increase in viscosity. Removal of gum from the exhausted molasses by various means caused 30-60% reduction in viscosity, depending on the molasses, but did not reduce purity, which apparently was still governed by the reducing sugars:ash ratio. On the other hand, addition of gums to the molasses caused a substantial increase in viscosity and a higher purity.

Seasonal effects on sugar quality: Since the gum content of sugar produced towards the end of the season is much higher than at any other time during the season, it has been suggested that reducing the grain size of the sugar might solve the problem. A series of experiments was carried out in which various raw sugar samples of different grain size fractions were prepared and analysed for gums, but no correlation could be found between gum content and grain size. A similar seasonal trend in sugar colour has also been observed but doubts have been expressed as to whether the increase towards the end of the season is true or whether it is due to the analytical procedure used. Comparison was made between the colour values obtained by the standard membrane method and the method using filter aid. Since the average difference was 0·002 units, the increase in sugar colour is regarded as true.

Crystal elongation: Investigation of the effect of kestose isomers on the shape of sugar crystals showed that, of the three isomers, neo-kestose has the greatest influence, resulting in elongation of the crystals along the *c* axis. However, the effect is relatively small and does not explain the formation of long needles sometimes found in low-grade boiling; the involvement of some other, as yet unknown, impurity is suggested. In the presence of kestoses, the sucrose crystallization rate fell considerably.

A new method of determining the pH of thick products in sugar and refined sugar manufacture. N. A. Arkhipovich, L. V. Tantsyura and N. A. Selyagina. *Sakhar. Prom.*, 1978, (4), 51-52 (*Russian*).—A method is described for calculating, by means of formulae and nomograms, the true pH of products of high solids contents, e.g. sugar, massecuite and molasses, where their buffering properties are inadequate to prevent pH changes occurring as a result of dilution.

Experience in application of Venema automated lines for evaluation of the processing qualities of sugar beet. M. Z. Khelemskii *et al. Sakhar. Prom.*, 1978, (4), 48-62 (*Russian*).—Details are given of the automatic tarehouse line manufactured by Venema Automation B.V., of Holland, and its use for analysis of beet and prediction of molasses losses is reported.

Application of capillary gas chromatography to the determination of volatile fatty acids in molasses. J. Hrivnák and M. Medved. *Kvasny Prumysl*, 1976, **22**, (10), 232-233; through *S.I.A.*, 1978, **40**, Abs. 78-320.—Brief experimental details are given of a GLC method developed by the authors. The following acids were found in beet molasses: acetic, propionic, *iso*-butyric, *n*-butyric, 3-methylbutyric, (±) 2-methyl butyric, *n*-valeric and *n*-hexanoic.

Isolation by chromatographic methods of the colorants formed by amino-carbonyl reaction. L. González, A. Lí and M. R. Pérez. *Centro Azúcar*, 1977, **4**, (1), 3-18 (*Spanish*).—Products from a Maillard reaction were submitted to molecular sieve fractionation. The method used employed paper chromatography and paper and gel electrophoresis and the consecutive use of different eluants. UV spectroscopy served to identify the separated substances. The results showed that the true melanoidin has a molecular weight higher than 5000 since the UV absorption spectrum showed a 320 m band and dark colour which is a characteristic property of this compound. During electrophoresis on cellulose acetate with veronal buffer the substances which migrate toward the positive electrode showed the UV spectrum typical of the original melanoidin. It was also confirmed that the colour of the original compound increases with time.

Study of the microflora in cane juices from various industrial units and on semi-industrial scale. T. Sais H. *Centro Azúcar*, 1977, **4**, (2), 3-19 (*Spanish*). Samples from sugar factories and from semi-industrial scale plants included crusher juices, first mill juice, mixed juice, last mill juice, imbibition water, limed juice, filtered juice and clarified juice. These were examined and counts made per gram of soluble solids of yeasts, moulds, coliform bacteria and microbial counts of cultures on five different media, as well as measurements of pH, temperature and Brix of the samples. Counts are also given of the micro-organisms identified. Juices from the extraction contained higher numbers than from the filtration and clarification stages and, where no disinfectant was used, there was an increase from crusher juice to mixed juice. A decrease occurred where disinfectant or heating was employed. Non-acid-producing mesophilic bacteria were encountered in all juices, but fungi were only in juices where hygiene was inadequate. Coliform bacteria were reduced in juices having a temperature above 50°C. Of micro-organisms present, the majority were gram-positive sporogenic bacilli. *Micrococcus* and *Staphylococcus* bacteria were only observed in juices from the extraction stages. The predominant moulds found were *Penicillium* and *Aspergillus* spp., the latter more especially. The principal coliform bacteria present were *Aerobacter aerogenes* var. I as well as var. II and *Escherichia coli* var. I.

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World sugar production 1978/79[1]

	1978/79	1977/78	1976/77
BEET SUGAR	*tonnes, raw value*		
Belgium/Luxembourg	902,000	791,000	732,000
Denmark	441,000	566,000	415,000
France	4,060,000	4,268,000	2,974,000
Germany, West	2,998,000	3,076,000	2,735,000
Holland	1,033,000	905,000	945,000
Ireland	207,000	182,000	189,000
Italy	1,630,000	1,355,000	1,747,000
UK	1,111,000	1,032,000	755,000
Total EEC	*12,382,000*	*12,175,000*	*10,492,000*
Austria	357,000	495,000	416,000
Finland	102,000	70,000	77,000
Greece	353,000	294,000	386,000
Spain	1,187,000	1,197,000	1,407,000
Sweden	339,000	343,000	302,000
Switzerland	107,000	85,000	83,000
Turkey	1,103,000	1,082,000	1,284,000
Yugoslavia	777,000	766,000	650,000
Total West Europe	*16,707,000*	*16,507,000*	*15,097,000*
Albania	20,000	12,000	15,000
Bulgaria	250,000	210,000	240,000
Czechoslovakia	850,000	939,000	620,000
Germany, East	730,000	780,000	560,000
Hungary	553,000	486,000	400,000
Poland	1,800,000	1,850,000	1,800,000
Rumania	700,000	775,000	610,000
USSR	9,100,000	8,825,000	7,350,000
Total East Europe	*14,003,000*	*13,877,000*	*11,595,000*
Total Europe	*30,710,000*	*30,384,000*	*26,692,000*
Afghanistan	15,000	12,000	15,000
Algeria	12,000	8,000	7,000
Azores	15,000	10,000	10,000
Canada	128,000	139,000	163,000
Chile	100,000	132,000	315,000
China	1,000,000	980,000	860,000
Iran	515,000	580,000	666,000
Iraq	13,000	13,000	11,000
Israel	15,000	37,000	39,000
Japan	415,000	364,000	339,000
Lebanon	13,000	14,000	15,000
Morocco	363,000	222,000	337,000
Pakistan	33,000	31,000	37,000
Syria	25,000	21,000	20,000
Tunisia	8,000	12,000	9,000
Uruguay	60,000	49,000	66,000
USA	2,959,000	2,820,000	3,534,000
Total Other Continents	*5,689,000*	*5,444,000*	*6,443,000*
Total Beet Sugar	36,399,000	35,828,000	33,135,000
CANE SUGAR			
Spain	13,000	15,000	22,000
Total Europe	*13,000*	*15,000*	*22,000*
Barbados	120,000	104,000	124,000
Belize	108,000	118,000	96,000
Costa Rica	217,000	192,000	195,000
Cuba	7,100,000	7,457,000	6,607,000
Dominican Republic	1,250,000	1,150,000	1,275,000
Guadeloupe	100,000	81,000	91,000
Guatemala	450,000	410,000	527,000
Haiti	65,000	51,000	48,000
Honduras	206,000	128,000	107,000
Jamaica	325,000	307,000	297,000
Martinique	13,000	14,000	16,000
Mexico	3,350,000	3,049,000	2,670,000
Nicaragua	220,000	219,000	225,000
Panama	210,000	187,000	181,000
Puerto Rico	192,000	184,000	243,000
St. Kitts	40,000	41,000	43,000
El Salvador	309,000	294,000	340,000
Trinidad	165,000	148,000	178,000
USA—Hawaii*	1,013,000	933,000	939,000
Mainland	1,410,000	1,497,000	1,519,000
Total N. & C. America	*16,863,000*	*16,564,000*	*15,721,000*
Argentina	1,397,000	1,666,000	1,559,000
Bolivia	270,000	281,000	272,000
Brazil	7,780,000	8,757,000	7,598,000
Colombia*	1,169,000	1,014,000	854,000
Ecuador	340,000	295,000	301,000
Guyana*	380,000	342,000	253,000
Paraguay	68,000	72,000	57,000
Peru*	769,000	881,000	926,000
Surinam	10,000	9,000	5,000
Uruguay	40,000	54,000	21,000
Venezeula	420,000	402,000	450,000
Total S. America	*12,643,000*	*13,773,000*	*12,296,000*
Angola	60,000	59,000	47,000
Cameroun	45,000	36,000	33,000
Chad	20,000	15,000	15,000
Congo	27,000	16,000	35,000
Egypt	690,000	634,000	662,000
Ethiopia	165,000	159,000	135,000
Ghana	12,000	8,000	13,000
Ivory Coast	66,000	35,000	32,000
Kenya	260,000	203,000	182,000
Liberia	10,000	9,000	1,000
Madagascar	123,000	117,000	114,000
Madeira	1,000	1,000	2,000
Malawi	92,000	90,000	87,0 0
Mali	16,000	15,000	15,000
Mauritius	695,000	705,000	731,000
Morocco	35,000	18,000	8,000
Mozambique	150,000	190,000	220,000
Nigeria	34,000	27,000	36,000
Réunion	296,000	270,000	249,000
Rhodesia	250,000	290,000	270,000
Senegal	30,000	30,000	35,000
Somalia	30,000	20,000	32,000
South Africa	2,243,000	2,244,000	2,198,000
Sudan	179,000	150,000	151,000
Swaziland	262,000	238,000	220,000
Tanzania	130,000	100,000	113,000
Uganda	12,000	16,000	23,000
Upper Volta	32,000	30,000	22,000
Zaire	39,000	45,000	46,00
Zambia	90,000	75,000	85,000
Total Africa	*6,094,000*	*5,845,000*	*5,812,000*
Bangladesh	185,000	192,000	152,000
Burma	43,000	39,000	32,000
China*	2,950,000	2,920,000	2,570,000
India	6,900,000	7,000,000	5,250,000
Indonesia	1,350,000	1,264,000	1,033,000
Iran	130,000	108,000	80,000
Iraq	20,000	20,000	15,000
Japan	269,000	279,000	228,000
Malaysia	90,000	80,000	50,000
Nepal	29,000	29,000	17,000
Pakistan	711,000	907,000	763,000
Philippines	2,250,000	2,387,000	2,750,000
Sri Lanka	29,000	25,000	25,000
Taiwan	850,000	767,000	1,123,000
Thailand	1,700,000	1,624,000	2,282,000
Vietnam	25,000	33,000	25,000
Total Asia	*17,531,000*	*17,674,000*	*16,395,000*
Australia	2,980,000	3,440,000	3,390,000
Fiji	357,000	376,000	307,000
Total Oceania	*3,337,000*	*3,816,000*	*3,697,000*
Total Cane Sugar	56,481,000	57,687,000	53,943,000
Total Beet Sugar	36,399,000	35,828,000	33,135,000
Total World Sugar	92,880,000	93,515,000	87,078,000

* 1979, 1978, 1977 calendar years.

[1] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 161-165.

US raw sugar imports[1]

	1978	1977	1976
	short tons, raw value		
Argentina	271,097	266,968	86,729
Australia	165,493*	494,225	469,534
Belgium	53,967	—	—
Belize	87,261	35,549	14,350
Bolivia	62,441	49,473	52,990
Brazil	600,401	566,862	—
Colombia	113,410	14,249	84,256
Costa Rica	78,317	95,365	65,025
Dominican Republic	733,530	974,788	971,051
Ecuador	37,294	55,380	28,441
Fiji	50,713	18,407	—
France	30,568	—	—
Germany, West	—	12,425	—
Guatemala	155,865	300,938	330,578
Haiti	5,757	—	6,218
Honduras	17,781	20,634	7,483
India	—	—	179,901
Malagasy Republic	14,295	12,052	13,400
Malawi	37,028	38,358	17,659
Mauritius	112,261	57,363	29,811
Mexico	52,822	—	—
Mozambique	12,913	97,311	31,847
Nicaragua	108,203	119,529	165,646
Panama	122,934	131,162	95,031
Paraguay	—	—	10,187
Peru	225,175	314,186	312,726
Philippines	846,829	1,442,991	913,781
Rumania	13,209	—	—
Salvador	130,364	166,028	143,114
South Africa	60,058	274,227	98,471
Swaziland	82,457	61,855	45,923
Taiwan	56,570	86,035	86,529
Thailand	64,761	—	70,059
Uruguay	8,220	—	5,229
Venezuela	—	—	—
West Indies	181,322	159,744	243,978
	4,593,316	5,866,104	4,579,947

*Includes 6516 tons reported by importers to have cleared customs in 1977.

Guatemala sugar factory.—The old Terrebonne sugar factory from Louisiana was inaugurated on March 31, 1979, as Ingenio Terra Buena, in the presence of the President of the Republic. As reported earlier[2], the factory will have an initial capacity of 3500 t.c.d., with provision for future expansion to 4000 t.c.d. The redesigning and modernization were by International Planning Services Inc., of Baton Rouge.

Tanzania factory destroyed[3].—Kagera sugar factory in Tanzania was blown up by Ugandan troops during their invasion of that country. A new factory was being erected but work on that was stopped during the emergency, and, as a consequence, Tanzania is likely to require further imports of sugar instead of becoming an exporter by 1980, as had been planned.

Colombia and the International Sugar Agreement[4]. Colombia refused to sign the International Sugar Agreement because it was offered a basic export tonnage of not more than 75,000 tonnes which, with the current reductions due to the low level of prices, means a quota in effect for 1979 of only 70,000 tonnes. Production for this year is forecast at 1,169,000 tonnes and, with domestic consumption at 907,000 tonnes and 24,000 tonnes left over from 1978, Colombia would be able to export up to 286,000 tonnes. Colombian sources consider the export capacity of the country to justify its request for a basic export tonnage of 250,000 tonnes and it is thought that such a quota would be needed for Colombia to sign the Agreement. As a non-member, Colombia is now unable to sell to the USA but has recently sold sugar to Chile, China and Morocco, with orders for 132,000 tonnes for delivery up to June 1979. ISO sources have said that Colombia would be offered a basic export tonnage for 1980 commensurate with its production and domestic consumption but only 75,000 tonnes for the first two years of the Agreement.

Mauritius sugar statistics[5]

	1978		1977	
	tonnes, tel quel			
Initial stocks		228,616		237,083
Production		665,219		665,435
		893,835		902,518
Consumption		37,906		37,500
Exports:				
Canada	39,576		44,186	
Comoro Islands	1,850		1,290	
France	6,350		0	
Ireland	0		4,877	
Italy	18		2,433	
Seychelles	0		1,196	
UK	439,603		528,782	
USA	91,193		53,651	
Other countries	42		10	
		578,632		636,425
Surplus in storage		1,370		23
Final stocks		278,667		228,616

US sugar production cost calculation doubts[6].—Congress should require all sectors of the sweetener industry to provide the US Secretary of Agriculture with cost-of-production data which they have previously refused to disclose, according to a report from the US General Accounting Office. The report said that many sugar beet growers claim to have operated at a loss in 1978 but recent data indicate that this claim may no longer be valid. On the contrary, data on 1977 US sugar beet receipts indicate that prices were above average production costs in many areas. Those in the cane sugar industry, however, probably would be losing money without Government payments, the report added. But because USDA attempts to conduct cost studies have been rebuffed, no reliable data are available. The report says that, without federal support payments, Hawaiian producers alone would have lost more than $40 million in 1977. An important factor in setting sweetener policy, and one which the GAO accuses the Agriculture Dept. of ignoring, is the effect such policy may have on high fructose corn syrup, the report said. It is anticipated that HFCS consumption will grow at about 200,000-300,000 short tons annually for the next few years, becoming an increasingly important factor in the US and world sweetener markets. The corn syrup industry must also end its refusal to provide cost-of-production data to the USDA, according to the report. Legislation setting a domestic sweetener policy should also direct the Secretary of Agriculture to identify the sugar industry segments most likely to be adversely affected by shifts between sugar and HFCS and assess the options possible to aid these segments, the GAO recommends.

US cane sugar factory closures[7].—The Billeaud Sugar Co., Broussard, and Valentine Sugars Inc., Lockport, have announced the closing of their cane sugar factories. This reduces the total of operating Louisiana factories to 26.

Israel sugar factories closure.—A new investigation by government economists has shown that the cumulative loss to the country's economy from operation of the two plants at Afula and Kiryat Gat in their 20 years of existence amounted to about $100 million. It confirmed that the two factories will be closed since sugar can be imported at half the price of domestic production.

Sweden sugar production, 1978/79[8].—The seven Svenska Sockerfabriks AB sugar factories sliced a total of 2,234,457 tonnes of beet in the 1978/79 campaign to produce 252,574 tonnes of white sugar, 60,945 tonnes of raw sugar, 93,760 tonnes of molasses, 88,380 tonnes of molassed dry beet pulp and 49,674 tonnes of pulp pellets.

[1] *Lamborn*, 1979, **57**, 48.
[2] *I.S.J.*, 1978, **80**, 223.
[3] *African Business*, March 1979.
[4] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 112.
[5] *Mauritius Sugar News Bull.*, 1978, (12).
[6] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 177-178.
[7] *Westway Newsletter*, 1979, (65), 14.
[8] *Zuckerind.*, 1979, **104**, 168.

West Indies sugar statistics[1]

	1978		1977	
	tonnes, raw value			
Production:				
Barbados	103,785		123,604	
Guyana	341,911		253,127	
Jamaica	307,149		297,174	
St. Kitts	40,899		42,794	
Trinidad	148,137		178,004	
		941,881		894,703
Local consumption		196,578		196,616
Exports:				
Algeria	0		5,673	
Canada	73,681		78,355	
China	0		856	
Germany, West	1,644		46	
Holland	265		463	
Ireland	15,472		41,866	
Portugal	14,505		11,530	
UK	437,946		443,041	
USA	183,442		147,244	
Other countries	2,819		1,166	
		729,774		730,240
Surplus/(Deficit)		15,529		(32,153)

Texas 1978/79 sugar crop.—The cane crop for the 1978/79 season was raised under lower than-average rainfall conditions but, approaching harvest, rain delayed the season's start from mid-October until November 6. Juice quality started slightly better than average but, on December 9, temperatures dropped below freezing for 9 hours, reaching 21°F in places. Cane was moderately to severely damaged in 80% of the cane area of the Rio Grande Valley Sugarcane Growers Inc. but juice purities stayed above 85 until rains came again and delayed operations. On January 2 a second freeze occurred, with temperatures down to 20°F, affecting the cane which had escaped the first. A month later, purities had dropped from the high 70's to the 60's and they continued to fall slowly for the remainder of the season ending April 4. A positive effect of the early freeze was that the resultant desiccation aided cane burning so that a record low campaign average of 8·06% trash was obtained. Variety N:Co 310 exhibited extraordinary freeze tolerance, averaging 9·96 pol and 68·13 purity in first expressed juice between January 8 and April 4. Recoveries were maximized by the skill of field and factory personnel; cane was topped below seriously deteriorated sections, and the best quality fields and those of highest tonnage were given harvesting priority. Yield averaged 26·93 short tons per acre for the 32,376 acres reaped. Cane was processed with juice of 7·03 pol and 52·35 purity during the last week. From 948,271 gross short tons of cane the factory produced 59,976 tons of 96 pol sugar and 48,311 tons of molasses, with a seasonal average recovery of 6·32% sugar on cane. This was a reduction of more than 40,000 tons on the original sugar production estimate.

Rust disease in Puerto Rico and US.—Cane rust, a fungus disease, has been found at four experiment stations and in commercial cane fields near Yabucoa, near Caguas, in Puerto Rico[2]. The disease had been identified previously in the Dominican Republic and Jamaica. Infected fields were sprayed and infected plants rogued as a control measure. Existing regulations were expected to be used to prevent spread of the disease to the continental US and Hawaii by inspection, treatment and return or destruction of infected cane; however, the disease has been found in cane in Florida[3]. The disease is caused by the fungus *Puccinia melanocephala* which does not attack other crops and causes significant damage to cane in India and China.

Peru sugar exports, 1978[4].—Exports of sugar by Peru in 1978 totalled 265,893 tonnes, raw value, and included 11,989 tonnes to Chile, 13,650 tonnes to Korea and 240,254 tonnes to the USA. This was a considerable reduction on 1977 exports which amounted to 411,832 tonnes, raw value, and included 10,668 tonnes to Canada, 87,706 tonnes to Chile, 25,948 tonnes to China, 4051 tonnes to Colombia and 26,000 tonnes to Portugal, the balance of 257,458 tonnes being to the USA.

Japan raw sugar imports[5]

	1978	1977
	tonnes, raw value	
Australia	795,153	640,618
Brazil	21,189	155,395
Cuba	364,698	163,922
Philippines	54,836	230,065
South Africa	497,057	610,650
Taiwan	159,086	275,959
Thailand	386,417	621,306
Other countries	5	872
	2,278,441	2,698,787

West German sugar factory closure planned[6].—The Dormagen factory of Pfeifer & Langen is to be closed down after the 1979 campaign.

High fructose corn syrup process licence[7].—A. E. Staley Mfg. Co., the largest producer of HFCS in the US, has acquired a licence from Mitsubishi Chemical Industries Ltd. to use the Japanese company's process for producing a levulose-enriched syrup from a mixture with dextrose by a technique of preferential adsorption on an ion exchange resin. The technique, developed by Mitsubishi Chemical Industries Ltd. some years ago, is suitable for continuous operation and is economical to operate. Staley plans to build a 100,000-ton plant in which the process will be employed. At present the company has a production capacity of 1,000,000 short tons, or nearly half the US demand for HFCS.

Belgium beet sugar production, 1978/79[8].—Production of sugar in Belgium from the 1978/79 crop totalled 829,926 tonnes, white value, equivalent to 122·05% of the country's A-quota under the EEC sugar regime.

Sri Lanka sugar project[9].—An Asian Development Bank aid scheme is promoting an approx. US $55 million sugar cane development project in Sri Lanka. The scheme hopes for the development of about 12,000 acres of sugar cane with a factory of 1250 t.c.d. crushing capacity. World-wide tenders will decide the choice of consultancy services and specialized personnel. At present the existing two factories produce only 25,000 tonnes of sugar against an annual requirement of 140,000 tonnes. It is expected that, with the new sugar factory in operation, production could increase by another 25,000–30,000 tonnes a year. A distillery will accompany the sugar factory. Some industry experts think, however, that it would be unwise to erect another factory when the present ones are working under capacity. In addition, gathering of the available sugar cane at present is erratic and late.

Denmark sugar production, 1978/79[10].—In the 1978/79 campaign, the six Danish sugar factories sliced 2,954,115 tonnes of beet to produce 406,453 tonnes of white sugar and 147,924 tonnes of molasses.

Switzerland sugar imports[11].—Imports of sugar by Switzerland totalled 161,593 tonnes, tel quel, in 1978, a considerable reduction from the 234,965 tonnes imported in 1977. Almost all came from two sources—West Germany with 103,858 tonnes and France with 55,796 tonnes. The same sources accounted for 115,997 and 78,611 tonnes in 1977 while the 33,051 tonnes provided by the UK in 1977 was reduced to a mere 756 tonnes in 1978.

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[1] Sugar Association of the Caribbean; through F. O. Licht *International Sugar Rpt.*, 1979, **111**, S49–S50.
[2] *U.S.D.A. News*, December 13, 1978.
[3] *Public Ledger*, April 14, 1979.
[4] *I.S.O. Stat. Bull.*, 1979, **38**, (2), 80.
[5] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, S52.
[6] *Zuckerind.*, 1979, **104**, 166.
[7] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 105.
[8] *Zuckerind.*, 1979, **104**, 167.
[9] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 105–106.
[10] *Zuckerind.*, 1979, **104**, 167.
[11] C. Czarnikow Ltd., *Sugar Review*, 1979, (1429), 43.

Belgium sugar imports and exports[1]

	1978	1977
Imports	*— tonnes, tel quel —*	
France	42,581	57,975
Germany, West	8,238	5,479
Holland	4,979	7,040
Other countries	522	111
	56,320	70,605
Exports		
Algeria	—	7,213
Bahrain	10,000	—
Benin	1,176	400
Cameroun	2,115	—
Cape Verde Islands	1,500	—
Chile	12,000	17,006
Colombia	—	21,100
Cyprus	120	1,473
Djibouti	3,110	754
Egypt	10,100	2,150
Finland	1	10,500
France	4,568	3,127
Gabon	1,008	300
Germany, West	52,741	29,157
Ghana	1,750	—
Holland	50,561	78,600
Iceland	835	2,098
Iran	26,692	45,260
Israel	9,547	3,137
Ivory Coast	1,375	4,240
Kenya	6,900	400
Kuwait	14,200	32,570
Lebanon	31,635	39,521
Mauritania	15,456	7,981
Morocco	8,200	16,795
Nepal	—	4,200
Nigeria	62,287	49,577
Norway	2,943	6,406
Oman	3,525	1,250
Portugal	12	5,262
Qatar	4,550	—
Rumania	—	25,000
Rwanda	1,816	52
Saudi Arabia	8,390	4,500
Sierra Leone	200	1,180
Somalia	5,864	7,150
Spain	208	2,027
Sri Lanka	11,780	—
Surinam	1,900	600
Syria	17,264	200
Tunisia	35,751	—
USSR	—	23,593
United Arab Emirates	10,164	12,950
UK	1,814	1,884
USA	21,690	1,419
Yemen, North	5,577	11,300
Yemen, South	20	3,450
Zaire	3,518	2,409
Other countries	9,129	5,834
	473,992	494,025

Hawaii sugar factory closure[2].—Hawaiian Commercial & Sugar Co. and Wailuku Sugar Co. have concluded an agreement whereby the Wailuku factory will be closed and the company's cane will be crushed by the H C & S mill.

PERSONAL NOTES

We regret to report the death in January 1979 of **Dr. Harry F. Clements,** of Hawaii. In recognition of his worldwide reputation as a sugar cane scientist, Dr. Clements was made a Life Member of the ISSCT during its 15th Congress in 1974.

Gilbert J. Durbin, Vice-President and General Manager of the American Sugar Cane League, retired in January 1979 with the warm good wishes of the Louisiana sugar industry which he has served for the past 27 years.

South Africa sugar exports[3]

	1978	1977	1976
	tonnes, raw value		
Canada	229,278	341,341	302,453
Hong Kong	0	0	209
Israel	0	0	8,894
Japan	424,457	696,130	477,354
Korea	25,331	34,620	0
Lebanon	0	6,003	0
Portugal	0	23,955	0
UK	0	22,114	0
USA	38,957	252,727	65,393
Zaire	0	5,435	0
Other countries	296	1,561	5,552
	718,319	1,383,886	859,855

In a series of regional managerial changes announced by British Sugar Corporation, Mr. **Geoff Taylor** takes up the appointment of northern region director on June 1. He will be responsible for factories at Newark, Nottingham, Brigg and Bardney. Mr. Taylor succeeds Mr. **Jack Aldridge,** who is retiring but who will continue to assist the company in a consultative capacity.

Mr. **Raymond Bond,** central region agricultural manager, moves to the West Midlands area as general manager for Allscott and Kidderminster factories from May 1. He succeeds Mr. **Peter Forster** who is relinquishing the post through ill health, but who will continue to act in a consultancy capacity.

Mr. **Don Brisbourne** has been appointed agricultural manager for the central region which encompasses factories at King's Lynn, Wissington, Peterborough and Spalding, from May 1. He will combine those duties with his present responsibilities as a director of Beet Sugar Developments Ltd.

Mr. **Frank Turner,** Allscott factory agricultural manager, is appointed agricultural manager for the southern region with responsibility for five factories at Bury St. Edmunds, Ely, Cantley, Felsted and Ipswich, from April 1. He succeeds Mr. **Alan Gibbs** who is retiring.

Mr. **Desmond O'Toole** retires as central region production manager on June 30. Mr. **David Ash** will act as regional production manager while retaining his present position of regional personnel manager.

Mr. **Eric Bruce** will become southern region production manager designate on October 1, retaining his present responsibilities as Ipswich factory works manager for the 1979/80 campaign.

Mr. **Sinforiano F. Echeverria** has been appointed President of agricultural equipment manufacturer Thomson International Company and its subsidiaries. A graduate of Louisiana State University, he was employed as Chief Engineer of the Jose Arechabalasa sugar factory and distillery in Cuba but joined Thomson in 1964 and served in various capacities, becoming International General Manager in 1974.

Mr. **S. W. D. Baxter,** formerly Marketing Manager of the Cane Equipment Division of Massey-Ferguson Australia Ltd., has left this company after 27 years and is establishing himself as a consultant in sugar cane field mechanization, based in Bundaberg. He has become well known in world cane sugar circles during his years of marketing cane harvesters and providing technical assistance.

We regret to report the death in February last of Dr. **Gabor Vavrinecz** at the age of 82. He had been associated with the Research Section of the Selyp sugar factory in Hungary and had made specialized studies on sucrose crystal habit and on beet molasses formation. He had made many contributions to the literature on these and other topics.

[1] C. Czarnikow Ltd., *Sugar Review,* 1979, (1431), 54.
[2] *Sugar y Azúcar,* 1979, **74,** (1), 14.
[3] F. O. Licht, *International Sugar Rpt.,* 1979, **111,** S59.

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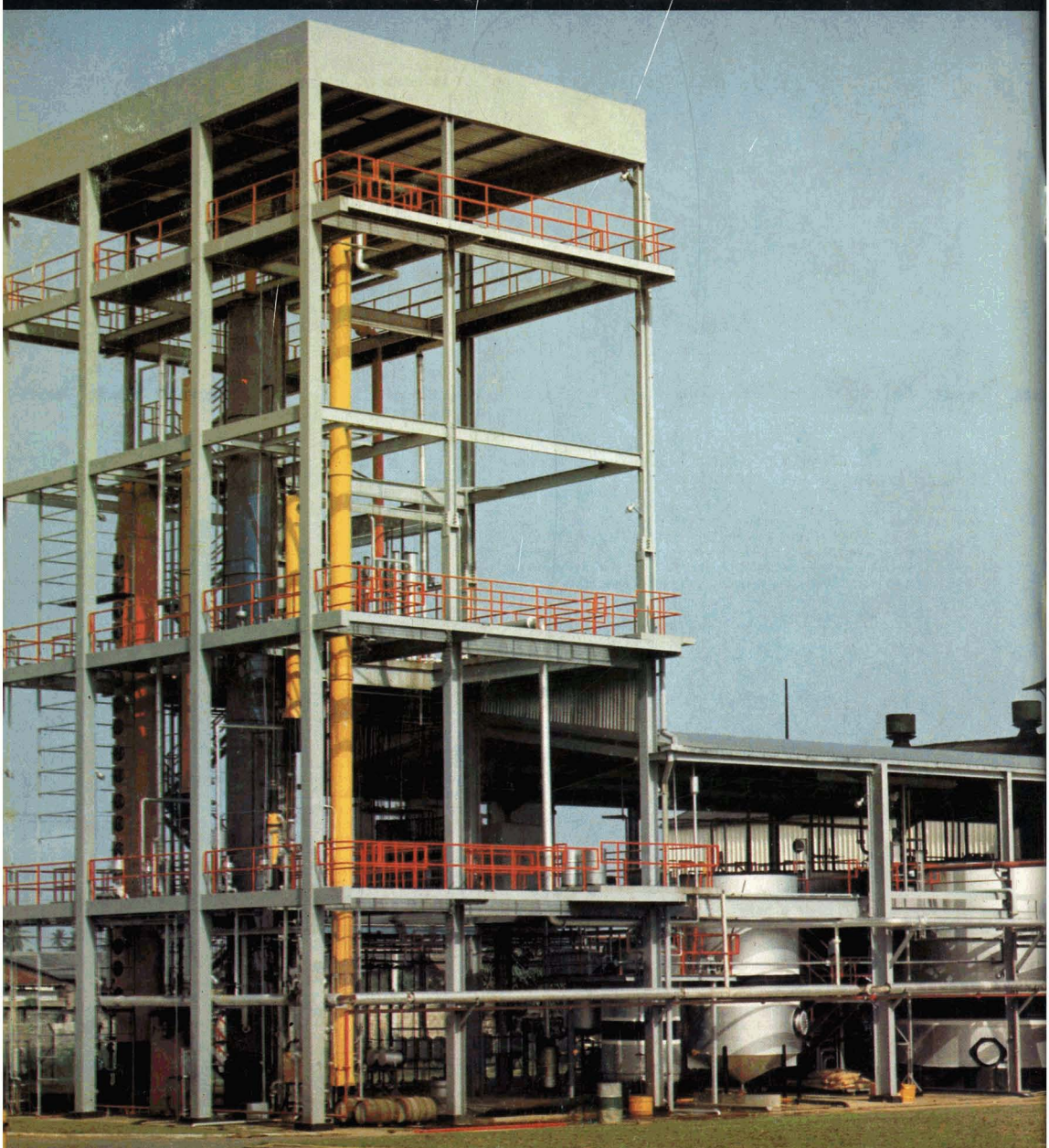

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