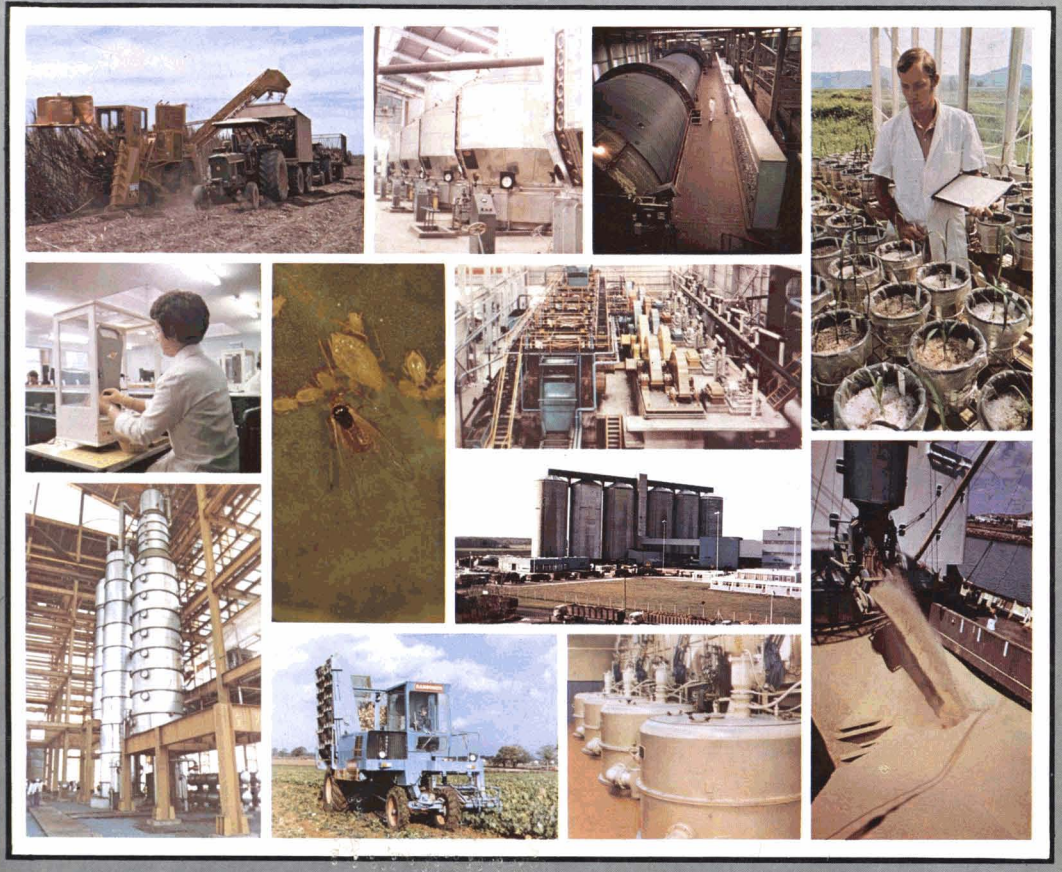
INTERNATIONAL SUGAR JOURNAL

VOLUME LXXXIII
ISSUE No. 994



OCTOBER 1981

Putsch

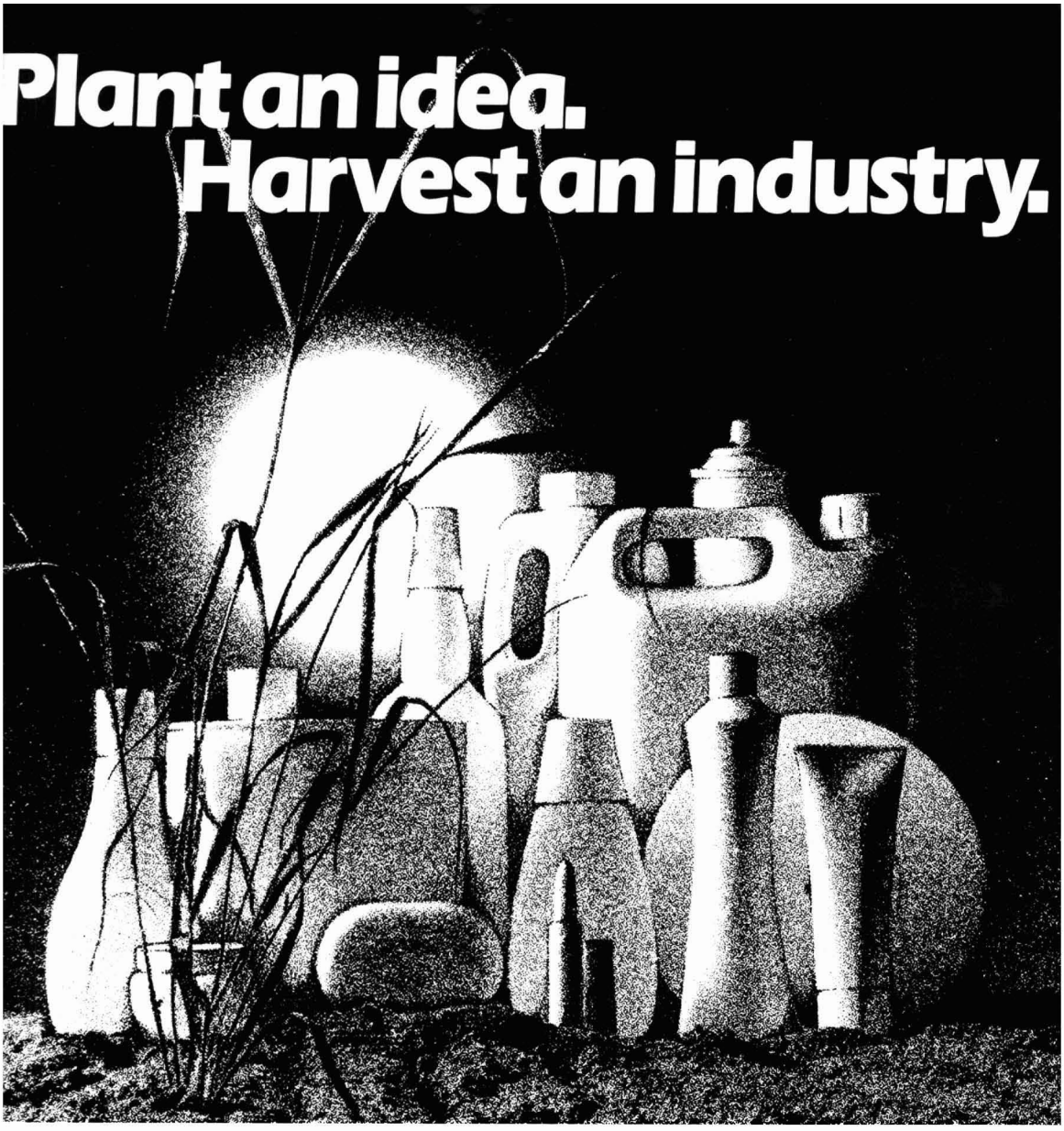
As the biggest Knife Manufacturer for the Sugar Industry, PUTSCH offers you all the trumps! For sharpening of the knives, PUTSCH offers semi- and fully automatic Sharpening Machines as well as Frasiers.
PUTSCH knows the field!

Putsch

Head Office:
H. Putsch & Comp.
Postfach 4221
5800 Hagen 1 / West Germany
Telephone (2331) 31031
Telegrams: Putsch Hagen
Telex: 823795

In the USA: H. Putsch & Company, Inc. P. O. Box 5128
Asheville, N. C. 28803
Telephone (704) 684-0671
Telegrams: Putsch Avl
Telex: 577443

ez 88



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

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

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

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

Adding value to agriculture

TATE + LYLE

Tate and Lyle Agribusiness Ltd., Cosmos House, Bromley Common, Bromley, BR2 9NA, England. Tel: 01-464 6556.


What
do I know
about sugar?
"Where I come from, sugar is something everybody knows something about. Because it's such an important business. And people in the sugar business in my country say that when it comes to machinery and equipment for their mills, Dorr-Oliver is a company they can count on."
All around the sugar belt of the world, Dorr-Oliver has proven its ability to supply top quality process equipment and the technology and engineering to assure maximum efficiency. For cane mud filters, cane juice clarifiers, DSM®screens, desanders or complete systems, Dorr-Oliver offers quality equipment and dependability of service.
In many countries, pollution control has become increasingly important in most industrial operations. Dorr-Oliver is equally capable in waste water treatment, and related technologies.
Get all the facts. Write, Larry Engel, Sugar Division, Dorr-Oliver Incorporated, 77 Havemeyer Lane, Stamford Connecticut 06904, U.S.A.
DORR-OLIVER
A step ahead in process equipment.

INTERNATIONAL SUGAR JOURNAL

Volume 83
Issue No. 994

CONTENTS October 1981

289	Notes and comments
291	**Collaborative study on the determination of trace elements in dried sugar beet pulp and molasses. Part III. Lead** By P. B. Koster, P. Raats, D. Hibbert, R. T. Phillipson, H. Schiweck and G. Steinle
296	**Composite panel production from sugar cane rind** By D. W. Nyberg
300	**Effect of aerated steam treatment on the incidence of red rot (*Colletotrichum falcatum* Went) of sugar cane** By S. Natarajan and S. Muthusamy
302	Sugar cane agronomy
305	Cane pests and diseases
307	Sugar beet agronomy
308	Cane sugar manufacture
310	Beet sugar manufacture
312	New books
313	Laboratory studies
315	By-products
316	Patents
318	Trade notices
319	Canada sugar imports and exports, 1980
319	Fiji sugar exports, 1980
320	Indonesia sugar imports, 1980
320	Argentina sugar exports, 1980
319-320	Brevities
xxii	*Index to advertisers*

UK ISSN 0020-8841

Annual Subscription:
£25.00 post free

Single Copies:
£2.50 post free

Airmail charges quoted on request to

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

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

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

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

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

France: MaG-Watt International,
6 rue des Acacias, Vert-le-Grand, 91810 Essonne.
Tel.: 492-00-15.

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

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

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

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

NOTES AND COMMENTS

World sugar prices

The first half of August saw a gentle decline in the LDP and LDP(W), but a dramatic fall occurred in the second half of the month so that the LDP, £226 on August 3 and £208 on August 19, fell to £179 on August 28, and £172 on the next market day, September 1. The LDP(W) started the month at £246, fell to £215 on August 19, to £178 on August 28 and to £166 on September 1.

The cause of this was the publication of beet tests from different European countries indicating that the recent, almost ideal weather had brought about an appreciable increase not only in root size but also in sugar contents, so that indications are for a bumper beet sugar crop in the coming campaign. With a falling price, potential purchasers naturally hold off buying until forced to make their purchases and provide a self-fulfilling prospect of lower and lower market levels. The EEC sells its sugar as whites and, as just indicated above, it was the LDP(W) which led the fall, with a price premium of £20 per tonne changed into a discount of £6 within the month.

As is indicated elsewhere, the prospect of higher sugar output in Europe does not necessarily mean a higher export availability of the same magnitude but the market evidently thinks it does.

International Sugar Agreement

The ISO held a meeting on September 4 to decide whether a special meeting of its Executive Committee should be held to discuss cutting of export quotas because of the slide in sugar prices. Since the cuts would have little effect on the availability of sugar entering world trade this year, it was agreed to defer decisions to the meeting previously arranged for September 16, by which time the prevailing price was expected to have been below 14 cents for the five days which would call for cuts.

In November the Council is to meet to decide on whether the Agreement should be extended beyond its normal end date of December 1982, a 2-year extension being provided for in the original Agreement, or if an attempt should be made to negotiate a new one to commence in January 1983. The Executive Committee was examining the alternatives at its September 16 meeting.

F. O. Licht GmbH[1] observe: "In many ways the simplest approach would be to extend the Agreement. This could be done without the lengthy and expensive procedure involved in a full scale UNCTAD Conference in Geneva and it is thought that it might receive readier acceptance from some governments than would a new Agreement. Yet it is clear that the current arrangements for establishing export quotas leave much to be desired, and if these were to be extended to cover a further one or two years they might prove to be unworkable as a method of ensuring that supplies of sugar did not vastly exceed the indicated outlets. Currently, with a relatively tight statistical position prevailing, restrictive quotas might not be of too much concern, but in two or three years' time it could well be that conditions of substantial surplus will have returned and in such circumstances, if the Agreement is to have any effect at all, it is imperative that it should have an effectively operating quota mechanism.

"Quite apart from the probable ineffectiveness of the arrangements for establishing export quotas, it is not at all certain whether the existing procedure may legally be extended past the end of next year. Although Article 83 of the Agreement clearly states that it may be extended for a period not exceeding two quota years, nowhere does it specify how those quotas are to be established. Indeed, Article 34, which details the manner in which basic export tonnages are to be determined, refers to the third, fourth and fifth quota years, but does not go beyond that. It would seem, therefore, that the first task would have to be to establish whether and to what extent a general consensus existed for the Agreement to be extended. If this were found to be the case it would then be necessary to see whether some way could be found to circumnavigate the difficulty as regard quotas. Indeed, in the interest of maintaining the Agreement in existence, it might be considered appropriate to sacrifice something of the quota mechanism. On the other hand, without such agreement among member countries, it is difficult to see how there could be any alternative to endeavouring to negotiate a new ISA.

"If that were to be the case, and should these efforts not meet with success, it would then be much more difficult to agree on an extension of the current Agreement. Much more likely would be a formula, such as has sometimes been adopted in the past, establishing an Agreement without economic clauses. This would keep the framework in existence, but the Agreement would cease to have any relevance as a world market factor. Nevertheless, the fact that the infrastructure was being maintained would ensure that when members felt that the time had become appropriate they could relatively speedily set in motion the procedure to negotiate a new Agreement.

"No doubt governments are already having discussions on these matters and much will depend on the attitudes of a few major importers and exporters. The 1977 Agreement has managed to operate without the EEC, but this group of countries are predominantly white sugar exporters and to some extent it has been possible to isolate this sector. Whatever decision the Council reaches, whether it be to attempt to extend the present arrangements or to negotiate a new Agreement, it would seem that there would need to be a close community of view among the major raw sugar exporters while, among importing countries, support from the USA, at the very least, would appear to be imperative."

Brazilian frost damage[2]

An assessment of the damage to the sugar cane crop in São Paulo state by the frosts of July was published in August. The Sugar and Alcohol Institute estimates that losses in sugar production from the 1981/82 crop will amount to 500,000-550,000 tonnes. It was the young cane plants for harvest next season which bore the brunt of the damage, however, and 1982/83 output will be down 1.0-1.2 million tonnes. No more raw sugar is being processed for export in the affected areas and officials do not expect any more will be produced for the export market during the remainder of the crop year ending May 1982. Brazil has also stopped accepting fresh

[1] *International Sugar Rpt.*, 1981, **113**, 513-514.
[2] *Public Ledger's Commodity Week*, August 22, 1981.

contracts for sugar for export from the 1982/83 crop; existing contracts currently total 1.3 million tonnes and the authorities have assured exporters that these will be honoured. Curtailment of sugar exports will ensure that Brazilian alcohol production is not affected, according to the Institute.

European beet sugar production, 1981/82

The figures on which the general situation reported earlier[1] was based, have been released by F. O. Licht GmbH[2], and are reproduced below:

	1981/82	1980/81	1979/80
	tonnes, raw value		
West Europe			
Belgium/Luxembourg	1,000,000	870,000	991,000
Denmark	465,000	464,000	492,000
France	4,900,000	4,253,000	4,313,000
Germany, West	3,300,000	2,982,000	3,094,000
Greece	330,000	190,000	319,000
Holland	1,000,000	951,000	927,000
Ireland	195,000	161,000	190,000
Italy	2,000,000	1,932,000	1,698,000
UK	1,200,000	1,202,000	1,260,000
Total EEC	*14,390,000*	*13,005,000*	*13,284,000*
Austria	490,000	456,000	410,000
Finland	115,000	123,000	100,000
Spain	1,100,000	965,000	714,000
Sweden	365,000	327,000	350,000
Switzerland	120,000	105,000	118,000
Turkey	1,380,000	935,000	1,068,000
Yugoslavia	880,000	723,000	852,000
Total West Europe	18,840,000	16,644,000	16,896,000
East Europe			
Albania	40,000	40,000	40,000
Bulgaria	240,000	250,000	240,000
Czechoslovakia	890,000	830,000	910,000
Germany, East	710,000	600,000	679,000
Hungary	550,000	480,000	510,000
Poland	1,700,000	1,130,000	1,580,000
Rumania	680,000	570,000	570,000
USSR	8,000,000	6,900,000	7,700,000
Total East Europe	12,810,000	10,800,000	12,229,000
TOTAL EUROPE	31,650,000	27,444,000	29,125,000

The West European figures reflect the 6% rise in overall beet area as well as the improvement in beet size and sugar contents shown in test results of recent weeks. Particularly large area expansions have taken place in Spain, Yugoslavia and Turkey, the last no less than 34%, and these three account for 737,000 tonnes of the West European increase, the EEC accounting for 1,385,000 tonnes of which almost half is in France.

The East European crop was hit by bad weather last season and production declined 12%. Not surprisingly, an increase to former levels is expected in the absence of adverse conditions while an increase above them is expected where the area has been expanded. The Soviet crop was badly affected by early frosts in 1980 and similar occurrences could affect the 1981/82 output; however, the 8,000,000 tonnes forecast represents average conditions.

The EEC figure is considered by Licht to indicate an export availability of 5.3 million tonnes, white value[1], but *World Sugar Journal* recently pointed out[3] that higher production does not always mean higher exports. Such a view assumes that there will be no change in stocks or consumption and both often change from one year to the next. The point is demonstrated in respect of the EEC as tabulated in the next column.

In the table, production is estimated to increase by 651,000 over 1980/81 but, if no further supplies are drawn from stocks, export availabilities would be reduced by 300,000 tonnes. Conversely, for exports to increase by the difference in production, i.e. 651,000 tonnes, stocks would have to be reduced to 2,676,926 tonnes – which is not likely. Alternatively, for exports to rise to say 5.5 million tonnes, production in 1981/82 will have to rise to 15.0 million tonnes, raw value, which while obviously possible, seems improbable, in the view of *World Sugar Journal*.

	1981/82*	1980/81*	1979/80
	tonnes, raw value		
Initial stocks	3,327,926	4,278,926	4,307,519
Production	14,000,000	13,349,000	13,319,894
Imports	1,500,000	1,500,000	1,470,739
	18,827,926	18,127,926	19,098,152
Consumption	11,000,000	11,000,000	10,722,605
Exports	4,500,000	4,800,000	4,096,621
Ending stocks	3,327,926	3,327,926	4,278,926

**WSJ estimates*

World sugar production, 1981/82

In its first estimate of sugar supply and demand in 1981/82, *World Sugar Journal*[4] foresees a production level of 91,030,000 tonnes, slightly less than consumption which it sets at 91,534,000 tonnes, raw value. By contrast, the forecast from E. D. & F. Man[5] is for a production of 93,175,000 tonnes, a difference of 2,145,000 tonnes which is some 40% greater than the difference in the estimates of the two observers for sugar production in the EEC (14,000,000 tonnes *vs.* 15,535,000 tonnes, respectively). The Man forecast was issued at the end of August, some weeks after that of *World Sugar Journal*, and the beet test results in the intervening period may have persuaded them of a greater production increase than would have been anticipated earlier, although the corresponding estimate by F. O. Licht GmbH[2] is for a production of 14,390,000 tonnes.

Man describe their estimate as "slightly conservative . . . , perhaps hoping that the recent days of extremely hot and dry weather may begin to stress the beets." But their world production forecast would, if achieved "put the world market into, at best, a modest 2 million tonne surplus, at worst a surplus which would have knock-on effects into the 1982/83 season. . . . We can only express the hope that the crop is being estimated at its best moment and that lifting, clamping and slicing will pare yields back to tolerable levels so that a giant EEC surplus, embarrassing both financially and politically, may be avoided".

The 93,175,000 tonnes estimate represents an increase of 7.3 million tonnes over 1980/81 production, according to Man, and it is interesting that, in a recent assessment, the same firm noted that a 4.5 million tonnes increase in production would be necessary if stocks were not to be further reduced between the ends of the 1980/81 and 1981/82 crop years.

World Sugar Journal concluded from its figures that the view that there would be plentiful supplies to meet potential demand in 1981/82 was incorrect and that either stocks would be reduced over the period or consumption would be a function of production. Time alone will tell which of the views is correct.

[1] *I.S.J.*, 1981, **83**, 258.
[2] *International Sugar Rpt.*, 1981, **113**, 527-530.
[3] 1981, **4**, (2), 4-5.
[4] 1981, **4**, (2), 6-19.
[5] *The Sugar Situation*, 1981, (343).

Collaborative study on the determination of trace elements in dried sugar beet pulp and molasses

Part III. Lead

By P. B. KOSTER*°, P. RAATS*, D. HIBBERT†, R. T. PHILLIPSON†, H. SCHIWECK‡, and G. STEINLE‡

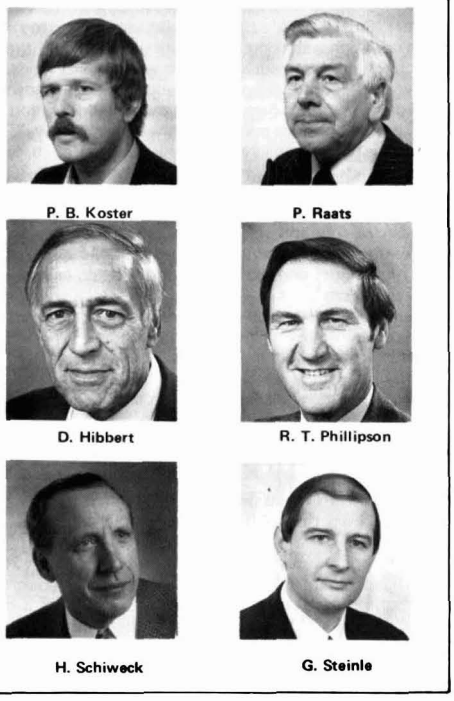
Introduction

Dried sugar beet pulp and molasses, or products derived from these, such as molassed dried pulp and pulp nuts, may form a substantial portion of animal diets. Knowledge of the levels of undesirable toxic trace elements in such feeding stuffs is important to ensure the absence of risk to animals.

Part III of our present series of collaborative studies (Parts I and II dealt with the determination of mercury[1] and fluorine[2] in dried sugar beet pulp and molasses) deals with the determination of lead.

The most important sources of lead contamination are exhaust fumes from motor vehicles and, in certain localities, atmospheric fall-out of industrial origin[3]. Lead from these sources can enter sugar beet plants either directly (lead being deposited on the plants) or indirectly through soil and water.

Most of the lead ingested into the alimentary tract of cattle is eliminated in the faeces. The lead which is adsorbed passes initially to the liver where the greater part is taken up and subsequently excreted to the gut in the bile. A proportion passes into the blood stream and is subsequently excreted through the kidneys. Lead may also be excreted in the milk of lactating animals and enough may be present to render the milk unfit for human consumption[4].



Cumulative lead poisoning is well known in man but there is little evidence for its occurrence to any appreciable extent in cattle and sheep. Chronic lead poisoning is manifested particularly by neurological defects, renal tubular dysfunction and anaemia[5].

The maximum level of lead permitted by the European Economic Community in animal feeding stuffs has been set at 10 mg/kg, referred to a moisture content of 12%. Very little information about levels of lead in sugar beet and sugar beet products has been published. Leh[6] studied the influence of motor car exhaust fumes on the lead contamination of sugar beet plants. Steinle[3] has reported average values for the lead content of dried pulp (1.3 mg/kg), pulp nuts (1.2 mg/kg), molassed dried pulp (1.4 mg/kg), molasses (0.5 mg/kg) and white sugar (0.1 mg/kg) produced in the 1973/74 and 1974/75 beet campaigns.

Morris *et al.*[7] and Clarke *et al.*[8] have published the results of a survey of trace heavy metals in (cane) sugar and sugar products. The amounts of lead found in these studies were well below the levels which might give rise to concern to the industry or to the regulating agencies.

In the present study the participating laboratories developed their own individual analytical methods and used these for replicated analyses of the samples examined. The same method was used for sample preparation and sub-sampling as has already been described in our first paper[1]. Samples of dried pulp and molasses were exchanged between the collaborating laboratories to verify the reliability of their methods. Series of samples of dried pulp and molasses produced in several beet campaigns in Holland, the United Kingdom and West Germany were investigated.

EXPERIMENTAL

Sample digestion

Attention has already been drawn in our paper on mercury[1] to ways in which dried pulp and molasses differ significantly from many other materials. To overcome these difficulties it is important that the digestion procedure should be of sufficient length and severity to

* Institut voor Rationele Suikerproductie, P.O. Box 32, 4600 AA Bergen op Zoom, Holland.
† British Sugar Corporation Ltd., Central Laboratory, P.O. Box 35, Wharf Road, Peterborough, PE2 9PU, United Kingdom.
‡ Süddeutsche Zucker-A.G., Zentral-Laboratorium, P.O. Box 1127, D-6718 Grünstadt 1, Germany.
° Present address: Directorate of Labour, P.O. Box 69, 2270 MA Voorburg, Holland.

[1] Koster *et al.*: *I.S.J.*, 1975, **77**, 299-305.
[2] *Idem*: *ibid.*, 1979, **81**, 4-8.
[3] Steinle: *Zucker*, 1977, **30**, 535-540.
[4] White *et al.*: *J. Amer. Vet. Med. Assoc.*, 1943, **102**, 292.
[5] Underwood: "Trace Elements in Human and Animal Nutrition," 4th Ed., (Academic Press, New York), 1977, 418.
[6] *Gesunde Pflanzen*, 1966, 18.
[7] *J. Agric. Food Chem.*, 1976, **24**, 45-47.
[8] *Ind. Technol.*, 1974, **33**, 91.

ensure satisfactory analytical results.

Wet digestion procedures were used by the Instituut voor Rationele Suikerproductie (IRS) and by Süddeutsche Zucker-AG (SZ) using nitric acid and *aqua regia,* respectively. To ensure the complete removal of organic material, mainly carbohydrates, an additional oxidation step using hydrogen peroxide was employed in the IRS procedure. A complexing/extraction method, leaving the organic materials in the original digest, was used by SZ. In this procedure a lead-diethylammonium diethyldithiocarbamate (D_3C) complex is formed in the aqueous phase and subsequently transferred into an organic (xylene) phase.

A dry ashing method for the destruction of organic matter was used by British Sugar Corporation Ltd (BS). The ash was extracted with hydrochloric acid solution and the lead transferred into xylene using the D_3C/xylene complexing/extraction technique.

Determination of lead content

Both IRS and SZ used a flameless atomic absorption technique for the determination of lead in the final extract. In this technique, a small quantity of extract is brought into a graphite atomizer which is then heated by an electric current to a sufficiently high temperature to cause dissociation of the salts and production of metal atoms. During the heating program an inert gas environment is provided in order to prevent or minimize oxidation of the incandescent carbon. The advantage of this flameless method lies not only in the small sample size required (5 to 50 mm^3) but also, because of the high efficiency of atomization, in the extremely low detection limits (1 pg for many elements).

Air/acetylene flame atomic absorption was used by BS for the determination of lead in the final extract.

DETAILED METHODS

(a) *Instituut voor Rationele Suikerproductie (IRS)*

Apparatus

Atomic absorption spectrophotometer: Varian Techtron Model AA-5, equipped with a Model 63 graphite atomizer and a Model BC-6 background corrector unit (Varian Techtron Limited, Melbourne, Australia).

Hollow cathode lead and hydrogen lamps (Varian Techtron).

Recorder: Varian Techtron Model A-25.

Micropipette 5 mm^3 (Oxford Laboratories International Corporation).

Micropipette 0.1 cm^3 (Ky. Finnpipette, Helsinki, Finland).

Instrument settings — atomic absorption spectrophotometer: wavelength 217.1 nm; lamp current 7 mA; slit width 300 μm; damping A; recorder 5 or 10 mV; chart speed 1 $cm.min^{-1}$; graphite atomizer, dry 0.5V (90 s), ash 0.8V (20 s), atomizer 5.5V (2.5 s), voltages measured over work-head with a Philips Model PM 2503 electronic multimeter; purge gas nitrogen.

Reagents

Concentrated nitric acid (BDH, AnalaR, 65%).

Hydrochloric acid (Merck, p.a. grade, about 32%).

Aqua regia: mixture of 1 volume concentrated nitric acid and 3 volumes hydrochloric acid.

Hydrogen peroxide solution (Merck, p.a. grade, 30%).

Stock lead solution (1000 $\mu g.cm^{-3}$): prepared from lead standard (Merck, Titrisol) with deionized water.

Working lead solution (10 $\mu g.cm^{-3}$): 10 cm^3 of the stock lead solution (1000 $\mu g.cm^{-3}$) and 50 cm^3 of concentrated nitric acid are brought to volume with deionized water in a 1 dm^3 volumetric flask; stored in a refrigerator, this solution is stable for at least 1 month.

Procedure

Pulp — 25 cm^3 of the sample digest used for the determination of mercury (about 5 g pulp dissolved in 100 cm^3 32.5% nitric acid), obtained by the procedure described in our first paper[1], is transferred to a 100 cm^3 volumetric flask. Hydrogen peroxide solution (20 cm^3) is added and the contents of the flask mixed well. The flask is placed in a drying oven and heated, successively, overnight at 70 to 80°C and then for 6 hr at 110 to 120°C.

After cooling to room temperature, the extract is made up to 100 cm^3 with deionized water. Aliquots (20 cm^3) of the solution are then pipetted into two 50 cm^3 volumetric flasks. Working lead solution (0.1 cm^3) is added to the contents of one of the flasks using the 0.1 cm^3 micropipette and both flasks are then made up to the mark with deionized water. The solutions represent about 5 g of pulp in 1 dm^3 of 3.25% nitric acid solution, one of the solutions being spiked with 0.02 μg Pb/cm^3.

Molasses — The molasses sample is warmed slightly and thoroughly mixed. A sub-sample (about 10 g) is weighed accurately into a 500 cm^3 volumetric flask and *aqua regia* (35 cm^3) added. The flask is closed with a glass stopper, previously moistened with *aqua regia,* and allowed to stand at room temperature for 24 hr in a fume chamber. *Aqua regia* (35 cm^3) is again added and the flask allowed to stand for a further 24 hr, after which deionized water (70 cm^3) is added; the flask is then allowed to stand, with occasional shaking, for a third period of 24 hr, after which the contents are brought to volume with deionized water. An aliquot (25 cm^3) of the extract is pipetted into a 100 cm^3 volumetric flask; hydrogen peroxide solution (20 cm^3) is added and the contents of the flask mixed well. The solution is then successively heated in a drying oven, firstly overnight at 70-80°C and then for 6 hr at 110-120°C. After cooling to room temperature the extract is made up to 100 cm^3 with deionized water. Working lead solution (0.1 cm^3) is then added to a 50 cm^3 portion of this solution. The extracts thus obtained represent 5 g of molasses in 1 dm^3 of solution, one of these solutions being spiked with 0.02 μg Pb/cm^3.

Blank solutions — Blanked and spiked blank solutions are prepared by following the above procedure without the addition of the pulp or molasses samples.

Determination — Duplicate determinations are carried out on the sample solution and the corresponding spiked solution by injecting aliquots (5 mm^3) into the graphite atomizer. On the basis of the mean values of the absorbances obtained, the lead content of the sample solution is calculated using the method of standard additions. The lead content of the blank solution is deducted from that of the sample solution. Samples are analysed in duplicate.

The standard addition line is straight up to 20% absorbance. In the event of the absorbance exceeding this value, the original sample digest (in the case of a pulp sample) must be diluted, before the hydrogen peroxide treatment, with 32.5% nitric acid or (in the case of a molasses sample) with diluted *aqua regia* (14 parts *aqua regia* and 86 parts deionized water).

(b) *British Sugar Corporation Limited (BS)*

Apparatus

Atomic absorption spectrophotometer: Perkin-Elmer 305B (Perkin-Elmer Ltd., Beaconsfield, Bucks., U.K.).

Lead electrodeless discharge lamp (Perkin-Elmer).

Recorder: Servoscribe Model RE 511.00 (Smith Industries, Wembley, U.K.).

Instrument settings: wavelength 283.3 nm, slit 1.0 mm, expansion to give reading of 80 units for 60 μg Pb standard on recorder, chart speed 3 $cm.min^{-1}$.

Burner: 3-slot, 11 cm, air/acetylene flame.

Muffle furnace: fitted with a West 96 three-term analogue controller with thyristor drive output which enables the temperature to be maintained at 550 ± 0.5 °C.

Pyrex graduated flasks (50 cm^3) with bulbous neck for mixing liquids.

Filtering apparatus: Pyrex Buchner funnel with ground glass joint to fit a Witt's filtering apparatus. The funnel (internal diameter 4.5 cm) contains a sintered glass plate of porosity 2. The stem of the funnel is tapered so that it delivers the filtrate into a graduated flask inside the filtering apparatus.

Reagents

Water: distilled water.

Concentrated hydrochloric acid (BDH, AristaR, 36%).

Hydrochloric acid solution: 1 N solution, prepared from concentrated hydrochloric acid by diluting 89 cm^3 of concentrated acid to 1 dm^3 with water.

Concentrated nitric acid (BDH, AristaR, 69-72%).

Concentrated sulphuric acid (BDH, AristaR).

Diethylammonium diethyldithiocarbamate: solution in xylene (BDH, AnalaR), 1 g/100 cm^3, referred to in the text as D_3C.

Ascorbic acid solution: 10 g ascorbic acid (BDH, AnalaR) is dissolved and diluted to 100 cm^3 with hydrochloric acid solution. This solution is freshly prepared each day.

Stock lead solution (400 $\mu g.cm^{-3}$): lead nitrate [$Pb(NO_3)_2$, BDH, AnalaR] (0.6394 g) is dissolved in water in a 1 dm^3 volumetric flask; concentrated nitric acid (10 cm^3) is added and the solution made up to the mark with distilled water.

Working lead solution (2 $\mu g.cm^{-3}$): stock lead solution (50 cm^3) is made up to 500 cm^3 in a volumetric flask with water. A further dilution of this solution is made by transferring 50 cm^3 to a 1 dm^3 volumetric flask, adding concentrated hydrochloric acid (89 cm^3), mixing and making up to the mark.

Procedure

Sample digestion — The sample (about 10 g) is accurately weighed into a clean silica dish and sufficient water added to moisten it. Concentrated sulphuric acid (5 cm^3) is added and the dish heated on an electric hotplate until the excess sulphuric acid is removed. The dish is then placed in a cool muffle furnace; the temperature of the furnace is then raised to 550 °C and maintained at this level overnight. The dish is then cooled, the ash moistened with water (1 cm^3) and concentrated hydrochloric acid (10 cm^3) cautiously added. The contents of the dish are evaporated to dryness over a boiling water bath. The ash is then taken up in a mixture of concentrated hydrochloric acid (5 cm^3) and concentrated nitric acid (5 cm^3) and cautiously warmed on a water bath. After the vigorous reaction has subsided the contents of the dish are evaporated to dryness on the water bath. Hydrochloric acid solution (10 cm^3) is added to the residue and warmed to dissolve the soluble ash. The solution is then cooled and filtered under vacuum through a paper filter pad prepared as indicated below.

Preparation of filter pad: ordinary filter paper clippings are shredded into small pieces (maximum size 2 cm^2) and reduced to a pulp by shaking vigorously with water. Sufficient pulp is then poured into a Buchner funnel to make a pad of 4 to 5 mm thickness after pressing the pulp down firmly with the application of vacuum. The pad is washed with water to remove loose fibres and excess water is then removed by suction, taking care not to dry out the pad completely. The pad, after preparation in this way, is ready for use; it is used in preference to a conventional filter paper or membrane filter because it can easily be washed completely free of the sample solution.

The residue on the filter pad is washed with hydrochloric acid solution; the filtrate is diluted with hydrochloric acid solution to 50 cm^3 in the the volumetric flask and shaken to mix the contents.

A blank solution is prepared by following the above procedure without addition of the sample.

Determination — An aliquot (5 cm^3) of the prepared solution is pipetted into a clean, dry stoppered glass container; this portion of the solution may subsequently be used for the determination of copper. The remainder of the prepared solution is diluted with ascorbic acid solution to 50 cm^3 and represents 9 g of sample.

A range of standards is prepared by pipetting respectively 0, 5, 10, 15, 20, 25 and 30 cm^3 of the working lead solution into 50 cm^3 volumetric flasks; to each of these flasks ascorbic acid solution (5 cm^3) is added and the solution made to volume with hydrochloric acid solution; the standards prepared in this way contain respectively 0, 10, 20, 30, 40, 50 and 60 μg lead.

D_3C solution (5 cm^3) is added to each of the sample and standard solutions; after shaking for 30 seconds the two phases are allowed to separate.

Xylene is aspirated into the flame of the atomic absorption spectrophotometer and the instrument adjusted to zero.

The xylene layers from the standard solutions are aspirated at the beginning and at the end of a series of samples. The peak height of the top standard solution at the beginning and at the end of a series should not differ by more than 3% (about 2.6 μg Pb).

A graph is constructed of the mean peak height of each pair of standard solutions against their lead content. The lead content of the sample solutions and of the blank solution are determined from this graph; the lead content of the blank solution is subtracted from that of the sample solutions, after which the lead content of the samples is calculated.

(c) *Süddeutsche Zucker-AG (SZ)*

Apparatus

Atomic absorption spectrophotometer: Perkin-Elmer Model 300S (Bodenseewerk Perkin-Elmer & Co., Ueberlingen, Germany), equipped with a Model HGA 72 graphite atomizer and a deuterium background compensation system.

Electrodeless discharge lamp: Perkin-Elmer Model M 1931 (Pb).

Recorder: Perkin-Elmer Model 56M.

Micropipette 50 mm^3 (Eppendorf Gerätebau, Hamburg, Germany).

Reaction tubes (12 mm internal diameter, 65 mm length with flat bottom).

Magnetic stirrer with container for reaction tubes.

Instrument settings — atomic absorption spectrophotometer: wavelength 283.3 nm; slit width 590 μm; recorder 10 mV, chart speed 2 cm.min^{-1}; graphite atomizer, dry 92°C (3 min), ash 245°C (30 s) (temperature rate 5°C.s^{-1}) and 550°C (3 min), atomize 2045°C (10 s); purge gas argon.

Reagents

Aqua regia: mixture of 1 volume concentrated nitric acid (Merck, Suprapur) and 3 volumes concentrated hydrochloric acid (Merck, Suprapur).

Diethylammonium diethyldithiocarbamate: solution of D_3C (Merck No. 3408) in xylene (Merck No. 8687), 1 g/100 cm^3 referred to in the text as D_3C.

Stock lead solution (1000 μg.cm^{-3}): as in IRS method.

Working lead solution (10 μg.cm^{-3}): 1 cm^3 of the stock lead solution and 30 cm^3 of *aqua regia* are brought to volume with distilled water in a 100 cm^3 volumetric flask.

Procedure

Sample digestion — A sample (10 to 15 g) is digested according to the procedure described in our first paper[1] on the determination of mercury, but with *aqua regia* instead of nitric acid. The digest obtained (representing 10 to 15 g sample) is made up to 250 cm^3 at the end of the procedure. A blank solution is prepared by carrying out the entire procedure but without the sample.

Determination — An aliquot of the sample solution (0.2 cm^3 for pulp or 0.5 cm^3 for molasses) is pipetted into a reaction tube; D_3C solution (0.5 cm^3) is added and the mixture stirred mechanically for exactly 2.5 min. The layers are then allowed to separate and 50 mm^3 of the the xylene layer is injected into the graphite atomizer, using the micropipette, and the absorbance recorded. The absorbance of the blank solution is deducted from that of the sample solution.

A range of standards is prepared by pipetting respectively 1, 2, 3 ..... 10 cm^3 of the working lead solution into 1000 cm^3 volumetric flasks; to each of these flasks *aqua regia* (30 cm^3) is added and the solutions are brought to volume with distilled water. The standard solutions prepared in this way, containing 0.01 to 0.1 μg.cm^{-3}, are treated in the same way as the sample solutions (see preceding paragraph).

A calibration graph is constructed by plotting the absorbance of the standard solutions against their lead concentrations. The lead content of the sample is calculated from this graph.

EVALUATION OF METHODS

In recovery experiments, known amounts of lead were added to blanks and samples before digestion. Recoveries were in the ranges of 100 to 101% (IRS), 97 to 109% (BS) and 98 to 101% (SZ). The limits of detection of the methods are 0.2 mg/kg (IRS), 0.1 mg/kg (BS) and 0.1 mg/kg (SZ).

Based on the results of 33 (IRS), 14 (BS) and 10 (SZ) duplicate analyses of dried pulp, the standard error of the mean of a duplicate determination has been found to be 0.18, 0.18 and 0.09 mg/kg respectively. These values imply confidence limits between duplicate tests (P = 0.05) of ±0.37 (IRS), ±0.39 (BS) and ±0.20 mg/kg (SZ).

RESULTS

Exchange samples

Replicate analyses were carried out by the three participating laboratories on fourteen samples of dried pulp, molasses pulp or pulp nuts. The samples were ground before distribution but were sub-divided by the individual receiving laboratories. The samples originated from various sugar factories in the three countries concerned.

The reliability of the analytical methods was additionally checked by analysing the National Bureau of Standards standard reference material NBS-1571 (orchard leaves). This standard has a certified lead content of 45 ±3 mg Pb/kg.

The results obtained are given in Table I. Variance analysis and a ranking test[9] showed that the differences between the results obtained in the three laboratories were not significant. Except in the case of sample 9, differences between individual variances tested by the method of Cochran[10] were shown to be insignificant. From the variance analysis and from the individual variances, it may be concluded that the best estimate of the standard error of an individual result (sample 9 excluded) is 0.30 mg/kg.

Table I. Lead content of pulp samples (mg/kg material referred to a moisture content of 12%) and NBS sample (mg/kg dry matter)

Sample No	Type	Laboratory			Mean	Standard deviation
		IRS	BS	SZ		
1	Dried pulp	1.5	0.9	1.3	1.2	0.31
2	Molassed pulp	0.7	1.2	1.1	1.0	0.26
3		4.0	4.3	3.8	4.0	0.25
4		0.8	0.8	0.8	0.8	0.00
5		0.8	0.4	0.4	0.5	0.23
6		1.5	1.1	1.1	1.2	0.23
7		4.9	4.0	4.3	4.4	0.46
8	Pulp nuts	2.5	2.7	3.2	2.8	0.36
9		3.5	3.0	4.8	3.8	0.93
10		4.9	4.2	4.4	4.5	0.36
11		4.8	4.2	5.2	4.7	0.50
12		2.7	2.4	2.2	2.4	0.25
13		1.0	1.1	1.0	1.0	0.06
14		1.7	2.1	1.6	1.8	0.26
NBS-1571 (content 45 ±3 mg/kg)	Orchard leaves	45.3	43.3	44.4	44.3	

Results obtained on the NBS standard sample confirm that the accuracy of the three methods of analysis is very satisfactory.

Importance of sub-sampling technique

An investigation into the effect of particle size of samples on their lead content confirms the results obtained in respect of mercury[1] and emphasises the extreme importance of adopting an adequate method for sample preparation.

Some ground samples of pulp nuts were sieved, using brass sieves with aperture sizes of 250 and 595 μm, to separate fine, medium and coarse fractions. The lead

[9] Sachs: "Angewandte Statistik" (Springer Verlag, Berlin-Heidelberg-New York), 1973, 422-426.

[10] *Idem: ibid.*, 383.

contents of these fractions were measured using the IRS method and the results are given in Table II. It is evident from these results that the lead content increases substantially with decreasing particle size. This is probably associated with the fact that most of the heavy metals in plant material are absorbed in the parenchymatous tissue.

Table II. Lead content of different size fractions of ground pulp nuts.

Sample	Fraction	Weight %	Lead content (mg/kg)	Weighted mean (mg/kg)
A	Coarse (>595 μm)	55.1	2.6	3.7
	Medium	26.9	4.4	
	Fine (<250 μm)	18.0	6.0	
B	Coarse	60.9	0.1	0.7
	Medium	23.1	0.9	
	Fine	16.0	2.4	
C	Coarse	52.5	1.9	3.2
	Medium	34.9	3.9	
	Fine	12.5	6.9	

Tests on routine samples

Composite samples of pulp nuts (IRS), molassed dried pulp and pulp nuts (BS) and of molassed dried pulp and pulp nuts (SZ), produced at various factories in the three participating countries, have been investigated in duplicate.

Samples examined were all composite samples but representing different production periods, i.e. 1 week (IRS), 2 weeks (SZ) or an entire campaign (BS). In general, during each campaign, 1 to 3 samples from each factory were analysed by IRS, 1 to 4 samples by SZ and 1 sample by BS.

The results obtained are summarized in Table III. It is clear from the results that the proposed EEC upper limit of 10 mg Pb/kg material (converted to a moisture content of 12%) is exceeded neither by any of the mean values nor by any of the individual results. The values found are, in general, only about 20% of the proposed maximum and do not vary much from year to year.

Table III. Lead content of samples of pulp from factories in Holland, United Kingdom and West Germany (mg Pb/kg material converted to a moisture content of 12%)

Campaign	Number of factories investigated	Lead content*		
		mean	minimum	maximum
1972/73	17	1.7	0.7	4.6
1973/74	17	1.9	0.7	6.8
1974/75	26	1.2	0.3	3.1
1975/76	11	2.0	0.6	5.0
1976/77	11	1.6	0.7	3.9
1977/78	11	2.3	1.1	4.3
1978/79	11	1.4	0.7	2.4
1979/80	11	1.9	0.7	3.5

*In instances where more than one sample from a single factory was investigated, average values were taken for the calculation of the mean value for the campaign and individual values were taken for the estimation of the minima and maxima.

Initial examination of some samples of molasses indicated that the lead content of this material is generally low (0.2 to 0.8 mg Pb/kg material). Investigations were therefore carried out on a relatively small number of molasses samples and the results are not included in the present paper.

Summary

Methods for the determination of lead in dried sugar beet pulp and molasses, using flame and flameless atomic absorption procedures, have been collaboratively studied. Each participating laboratory developed its own method of analysis. Recoveries of added lead ranged from 97 to 109%. Limits of detection of the methods ranged from 0.1 to 0.2 mg Pb/kg. Investigation into the relationship between particle size and lead content revealed an increasing lead content with decreasing particle size. Fourteen samples of dried pulp were distributed and subjected to replicate analysis in the participating laboratories. Good agreement is shown between the methods. All methods gave satisfactory results when checked by analysis of an NBS standard sample of orchard leaves. The methods were applied to samples of pulp produced at various sugar factories in Holland, the United Kingdom and West Germany over a period of several years. The levels of lead found in these samples were considerably lower than the proposed EEC standard for animal feeding stuffs (not exceeding 10 mg Pb/kg material at a moisture content of 12%).

Etude en collaboration sur le dosage des micro-éléments dans les pulpes sèches de betterave sucrière et les mélasses. 3me partie. Le plomb

On a étudié, en collaboration, des méthodes de dosage du plomb dans les pulpes sèches et les mélasses de betterave par absorption atomique avec et sans flamme. Chaque laboratoire participant à l'étude a mis au point sa propre méthode d'analyse. La récupération du plomb ajouté va de 97 à 109% . Les seuils de détection des méthodes vont de 0,1 à 0,2 mg de Pb/kg. L'étude de la relation entre les dimensions des particules et la teneur en plomb montre que la teneur en plomb augmente quand les dimensions des particules diminuent. 14 échantillons de pulpes sèches ont été distribués et analysés deux fois par les laboratoires participants. On a constaté une bonne concordance entre les méthodes. Toutes les méthodes ont donné des résultats satisfaisants quand on les contrôlait par analyse d'un échantillon standard NBS, constitué de feuilles de verger. On a utilisé ces méthodes pour l'analyse de divers échantillons de pulpes produites dans diverses usines situées aux Pays-Bas, en Grande-Bretagne et en République Fédérale d'Allemagne au cours d'une période de plusieurs années. Les niveaux de plomb trouvés dans ces échantillons sont considérablement plus faibles que le standard proposé par la CEE pour les aliments pour animaux (ne pas excéder 10 mg de Pb/kg de produit ramené à une humidité de 12%).

Gemeinsame Studie über die Bestimmung von Spurenelementen in Zuckerrübentrockenschnitzeln und Melassen. Teil 3. Blei

Es wurden gemeinsam Methoden zur Bestimmung des

Bleigehaltes in Schnitzeln und Melassen untersucht unter Anwendung der Atomabsorptionsspektrophotometrie mit und ohne Flamme. Jedes der drei beteiligten Laboratorien entwickelte seine eigene Analysenmethode. Beim Zusatz bekannter Bleimengen wurden 97 bis 109% wiedergefunden. Die Nachweisgrenze der Methoden liegt bei 0,1 bis 0,2 mg Pb/kg. Die Untersuchung des Zusammenhanges von Korngrößenzusammensetzung und Bleigehalt zeigte die Erhöhung des Bleigehaltes mit abnehmender Korngrößenzusammensetzung. In einem Ringversuch wurden 14 Proben ausgetauscht und von den drei Laboratorien parallel untersucht. Zwischen den drei Methoden ist die Übereinstimmung gut. Alle Methoden geben befriedigende Ergebnisse bei der Untersuchung einer NBS-Standardprobe von Efeublättern. Die Meßverfahren wurden zur Untersuchung von Schnitzelproben aus verschiedenen Fabriken in den Niederlanden, dem Vereinigten Königreich und Deutschland während eines Zeitraumes von mehreren Jahren angewendet. Der in diesen Proben gefundene Bleigehalt liegt beträchtlich niedriger als der vorgeschlagene EG-Richtwert für tierische Futtermittel, der eine Nichtüberschreitung von 10 mg Pb/kg Substanz bei einem Wassergehalt von 12% vorsieht.

Estudio colaborativo de la determinación de elementos vestigiales en pulpa seca de remolacha y en melaza. Parte III. Plomo.

Métodos para la determinación de plomo en pulpa seca de remolacha y en melaza, utilizando procedimientos de absorción atómica con y sin llama, se han estudiado por colaboración. Cada laboratorio que participa ha desarrollado su proprio método de análisis. Recuperaciónes de plomo añadido se colocan entre 97 y 109%. Limites de detección de los métodos se colocan entre 0.1 y 0.2 mg Pb/kg. Investigación de la relación entre tamaño de la partícula y contenido de plomo reveló un aumento del contenido de plomo con disminución del tamaño de la partícula. Se han distribuido catorce muestras de pulpa seca y se han sometido a análisis con replicación en los laboratorios que participan. Se ha obtenido buen acuerdo entre los diferente métodos. Todos dan resultas satisfactorias cuando se han controlado por análisis de una muestra normal de hojas de una huerta del NBS. Los métodos se han aplicado a muestras de pulpa producido en diferentes ingenios azucareros de los Paises Bajos, del Reino Unido y de Alemania Occidental, durante un período de algunos años. Los niveles de plomo encontrado en estas muestras estuvieron notablemente más bajo de la norma proponido por la CEE para alimentos de ganadería (no superar 10 mg Pb/kg de la materia a un contenido de agua de 12%). □

Composite panel production from sugar cane rind

By D. W. NYBERG
(Hawker Siddeley Canada Ltd., Lignex Products Group, Vancouver, Canada)

Introduction

In the conventional sugar cane milling operation, the cane is shredded and crushed in preparation for extraction of the sugar. The main residue of the mill is bagasse, which may be used as fuel in the plant boilers to produce steam for process heat and electric power generation. Alternatively, the bagasse, the particle size distribution of which varies considerably, depending on the details of the milling operation, may be depithed to obtain raw material suitable for particle board production. The small particle size necessitates the use of 8 to 11% resin binder and for this reason the less expensive urea-formaldehyde resins are commonly used. The product is restricted to interior use, because urea-formaldehyde bonded boards begin to disintegrate when exposed to humid conditions. In addition, the low press temperatures used in curing urea-formaldehyde resins do not chemically convert the small quantities of residual sugar in the bagasse. Thus, bagasse particle boards are subject to insect, fungus and bacteriological attack if not protected by a preservative.

D. W. Nyberg

In the mid-1960's, a revolutionary method for processing sugar cane was invented in Canada. In this method, the cane is processed in such a way that its three principal components, the outer epidermis layer, the rind, and the inner pith material, are separated by mechanical means without significant damage to the rind fibre.

In the Separator machine, illustrated in Figure 1, the cane enters the machine at high speed (6 $m.sec^{-1}$) in the form of billets up to 200 mm long. First, the cane is split longitudinally into two halves, after which the halves are flattened and a series of high speed cutter rolls scrape the pith and epidermis clear of the rind as it passes through the machine. The rind suffers little physical damage, remaining substantially uncrushed.

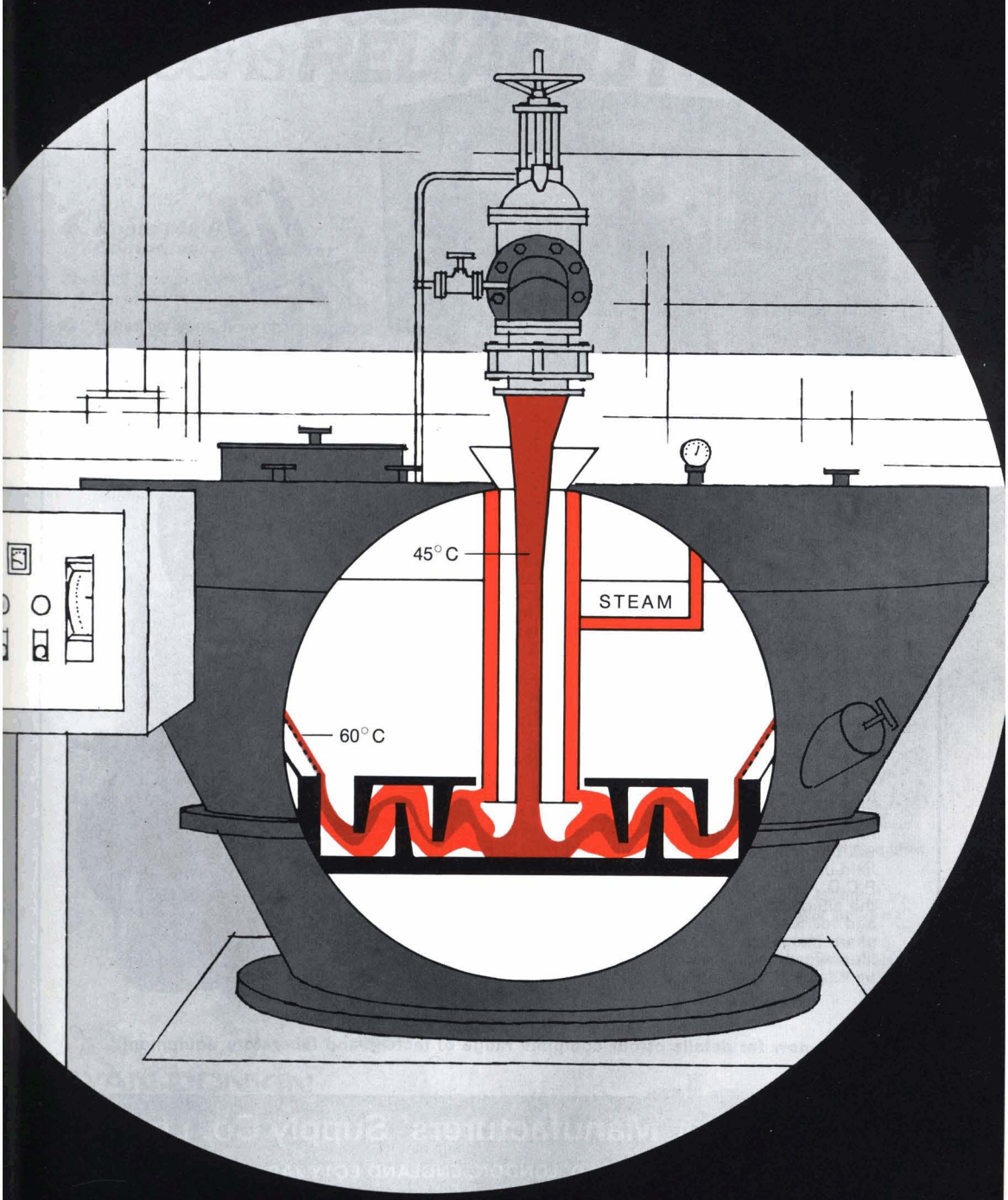
The rind comprises on average 19% by weight of the original green cane. The rind is 55% to 60% water and, after drying, it contains approximately 70% high quality fibre. The fibre bundles are oriented parallel to the axis of the stalk and, although fairly strong, are linked weakly to each other. Thus rind is similar to wood, having high tensile strength in the longitudinal direction and relatively weak strength perpendicular to the fibre bundles. As a raw material for composite panel manufacture, these strength properties are ideal, since the rind may be randomly oriented in the plane of the board, to produce boards with homogeneous strength properties, or oriented in alternate layers or unidirectionally to produce strength properties similar to plywood or to timber.

Konti 10-DC

Hein, Lehmann Centrifugal

New with inner heating system

Much more capacity
Better sugar quality
Lowest molasses purity



A member of
MECAN ARBED

HEIN, LEHMANN AKTIENGESELLSCHAFT

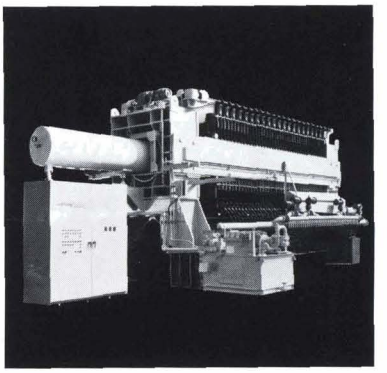
D-4000 Duesseldorf 1, P.O.B. 4109
Telex 8 582 740 hld

There are at least 5 good reasons for choosing a LASTA fully automatic filter press.

1. Travelling Filter Cloth.

Secures fully automatic cake discharge even for sticky filter cakes.

No manual assistance is needed as may be the case in other »automatic cake discharge systems«.



2. Simultaneous Cake Discharge.

Secures an ultra short cycle time and consequently a much bigger output per m² filter cloth per hour than conventional filter presses opening and emptying one chamber at a time.

3. Horizontal Pressing and Vertical Cake Discharge.

Horizontal design (horizontal pressing and vertical cake discharge) permits a much bigger filter area in one press than vertical design (vertical pressing and horizontal cake discharge).

So where you need 2, 4 or 8 vertical presses, you can manage with just 1 horizontal press.

Horizontal design facilitates maintenance. The filter plates are placed vertically in the press and can easily be lifted up - unlike to vertical design where you have to remove the heavy filter plates horizontally from the press, causing support problems etc.

In horizontal presses the slurry is pressed between 2 filter cloths. In vertical presses, the slurry is pressed directly against the membranes. This constant, direct contact with slurry particles will reduce the lifetime of the membranes considerably.

In horizontal presses of the LASTA type you only have to change 1 filter cloth (appr. 5% of total filtering area) in case of breakage - whereas in existing vertical presses you have to change the whole filter cloth.

In horizontal presses one side of the filter cloth is always the »filtrate side«. In vertical presses with endless filter cloth, it changes between being »filtrate side« and »cake side«. Small cake particles left on the filter cloth from one pressing to another may combine with the filtrate and make it more difficult to produce a very clean filtrate.

4. With or Without Membranes.

The extra costs of membranes is fully justified when you have a compressible filter cake.

When you have a non-compressible filter cake, they may not be justified.

LASTA is supplied in two versions:

- ISD-H with membranes.
- ISF-H without membranes.

It is relatively easy and inexpensive to change an ISD-H press to an ISF-H press and vice versa.

5. New Design of Filter Cloth Suspension.

Vastly reduceds downtime when changing filter cloths.

Let us try to find another 5 together!

Please contact:

GV-Separation A/S
International House
Center Boulevard 5
DK-2300 Copenhagen S.
Denmark
Phone: +45 1 52 02 11
Telex: 31124

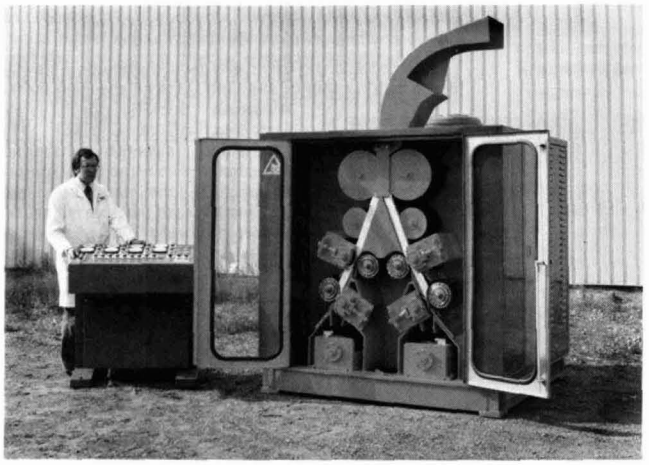


Fig. 1

A production machine, rated at 20 tonnes of cane per hour, was in operation at the Uplands mill in Barbados during the 1978/79 sugar cane harvesting season. After testing, evaluation and field modification, the machine successfully met all performance criteria. Fresh rind from this installation was dried, baled and shipped to the Company's research and development facility in Vancouver, Canada, for research work on rind board composite products.

The following sections describe the laboratory work in developing the process parameters for the various types of board. In addition, the production, under simulated production conditions, of boards and timber subsequently used for demonstration houses in Barbados, is described.

Laboratory work

Material preparation

Fresh cane rind was processed by the Separator machine in Barbados, dried to less than 10% moisture content by solar energy and in an agricultural type dryer, baled to increase the bulk density, and shipped in containers to the Company's laboratory in Vancouver.

As produced, the rind strips are 20 to 40 mm wide and up to 200 mm long. They are rather weak across their width because there is little bonding between fibre bundles, and because the strips tend to be fractured longitudinally by the feed rolls of the Separator. In this form, the rind is very difficult to handle as it tends to intertwine and form low density nests.

There are two alternative methods of further processing the rind integrally in the Separator. The first process is serration of the rind into strands approximately 3 mm wide by passing it through sets of meshing discs. The chief disadvantage of producing long strands is that they are even more difficult to handle than the long full-width rind. The second process is chopping of the long strips into shorter wafer-like pieces 30 to 40 mm long. In this form, the rind is relatively easy to handle and, if desired, can be broken up into strands 2 to 6 mm wide by a relatively gentle mechanical beating action. A significant advantage of the second process over the first is that the chopper is much easier to maintain than the meshing discs.

Although in many ways, the rind fibre is highly suitable as a raw material for composite board products, there were two problem areas which required detailed investigation, namely the sugar content in the rind and the residual epidermis material, on the outer surface.

On a dry basis, the rind contains approximately 70% fibre and 20 to 30% water-soluble material, a large percentage of which is sugar. Residual sugar in the finished board leaves it subject to bacteriological attack. On the other hand, at high temperature the sugar undergoes chemical change and improves the board properties by acting as a glue and by reducing thickness swell when the board is wetted. In the experimental work, when it was required to remove the readily soluble material, the rind was soaked in hot water.

Residual epidermis creates gluing problems, since the resin will not bond to the hard wax surface. The problem is most severe with the full width rind since the epidermis areas are concentrated. Breaking the rind up into strands is beneficial since the epidermis areas become less concentrated. As an alternative form of preparation, the rind was processed through a knife flaker, resulting in still further dispersal of the epidermis material through the board. As field experience was gained in Barbados, acceptable levels of epidermis removal were achieved. However, there is a trade-off since complete removal of the epidermis will result in the loss of some rind fibre.

Five methods of preparing the rind, prior to final drying and blending with resin, were employed:

(a) Full width rind strips were chopped into wafers approximately 40 mm long;

(b) Rind was prepared as in (a), then soaked in hot water to remove soluble material;

(c) Full length strands were chopped to approximately 40 mm lengths;

(d) Strands were prepared as in (c), then soaked in hot water to remove soluble material; and,

(e) Rind was flaked to produce particles primarily in the range between 8 and 40 mesh screen with a minimum of fines.

Before chopping or flaking the rind, it was rewetted to minimize production of fines. Following mechanical preparation and the hot water extraction, the material was redried and sealed in plastic bags for storage.

The rind was taken from storage, as required, and batch-blended with phenol-formaldehyde resin in a rotating drum laboratory blender. 4% resin was applied to the wafer and strand material, and 6% to the flaked rind, along with 1% wax sizing. Further work is under way to determine if these resin percentages can be lowered, since resin usage is a significant factor in production costs.

Composite panel production

In the initial laboratory program, the five types of furnish were prepared, as described above, and hand felted, 38 x 38 x 13 mm boards were pressed in the medium-sized laboratory press (850 x 850 mm platens) illustrated in Figure 2. Five replications of each type of board were

pressed, using a total press cycle of 8 minutes, platen temperature of 215°C, and a maximum mat pressure of 35.2 kg.cm^{-2} (500 psi).

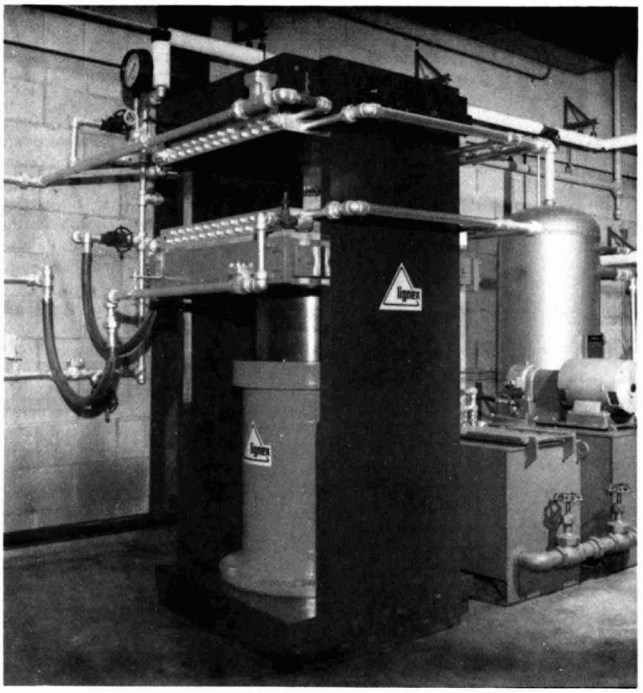


Fig. 2

In addition to the small panel research work, approximately 8 tonnes of 1.2 x 2.4 m (4 x 8 ft) panels were produced on the Company's pilot production line. This work was done under contract to the Canadian Government to specifications defined by their laboratories. These boards were manufactured from flaked rind which was batch-blended with 6% of powdered phenol-formaldehyde resin and 1% of petroleum-based slack wax. The blended furnish was laid up on steel caul plates treated with a release agent. Uniform mats, yielding the required board thickness and density, were obtained using a tube-type felter specially designed by Hawker Siddeley Canada Ltd. The felted mats were then conveyed into the large press where they were subject to similar press temperature and pressure to those described above. Press times varied from 6 minutes for the thinnest panels to 35 minutes for the 38 mm panels. Stops were used along the sides of the press and a LVDT sensor provided a control signal to the hydraulic system. To maintain quality control, each panel was weighed as it came out of the press.

The 1.2 x 2.4 m panels were produced in four thicknesses: 16 mm for flooring; 11 mm for roof sheathing and exterior siding; 9.5 mm for interior partitions. Further panels of 38 mm thickness were produced and cut to size for use as studs, joists, headers and rafters. The panels and timber were subsequently shipped to the Ottawa Laboratory of Forintek Canada Corporation for treatment with a fungicide and insecticide preservative in preparation for shipment to Barbados where demonstration houses were erected.

Composite panel strength properties

After conditioning for several days, the boards were subjected to a number of standard tests as specified by the American Society for Testing Materials, ASTM D-1037. The mechanical strength properties measured were the moduli of rupture and elasticity, the internal bond, and the modulus of rupture after accelerated ageing (Canadian Standards Association, 2 hour boil test.

In common with wood-based particle boards, the strength properties of cane rind boards are strongly correlated with density. A range of densities was investigated, and the experimental data were subjected to linear regression analyses by the method of least squares.

The moduli of rupture (MOR) as a function of density are plotted in Figure 3. The MOR are well above the minimum value required for exterior particle board by U.S., Canadian and other major recognised standards, at densities above 640 kg.m^{-3}. In general, the correlations between MOR and density were fair to good. The flaked rind panels, which were machine felted, show significantly higher strength in the machine direction, i.e. the direction the caul plate travels through the felter, than in the cross-machine direction. This is due to a tendency of the rind flakes to orient in the machine direction. The flaked rind boards contained 6% phenol-formaldehyde resin and no attempt was made to extract sugar. No significant differences in MOR were found for the unwashed strands, the washed wafers, or the unwashed wafers with 4% phenol-formaldehyde resin as a binder. On the other hand, the unwashed rind strands yielded panels with higher MOR indicating that the sugar which is caramelized by the high temperature, acts as an additional binder. It is also noted that at the lower densities, there is no significant difference in MOR for strands or wafers, whether washed or un-washed. This indicates that caramelized sugar is more effective as a binder as density increases.

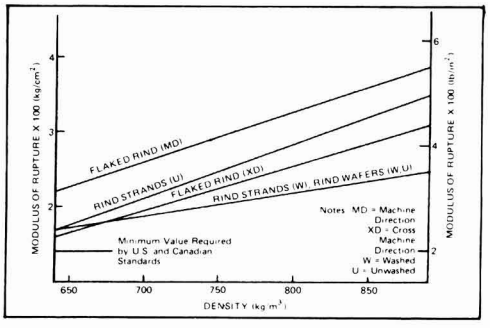


Fig. 3. Modulus of rupture *vs.* density of sugar cane rind composite panel. (Linear regression analysis of test data)

The moduli of elasticity (MOE) as a function of density are plotted in Figure 4. Once again, values of MOE well above recognized standards are readily obtained. The MOE is the important strength property in applications, such as roof sheathing and subfloors, where minimum deflection is the major criterion. As with the MOR data, the caramelized sugar appears to be increasingly effective as a glue as density increases.

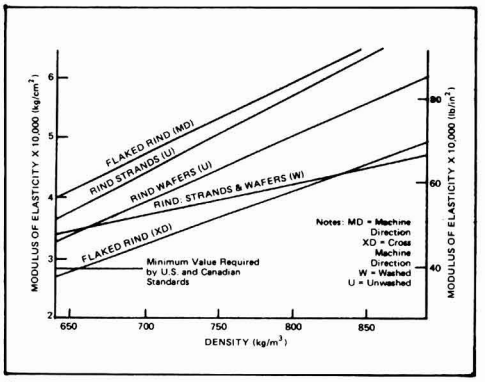


Fig. 4. Modulus of elasticity *vs.* density for sugar cane rind composite panels. (Linear regression analysis of test data)

The tensile strengths perpendicular to the surface of the panels (internal bonds) are summarized in Figure 5. Over the density range of 650 to 850 kg.m^{-3} there was no correlation between the internal bond and density. The midpoint of the vertical line represents the average value and the top and bottom extremes represent one standard deviation. These data illustrate clearly the effect of the epidermis material on the adhesion of glue and the rind. Acceptable levels of epidermis removal by the Separator machine are now being achieved, signifiantly improving this condition.

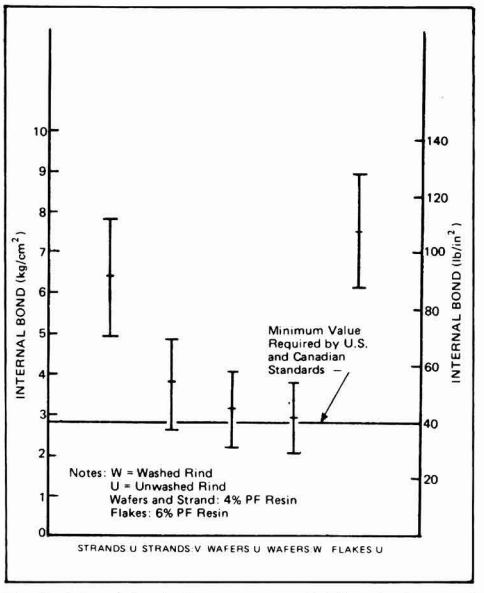


Fig. 5. Internal bonds for sugar cane rind boards. Average ± Standard Deviation

Basically, the resin will not bond to the hard wax-like epidermis layer. Without efficient removal, the epidermis areas on wafers may be large and are concentrated, resulting in internal bonding defects. When epidermis is present, processing the rind into strands improves the internal bond, since the areas with epidermis are dispersed throughout the board. With adequate epidermis removal, either wafers or strands produce panels to standards better than Canadian and U.S. requirements for exterior grade boards. However, still better results are obtained with the flaked material because of the increased surface area, although this is at the expense of increased resin usage. The effect of the caramelized residual sugar is to increase the internal bond strength, particularly at the higher board densities.

Work is continuing on the evaluation of long-term ageing effects and susceptibility to bacteriological action of the caramelized residual sugar. However, all boards passed the Canadian accelerated ageing test, where samples are boiled for two hours. With the flaked rind, a lower resin level of around 5% is expected to yield satisfactory strength properties and further work is under way to confirm this.

Discussion and conclusions

The production of exterior quality structural grade panels, from the rind portion of the sugar cane stalk, has been shown to be technically feasible. The economics of producing this type of board are also expected to be very favourable. This technological breakthrough has been made possible by the Separator machine which breaks the cane stalk down into its basic physical constituents, the epidermis, rind and pith. The substantially undamaged rind requires only minimal further processing to prepare it as a raw material for the panel manufacturing process.

The successful use of sugar cane rind for panel production required the investigation of two main technical problems, namely the effects of the sugar in the rind and residual epidermis on the outer surface of the rind. Removal of the majority of the epidermis was found to be essential, since the resin will not bond to it. The sugar in the rind may be extracted by diffusion prior to board production. This adds to the production costs because of the added costs of the diffusing equipment and additional drying capacity, which may prove to be uneconomical when considering the low yield of sucrose from the rind. On the other hand, the sugar recovered may compensate for these additional costs. If the sugar is left in the rind, it undergoes chemical change, and becomes an insoluble glue at the high temperature required to cure phenol-formaldehyde resin. At board densities above 700 kg.m^{-3}, the caramelized sugar acts as an additional bonding agent, increasing the mechanical strength properties. In either case, the board must be adequately treated to prevent any small amounts of residual sugar from bacteriological attack.

In conclusion, it has been shown that new technology is available to upgrade the conventional low quality interior grade bagasse board to an exterior quality structural grade panel. Economic benefits to the sugar mill can be shown to be substantial.

Summary

A process for utilizing sugar cane rind fibre to produce exterior structural grade composite panels has been developed, and the effects of particle geometry, residual sugar content, epidermis material, and panel density on mechanical properties studied. Panel strength properties,

in particular moduli of rupture and elasticity and internal bond, exceeding the Canadian, US and other recognized standards for structural grade board, are obtainable, using phenol-formaldehyde resin, at a panel density of 650 kg per cubic metre. Optimum particle geometry is a compromise between large area pieces of rind which require the least resin, and smaller particles which result in more uniform strength properties. The hard, wax-bearing epidermis material of the rind is detrimental to board properties because the resin will not bond to it, and it must be removed as completely as possible during production of the rind particles. Residual sugar present in the rind is caramelized during the hot pressing operation and the hard, insoluble caramel acts as a bonding agent, improving the strength properties.

La production de panneaux comprimés à partir d'écorce de canne à sucre

Un procédé d'utilisation de la fibre de l'écorce de canne à sucre pour la production de panneaux comprimés pour constructions à l'extérieur a été mis au point et les effets de la géométrie des particules, de la teneur résiduaire en sucre, du matériau de l'épiderme et de la densité du panneau sur les propriétés mécaniques ont été étudiés. On peut obtenir des propriétés de résistance du panneau, en particulier des modules de rupture, d'élasticité et de liaison interne supérieures aux normes canadiennes et U.S. reconnues pour les panneaux de la qualité pour construction par l'emploi de résine phénol-formaldéhyde à une densité de 650 kg par m^3. La géométrie optimale des particules est un compromis entre les grands morceaux d'écorce qui demandent le moins de résine et les particules plus petites qui assurent des propriétés de résistance plus uniformes. Le matériau de l'épiderme de l'écorce, dur et enduit de cire, est nuisible pour les propriétés du panneau parce que la résine ne s'y attachera pas et il doit être éliminé aussi complètement que possible au cours de la production des particules d'écorce. Le sucre résiduaire présent dans l'écorce est caramélisé au cours de l'opération de pressage à chaud et le caramel, dur et insoluble, agit comme agent de liaison, améliorant les propriétés de résistance.

Fiberspanplattenherstellung aus Zuckerrohrrinde

Ein Verfahren zur Verwendung des Fibers von Zuckerrohrrinde für die Herstellung von Spanplatten, die den Baunormen für den Hausbau entsprechen, ist entwickelt worden, und der Einfluß der Teilchen-Größe, des Rest-Zuckerghaltes, des Epidermis-Anteils und der Platten-Dichte auf die mechanischen Eigenschaften ist untersucht worden. Bei Verwendung eines Phenol-Formaldehyd-Harzes und einer Platten-Dichte von 650 kg/m^3 sind Festigkeitseigenschaften möglich, die besonders in Bezug auf den Bruch-Modul, den Elastizitätsmodul und die innere Bindung den kanadischen, US-amerikanischen und anderen anerkannten Normen für den Hausbau entsprechen. Die optimale Teilchengröße ist ein Kompromiß zwischen großen Rindenteilchen, die die geringste Menge an Harz erfordern und kleineren Teilchen, die eine gleichmäßigere Verteilung der Festigkeitseigenschaften bewirken. Die das Wachs enthaltende harte Epidermis der Rinde verschlechtert die Platteneigenschaften, weil das Harz nicht an das Wachs bindet, und daher so gut wie möglich während der Herstellung der Rindenteilchen entfernt werden muß. Der in der Rinde vorhandene Rest-Zucker wird während des heißen Preßvorgangs karamelisiert, und der harte unlösliche Karamel wirkt als Bindehilfsmittel und verbessert damit die Festigkeitseigenschaften.

Producción de paneles compuestos de la corteza de caña de azúcar

Se ha desarrollado un proceso para utilizar la fibra de la corteza de caña de azúcar para producir paneles compuestos de un grado para estructuras exteriores. Los efectos sobre propiedades mecánicas de la geometría de las partículas, el contenido residual de azúcar, la material de la epidermis y la densidad del panel se han estudiado. Propiedades de resistencia del panel, en particular módulos de ruptura y elasticidad y adhesión interna, que superan las normas de la Canadá, de los E.U.A. y otros reconocido para tablas de grado estructural, pueden obtenerse, usando resina de fenol-formaldehido, a una densidad del panel de 650 kg por metro cúbico. Geometría óptima de la partícula es un compromiso entre pedazos de la corteza de grande área, que necesitan un mínimo de resina, y partículas más pequeñas, que dan propriedades más uniforme de resistencia. La materia dura de la epidermis de la corteza, que contiene cera, es perjudicial a las propriedades de la tabla porque la resina no la puede adherir, y es necesario eliminarla tan completamente que posible durante producción de las partículas de la corteza. Azúcar residual presente en la corteza se carameliza durante la operación de compresión con calor, y el caramelo, duro y insoluble, funciona como un agente de adhesión, mejorando las propriedades de resistencia.

Effect of aerated steam treatment on the incidence of red rot (*Colletotrichum falcatum* Went) of sugar cane

By S. NATARAJAN and S. MUTHUSAMY
(Sugarcane Experiment Station, Cuddalore, Tamil Nadu, India 607001)

Red rot (*Colletotrichum falcatum* Went) of sugar cane is the most important disease in Tamil Nadu causing total loss in yield. This disease was responsible for the elimination of two important high quality canes, viz. Co 658 and Co 449 from cultivation after the outbreak of the disease during 1974[1]. Control of the disease by chemical means did not yield any consistent results[2,3]. Of late, heat therapy is commonly suggested for the control of virus and mycoplasma diseases in cane. This method has been recommended for the control of fungal diseases of cane, particularly red rot and smut (*Ustilago scitaminea* Syd.), but no concurring results were obtained so far[4,5,6,7]. The above heat treatment trials were carried out either with hot water or hot air and not much work

[1] Lewin, Natarajan & Rajan: *Farm Science*, 1976, **3**, (2), 15–17.
[2] Idem: *Sugarcane Pathologists' Newsletter*, 1976, **17**, 17–20.
[3] Anon: *Tech. Rpt. All-India Coordinated Research Project on Sugar cane* (1978–79), *Plant Diseases Section*, 1979, 1–20.
[4] Jha, Singh, Prasad & Jha: *Indian Sugar*, 1976, **26**, 441–447.
[5] Jha & Singh: *Indian Sugar Crops J.*, 1977, **4**, (2), 47–48.
[6] Singh: *Plant Disease Reporter*, 1972, **57**, 220–222.
[7] Anon: *Ann. Rpt. Sugarcane Breeding Inst.* (Coimbatore, India), 1976, 89.

has been done with aerated steam. Hence to ascertain the effect of aerated steam treatment (AST) on red rot, a field trial was laid out during 1978–79 at this station and results are furnished here.

Materials and methods

The trial was laid out using as test variety Co 658 which is highly susceptible to red rot. Canes showing typical early symptoms of the disease (yellowing of leaves, nodal rooting, rind discoloration, etc.) but with firm buds were selected for infected material and apparently healthy canes for comparison. The canes were cut into two-budded setts and treated in a commercially available AST unit at 50°C for 4 hours. After treatment the setts were planted in the field. The plot size adopted was 48 sq.m. with 0.8 m between rows. The trial layout was a randomized block design and replicated thrice. Red rot incidence was recorded on tiller basis from 35th day onwards at 15 days interval up to 10 months. Yield was recorded at harvest (11 months). After each count, infected tillers were removed from the mother clump. The trial was laid out in mid-season, i.e. during February, and recommended practices followed.

Results and discussion

Germination, disease incidence and yield data are recorded in Table I. Germination was found to be slightly improved (by 7.5%) in healthy treated cane over the healthy control and this difference in germination was still wider (39.7%) in the case of treated and untreated infected cane.

Table 1. Effect of aerated steam treatment on germination, red rot incidence and yield of sugar cane

Treatment	% Germination	Mean red rot incidence (TV)	Yield, tonnes.ha^{-1}
Apparently healthy			
AST	58.42	44.10	5.35
Bavistin sett dip	54.45	43.48	4.30
control	54.35	36.29	7.22
Infected material			
AST	34.25	69.44	4.17
Bavistin sett dip	36.30	69.12	3.51
control	24.59	76.59	1.90
CD	7.71	17.53	1.68

A similar increase in germination in aerated steam-treated cane has also been observed in the case of smut-infected cane[8]. Gupta *et al.*[9] also observed similar trends when cane infected with grassy shoot disease was subjected to hot water treatment at specified temperature and time.

There was an increase of 21.52% in red rot disease incidence in AS-treated healthy canes over the control. A similar occurrence has also been observed with smut disease; more smut developed in hot water-treated canes than in untreated N:Co 376. The treatment had an ameliorating effect in the case of infected cane where there was a reduction of about 9.3% in the red rot incidence, but this reduction was negligible because more than 80% incidence was observed in the infected AS-treated material. Hence it could be safely concluded that AST had no practical effect in reducing or controlling the red rot disease in cane. This also confirms the findings of earlier workers[4,7].

Yield data recorded in different treatments were very low. Maximum yield obtained was from the healthy control followed by healthy AS-treated cane. At harvest only a few canes were standing in most of the plots. Such a total loss could be attributed only to very high incidence of red rot.

Conclusion

Aerated steam treatment at 50°C for 4 hours was employed for the treatment of healthy and red rot infected sugar cane. The treatment increased the germination of healthy setts by 7.5% and 39.7% in infected setts over the respective controls. The treatment aggravated the disease in healthy canes by 21.52% over the healthy control, however. In infected material, the reduction in red rot incidence was only 9.3%. Even in treated infected canes, the incidence was more than 80%. Hence it can be concluded that the treatment had practically no effect in controlling the disease and at the same time aggravated the incidence in healthy canes. Near-total loss in yield was recorded.

Acknowledgement

The authors are thankful to Thiru P.S. Sanjeevi, Crop Specialist (Sugarcane), and to Thiru H.D. Lewin, Plant Pathologist, for their interest and guidance during the course of the work.

Summary

Trials using aerated steam treatment showed that this did not give any practical control of red rot disease of sugar cane.

L'effet du traitement à la vapeur aérée sur l'incidence de la pourriture rouge de la canne à sucre

Des essais de traitement à la vapeur aérée révèlent que ceci ne donne aucun résultat pratique dans la lutte contre la maladie de la pourriture rouge de la canne à sucre.

Wirkung der Behandlung mit lufthaltigem Dampf auf das Vorkommen von Rot-Rotz bei Zuckerrohr

Versuche mit der Behandlung von Zuckerrohr mit lufthaltigem Dampf ergaben keine praktische Bekämpfung des Rot-Rotzes bei Zuckerrohr.

Efecto de tratamiento con vapor aireado sobre la incidencia de muermo rojo (*Colletotrichum falcatum* Went) de caña de azúcar.

Ensayos del tratamiento con vapor aireado demostraron que ésto no puede dar algun control práctico del muermo rojo de caña de azúcar.

[8] Natarajan & Muthusamy: *I.S.J.*, 1981, **83**, 39-40.
[9] *Indian Sugar Crops. J.*, 1978, **5**, (2), 28-29, 36.

SUGAR CANE AGRONOMY

The influence of row spacing on sugar cane stalk population, sugar content and cane yield. R. J. Matherne and J. E. Irvine. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 96-100. — The effect of row spacing on cane yield was studied over a 10-year period, row spacings being in the range 12-84 inches. Plant population increased per unit area as the inter-row spacing decreased, and increases in plant population were very closely associated with increases in cane yield. Neither row spacing nor population was related to sugar content. Problems associated with changing row spacing in sugar cane plantations are discussed.

Maturity testing of sugar cane. J. D. Miller and N. I. James. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 101-106. Six Florida commercial varieties were sampled every two weeks from August 26 to May 17 for sugar content, Brix and purity, and the data used to compare various maturity testing schemes. Brix at the midpoint of the stalk was a better indicator of sugar content early in the season than top or bottom Brix. After mid-January, Brix of the different segments was not significantly different from whole-stalk Brix. Data suggested that plotting bottom Brix minus top Brix provided a reasonably accurate indication of maturity status. Varieties were mature within two weeks of the time the difference in Brix in the bottom minus top stalk segments equalled zero.

Flame cultivation compared with MSMA for control of itch grass (*Rottboellia exaltata*) in sugar cane. R. W. Millhollon. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 112-114. A flame cultivator utilizing commercial flat burners and propane fuel was used on a 2-ft band over the cane drill or, after the last cultivation, on a 5-ft area covering the entire row. A speed of 3 mph and a gas pressure of 40 psi were found to be optimum for effective control of the grass and for cane safety. Flame gave about 88% control of grass 4 inches tall, while MSMA (monosodium methanearsonate) at 2.5 or 3.5 lb.acre^{-1} gave about 99% control. Neither treatment reduced cane yield by comparison with a hoed control.

Controlling *Aster lateriflorus* in sugar cane. R. W. Millhollon. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 115. — *A. lateriflorus* is a perennial weed which began invading cane fields in Louisiana about 1972, since when it has spread rapidly through the cane and non-cropped areas of the southern region of the state, its seed being windborne. Trials were conducted on its control, for which 2,4-D is unsuitable. Most herbicide treatments giving at least 50% control stunted the weed, so that plants remained relatively small during the growing season and produced few flowers.

Effect of row width on yields of three sugar cane varieties in Florida. E. R. Rice. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 122-124. — A 3-year study on 3- and 5-ft row spacings, involving three varieties, showed little advantage in reducing the spacing from the 5 ft generally used in Florida, the average cane yield being only 5% higher with the reduced spacing. On the other hand, yields of sugar per ton of cane were significantly higher with the 5-ft spacing in both plant and 2nd ratoon crops, although there was no significant difference between the indicated yields of sugar per acre with the two row widths.

Crop logging: a guide for maximizing sugar cane yields in the Lower Rio Grande Valley. A. W. Scott, J. R. Thomas and B. Sleeth. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 127. — The use of foliar diagnosis to identify factors that may be associated with low sugar production in the Lower Rio Grande Valley of Texas was investigated. Fields were sampled at intervals from late May to end-October, leaves and sheaths numbered 3-6 being collected for N, P and moisture determination, and the growth of five primary stalks being measured weekly. The leaf sheath moisture content fell with age, as did the growth index (green weight of the sheath) which was significantly correlated with sheath moisture. Leaf N also fell with age, fluctuation in the N-age curves being related to the plant moisture status. Leaf N and sheath moisture were significantly inter-related. Plant age and sheath moisture accounted for 59% of the variability in leaf N, although other factors could also affect the change in the N concentration with age. Leaf P fell with age, although it was markedly affected by N and moisture contents, stage of plant growth and availability of soil P. A 0.5% decrease in leaf N increased the sugar:cane yield ratio by 2.25%, while a 5.0% fall in sheath moisture increased the ratio by 1.1%.

Growth and yield of sugar cane as affected by row spacing and irrigation regime. J. R. Thomas, F. G. Salinas and L. N. Namken. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 129-135. — The influence of row spacing and irrigation regime on depth and rate of soil water depletion, cane growth, yield and quality (in both plant and ratoon crops) was investigated. Treatments consisted of all combinations of three irrigation regimes (when 40, 60 and 80% of the available soil water in the top 60 cm of soil had been depleted) and three row spacings (122, 152 and 182 cm). Frequent irrigation (at 40% depletion) restricted root development to the upper 60 cm of the soil profile, whereas, with the two other regimes, plants extracted significant amounts of water to a depth of 120 cm. Rate of stalk elongation was significantly affected by the irrigation regime. Seasonal mean daily growth rates of stalk elongation decreased by 0.42, 0.24 and 0.17 cm/day for each 10% decrease in available soil water with irrigation at 40, 60 and 80% depletion, respectively. Plant cane irrigated under the 40% regime out-yielded the least frequently irrigated cane by 15.8 tonnes.ha^{-1}. Reducing the row spacing from 182 to 122 cm increased cane yield by 7.9 and 11.1 tonnes.ha^{-1} in plant and 1st ratoon crops, respectively, but had no effect on subsequent crops. Narrow spacing significantly increased pol, Brix and purity of juice.

Rope wick herbicide applicators. C. Richard. *Sugar Bull.*, 1980, **58**, (12), 12-15. — Details are given of a tractor-drawn device for application of Roundup to control Johnson grass. Designed by an employee of the USDA, it comprises a sealed-end plastic tube, 13 ft long and 3 inches in diameter, having a number of perforations through which lengths of nylon rope are threaded (as with shoe laces), so that they lie tight along the outside surface of the pipe in series and in parallel rows. These rope sections act as wicks, absorbing the chemical (fed into the

pipe through a spout) and applying it to the grass. Advantages include the small amount of herbicide needed, the relative safety to the environment, lack of moving parts and hence low maintenance costs, and high control efficiency (up to 97% with two passes). The applicator is considered highly suitable for grass control on ditch banks or fallow ground, and is to be tested in cane fields where the Johnson grass is taller than the cane (Roundup being phytotoxic to cane).

Population dynamics of microbes in a herbicide (Karmex)-amended sugar cane soil. A. P. Sinha, V. P. Agnihotri and K. Singh. *Indian Sugar Crops J.,* 1979, **6**, 41-44. Although addition of 2 kg.ha^{-1} Karmex to 500-g soil samples, collected from a cane field to a depth of 15 cm, did not have any adverse effect on microbe population over a 45-day incubation period, it did cause a marked fall in the total biological activity of the soil microbes as expressed by the amount of CO_2 evolved.

Companion cropping with autumn-planted sugar cane — a critical review. Intercropping of wheat with autumn-planted sugar cane. K. S. Rathi and R. A. Singh. *Indian Sugar Crops J.,* 1979, **6**, 45-52. — Data from the literature on wheat intercropping with cane are analysed. While, in most cases, authors failed to give details of the agronomic practices used, the authors of the present article give some *ad hoc* recommendations based on their own experiments over a number of years.

Effect of lodging of sugar cane on its yield and quality. R. A. Sharma and S. R. Sharma. *Indian Sugar Crops J.,* 1979, **6**, 53-55. — A study aimed at quantifying the losses in yield and quality of the cane crop as a result of lodging is reported. Comparison was made between results for erect, half-lodged and fully lodged cane. Tabulated data for four varieties demonstrate the adverse effects of lodging on all parameters studied, although there were marked varietal differences; the variety which suffered greatest loss when half-lodged was not necessarily that which was most affected by full lodging.

Pulses as intercrops in sugar cane. Y. Rai, M. H. Ashraf and S. Zaman. *Indian Sugar Crops J.,* 1979, **6**, 64. Recommendations are given on practices to follow when intercropping cane with pulses (a major source of protein in India).

Effect of low-grade pyrites on soil characteristics and yield of sugar cane in calcareous saline-alkali soils. Y. Rai, D. Singh, B. P. Sahi, K. D. N. Singh and M. Prasad. *Indian Sugar,* 1980, **29**, 639-643. — Trials are reported in which pyrites applied to calcareous saline-alkali soil reduced pH, electrical conductivity and exchangeable sodium content, such decrease being greater in post-monsoon than in pre-monsoon soil samples. Leaching also reduced the parameters to some extent. Of the quantity of pyrites applied in the range 1-8 tonnes.ha^{-1}, 4 tonnes.ha^{-1} was optimum as regards greatest increase in yield and profitability over the control.

Economic dose of nitrogen to sugar cane varieties under cultivation in Tamil Nadu. K. V. Daniel and L. Sanjeevirayar. *Indian Sugar,* 1980, **29**, 645-648. — Nitrogen trials involving four cane varieties are reported in which cane yield rose as the N dosage rate was increased in 125 kg.ha^{-1} stages to 375 kg.ha^{-1}. The effects on sugar content and juice purity fluctuated, and differences were found between the varieties as regards economically optimum dosage.

Phosphorus x potassium x lime interaction in sugar cane (plant cane). J. F. da Silveira, J. O. de Siqueira and G. A. A. Guedes. *Brasil Açuc.,* 1980, **95**, 18-21 (*Portuguese*). Trials were conducted with CB 41-76 cane grown on a dark red distrophic clay latosol, treated with calcitic and dolomitic lime and each treated with varying amounts (0, 100 and 200 kg.ha^{-1}) of phosphate and 0, 120, 240 and 480 kg.ha^{-1} of potassium (as K_2O). The dolomitic lime was found to give a higher yield and better juice quality, while the phosphate produced a response in terms of cane yield and especially juice quality. Potassium gave the best response at the lowest dose with calcitic lime but at the highest dose with dolomitic lime. Interactions were generally non-significant.

NPK fertilization of sugar cane (*Saccharum* spp.) in soil at Linhares, ES. G. S. Gondim, L. B. do Rosario, J. A. E. Agostini and D. P. S. Britto. *Brasil Açuc.,* 1980, **95**, 22-30 (*Portuguese*). — A fertilization trial was conducted on a poor, sandy soil in the state of Espiritu Santo on which cane had never been grown before nor fertilizer applied. Two levels each of N as ammonium sulphate, P as calcium superphosphate and K as potassium chloride were applied. The response to N and K was not economical but there was a good response to P in both plant and first ratoon crops in terms of yield of both cane and sugar.

Determination of soil non-exchangeable potassium in relation to cane growth. I. J. Fang and C. C. Wang. *Rpt. Taiwan Sugar Research Inst.,* 1979, (86), 21-40 (*Chinese*). — Of the 217 field experiments on K fertilization conducted in Taiwan during 1963/64-1972/73, 34 showed a significant response, and the cane yields from the plots concerned were studied in relation to the soil K content. Non-exchangeable K in the soil, determined by a modification of the Hunter & Pratt No. 1a method, was highly correlated with cane yield, although it averaged only 1.14% of the total soil K. The details of the technique are given and classification of soil K fertility on the basis of the results is tabulated, together with the recommended rate of fertilizer application.

Companion cropping with autumn-planted sugar cane — a critical review. II. Intercropping of potato with autumn-planted cane. K. S. Rathi and R. S. Singh. *Indian Sugar Crops J.,* 1979, **6**, 71-75. **III. Intercropping of mustard with autumn-planted cane.** Idem. *ibid.,* 76-82.

II. A review is presented of the literature concerning the intercropping of potato with cane and a summary of recommended practices is given.

III. A similar review and summary of recommendations are presented concerning mustard intercropping with cane.

Ratoon management in sugar cane — an agronomic perspective. R. L. Yadav. *Indian Sugar Crops J.,* 1979, **6**, 83-86. — Reports in the literature on ratoon management indicated that, in some places, ratoon yields were higher with trench planting and vertical planting than with flat-planted cane, although no differences were observed in other locations. The best times for harvesting of the plant crop to give highest ratoon yields were different for different varieties, but mid-February to end-March appears to be best generally. Contradictory results have been reported for the effect of plant cane cutting level on ratoon yield. The ratoon crop requires more N fertilizer than plant cane, but the dosage can be reduced by split application; 200 kg.ha^{-1} applied in three split doses in March, April and

May gave the same ratoon yield as 300 kg.ha $^{-1}$ applied in a single dose in March.

Long-range effect of sugar cane cultivation on the soil, yield and quality of sugar cane (Co 419) under V.C. tract soil conditions. B. Rabindra, T. Sheshgirirao and S. B. K. Gowda. *Indian Sugar Crops J.*, 1979, **6**, 99-101. — An experiment was set up at the Mandya Regional Research Station in 1961/62 and studies have been made to determine the effect of long-term cane cropping, both continuous and with fallows and rotational crops, with application of fertilizer and without. Continuous cropping reduced the pH of the soil e.g. from 6.8 to 6.3, but no change occurred when rotations and fallows were employed. In the absence of fertilizer the soil nutrient contents fell, but they were higher than the control where fertilizer was applied. Fertilizer application was also found to benefit juice quality, and omission of fertilizer was found to reduce the cane yield drastically to a minimum of 7 tonnes/acre against a minimum of 34.2 tonnes/acre in the plots with fertilizer. Ragi proved a better rotational crop than sunn hemp or lucerne.

Fractionation of phosphorus in soils incubated with vinasse. M. E. Mattiazzo and N. A. da Glória. *Brasil Açuc.*, 1980, **95**, 72-85 (*Portuguese*). — Two soil types were incubated with vinasse in the presence and absence of soluble and insoluble forms of phosphate. Samples were taken periodically and the status of the various forms of phosphate analysed. The results showed that the fate of soluble phosphate depended on the type of soil, fixation being greater with the soil containing more ferric oxide, and that the addition of vinasse, together with (insoluble) natural phosphate, kept calcium dihydrogen phosphate in its soluble form for a longer time.

Ideas about green fertilizers with especial reference to sugar cane. F. A. Fogliata. *La Ind. Azuc.*, 1979, **86**, 290-297 (*Spanish*). — The increasing of soil N by cultivation and ploughing-in of leguminous plants is discussed and a survey made of reports by a number of cane workers in this respect. Use of such a crop between two cane crops may be useful in reducing soil erosion in a bare field, but the fertilization effect is relatively small and only applies to the plant crop, disappearing in the first ratoons. Furthermore, the trash from a cane crop, if ploughed-in, helps to provide an appreciable amount of nutrients.

Current research with sugar cane in the Ord. G. Kingston, D. M. Hogarth, T. O. Albertsen and I. T. Freshwater. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 43-49. The history of previous sugar cane projects in the Ord River area of Western Australia is summarized and an outline given of current research, with details of climate, soils, variety experiments and agronomy trials, including those concerned with irrigation, ratoon management, superphosphate and long-range potassium fertilizer experiments, crop cycle trials, and work on nitrogen x variety interactions and those of depth of planting x ratooning treatment. Brief mention is made of weeds and pests.

Effect on soil movement of continued cultivation into the wet season. M. M. Sallaway. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 51-54. — It has been recognized that cultivation for weed control into the wet season leaves the soil in a loose, fine condition and susceptible to erosion. Trials near Mackay in 1978/79 showed that a pronounced increase in soil movement resulted from such late cultivation of soils on various slopes. While cultivation is needed for weed control and fertilizer application, and rainfall is highly variable at the beginning of the wet season, the results indicate the need for caution in regard to late cultivation in erosion-susceptible areas.

Some aspects of calcium and magnesium nutrition in North Queensland. D. R. Ridge, A. P. Hurney and M. B. C. Haysom. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 55-61. — From a series of replicated Ca and Mg trials in the Ingham-Mossman region it was found that both were required for optimum yields and gave responses of the order of 25 tonnes.ha^{-1}. Lime as $CaCO_3$ is less effective than application as hydrated lime or cement when only a short time (up to 6 weeks) is allowed before planting, while gypsum is not a satisfactory Ca source at the rate used in the trials (300 kg.ha^{-1}). Liming not only improves Ca nutrition but also improves P availability and decreases Al availability. Orange freckle symptoms are prevented by application of soluble Mg at or before planting.

Long term responses in cane yields and soil analyses from potassium fertilizer. L. S. Chapman. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 63-69. — Five trials were conducted at four sites on the soil potassium levels in cane plots where the crop was grown up to 7th ratoons, with applications of fertilizer, including K. The results are discussed, and it is concluded that soil analysis for exchangeable K during the fallow period did not give a good prediction of the responses to K fertilizer. Analysis by soil extraction with boiling N HNO_3 for 1 hr was not better than extraction by shaking with N/50 HCl for 16 hr for predicting yield responses from K fertilizer. All sites showed a cane yield response to fertilizer, although two had a sufficiently high exchangeable K content that fertilizer would not previously have been recommended. Without fertilizer, the K level fell to a stable level at three sites but continued on a downward trend for 12 years at the fourth. Trends of K levels in nitric acid extract were not consistent, while both extractants gave solutions of higher K content for soils with applied K fertilizer, compared with the controls, the increase being greater for higher application rates. Cane yield responses to K fertilizer changed little over the period of the trials, and application rates greater than 120 kg.ha^{-1} did not appear justified, while c.c.s. levels were not markedly influenced by excess K levels.

Contribution to chemical weed control in sugar cane in the Ivory Coast. R. Claus. *Agron. Trop.*, 1980, **35**, 86-91 *(French).* — Trials of pre- and post-emergence herbicides on various soils are reported. An Ametryne + Atrazine mix has proved successful (at dosage rates that depend on the soil type) without being phytotoxic to cane, although other triazines, on their own or with other herbicides, have also given highly satisfactory results. *Striga* sp. occurred from the very first cane plantings, but 88% elimination has been achieved with Ametryne + 2,4-D + Fenac (2 + 1 + 0.18 kg.ha^{-1} a.i.), although, since the harm done to cane by the parasitic plant is irreversible, such treatment is only recommended where infestation is on a large scale and localized. However, under irrigation, the weed has been found to disappear by the ratoon crop.

FS in the Philippines

Fletcher and Stewart have been actively engaged in the supply of plant and equipment to the Philippine sugar industry for over a decade.

We have recently completed our fourth turnkey project in the islands namely the Batangas sugar refinery located on the island of Luzon.

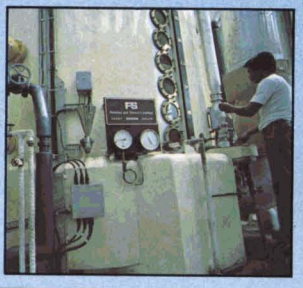
The refinery process, capable of producing 550 tonnes of high quality refined sugar per day, also incorporates a self-contained recovery plant to convert refinery reject liquors to raw sugar for recycling with the incoming raws.

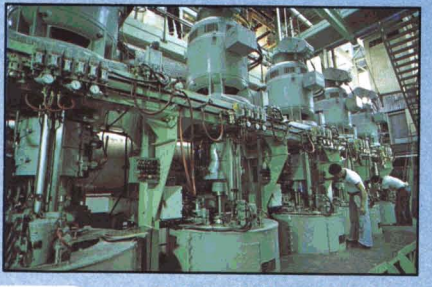
The Batangas refinery will play an important role in the Philippine Sugar Commission's (PHILSUCOM) strategy for improving the quality of sugar produced in the islands and so encourage the further development of local industries such as soft drinks and fruit canning without the need for importing the special grades required by these users.

FS Turnkey Projects in the Philippines

- **Northern Cotabato Sugar Factory 4000 MTCD—raw**
- **Davao Sugar Factory 4000 MTCD—raw**
- **Bicolandia Sugar Factory 4000 MTCD—raw**
- **Batangas Sugar Refinery 550 MTCD—high quality refined granulated white sugar**

Fletcher and Stewart also have manufacturing and associate business companies, both solely concerned with projects planned for the islands - offering on-the-spot localised knowledge.



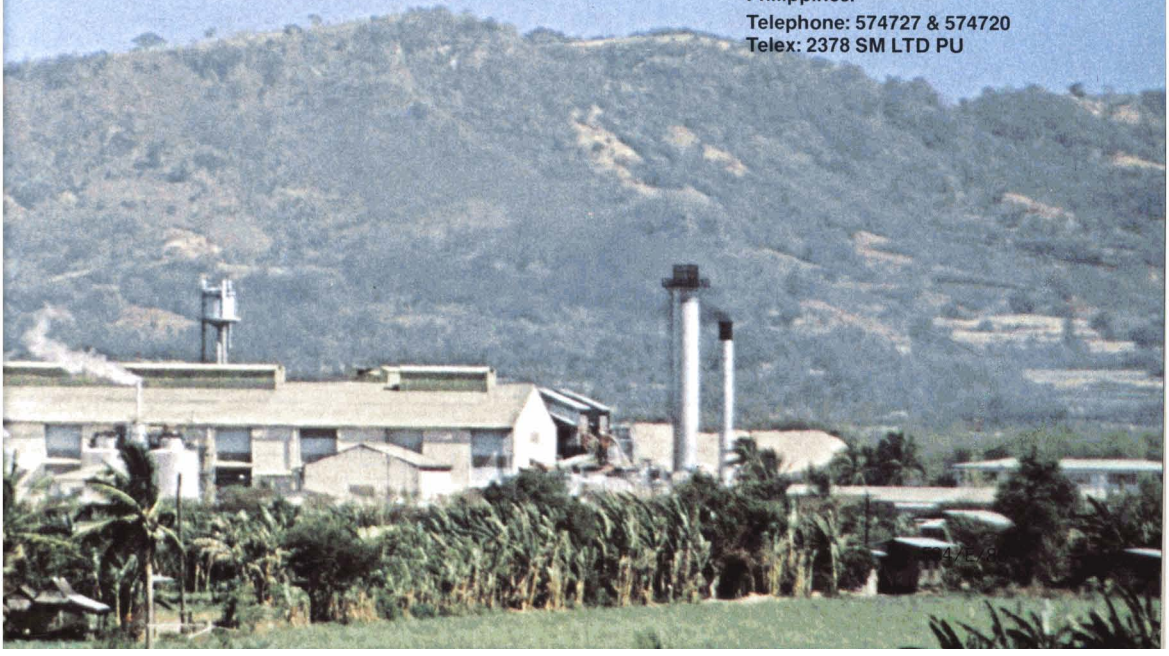


FS

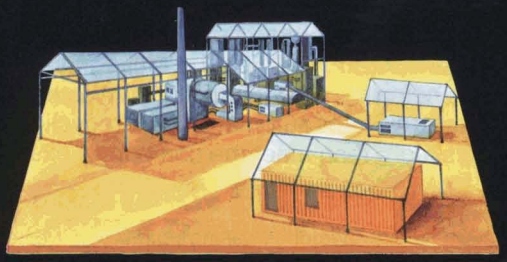
A World of Experience

Fletcher & Stewart Limited,
Masson Works,
Litchurch Lane,
Derby DE2 8AB. England.
Telephone: (0332) 40261
Telex: 37514

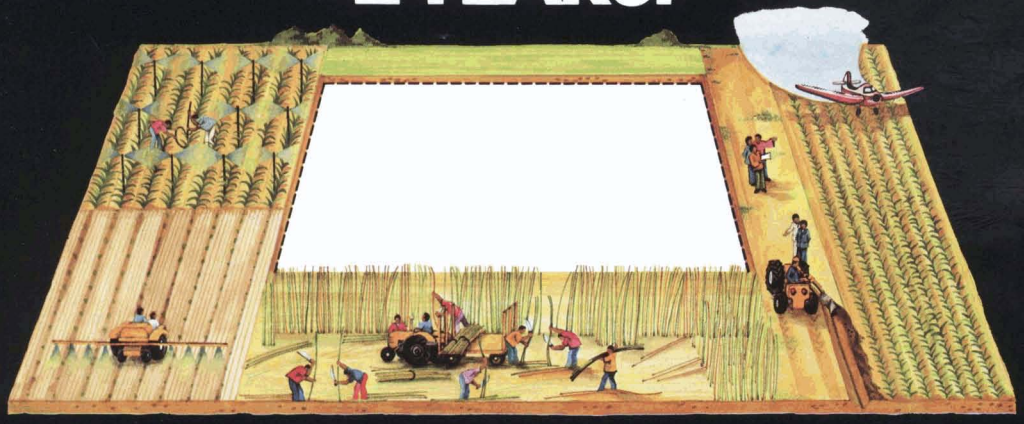
Strachen & MacMurray Ltd.,
Kanlaon Towers,
Roxas Blvd.,
Pasay City,
Metro Manila,
Philippines.
Telephone: 574727 & 574720
Telex: 2378 SM LTD PU



NOW YOUR SUGAR COMPLEX*...



...IN LESS THAN 2 YEARS.



The AGROTECHNIP idea is based on integrated MINI-COMPLEXES adapted to their environment as well as to your needs:
Their annual production capacities range from 2000 to 12000 tons of crystalline raw or white sugar, free flowing or in cubes.

Your benefits:
- easier project financing
- shorter construction time due to the modular concept
- excellent technical performances
- sugar produced at competitive prices
- multi-regional development.

* **AGROTECHNIP'S concept of a sugar complex consists not merely of a factory: it is an integrated entity which includes the plantations, the factory, and all surrounding facilities.**

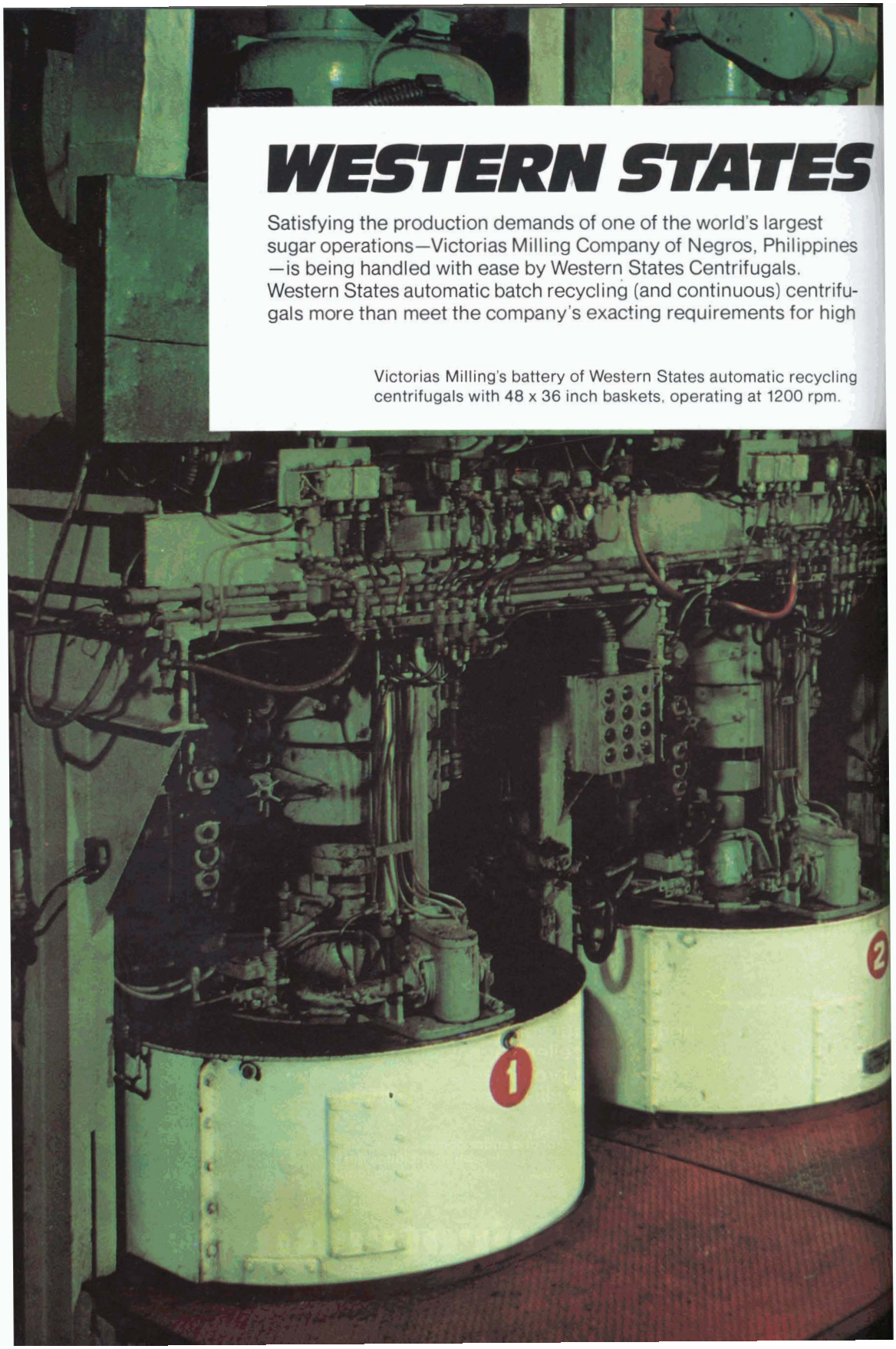
agrotechnip

experts who think, make, and know sugar.

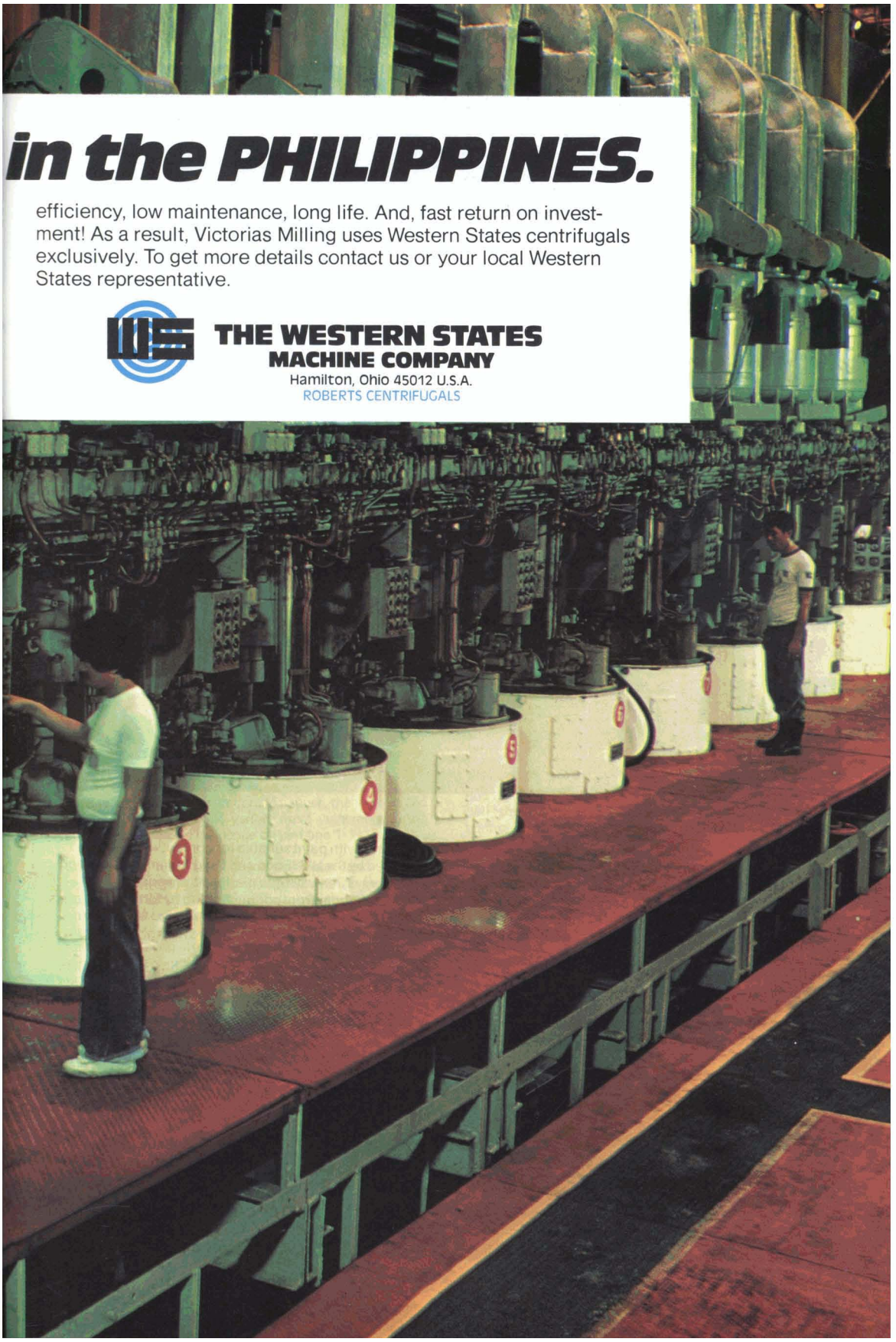
Cédex 23 - 92090 Paris La Défense - FRANCE - Phone: 778.21.21 - Telex: TCNIP A 612 839 F

WESTERN STATES

Satisfying the production demands of one of the world's largest sugar operations—Victorias Milling Company of Negros, Philippines—is being handled with ease by Western States Centrifugals. Western States automatic batch recycling (and continuous) centrifugals more than meet the company's exacting requirements for high



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


in the PHILIPPINES.
efficiency, low maintenance, long life. And, fast return on investment! As a result, Victorias Milling uses Western States centrifugals exclusively. To get more details contact us or your local Western States representative.
THE WESTERN STATES
MACHINE COMPANY
Hamilton, Ohio 45012 U.S.A.
ROBERTS CENTRIFUGALS

CANE PESTS AND DISEASES

Basic studies on resistance of sugar cane varieties to the sugar cane borer in Brazil. N. Macedo, A. C. Mendes, P. S. M. Botelho and R. Vencovsky. *Paper presented to the 17th Congr. ISSCT,* 1980, 12 pp. — An account is given of experiments in which clones were screened for resistance to the borer *Diatraea saccharalis,* a second set being concerned with progenies derived from clones concerned in the first set. Measurements of clonal repeatability and association between parent and progeny behaviour showed that screening clones from the FT_4 phase of the Planalsucar breeding program (which operates the polycross system) for borer resistance could be practised with a good chance of progress. Genetic variance prevailed over other interaction components of variance and it was apparent that clonal response to borer infestation between locations and between plant cane and first ratoons was relatively consistent, thus allowing selection in only one experimental area and only on plant cane provided a large number of replications are used. The high correlation coefficient ($r = 0.86$) obtained between parent and progeny behaviour indicated that there is an additive genetic control for the character of resistance.

Biological and ecological factors affecting the control of sugar cane borer *Diatraea saccharalis* (F.) in Barbados, W.I. M. M. Alam. *Paper presented to the 17th Congr. ISSCT,* 1980, 11 pp. — Infestation by the borer has been reduced by a number of changes: introduction of two larval parasites (*Apanteles flavipes* and *Lixophaga diatraeae*) has reduced infestation by about 8%, pre-harvest burning has caused a further 4% reduction. However, the widespread use of B 62163, a cane variety more vulnerable to the borer, has increased incidence by perhaps 1-1½%.

Sugar cane rust inoculation technique and varietal resistance ratings in Florida. E. H. Todd and T. E. Summers. *Sugar J.,* 1980, **42**, (9), 17. — After unsuccessful attempts to find an efficient method of inoculating cane plants with *Puccinia melanocephala,* the causal agent of rust (failure being attributed to uncontrolled temperatures and humidity conditions at the time of the tests), success was achieved by placing replicated flats of varieties next to stools of nearly mature, heavily infected plants for 7-10 days at that time of year when night temperatures were in the range of 60-70°F and heavy dew or fog prevailed. The rust spores dropped naturally from the infected leaves onto the test plants, severely diseased leaves being sometimes shaken to increase spore fall. The test plants were then planted in the field and their reactions determined periodically. Of 39 varieties for which ratings are tabulated, only 13 were found to be susceptible.

Rusts on sugar cane and some grasses in Réunion. E. Boyer de la Giroday, M. Chatenet and P. Baudin. *Agron. Trop.,* 1979, **34**, 372-376 (*French*). — Rust, caused by *Puccinia melanocephala,* was first found in Réunion in 1965 but has not been considered of any importance until 1975, since when it has spread to cover the entire west and south of the island, affecting a number of varieties. The reactions of 42 cane varieties to the disease are indicated, and details are given of susceptible seedlings. Comparison is made between the uredospores, teleutospores and paraphyses of *P. melanocephala* and *P. kuehnii* and as found on five cane varieties. Three rusts found on grasses growing in cane fields (*P. versicolor, P. purpurea* and *Uromyces leptodermus*) do not affect cane.

Report of the first two parasites of *Elasmopalpus lignosellus* Zeller in Cuba. Z. Pérez A. *Cienc. Agric.* (Cuba), 1978, (3), 169 (*Spanish*). — Larvae which have been found at the Cuban Academy of Sciences Sugar Cane Research Institute to have parasitized *E. lignosellus* were classified as members of the Bethylidae family, but genus and species have not yet been identified. Another parasite, after passing through the chrysalis stage, emerged as a fly, identified as *Lixophaga diatraeae* (Townsend), already known as a parasite of the borer *Diatraea saccharalis.*

Two new parasites of larvae and chrysalids of *Mocis* spp. R. Álvarez C. *Cienc. Agric.* (Cuba), 1978, (3), 170 (*Spanish*). — Two new parasites are reported of *Mocis* spp., a cane pest in Cuba. They are *Rogas* sp., a member of the Braconidae family, and *Euphorocera claripennis,* one of the Tachinidae family.

Preliminary observations on Dermaptera as biological regulators of sugar cane borers in India. B. N. Ramamurti and A. R. Solyappan. *Indian Sugar,* 1979, **29**, 523-527. The possibility of borer control by insects of the Dermaptera order (e.g. earwigs) is discussed, references being made to the literature on use of the predators to control pests in various crops including sugar cane.

Studies on the preference of crawlers of the sugar cane scale insect, *Melanaspis glomerata* (Green), Hemiptera: Coccidae in relation to the age of the internodes of sugar cane. G. S. Shukla and N. Tripathi. *Indian Sugar,* 1979, **29**, 535-536. — Since the freshly hatched crawlers of *M. glomerata* prefer to settle on those internodes having a soft rind and partially opened leaf sheaths, it is considered that detrashing cane at a suitable time would contribute to control of the pest by removing niches to harbour the crawler while also allowing the rind to harden.

Field screening of sugar cane clones against borers at Padegaon — a review. A. S. Patil, D. G. Hapase, D. D. Wasnik and R. Y. Jadhav. *Maharashtra Sugar,* 1980, **5**, (4), 9, 11-18. — Details are given of the reactions of 734 cane varieties to borers as determined in screening trials conducted in 1958-78. Susceptibility to the early shoot borer, top borer, internode borer or all three is indicated for each variety, as well as cases of tolerance of all three borers. Of the 91 found to be tolerant, 57 were in the Co series. Properties of many of these tolerant canes are summarized.

Some observations on the mating behaviour of the sugar cane stalk borer, *Chilo auricilius* Dgn. A. N. Kalra, A. K. Mehrotra, H. David and J. Chandra. *Indian Sugar,* 1979, **29**, 583-584. — Moths of the stalk borer (both sexes) mated within 24 hr of emergence from the pupa, although individual moths of both sexes mostly mated only once. Sex activity was enhanced by moderately cool conditions accompanied by a somewhat high relative humidity and a gentle breeze. The moths preferred darkness or a dim light for mating.

Aerated steam therapy for control of ratoon stunting disease and possibly sugar cane mosaic. O. M. Cifuentes and R. J. Steib. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 28. — Stalks with trash still adhering were treated with aerated steam and cut into single-eye setts which were then planted under optimum growth conditions in the greenhouse, while whole stalks after similar treatment were planted in the field. Germination of all varieties was excellent after steam treatment at 51°C for 8 hr, 52° and 53°C for 5 hr and 54°C for 3 hr. Tolerance of the most severe treatments differed with variety. After treatment at 51°C for 8-10 hr and 54°C for 5 hr had failed to reduce germination of aerated steam-tolerant varieties, seed cane stalks infected with both RSD and mosaic were treated for 2½-3 hr at 56°C or for 2 hr at 57°C. 100% control of mosaic was achieved in two varieties after 3 hr at 56°C and 92% in a third variety, while RSD was also effectively controlled. Germination was 55% for L 62-96 cane and 67% for N:Co 310 cane, but only 12% for heat-susceptible CP 65-357 cane. While treatment at 56°C for 2½ hr improved germination by comparison with 3 hr, it was less effective in mosaic control, while control of both RSD and mosaic was not as good after 2 hr at 57°C as after 3 hr at 56°C, possibly because insufficient time was allowed for adequate heat distribution among the trashy stalks. Preliminary results of the experiments indicate that aerated steam treatment at high temperatures for shorter periods than necessary for RSD control may control other systemic diseases of cane.

Serologically specific electron microscopy detects the ratoon stunting disease-associated bacterium. K. E. Damann, K. S. Derrick and A. G. Gillaspie. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 35. — Serologically specific electron microscopy (SSEM) was used to detect and identify the RSD-associated bacterium. An anti-serum to the bacterium was made by injecting purified preparations of the bacterium into a rabbit at weekly intervals for 3 months. Parlodion-coated carbon-fronted electron microscope grids were floated on drops of the anti-serum (diluted 1:500) for 30 min. Floating these anti-serum-coated grids on drops of juice or vascular extracts from RSD-infected plants for 3 hr resulted in the attachment of the bacterium to the grid surface by a specific antigen-antibody reaction. SSEM did not require concentration of the RSD bacterium, as does the micro-precipitation test for bacterial detection. The technique appears to be more powerful than quick-drip electron microscopy and has been used to diagnose RSD.

Smut threatens mainland sugar cane. J. L. Dean. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 36. — Descriptions are given of the symptoms of smut, caused by *Ustilago scitaminea,* and of the way in which cane becomes infected as well as the effect of the disease. The history of the spread of the disease, long present in Asia and Africa but first occurring in the Western Hemisphere (in Argentina) only in 1940, is recounted.

Sugar cane smut — an imminent threat to the US Mainland. N. I. James. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 63-66. — The author briefly describes distribution, symptoms, transmission and economic importance of culmicolous smut and examines possible methods of control. The resistance ratings of certain varieties in the USA are indicated and plans for testing US Mainland varieties in Jamaica are reported.

Pathogenicity of *Fusarium tricinctum* and *F. moniliforme* to sugar cane. H. Hoike. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 71-74. — The two title diseases were isolated from frost-damaged stalks of L65-59 cane. Pathogenicity studies indicated that both are mildly pathogenic to sugar cane, *F. tricinctum* being less so than *F. moniliforme,* which caused more reddish-purple discoloration in cut whole stalks or pieces of stalks than in stalks of growing cane. Stalks exposed to freezing temperatures appeared to be more susceptible to discoloration by both fungi than stalks not exposed to such temperatures.

Assessment of rat damage to Florida sugar cane in 1975. L. W. Lefebvre, C. R. Ingram and M. C. Yang. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 75-80. — Damage to Florida cane caused by *Sigmodon hispidus, Rattus rattus* and *Neofiber alleni* was assessed for 41 fields. Damaged stalk incidence ranged from 4.5% to 38.6%, averaging 14.0%. The mean damage in field centres was greater than at the edges of the fields and middle ditch borders. Damage was not significantly correlated with field age, % sugar yield, Brix, pol or harvest date, but was negatively correlated with cane yield per acre for 28 fields from three adjacent plantations. Economic loss was estimated at approx. $95 per acre in one grower/processor's crop (based on an average raw sugar price of $0.146 per lb). Sample size for future field testing of rodenticides was determined.

Flooding for the control of the white grub, *Bothynus subtropicus,* in Florida. T. E. Summers. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 128. — *B. subtropicus* is described as currently the most destructive of seven species of grub identified as attacking cane in Florida. Its larvae destroy roots, latent buds or shoots and the regenerative portion of the underground stems, thus destroying the potential for the subsequent ratoon to produce a satisfactory stand. At present, the most effective control means is flooding of the standing cane for 5-7 days in August-November, or flooding the cut stubble after harvesting, before February. Flooding standing cane for 120-168 hr did not reduce the sugar content and gave satisfactory control. A method is needed for detecting the presence of the larvae before the damage it inflicts becomes obvious.

Peculiar symptoms of smut disease in sugar cane in India. M. R. Gupta and S. Raj. *Indian Sugar Crops J.*, 1979, **6**, 65. — The unusual symptoms of *Ustilago scitaminea* observed by Byther & Steiner on cane in Hawaii[1] have been found on Co 1158 and Co 6516 cane in India, and are briefly described.

Updated recommendations for control of Eldana. Anon. *S. African Sugar J.*, 1980, **64**, 111. — It is expected that *Eldana saccharina,* already moving southwards, will increase in incidence in southern Zululand and may well become more widespread in the south, while in the northern areas the position has changed very little. Recommendations are given on harvesting measures to control the pest; it is stressed that these are aimed at maintaining the borer populations at the lowest possible level. It has been found that the longer a cane crop remains unharvested, the greater is the potential for the borer populations to increase; cane usually becomes badly damaged by the pest once it is older than 12 months. Recommendations are also given on treatment of infested seed cane and on selection of planting material.

[1] *I.S.J.*, 1975, **77**, 46.

SUGAR BEET AGRONOMY

The effect of location, production technique and weather on field emergence of sugar beet as represented on the basis of ISPFLANZ data. A. Mangstl, A. Aigner, L. Reiner, G. Englert and I. Günther. *Zuckerind.*, 1980, **105**, 261-267 (*German*). — Results of programming an ISPFLANZ system (information system for farming and crop growing) with data on the effect of soil type and composition, production method (soil treatment, fertilization, type of seed) and sowing time and weather on emergence are reported. These showed that heavier soils are better than lighter soils; that the furrow should not be dug too early; that levelling of the furrow is of advantage only in the spring; that seedbed preparation should be carried out in two or three stages on as level a soil as possible; that high mineral fertilizer dosage rates do not adversely affect emergence, while organic fertilization has a positive effect; that genetic monogerm seed gives maximum emergence; and that early sowing is particularly disadvantageous if, 10 days beforehand, the average maximum temperature at 2 m above the soil is below 10°C.

Post-emergence treatments, or completing the fight against weeds in sugar beet. J. M. Belien and J. F. Salembier. *Le Betteravier*, 1980, **14**, (141), 12-14 (*French*). — Guidance is given on application of post-emergence herbicides, either in single or in split doses and possibly with a final application against late-developing weeds and grasses. Information is given on a new herbicide, Cyronal (containing 3,6-dichloropicolinic acid as active ingredient), which has proved effective against thistle.

Weed control after sugar beet emergence. —. Bartels. *Die Zuckerrübe*, 1980, **29**, (3), 30-32 (*German*). — Advice is given on control of late weeds in beet fields. The importance of timing is discussed, and factors affecting both the time of spraying and the amount of herbicide applied are listed.

Late weed control firmly in hand. H. J. Wagner. *Die Zuckerrübe*, 1980, **29**, (3), 39-40 (*German*). — Guidance is given on what is considered the greatest problem in weed control — elimination of late-developing weeds, with particular mention of underleaf spraying.

Trials on 12-cm beet seed spacing. H. Schafmayer and C. Winner. *Zuckerind.*, 1980, **105**, 359-363 (*German*). Experiments are reported which showed that manually thinned stands of beet spaced 12 cm apart gave an average increase of 5% in the corrected sugar yield by comparison with unthinned beet spaced 18 cm apart. However, yield fell considerably with the narrower spacing when emergence was low, particularly if no thinning was carried out, while topping was very poor where the proportion of narrowly spaced beets was very high and/or where emergence was low.

Chamomile, a troublesome weed. Anon. *Die Zuckerrübe*, 1980, **29**, (3), 41 (*German*). — Five types of chamomile are mentioned (*Anthemis arvenis, A. cotula, Matricaria chamomilla, M. maritima* and *M. matricaroides*). When it occurs in beet fields, it offers considerable competition for both nutrients and light, especially after late sowing or when the beets have suffered damage from hail. Advice is given on chemical control of the weed.

Agronomic factors influencing the sugar industry in Ireland. J. Britton. *Sucr. Belge*, 1980, **99**, 51-61, 95-104 (*French*). — During the last five years the sugar yield per ha in Ireland has remained at a constant level after a previous fifteen years of gradual increase, whereas further increase is necessary if sugar beet is to remain competitive. In the meantime, beet sugar content has been progressively falling, leading to discontent on the part of the growers and creating a greater amount of work for the processors. Agronomic factors affecting beet yield and quality in Ireland are surveyed, including climate, nitrogen fertilization (which is considered excessive at the national level), beet plant population, sowing date and variety. Losses in harvesting and in the beet yard (including storage) are discussed, and possible remedies to improve the situation are indicated, including a modification to the system of beet payment.

Aspects of the new technology in sugar beet cultivation in 1980. Z. Stanescu, G. Clotan, A Codrescu and V. Ciochia. *Prod. Veg., Cereale si Plante Tehn.*, 1980, **32**, (2), 3-8 (*Rumanian*). — Varietal trials at four locations, investigations on row and seed spacing in relation to final plant population, and recommendations on chemical control of weeds (using Dual, Ro-Neet and Venzar) and of soil pests are reported.

Mechanical planting of sugar beet seedlings. G. Sirbu and A. Stefanescu. *Prod. Veg., Cereale si Plante Tehn.*, 1980, **32**, (2), 9-13 (*Rumanian*). — Information is given on beet seedling planting by labourers riding on tractor-drawn machinery. The planter described allows 0.2 ha to be planted per hr at a forward speed of 0.7 $km.hr^{-1}$.

Efficiency of weed control in sugar beet by chemical and mechanical means. G. Clotan *et al. Prod. Veg., Cereale si Plante Tehn.*, 1980, **32**, (2), 14-18 (*Rumanian*). — Trials on weed control with various herbicides and by mechanical cultivation are reported. Results showed that Ro-Neet + Venzar at 6 + 1 $l.ha^{-1}$ a.i. gave slightly better yields of beet than Dual + Venzar at 5 + 1 $l.ha^{-1}$ a.i. Both treatments gave better results than two cultivations, while three cultivations gave the same results as the best given to Ro-Neet + Venzar.

Effect of phosphorus fertilizers on beet and sugar yield. E. Jaszczolt. *Gaz. Cukr.*, 1980, **88**, 84-86 (*Polish*). — P fertilization trials are reported in which the high soil P content reduced the response to the fertilizer, in terms of beet and sugar yield and quality, to a bare minimum at 400 and 800 $kg.ha^{-1}$ P.

Irrigation and fertilization effect on yield and processing value of sugar beet. J. Gruszka. *Gaz. Cukr.*, 1980, **88**, 86-88 (*Polish*). — Four-year trials are reported, in which root yield was increased by NPK fertilization and still further by irrigation, while sugar content fell, although irrigation tended to offset the adverse effect of fertilization in this respect, so giving a sugar yield which was higher than with the control. The balancing effect of irrigation was also evident in the case of chemical composition and processing quality.

CANE SUGAR MANUFACTURE

Excess power in cane sugar factories. J. J. Mecsery. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 163-166. — Means by which the utilization of bagasse as fuel can be made more efficient so as to generate more power are discussed, and details given of two Cuban factories where the author participated in the design, installation and operation of the power plant. In both cases, steam pressure and temperature were raised, bled steam was used to heat the boiler feedwater, boiler efficiency was raised, there was greater attention to heat conservation in factory operations, and modern instrumentation was used.

Cooling spray pond: performance evaluation. A. Tellechea. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 180. — It has been observed that, under bad meteorological conditions, a sugar factory may not reach its design capacity because of increase in the temperature of cooling water. Evaluation of spray pond performance showed that raising the spray nozzle elevation above the water surface did not significantly increase the thermal performance, considering the expense and inconvenience of the alteration, and that even at maximum flow rate, there will still be some days when full plant capacity will not be achieved, particularly when the average wet bulb temperature exceeds 75°F, although maximizing flow rate is recommended since no extra capital investment is needed and flexibility of plant design permits it.

Old and new techniques in processing freeze-damaged cane. C. R. Toca. *Proc. Amer. Soc. Sugar Cane Tech.*, 1977, 181. — Experiences in processing frost-damaged cane in Florida and Louisiana are discussed, including cane conditioning, recommendations on liming and bacteriological control, chemicals to be used and the boiling system.

Extraneous matter in cane and its effect on the extraction plant. J. P. Lamusse and S. Munsamy. *S. African Sugar J.*, 1980, **64**, 113, 115-117, 120-121. — See *I.S.J.*, 1981, **83**, 84.

Chlorine as an anti-microbial. D. F. Day. *Sugar Bull.*, 1980, **58**, (12), 10. — The use of chlorine as a disinfectant, either in the form of calcium hypochlorite or as chlorine gas, is briefly discussed. Continuous addition at the mill or to juice before liming is an effective and inexpensive means of microbiological control.

Factory research and development in South Africa. Anon. *Ann. Rpt. Sugar Milling Research Inst.*, 1979/80, 7-13. A brief initial study has been made of cane sampling at the weighbridge instead of by hatch; savings are possible, especially in the elimination of chains and their maintenance, but significant capital expenditure would be needed for a new system. § Tests indicated that the wire welding method of hard-facing worn shredder hammers would give faster deposition rates and better metal utilization than using stick electrodes. Electrode performance may also be improved by depositing a medium hardness layer between the parent metal and the final hard-facing. Work is to continue on use of blocks, including tungsten carbide, and comparison of cheaper, easily replaceable blocks and longer-lasting but more expensive ones. § Tests were made at Gledhow to determine the effects of trash on diffuser performance and capacity; no difficulties were found in handling burnt and unburnt cane, and the former permitted higher throughput and better extraction. However, owing to the higher content of tops and Eldana infestation in the burnt cane, the cane supplies were not comparable and the trials were discontinued. § A survey showed that stainless steel DSM-type screens were the most common for juice in South African sugar factories, with apertures of 0.35 to 1.0 mm and areas ranging from 0.0084 to 0.114 m^2 per tch, with area and aperture being generally lower for factories employing diffusers. Juice distribution has an important effect on DSM screen capacity. § Addition of magnetite (Fe_3O_4) to clarification causes flocs to form around the particles which can then be removed using magnets, so eliminating the need for settling and filtration, since a clear juice is left. The cost of the magnetite is far higher than the savings possible, however, and the process is uneconomical unless the magnetite can be recycled. § An attempt to determine whether non-pol ratio in juice was affected by residence time in clarifiers was unsuccessful because juice flow measurement was insufficiently precise. § Use of a radio-active LiCl tracer technique showed satisfactory plug flow in three types of clarifier, with various degrees of mixing, but more work is needed to determine the dead volume of each type. § Testing of the use of boiler fly-ash as a filter-aid in place of bagacillo added to clarifier mud showed that the filtration rate was higher and filtrate Brix lower, but the filtrate contained more K and Na, possibly leached from the fly-ash, and this might have an adverse effect on molasses losses. § It had been thought that an extensive time, perhaps 30 minutes, would be needed for electrode-solution equilibrium to be reached when measuring the pH of syrups; tests with 66-68°Bx syrups showed that equilibrium satisfactory for factory control purposes was reached within a minute. § Tests with a Fives-Cail Babcock continuous centrifugal at Illovo, by comparison with automatic batch machines operating in parallel, showed that the FCB machine gave more regular crystals with no significant crystal breakage. Power requirement was only 45 amps against 220 amps, but the moisture content of the sugar was significantly higher and the pol consequently lower. The capacity of the FCB machine was 13 tons of massecuite per hour when operating at 1200 rpm. § In order to be able to construct a mathematical model of crystallization in *A*-, *B*- and *C*-crystallizers, the saturation coefficient of two molasses samples of different reducing sugars:ash ratio was measured for different temperatures. It was found that the coefficient was a function of the non-sucrose:water ratio, the RS:ash ratio and temperature, which confirms observations in Australia but conflicts with some made in Hawaii. § An equation was developed on a basis of 175 measurements, whereby molasses viscosity may be calculated as a function of the dry solids, purity, reducing sugars:ash ratio and temperature; other variables influencing molasses viscosity, including colloids, polysaccharides and shear rate, were not taken into account. The coefficient of correlation between measured and calculated values was 0.989. § A mathematical model has been calculated from which it is possible to calculate the purity, supersaturation, viscosity and temperature of massecuite as well as viscosity of the molasses and the power required for agitation. § The quantitative effect of

C-sugar purity on the volume of *C*-massecuite and on non-pol recirculation have been calculated. § A new design of nutsch bomb has been developed for rapid separation of molasses from a massecuite sample for analysis. A 100-mesh stainless steel screen is used and, for a high Brix *C*-massecuite, 2 minutes is required at 54°C, rising to 8 minutes at 36°C. § Studies were made on conditioning of refined sugar and its caking under simulated storage conditions. Sugar conditioned by passage of air at 10% R.H. reached a lower moisture content at 50°C than at 40°C; the presence of sugar dust did not influence conditioning time, which was related to the crystal size. Bulk density was not affected by conditioning, but the angle of repose changed from 36-39° to 32-34°. Air flow could be reduced far below that stated in the literature without affecting the conditioning time, provided no serious channelling occurred. With one exception, conditioned sugar did not form cakes when tested immediately after conditioning or after six weeks of storage. § Tests to see if hot bagasse from a diffuser was amenable to acid treatment for hydrolysis of its hemicellulose content to xylose indicated that the hydrolysis could be readily achieved by spraying the hot bagasse with acid and allowing it to stand in self-insulating piles for 1-2 days. § Metallurgical, dimensional and performance testing of a wide range of chains were used to try to draw up a standard specification for chains to be used in the South African sugar industry. The project became unpractical, however, because of the wide range of requirements set by individual mills and the resistance of manufacturers who wished to retain their own characteristics and specifications. Failures of locally made chains were found to be due not to design faults but to poor quality control, and it was decided to limit the standard specification to definition of quality control procedures for manufacturers to ensure that their products meet their own specifications. § The performance of a water cooling tower at Noodsberg and the spray cooling pond at Darnall were assessed. It was found that the tower's results were in good agreement with the theoretical performance. Because the mass of water in the spray pond system is so large, however, the temperature remains almost constant and cooling performance depends more on the relative humidity than the absolute value of the wet bulb temperature. Performance of the pond near the edges is in accordance with that predicted from the literature but falls off dramatically near the centre of the pond. A marginal improvement could be achieved by redistribution of spray nozzles, but a significant improvement in injection water temperature will only be obtained by replacement with a tower.

Utilization of cane bagasse as a fuel in factories and distilleries. H. P. de Oliveira. *Brasil Açuc.*, 1980, **95**, 68-71 (*Portuguese*). — The history of bagasse utilization for sugar factory fuel in Brazil is briefly recounted and the variation of calorific value with moisture content quoted from the literature, as is the composition of bagasse. There is an approximate 3% deficit in bagasse used in factories, but the distilleries which produce alcohol direct from cane produce 33% more bagasse than they need to raise sufficient steam for distillation. Consequently, the sugar factories should not need to burn oil but should use this bagasse to meet their deficit.

It's the world's biggest sugar storage complex. Anon. *Australian Canegrower*, 1980, **2**, (3), 29-30. Illustrations are provided of the Mackay bulk shipping terminal in Australia which, with the addition of a fourth shed, now has a storage capacity of 667,000 tonnes. The new shed, of 240,000 tonnes capacity, is built with load-bearing end walls and one load-bearing side wall. Inside the other wall is an internal roadway which permits access to any point along the sugar pile. Reclamation is through an under-floor conveyor, and can attain 1500 tonnes.hr^{-1}. The new shed cost an estimated $A15,000,000.

The influence of extraneous matter on c.c.s. G. A. Brotherton. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 7-12. — Research by the Bureau of Sugar Experiment Stations has permitted establishment of a relationship whereby the rate of reduction in c.c.s. is given by (0.01 R − 0.023) per 1% extraneous matter, where R is the c.c.s. of clean cane. Extraneous matter has a greater effect on c.c.s. than other factors usually considered to have a bearing on it, and the importance of maintaining optimum field conditions and designing harvesters to reduce extraneous matter to a minimum is stressed.

Cane quality in the South Johnstone area. M. B. Frost and D. M. Stevenson. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 13-20. — An initial survey was made in November 1978 and a statistical analysis made of data gathered on % extraneous matter, % good, sound billets of good length, cut-to-crush delay, juice dextran content, average bin weight and c.c.s. It was found that dextran content was higher than would be expected, indicating serious billet quality problems. This was drawn to the attention of the farmers. The next year a more detailed study was made with a closer examination of the factors involved. It was concluded that billet quality had improved markedly, with good billet proportion risen from 30.2 to 58.4%. Recording of delay times had encouraged closer control of transport and the cut-to-crush delay had fallen from 10.7 to 8.5 hours. The South Johnstone mill area was the only area to increase the c.c.s. figure in 1979 as a consequence; in previous years the figure had been on a par with other areas. Sugar quality in respect of fine grain, dextran and grain elongation improved substantially.

The sampling of cane for extraneous matter content. Anon. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 21-26. — A comparison was made between the results of analysis of samples collected in the field (by separation of cane in a chute on the bin receiving directly from the harvester elevator) and at the factory where a sample bucket receives part of the cane discharged when the cane car tippler operates. Statistical analysis showed a correlation coefficient between paired samples which, although lower than expected, was highly significant, as was that of the means between field and mill paired samples. There is a large degree of non-homogeneity within a bin, and this accounts for the largest component of the variation within a rake (a delivery comprising several bins). The bin-to-bin variation would appear to be small. Little reliance can be placed on the result from an individual sample from a bin; the true extraneous matter is given by the observed value ± 6.02 for a 90% confidence limit. With ten samples, this was reduced to ± 1.90 and forty samples were required to bring the difference to ± 0.95.

The application of special steels in the sugar industry. J. Pattenden and R. Walker. *Proc. Australian Soc. Sugar Cane Tech.*, 1980, 147-153. — A survey is presented of the various forms of carbon and stainless steels and, in regard to selecting a special steel, the service requirements and manufacturing method requirements are considered, as are availability and cost.

BEET SUGAR MANUFACTURE

The 1979 campaign (in West Germany). E. Reinefeld. *Zuckerind.*, 1980, **105**, 329-340 (*German*). — A survey is presented of the 1979/80 beet campaign in West Germany, covering beet growth conditions and crop results, beet and juice quality, molasses composition, diffusion (particularly the tendency to decrease juice draft to as low a level as practical in order to reduce energy demands), pulp pressing and drying (again in connexion with energy consumption), juice purification (mention being made of the possible adverse effect of prolonged main liming on filtration when juice volumes are low such as at the start-up of a factory at the beginning of the campaign), boiling and raw sugar melting (tests with an experimental stirrer-equipped vessel being described), waste water treatment, dust separation from pulp dryer vapour, and research on beet as a possible source of biomass for alcohol manufacture.

Application of process computers in Belgian and Dutch sugar factories. H. A. Paschold. *Zuckerind.*, 1980, **105**, 343-344 (*German*). — Mention is made of evaporator control at Tirelemont sugar factory in Belgium and of pan control at Groningen in Holland[1]. At Tirlemont a FOX-3 system controls the Brix of the juice (which is raised from 68° to 76°) in two parallel Alfa-Laval double falling-film evaporators of 50 $m^3.hr^{-1}$ throughput. Since November 1979 both evaporators have operated almost completely trouble-free, with the target Brix being maintained within ± 0.1 °Bx.

Performance comparison of low-grade crystallizers. E. Hess. *Zuckerind.*, 1980, **105**, 353-359 (*German*). Investigations of heat transfer in low-grade crystallizers showed that, irrespective of whether the crystallizer was horizontal or vertical, the use of fixed coiled pipes as cooling elements was much more effective than the use of a rotary system of discs. Experiments with a horizontal crystallizer showed that the heat transfer coefficient obtained with a disc system (approx. 20 $W.m^{-2}\,°K^{-1}$) was raised to about 50 $W.m^{-2}\,°K^{-1}$ when cooled immersed piping was installed in the crystallizer, extending in a star formation from the wall. The difference is attributed to the low velocity of the massecuite relative to the discs and the greater distance of flow from the inflow edge to the outflow edge, which create a very pronounced laminar flow boundary layer and a correspondingly smaller thermal boundary layer; on the other hand, the relative velocity of the rotating massecuite with respect to the walls of the fixed pipes and the shorter distance of flow mean that the flow boundary layer and thermal boundary layer are thinner, and resistance to heat transfer lower. Comparison of two vertical crystallizers equipped with tube bundles demonstrated that the smaller diameter tubes gave small boundary layer thicknesses and hence greater heat transfer coefficients than larger diameter tubes. From these observations it followed that separation of the cooling from the stirring sections of a crystallizer system, coupled with suitable dimensioning of the cooling elements, with use of greater spacing between smaller diameter fixed tubes, could be expected to give flow conditions necessary for optimum heat transfer. The system at Zeil is described, where the massecuite is first cooled in a battery of 10 horizontal crystallizers and part of it diluted with water in a mixer to a desired viscosity as controlled by a consistency controller. The massecuite then flows from top to bottom of one of a pair of Buckau-Wolf vertical crystallizers and, via a bottom connecting pipe, from bottom to top of the second crystallizer. Tests with LiCl as tracer showed that residence time in the first vertical crystallizer was 25 hr and in the second, 18 hr. Average temperature fall in crystallizer I is from about 50°C to about 40°C, and in crystallizer II to about 32°C.

Optimum operating speeds of beet slicers. V. G. Belik and A. M. Shcherbakov. *Sakhar. Prom.*, 1980, (5), 34-36 (*Russian*). — Factors affecting the performance of centrifugal beet slicers are examined, particularly the relationship between speed of slicing on the one hand, and elasticity modulus, specific cutting force and mean force by which the beets are held against the knives on the other. From results of investigations, a speed of 5-8 $m.sec^{-1}$ is recommended for a 12-frame slicer, and 6-8 $m.sec^{-1}$ for a 16-frame slicer. However, a widening of the lower range to 3.5-6 $m.sec^{-1}$ is advocated, for which work on a new slicer design is being carried out.

Calculation of the optimum conditions for low-grade massecuite cooling. A. I. Gromkovskii and V. S. Bogdanchikova. *Sakhar. Prom.*, 1980, (5), 40-43 (*Russian*). — Equations are presented for calculation of massecuite parameters important for the establishment of optimum crystallization conditions, and values are tabulated for temperature stages in cooling from 76° to 29°C. It is emphasized that optimum crystallization involves cooling at a varying rate and not at a constant rate as used at many Soviet sugar factories, since, under the latter conditions, crystallization occurs faster than the temperature falls. Crystallization was carried out in a battery of four crystallizers under conditions corresponding to the calculated optimum, and demonstrated the possibility of achieving an improvement in performance by this means; the average exhaustion efficiency rose by approx. 82% and the purity fell by 3.8% compared with non-optimum cooling at constant rate.

Experiments on prolonged storage of sugar beet 1978-79. L. Lukács. *Cukoripar*, 1980, **33**, 4-7 (*Hungarian*). — Beets stored for approx. 60 days in piles at three sugar factories were treated with various fungicides, and their weight, sugar, sodium and amino-N contents and resistance to slicing determined before and after storage. Tabulated results show that none of the treatments (0.2% solution of Chinoin Fundazol 50 WP, 0.2% Orthophaltan, 0.3% Allisan, 2.0% lozan or Allisan powder) were better than the control (in some cases the results were even poorer than with the control), although dusting with Allisan was most effective in controlling surface mould.

Optimization of the energy economy in a sugar factory. A. Fényes. *Cukoripar*, 1980, **33**, 14-18 (*Hungarian*). Steam generation and consumption in a Hungarian sugar factory are discussed mathematically with the aim of establishing optimum conditions under which energy costs would be minimum. For a factory slicing 3000 tonnes of beet daily at a specific electricity consumption of 40 kW per tonne, boiler, turbine and generator efficiencies of

[1] See *I.S.J.*, 1981, **83**, 166-168.

80%, 86% and 91%, respectively, a return steam temperature of 140°C and a fuel calorific value of 41,870 kJ.kg^{-1}, the energy costs would be minimum where a sextuple-effect evaporator was installed; the higher capital outlay on such an evaporator would be offset by the lower fuel consumption.

Improving sugar quality. Z. Komlóssy. *Cukoripar,* 1980, **33,** 18-25 (*Hungarian*). — The standards set for white sugar quality and visual appearance in East European countries as well as Yugoslavia, Turkey and India are tabulated, and factors having effect on sugar quality at each stage in processing (as well as seed material and agronomic factors) are discussed, covering beet handling, diffusion, juice purification, evaporation, boiling, curing in centrifugals, granulation and classification. Means of maintaining the required standard are indicated.

Comparison of sugar factories by a mathematical method. F. Nagymihály and J. Gerse. *Cukoripar,* 1980, **33,** 25-30 (*Hungarian*). — A mathematical method for comparison and rating of sugar factory performances has been developed and is described with the aid of tabulated data. A program has been compiled for use in computers.

Improving the turbo-generator cooling system at Sarkad sugar factory. K. Juhász. *Cukoripar,* 1980, **33,** 30-34 (*Hungarian*). — The system for oil and air cooling of the turbo-generator at Sarkad is described, with particular mention of the steps taken to improve the quality of the cooling water.

Energy economy. P. Wertán. *Cukoripar,* 1980, **33,** 39-40 (*Hungarian*). — An appraisal is made of modern steam practices in sugar factories, and advice is offered on ways of optimizing steam usage, e.g. in evaporation, so as to minimize fuel consumption while maintaining the slicing rate and sugar yield and quality.

A disc pump for sugar syrup transfer. A. M. Grabovskii, K. F. Ivanov and O. N. Tsabiev. *Izv. Vuzov, Pishch. Tekh.,* 1980, (2), 70-72 (*Russian*). — Experimental work on the use of a disc pump for the transfer of highly viscous materials is reported, particularly regarding the effect of the ratio of the outer to the inner diameter of the annular disc on pump efficiency at an optimum clearance. The pump can be provided with any number of discs, increase in the number increasing delivery. A four-slot disc rotor of 142 mm o.d. was mounted in a pump casing and tested on syrup of 3.2 x 10^{-4} m^2.sec^{-1} viscosity. At a delivery of 1.5 kg.sec^{-1}, a head of 28 m was created and efficiency was 0.35%

The sugar industry in the German Federal Republic. K. Oberheide. *Sucr. Franç.,* 1980, **121,** 221-227 (*French*). A survey is presented of the West German sugar industry, which includes 10 raw sugar factories and 40 white sugar factories, with a list of six factories built in the period 1952-77 and information on expansion of others. Technological advances in the industry, future problems involving energy costs and EEC rulings on e.g. isoglucose manufacture, and the professional organization of the industry are also briefly discussed.

Sugar storage in silos. I. L. Budicek, O. Mikus, J. Gebler and B. Tichá. *Listy Cukr.,* 1980, **96,** 112-116 (*Czech*). Sugar may be stored ventilated or unventilated in a heated or unheated silo; each of these methods is discussed, and their advantages and disadvantages listed. Types of silo available and/or erected in various countries are briefly described, and details given of forms of storage in a Czechoslovakian TMS silo, which comprises four steel cells grouped in a square. Its standard capacity of 5000 tonnes may be increased to 10,000 tonnes by doubling the unit.

Experimental investigations of bacterial degradation of sugar in raw juice and predefecation juice. F. Hollaus and L. Wieninger. *Sucr. Belge,* 1980, **99,** 183-193 (*French*). See *I.S.J.,* 1980, **82,** 345.

Means of improving the performance of the boiling house at a sugar factory. A. R. Sapronov, V. E. Apasov, B. P. Miroshnichenko and V. M. Fursov. *Sakhar. Prom.,* 1980, (6), 27-28 (*Russian*). — By treating *B*-massecuite with 0.03-0.04% by weight of sodium sulphite (added in the vacuum pan with syrup drinks), reheating the massecuite to 85°C before curing, mixing with diluted *A*-massecuite 2nd run-off and then washing with hot water at 90°C in the centrifugals (at 0.3-0.4% water usage on massecuite weight), a *B*-sugar was obtained, of 1.4-1.8°St colour content and 99.4-99.7 purity, that could be used for industrial purposes, e.g. in baking, confectionery manufacture and canning, or, as a 1:4 blend with *A*-sugar, for domestic food purposes. (After removal of crystals smaller than 0.3mm, this blend had a colour content of 0.75°St.)

Method of beet cleaning with mechanical screens. L. A. Kuznetsova *et al. Sakhar. Prom.,* 1980, (6), 31-35 (*Russian*). — Descriptions are given of types of mechanical screen mounted on beet pilers for removal of soil and other extraneous matter.

Complex development of vacuum-condensation units for sugar factories. S. V. Markitan and I. B. Chernyakhovskii. *Sakhar. Prom.,* 1980, (6), 35-39 (*Russian*). — While modern vacuum pans make use of bled vapour from the 2nd evaporator effect, at a number of Soviet sugar factories this is not always possible because of inadequate vacuum. The problem can be solved by means of paired units comprising a pre-condenser and the main condenser; a number of such units are described and their performances discussed. The best, as regards economics and performance, has proved to be a direct-flow type of combined condenser with a counter-flow plate-type incondensable gas cooler, which operates best at a recirculating water temperature no higher than 20°C.

Purification of juices extracted from beets of reduced technological value. I. Oglaza, E. Walerianczyk, J. Haszczynska and S. Zarzycki. *Gaz. Cukr.,* 1980, **88,** (5), 138 *(Polish).* — Causes of fall in beet processing properties are briefly discussed and reference made to studies on beet composition, which showed that quantity rather than quality of certain beet constituents was important as regards sugar yield. The most important factors were found to be the ratios of sugar to invert sugar, total acids and α—amino N and the level of enzyme activity. Differences have been found between the sugar yield estimations based on chemical composition of the beet and those based on the chemical composition of the raw juice; these differences increase as the campaign progresses and may be in the range 0.3-0.8% absolute on beet. The possibility of modifying the juice purification process by using substances to increase milk-of-lime activity is mentioned.

NEW BOOKS

Sweeteners and related products in the 1980's. 58 pp; 20.7 x 29.5 cm. (F. O. Licht GmbH, P.O. Box 1220, D-2418 Ratzeburg, Germany.) 1981.

One in the series of International Sugar Reports published by F. O. Licht, the well-known sugar economic publishers, this is a collection of seven articles on various aspects of sugar production and marketing of other sweeteners. G. B. Hagelberg & H. Ahlfeld look at the pattern of sugar consumption as food and the competition from high fructose corn syrups, and then examine the effect of energy consumption on sugar industry developments – they consider that almost certainly the main aim of cane sugar factories will be to improve thermal efficiency. K. S. Mulherin and F. Pignalosa discuss the world sugar situation, including production and consumption, give some projections, examine the developments as regards high fructose corn syrups and discuss possible patterns of production and consumption (they consider that 80% of the increase in consumption will occur in deveoping countries, where most of the production gains will also take place, so that international trade as a proportion of total production will continue its long-term decline). Alcohol production from cane is discussed; apart from Brazil, no country is considered capable of a major program, so that use of cane for alcohol production is likely to be on a modest scale. The need for greater sugar market stability is stressed. "The sugar cane industry in developing countries" is written by P. Lindholm and S. Chaudhry and particularly examines by-products utilization. D. E. Nordlund and R. C. Liebenow are the authors of "High fructose corn syrup in the US sweetener market"; this is followed by "Molasses in the 1980's" by J. H. Cheetham, who feels that animal feed markets in Europe and the USA will use increasing quantities of other by-products in place of molasses, so that, while there is still a substantial market potential for molasses, it may not be sufficient to increase overall molasses consumption. A. J. Vlitos and K. J. Parker discuss sucrose as a renewable source for the chemical industry, while R. A. Yates looks at the potential renewable energy yield from various crops, including sugar cane and beet.

The South African sugar year book 1979-1980. 208 pp; 22 x 29 cm. (The South African Sugar Journal, P.O. Box 1209, Durban, Natal, South Africa.) 1981. Price: $12.00.

Since this is the 50th edition of the South African sugar year book, it is understandable that it has something of a historical flavour, including a story of the pioneer cane planters of Victoria County (an area of 1500 square miles to the north of the Umgeni river and hence north of Durban) as well as highlights of the first 132 years of the South African sugar industry. However, the section of the year book devoted to special articles and features does not limit itself to historical surveys but also examines the more immediate problems besetting the South African sugar industry (particularly drought and infestation by the Eldana borer) and looks at the expansion program for the industry, which includes the erection of the largest sugar factory in South Africa, at Felixton, the crushing capacity of which will be 600 tch once the second phase is completed in 1984 (thus replacing the old Felixton factory and that at Empangeni). The second section of the year book is a collection of industrial reviews and reports, following which are tables of performance data for the industry in 1979-80 and a directory of the South African sugar industry and the sugar industries of neighbouring countries. The book contains a wealth of information on one of the most progressive cane sugar industries in the world.

Australian sugar year book, 1981 edition. 320 pp; 18.5 x 24.7 cm. (Strand Publishing Pty. Ltd., G.P.O. Box 1185, Brisbane, Australia 4001.) 1981. Price: A$21.00.

The latest edition of the Australian sugar year book is packed with interesting material on the Australian sugar industry, which includes 33 raw sugar mills and six refineries. The first section sets out the organization of the industry, with information on the various associations, boards, councils and official organizations. A sugar mill directory gives details of the factories in Queensland and New South Wales, and this is followed by a review of the 1980 season. The next section, a review of sugar research, contains extracts from the 1980 annual review of the Sugar Research Institute, the 1980 report of the Bureau of Sugar Experiment Stations, and a general survey of the industry. The book concludes with a collection of data concerning cane varieties, mill performances, etc. for 1979 and previous years. For readers wishing to know more about the Australian sugar industry, the year book has much to offer and is made even more interesting by colour photographs illustrating various aspects of the industry.

Relatório anual Planalsucar 1979. 100 pp; 20.5 x 27.2 cm. (Programa nacional de melhoramento de cana de açúcar, Rua 13 de Maio 768, Edificio Sisal Center, Piracicaba, SP, 13400 Brazil.) 1980.

This is a report of work carried out by Planalsucar mostly in cane research, covering breeding and selection, entomology, agronomy, nutrition and fertility, irrigation and climatology, physiology and weed science, and agricultural operations; some work in sugar manufacture, but mainly concerned with by-products utilization, is also briefly mentioned. The report is split into two language sections, a Portuguese one preceding an English version, and gives a good insight into the type and level of work being carried out in Brazil.

Biotechnology in the '80's. 17 pp; 21 x 19.5 cm. (Tate & Lyle Ltd., Group Scientific Directorate, Sugar Quay, Lower Thames St., London EC3R 6DQ, England.) 1980.

In the introduction to this report, the Group Scientific and Agricultural Director, Professor A. J. Vlitos, states that Tate & Lyle's corporate research and development programs have had a biotechnological bias for well over ten years. In just a few pages, with the aid of colour photographs, the type of work conducted at the Group's Research & Development centre is described, covering enzyme technology for glucose syrup manufacture, development of immobilized enzyme systems, fermentation processes to produce speciality organic chemicals, ethanol production, effluent treatment, crop protection, fish and algal culture, and future directions for research.

BALCO SCREENS

for continuous centrifugals

a top product developed
in close cooperation with the most important centrifugal manufacturers, used in all sugar producing countries of the world.

Material: pure nickel, hard-chromium plated
Working side: absolutely plane
Perforations: conical, non-clogging distributed uniformly over the entire suface

BALCO

Balco Filtertechnik GmbH
Am Alten Bahnhof 5 D-3300 Braunschweig Federal Republic of Germany
Telephone (05 31) 8 30 71 Telex 09 52 509

LABORATORY STUDIES

Distribution of colouring matter in $CaCO_3$ crystals in filter mud. I. F. Bugaenko and E. P. Kindinova. *Sakhar. Prom.*, 1980, (3), 39-40 (*Russian*). — Investigations were conducted on cane raw sugar melt of 41.2°St colour which was limed and filtered. The filter cake was washed with distilled water and then fractionally dissolved in HCl. After 30 min, the solution was filtered and the optical density *D* of the filtrate determined at 560 nm; the amount of $CaCO_3$ dissolved was calculated. A graph shows that the relationship between *D* and particle size was virtually linear from 0.4 to 2.0 mg, after which there was a sharp, vertical climb followed by a slight decline. The initial part of the curve was found to be associated with colouring matter adsorbed on the surface of the carbonate particles, whereas inclusion of colouring matter occurred in the particles greater than 2.0 mg, such inclusions constituting the overwhelming part of the total colouring matter. For this reason, and in order to make greater use of it, the lime should be added fractionally.

Results of a study on beet invertase. J. Hasek and I. Cahová. *Listy Cukr.*, 1980, **96**, 49-57 (*Czech*). — Neutral invertase (the dominant form of the enzyme in beet tissue) was isolated from Dobrovická A beet variety. From the reaction with sodium parachloromercuric benzoate (SPMB) it was established that the thiol groups are mainly responsible for the catalytic action of invertase, which has an optimum pH of 6.8-7.4. Total inactivation occurs at temperatures above 60°C. Of various chemicals tested for invertase inactivation, only SPMB and Syntefix (a cationic organic flocculant) proved effective *in vitro* (77% and 40% inhibition, respectively) but no positive results were obtained *in situ*, although AITK and sodium azide considerably reduced the concentration of active invertase (by 92.5% and 60%, respectively). The pattern of invertase concentration in the growing beet was that of a parabola, reaching a minimum in the period September 10-25, after which it rose to almost the maximum achieved at the start of the growing period. During 3 months' storage invertase activity fell by about half.

Quality factors in commercial white granulated sugar. W. Mauch and E. Farhoudi. *Sugar Tech. Rev.*, 1980, **7**, 87-171. — Physical and chemical properties of white sugar are discussed and methods of analysing for various constituents are described; the behaviour of the components during processing is indicated. The components covered include water; reducing sugars and raffinose; polysaccharides; saponin; metals; nitrogenous compounds; organic acids and anions; sulphur dioxide and colouring matter. Measurement of buffering capacity and reflectance and visual grading of white sugar are also described, and microbiological standards and determination of bacteria and contaminants (water-insoluble matter) such as foreign bodies explained. The survey concludes with a discussion of crystal properties and determination of grain size distribution. Three hundred references are given to the literature.

Comparative study of three methods for calculating pol % and variability of the fibre % in sugar cane. N. Milanés and F. Pardo. *Cienc. Agric.* (Cuba), 1978, (3), 3-11 (*Spanish*). The VCF method of Arceneaux, developed in Louisiana in the 1930's, has been applied in Cuba for a long time to estimate rendement. Comparative determination of pol % cane by the VCG method and by application of the Hoarau equation[1] [pol % cane = pol in juice × (100 − fibre % cane)/100], (a) assuming a value of 12.5% for F, and (b) calculating a fibre value for each of the five varieties used in the study. The investigation also involved two sowing dates and four periods of analysis covering ages varying by up to 4 months, i.e. 11-15 months and 15-19 months. The results showed that it was feasible to calculate pol % cane from the equation assuming a fibre content of 12.5%. Such factors as planting date and variety influenced the cane fibre content significantly, but there was no significant difference detected between the age ranges studied.

The crystallographic substructure of sugar in relation to elongated growth. A. Pérez R. and J. Cremata A. *Cuba-Azúcar*, 1979, (April/June), 20-26 (*Spanish*). — A report is presented on the microscopic substructure of three types of sugar crystals (two normal crystals grown in the laboratory and one elongated sugar crystal from a sugar factory). Two exfoliation planes were examined: one parallel to face c (001) and the other parallel to the direction of elongation (010). The disordered state of the mosaic structure found in layers of plane 001 for elongated factory crystals was corroborated by electron diffraction of the mosaic crystallites extracted by means of extraction replicates, after an overall examination using replicate electronic microscopy. The mosaic structure was found to be only an aggregate of crystallites, its non-continuity being shown by photomicrographs of different crystals and exfoliation planes. It is suggested that crystals grow by aggregation of such crystallite "blocks", the rate and orientation of the crystallites being affected by temperature, etc., including non-sucrose material which can thereby produce elongation.

Analysis of sugar cane saccharides by liquid chromatography. I. Adsorption chromatography with flow programming. J. Wong-Chong and F. A. Martin. *J. Agric. Food Chem.*, 1979, **27**, (5), 927-929. **II. Ion exchange resins.** Idem. *ibid.*, 929-932: through *Anal. Abs.*, 1980, **38**, Abs. 4F23, 4F24.

I. Sucrose, glucose, fructose and raffinose in sugar cane juice were separated in 21 min by high-performance liquid chromatography on a column (30 cm x 4 mm i.d.) packed with μBondapak carbohydrate (8 to 12 μm) with aqueous 80% acentonitrile as mobile phase (2 $ml.min^{-1}$) and detection by a differential refractometer. Juice was first treated with Celite, then diluted 1:10 and filtered. By programming the flow rate to increase from 2 to 4 $ml.min^{-1}$ over 1 min, the analysis time was reduced to <12 min. The presence of slower-eluting compounds, e.g. dextrans, made it difficult to know when the last peak of interest in a sample had been eluted, and the column required frequent re-calibration.

II. Three such resins were evaluated for the HPLC separation of sucrose, glucose and fructose in cane juice: (i) Aminex A5 (13 ± 2 μm) in Ca^{++} form, in a column (25.4 cm x 7 mm i.d.) maintained at 85°C; (ii) Aminex Q15S (22 ± 3 μm) in Ca^{++} form, in a column (61 cm x 7 mm i.d.) maintained at 60°C; and (iii) Aminex Q150S

[1] *I.S.J.*, 1969, **71**, 328-333.

(28 ± 7 μm) in K^+ form, in a column (61 cm x 7 mm i.d.) maintained at 60°C. For each analysis the mobile phase was water, the flow rate being 1, 2.8 and 2.5 ml.min^{-1} for (i), (ii) and (iii), respectively; a differential refractometer was used as detector. Separation took <9 min on each column. Products of deterioration of juice were successfully analysed on (iii).

Tagging of sugars with a fluorescent compound, 2-aminopyridine. S. Hase, S. Hara and Y. Matsushima. *J. Biochem.*, 1979, **85**, (1), 217-220; through *Anal. Abs.*, 1980, **38**, Abs. 4C23. — In developing the method, the products of reaction of various sugars with 2-aminopyridine in the presence of $NaCNBH_3$ were purified on a column of Dowex 50-X2 resin (H^+ form), with aqueous ammonia as eluent. Paper electrophoresis (at pH 5) of the eluates gave a single spot for the derivative of each sugar (and another for 2-aminopyridine), and the compounds were located in U.V. radiation. The migration rates of the derivatives were related to the degree of polymerization of the sugar and were independent of the linkage points or the anomeric configuration. Mobilities are reported for the derivatives of 11 mono-, 7 di-, 3 tri-, 3 tetra- and 3 penta-saccharides. The derivatives of the mono-saccharides can be analysed by gas-liquid chromatography at 210°C, with OV-17 as stationary phase; retention times are reported for six compounds. Fructose does not form a derivative.

Determination of carbohydrates by direct-injection enthalpimetry. W. A. de Oliveira and A. A. Rodella. *Talanta*, 1979, **26**, (10), 965-967; through *Anal. Abs.*, 1980, **38**, Abs. 5C19. — A sample containing up to 25 mg of carbohydrate is dissolved in buffer solution of pH 7.2 [4 g.l^{-1} of $NH_4H_2PO_4$ and 17.57 g.l^{-1} of $(NH_4)_2HPO_4$] to give a volume of 55 ml, then 2 ml of oxidizing reagent (prepared by dissolving 7.353 g of $HIO_4,2H_2O$ in 22.5 ml of 0.96M NaOH and diluting to 50 ml) is placed in a narrow polyethylene spiral tube, the coil of which is immersed in the buffered sample solution (contained in a Dewar flask) for rapid temperature equilibration. The oxidizing reagent is forced into the stirred sample solution by injecting air from a syringe into the upper end of the polyethylene tube. By means of a thermistor, Wheatstone bridge and recorder, measurements are made when the first, rapid, portion of the reaction is substantially completed. The calibration graphs are rectilinear over the concentration range indicated, and single carbohydrates can be determined with a precision of 1%. The analysis of mixtures of glucose and fructose is reported.

Effect of certain chemical compounds on the polarimetric measurement of sucrose (model solutions). H. Gruszecka. *Gaz. Cukr.*, 1980, **88**, 73-74 (*Polish*). — The effects of glucose, fructose, raffinose, arabinose, glactose, glutamine and asparagine on the optical rotation and hence polarimetric values of a model aqueous solution of sucrose (clarified with basic lead subacetate) as well as a clarified cell juice sample of known pol were determined by adding given quantities of the individual sugars and amino-acids. Tabulated values are given for each in the concentration range 0.02-1.00% (w/v).

The formation of colouring matter from monosaccharide degradation products. I. F. Bugaenko and M. Saber Guda. *Izv. Vuzov, Pishch. Tekh.*, 1980, (1), 16-18 (*Russian*). Glycine and ammonium chloride were added, separately, at 0.1 mole.l^{-1} to a solution of invert sugar thermal degradation products which were buffered at pH 9 and then heated on a water bath at 90°C. The optical density *D* increased as a result of heating, this increase being greater in the presence of NH_4Cl than in a control, and considerably greater in the presence of glycine. The rise in *D* was attributed to reaction of carbonyl groups, present in the degradation products, with amino groups in the nitrogenous additives. Gel chromatography showed that heating caused an initial increase in the colorants of lower M.W., which then condensed to give higher M.W. colorants. Addition of 0.1 mole.l^{-1} glycine to the low M.W. fractions (>100) and high M.W. fractions (>5000) was followed by heating under the same conditions as above. The increase in *D* as a result of the heating was greater in the low M.W. fraction than in the other fraction. The rise in colour resulting from monosaccharide degradation in liming can be reduced by minimizing carbonyl compound formation through the use of air blowing.

Laboratory research in South Africa. Anon. *Ann. Rpt. Sugar Milling Research Inst.*, 1979/80, 13-14. Development of a method for analysis of non-volatile organic acids in cane juice and molasses has continued. Juice is filtered, glutaric acid added as an internal standard and the sample passed through a cation and then an anion exchanger. The acids adsorbed by the latter are eluted as their ammonium salts, liberated with trifluoracetic acid, dried, silylated with bis(trimethylsilyl)trifluoroacetamide and subjected to gas chromatography using a 3-m packed column with 3% OV17 as the liquid phase. In some cases separation of the acids was not entirely satisfactory and the method is to be improved by the use of capillary columns. § Investigations into various column packings for HPLC showed that recoveries were low with a μBondapak packing, accuracy achieved was inadequate, retention times were not constant and some carbohydrate in the samples was irreversibly bonded to the packing. Aminex Q15S cation exchanger in Ca^{++} form was tested but did not resolve sucrose and glucose unless a very low flow rate was used, which prolonged analysis to an unpractical extent. Another prepacked column using Aminex HPX-87 gave a higher separation efficiency at first, but performance dropped rapidly. § Two non-quartz wedge-type polarimeters were tested: the Schmidt & Haensch Polartronic instrument performed well, with linearity, speed of operation, cell compartment temperature, ability to read coloured solutions and repeatability all within the Australian Standard K 157 (1968) and only the drift over 24 hours slightly higher than the specification. The Seres Sacchamatic S 5556 A has the advantage of being completely electronic, with no moving parts, but did not meet the Standard specification for linearity, cell compartment temperature, drift and ability to read coloured solutions. § A number of important precautions have been noted in the measurement of specific conductance of mixed juice so as to obtain accurate readings: these include precise sample temperature measurement, dilution of samples to 5°Bx, and filtration of samples to remove suspended matter which affects conductivity. Provided the measurements are made close to 20°C, addition of mercuric chloride as preservative did not have any significant influence on conductivity readings. § The use of transmitted light and reflected light of different wavelengths did not affect readings of refractometer Brix for water, refined sugar solution or organic solvents but did for molasses, probably owing to suspended matter and/or colour. Transmitted light of 525 and 589 nm gave lower Brix readings than reflected light and the reverse was true for light of 624nm.

BY-PRODUCTS

Increase in the digestibility of yeast by chemical treatment methods. M. A. Otero and A. Cabello. *CubaAzúcar,* 1979, (April/June), 13-19 (*Spanish*). — *Candida utilis* yeast produced by fermentation possesses disadvantages as an animal fodder ingredient, viz. variation in digestibility of its constituents, a high percentage of nucleic acids (which cause accumulation of uric acid in the blood), and low content of methionine. Yeast samples produced in a pilot plant were agitated moderately for 30 min at 60, 75 and 90°C at natural pH (5.6) and 9.5 and improved digestibility measured *in vitro* by the method of Frayre & Adrian[1] but did not affect the nucleic acid or crude protein content. The experiments were then carried out with addition of NaOH and HCl to the extent of 6% on dry solids content of the yeast. The alkaline treatments produced a considerable reduction in nucleic acids, from 11% to 2% or less at all three temperatures; a similar reduction occurred with acid at 90°C, but, while the alkali treatment improved digestibility, there was little or no improvement under acid conditions. Analysis of amino-acids in the alkali-treated yeast showed a spectrum similar to that of soya protein.

Development of a deterministic model for the liquid/vapour equilibrium of aqueous alcohol solution. R. Rabelo L., J. L. García R. and R. Arce. *CubaAzúcar,* 1979, (April/June), 34-40 (*Spanish*). — A model was designed using equations from the literature in order to predict the ethanol content of vapours in equilibrium with aqueous alcoholic solutions at given temperatures and at atmospheric pressure for concentrations from 0.2-0.9 molar. The model is intended for use in the design of distillation columns.

Ethanol from sugar beet—French experiences. — Prött. *Die Zuckerrübe,* 1980, **29,** (2), 36, 39-41 *(German).* Observations made on a study tour of French alcohol distilleries using sugar beet as raw material are discussed. At present, beet from some 40,000 ha is used for ethanol production, yielding about 1,200,000 hl per year, while molasses yields a further 650,000 hl. While most of the alcohol is used for human consumption or is used in the cosmetics industry, with the rising costs of petroleum it could become of greater importance as chemical feedstock or as 10% mixture with petrol in motor fuel. The extra 400,000 ha needed for the beet from which to produce sufficient alcohol for motor fuel is considered by the French to pose no problem, and the cost of the ethanol component should not be greater than that of the petrol it replaces, provided the state does not impose a duty on the alcohol.

Plant scale trials on recovery and recycle of yeast for the production of alcohol. H. C. Bhandari, B. K. Malik and L. R. Juneja. *Proc. 43rd Ann. Conv. Sugar Tech. Assoc. India,* 1979, G.55-G.63. — It is stated that processes involving yeast recovery from fermented wash, as in the Melle Boinot process, have not yet been applied in India because of lack of knowledge on the technical stages involved and because it has been thought necessary to preclarify the molasses. Trials are reported in which recovery of viable yeast was achieved, while molasses preclarification was found to be unnecessary.

Treatment of distillery effluent. H. C. Bhandari, A. K. Mitra and V. K. Malik. *Proc. 43rd Ann. Conv. Sugar Tech. Assoc. India,* 1979, G.65-G.72. — Descriptions are given of a number of methods for treatment of vinasse, none of which is considered suitable under Indian conditions for various reasons, mainly high costs and inadequate pollution reduction. However, adoption of an integrated system is advocated, such as evaporation for recovery of potassium and anaerobic fermentation for methane gas recovery.

Use of yeasts in pure and mixed cultures with the object of utilization of vinasse. D. F. de Angelis, C. Kiyan, C. R. Corso and S. M. Tauk. *Brasil Açuc.,* 1979, **94,** 401-406 *(Portuguese).* — Four yeasts (*Candida utilis, C. lipolytica, Rhodotorula glutinis* and *Torula utilis*) were grown in pure culture and in six two-yeast mixtures on a range of media including molasses media, vinasse media (with and without a range of added nutrients) and on a medium containing molasses and vinasse. The results showed that, in general, mixed yeasts produced the greater yields of biomass, the pure strains gave higher protein contents, mixed strains consumed more oxidizable matter than the pure strains and that the yeasts can use vinasse as a growth medium. Other workers have shown, however, that vinasse is a material of very variable composition and further work is necessary on its utilization as a yeast culture medium.

The alcohol industry in Taiwan. J. S. I. Wang. *Taiwan Sugar,* 1979, **26,** 205-208. — In Taiwan, some 45% of the annual 260-290,000 tonnes of molasses resulting from cane sugar manufacture is used for ethanol fermentation, most of the alcohol being used for beverage production. The Taiwan Sugar Corporation operates four distilleries (one of which, at Suantow, is classified as "idle") having a total daily capacity of 154,000 litres of alcohol. Only the distillery at Hsinying operates throughout the year, and produces both alcohol and yeast, the latter by utilizing some vinasse together with molasses. Descriptions are given of the processes used for ethanol fermentation and yeast manufacture. Future prospects are discussed.

Production of ethyl alcohol by fermentation and its utilization as automotive fuel. J. E. Lima. *Sugar y Azúcar,* 1980, **75,** (3), 27, 30-31. — In a discussion of ethanol fermentation from materials such as sugar cane and its use as motor fuel, the author considers the main disadvantage of alcohol as a fuel to be its relatively high production cost. However, in developing countries it is thought possible that eventually economic factors will favour production of fuel alcohol, and a number of advantages obtainable at company or regional level are listed. A number of recommendations are given with regard to implementation of a national alcohol program, including the need to consider local factors rather than use ideas which are valid in one country but possibly not in others.

Sugar-based fermentation for fuel alcohol. J. E. Irvine. *Sugar J.,* 1980, **42,** (8), 17-20. — See *I.S.J.,* 1981, **83,** 154.

[1] *Ann. Nutr. Alim.,* 1967, **21,** 3.

PATENTS

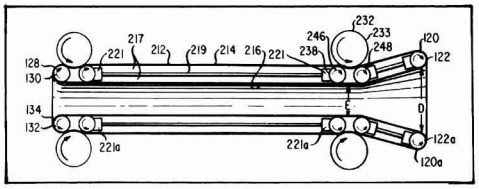
UNITED STATES

Cane harvester. M. A. Moreno, J. A. Cil, J. B. Montero, G. B. Novais, J. A. R. Morales, F. C. Montalvo, A. A. Rivero, M. J. M. Castro and J. F. Suarez, of Havana, Cuba. **4,170,098.** August 2, 1977; October 9, 1979.

Beet harvester. D. G. Mortensen and J. T. Browning, *assrs.* FMC Corporation, of San Jose, CA, USA. **4,173,257.** August 11, 1977; November 6, 1979.

Molasses conveyor. R. Parsons, of Hillsborough, NJ, USA. **4,174,033.** August 12, 1977; November 13, 1979.

A tube 212 has an inner surface 216 and an outer surface 214 forming an enclosed space 217. Within this space are shafts 219 which locate axle supports 221, 221a which carry the axles of rollers 246. Driven external rollers 233 engage with the outer surface of the tube as it passes between rollers 246 and rollers 248,

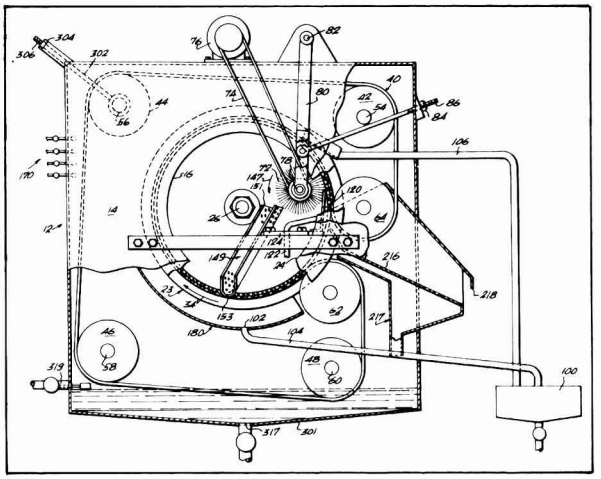


130, 134, and the wider end of the tube is supported by rollers 120, 120a. Rotation of the driven rollers in the direction of the arrows causes the tube to turn itself "inside out" continuously whereby the internal surface 216 moves continuously in the direction from right to left in the drawing and molasses admitted at the end with the wider aperture D is carried to the other end.

Cane juice separator. C. R. Cuza, of Miami, FL, USA. **4,174,660.** July 31, 1978; November 20, 1979.

The housing 12 has a front face 14 in which is a circular hole 16 which corresponds to a drum 13 within the housing. The latter is mounted on an idle shaft 26 which passes through the back of the housing and is supported by suitable bearings. Also within the housing are a series of pulleys 62, 48, 46, 44, 42 and 64 mounted on horizontal shafts and the last one being driven by an electric motor. Around the pulleys and the drum passes a belt 40, the tension of which is maintained by adjustment of pulley 44. The suface of the drum is perforated so that, when pulverized cane is fed into it and the pulley 64 is driven by its motor, the drum revolves and juice passes through an internal screen and so through the perforations.

It is caught by the shield 180 and drains through aperture 102 into pipe 104 leading to receiver 100. Other quantities of juice flung out at the top of the drum are carried by pipe 106 to receiver 100 while any mixture of cane and juice which falls onto perforated plate 216 is separated by gravity, the juice passing into the compartment formed by plate 217 and passing thence into pipe 104. Water is sprayed onto the inner surface of the drum through a nozzle at the end of



pipe 122 and a rotary brush 72, driven by motor 76 and located by arm 80 and adjustable bracket 86, removes the cane which falls into the channel 149 and so is removed.

Acid hydrolysis of cellulose to yield glucose. G. T. Tso, M. R. Ladisch and A. Bose, of West Lafayette, IN, USA, *assrs.* Purdue Research Foundation. **4,174,976.** March 8, 1978; November 20, 1979. — The cellulose is extracted from the material containing it (bagasse) by bringing it into contact with a solvent such as (e.g. 25-30%) ethylene diamine, (e.g. 70-75%) water and (e.g. 4.5-7%) cadmium hydroxide, or with a solvent comprising a chelating metal caustic swelling agent (e.g. 17% aqueous Na tartrate + 6.6% $FeCl_3$ + 7.8% NaOH, stabilized with 6.2% Na_2SO_3). The treatment dissolves the cellulose and the solution is separated from the non-cellulose residue (lignin) (by filtration or centrifuging). The cellulose is precipitated from the solution (e.g. by adding water or an acid), and the precipitated cellulose hydrolysed [at between ambient temperature and 200°C (100°-200°C) (in a closed vessel)] with a mineral or organic acid (H_2SO_4, HCl or H_3PO_4). The lignin separation may take place after the hydrolysis to glucose.

Cane harvester. L. A. C. R. Pinto, of Riberão Preto, Brazil, *assr.* Santal Equipamentos S.A. Comercio e Industria. **4,177,953.** March 29, 1978; December 11, 1979.

Copies of specifications of United Kingdom patents can be obtained on application to The Patent Office Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington, Kent, England (price £1.45 each). United States patent specification are obtainable from: The Commissioner of Patents, Washington, D.C., USA 20231 (price 50 cents each).

Beet harvester and topper. R. J. Hurliman and F. F. Scribner, *assrs.* FMC Corporation, of San Jose, CA, USA. **4,182,420.** January 23, 1978; January 8, 1980.

Cane diffuser. J. M. Cargill, of Mount Edgecombe, Natal, South Africa. **4,182,632.** September 14, 1977; January 8, 1980. – See UK Patent 1,542,482[1].

Separation of glucose and fructose from a mixture. H. Ishikawa, H. Tanabe and K. Usui, *assrs.* Mitsubishi Chemical Industries Ltd., of Tokyo, Japan **4,182,633.** December 19, 1977; January 8, 1980. – A simulated moving bed is one in which the adsorbent remains stationary but which is housed in a vessel from the end or bottom of which a conduit leads back to the beginning or the top; at intervals along the bed are provided addition points and drain pipes, and the feed to the bed and elution liquid are applied to successive points and the eluate withdrawn through successive corresponding drain pipes at controlled intervals so that the head of the column is moved along the bed which behaves effectively as if it were moving. Such a bed, comprising a Ca^{++} – type strongly acidic cation exchange resin, is used for separation of aqueous solutions containing 15-35% glucose and 20-40% fructose from a mixture applied to the bed, each being removed from selected positions along the bed. The feed and withdrawal points are altered along the bed at predetermined intervals and the concentrations of each sugar are monitored by means of a polarimeter and refractometer so as to establish a concentration gradient pattern.

Insolubilized enzyme product. V. Krasnobajew and R. Boeniger, *assrs.* Givaudan Corporation, of Clifton, NJ, USA. **4,186,053.** August 3, 1977; January 29, 1980. The enzyme (glucose isomerase) is insolubilized by bonding to the condensation product obtained by reacting 1,3-phenylene diamine with glutardialdehyde, to form a product insoluble in water and water immiscible solvents and in the form of spherical homogeneous particles capable of good filtration.

Purification of polyhydric alcohols (sugar). R. Kunin and L. I. Blaine, *assrs.* Ecodyne Corporation, of Chicago, IL, USA. **4,187,120.** May 30, 1978; February 5, 1980. A liquid slurry of filter particles, less than 37 μm (10-30 μm) in size, including a (quaternized, aminolysed cross-linked acrylate) anion exchange resin (in the Cl^- form) (having a moisture content of 45-80%) and a (sulphonated cross-linked styrene-divinyl benzene) cation exchange resin (in the Na^+ form) (in a proportion of 1:1-99:1 anion exchange resin:cation exchange resin by dry weight) and a filter aid material [a fibrous substance (alpha-cellulose), each fibre being <50 μm in diameter and <1 mm long] (in a proportion of 1:4-9:1 total resins:filter aid) is used to pre-coat a porous support (a tubular filter element) to form a precoat layer (of 0.1-1 $lb.ft^{-2}$) through which a sugar syrup is passed at 120°-180°F (about 180°F) and at a flow rate of 0.1-2 (0.125) $gallons.min^{-1}.ft^{-2}$. The filter particle mixture is regenerated *in situ* by passage of a brine solution at pH 7-10.

Production of immobilized glucose isomerase. N. Yoshikazu, S. Kazumasa and M. Tsuyoshi, *assrs.* Mitsui Sugar Co. Ltd., of Tokyo, Japan. **4,191,810.** December 1, 1977; March 4, 1980. – Microbial cells of an actinomycetes micro-organism *[a Streptomyces* sp. *(S. phaechromogenus, S. fradiae, S. albus, S. achromogenus, S. echinatus, S. wedmorensis, S. flavovivens* or *S. olivochromogenes)]* which have glucose isomerase activity are heated at 70°-80°C (60°-70°C) for 1-20 minutes in a culture medium adjusted to pH 6-9. The cells are then collected by filtration or centrifuging, frozen overnight by standing in a polyethylene bag at −20°C, thawed to room temperature, (warmed to 60°-70°C,) 2-10% of gelatine (in a powdered form) or a caseinate on weight of dry cells is added and a paste formed in acetone which contains 0.2-1% of glutaraldehyde to result in solidification, after which the solvent is filtered off. The immobilized enzyme is then dried at 45°-50°C.

Production of bottler's liquid sugar. T. R. Dillman and D. J. Burke, of Rockford, IL, USA, *assrs.* Illinois Water Treatment Co. **4,193,817.** March 22, 1979; March 18, 1980. – The crystallized product of one of more of the intermediate strikes in a raw cane sugar refining process is remelted, filtered and the melt liquor passed (at about 30°C) through a (series of beds of a) Type 1 strong-base anion exchange resin in the Cl^- form (the feed to the beds being sequential at intervals to permit regeneration). The resin is regenerated by countercurrent passage of aqueous NaCl (containing NaOH, KOH and/or NH_4OH). Alternatively, the NaCl solution may be preceded by the NaOH, KOH and/or NH_4OH or by an aqueous solution of HCl (containing NaOCl).

Immobilization of enzymes. I. Kaetsu, H. Watanabe, T. Sato and A. Ito, *assrs.* Japan Atomic Energy Research Institute, of Tokyo, Japan. **4,193,845.** May 19, 1976; March 18, 1980. – An aqueous enzyme (e.g. glucose isomerase) solution or an aqueous dispersion of bacterial cells is mixed with one or more monomers of the group comprising hydroxyethyl methacrylate, hydroxyethyl acrylate, hydroxypropyl methacrylate and hydroxypropyl acrylate [and <40% (<20%) of another monomer (the dimethyacrylate or diacrylate of propylene glycol, butanediol, pentanediol, hexanediol, triethylene glycol, polyethylene glycol, neopentyl glycol or polypropylene glycol; the trimethacrylate or triacrylate of trimethylol propane; ethyl, methyl, butyl, cyclo-hexyl, furfuryl, benzyl or glycidyl methacrylate or acrylate; stearyl or octyl methacrylate; vinyl acetate, propionate, stearate or palmitate, monomethacrylate or monoacrylate of butanediol, pentanediol, hexanediol, nonanediol; pyrrolidone acrylic acid, methacrylic acid or metal salts of these)]. The mixture is frozen and the monomer polymerized (and/or copolymerized) by means of an ionizing radiation whereby the polymer is rendered water-insoluble.

Immobilization of enzymes or bacteria cells. I. Kaetsu and M. Kumkaura, of Takasaki, Japan, *assrs.* Japan Atomic Energy Research Institute. **4,194,066.** August 20, 1975; March 18, 1980. – A porous polymer containing immobilized enzyme (e.g. glucose isomerase) or bacterial cells is prepared by mixing the enzyme(s) with a monomer (one or more monomers) of formula

$$CH_2 = CX - CO - (OR)_n - OR' \text{ or}$$

$$CH_2 = CX - CO - (OR)_m - O - CO - CX = CH_2,$$

where X is H or methyl, R is $-CH_2-CH_2-$, $-CH(CH_3)-CH_2-$, $-CH_2-CH(CH_3)-$ or $-CH_2-CH_2-CH_2-$, R' is H or alkyl, n is 2 or more, m is 4 or more, thereafter polymerizing by means of ionizing radiation of the mixture at a temperature <0°C, thereby depositing the polymer from the water.

[1] *I.S.J.*, 1981, **83**, 157.

TRADE NOTICES

PUBLICATIONS RECEIVED

Dust separation equipment. Actair International Ltd., Penarth Rd., Cardiff CF1 7UG, Wales.

Brochure No. 316 from Actair describes the new Pactecon PC 200 dust filter designed for applications where process shut-down for filter bag cleaning is impossible or unpractical; bags are kept clean continuously by means of a simple, automatic, maintenance-free pulse cleaning system, in which the pulses are uniformly distributed in each cell, causing envelope-type bags to flex and allow excess dust to be removed without damaging the fabric. General brochure No. 306 R:1 describes the complete range of industrial dust and fume control equipment designed and manufactured by Actair.

"Project engineering". Peter Brotherhood Ltd., Peterborough PE4 6AB, England.

A 4-page brochure from Peter Brotherhood outlines their project engineering services available for the production of custom-built precision machines. Included is an illustration of cane mud filters manufactured for Dorr-Oliver Co. Ltd.

Slurry pumps. Friedrich Wilh. Schwing GmbH, Postf. 247, D-4690 Herne 2, Germany.

A special folder from Schwing illustrates their slurry pumps, which can transfer materials of up to 68% solids content over a distance greater than 2000 m at pressures exceeding 100 bar and outputs of up to 100 $m^3.hr^{-1}$. The pumps are available as piston or plunger types.

Process computers. Foxboro Yoxall, Redhill, Surrey RH1 2HL, England.

A new 20-page, full-colour brochure describes the Fox 1/A computer system for large-scale process management and control applications. Particular attention is paid to the sophisticated yet easy-to-use operator interface.

Garvox pesticide. FBC Ltd., Hauxton, Cambridge CB2 5HU, England.

Garvox (Bendiocarb) was introduced in 1979 for control of soil pests, and has been used in France, Holland and the UK in beet fields, where it has proved effective against wireworms (*Agriotes* spp.), symphylids (*Scutigerella immaculata*), springtails (*Onychiurus* spp.), pygmy beetle (*Atomaria linearis*) and millepedes (including *Blaniulus guttulatus*). A folded leaflet describes the main advantages of Garvox.

Cooling towers. Acalor International Ltd., Crompton Way, Crawley, Sussex RH10 2QR, England.

A 4-page brochure describes Acalor plastic cooling towers, which are delivered as prefabricated units and can be installed in a few operations. The SG series of forced- and induced-draught towers has a range of up to 700 $gal.min^{-1}$, while the Series M induced-draught model for water of high solids content has a range of 350-1200 $gal.min^{-1}$, and the SGR and L series of forced-draught towers can handle up to 350 $gal.min^{-1}$.

"BMA Information". Braunschweigische Maschinenbauanstalt AG, Postf. 3225, D-3300 Braunschweig, Germany.

A recent copy of this BMA publication carries details of Ormoz and Virovitica sugar factories (each of 4000 tonnes/day beet slice) erected by BMA in Yugoslavia, of Numan sugar factory (of 4000 tcd crushing capacity, extendable to 7500 tcd) in Nigeria, of a beet transport and preparation system installed by BMA at the Zeil factory of Zuckerfabrik Franken GmbH, and of the tower diffuser and Babbini-type double-spindle beet pulp presses supplied to Zuckerfabrik Uelzen AG. Also described is BMA beet unloading and preparation equipment, the contribution made to energy saving by BMA processes, and developments in BMA cane diffusers. The K 1500 continous centrifugal is described as well as equipment supplied to various sugar factories, including a new leaf filter, arcuate screens, ribbon pans provided with massecuite stirrers (nine of which have been ordered by Süddeutsche Zucker-AG), dust separation plant and the BMA vertical crystallizer. Activities of subsidiary companies, including installation of a fructose syrup plant by Starcosa at Lehrte sugar factory, are also mentioned.

Cane sugar mill chains. Renold Power Transmission Ltd., Renold House, Styal Rd., Wythenshawe, Manchester M22 5WL, England.

Catalogue C812 features the various types of Renold chain used in the cane sugar industry, including Series 2001 cane feeding table chain, Series 2002 cane carrier chains, Series 2003 intermediate carrier chains, and Series 2004 bagasse conveying chains, as well as carrier slats and conveying sprockets. Also included are illustrations of Renold gears and chains used in various other applications, e.g. diffuser and cane mill drives, crystallizer drives, drives for bagasse furnace feed drums, chains for cane harvesters, etc.

Continuous centrifugals. Fives-Cail Babcock, 7 rue Montalivet, 75383 Paris Cedex 08, France.

A colourful brochure available from Fives-Cail Babcock gives details of the FC series of continuous centrifugals which were developed from the FC 1000 model, initially designed for low-grade sugar. The series includes the FC 1000-BP for low-grade massecuites, the FC 1250 for both low-grade massecuites and affination, the FC 1000-AF for affination and cane sugar *B*-massecuite, and the FC 1000-SE for beet sugar *B*-massecuite, cane sugar *A*-massecuite and cane and refined sugar *B*-massecuite affination. Mechanical and operational data are given for each model with details in English, French and Spanish.

Refinery weighers. — Tate & Lyle Refineries Ltd. have ordered four different systems from Darenth Weighing Equipment Ltd. for their plants at Silvertown, Plaistow Wharf and Millwall. Two complete open-mouth sack bagging lines are to be supplied to Millwall; the lines have been designed to bag sugar into 50-kg sacks and will include vibratory feeders, pneumatic gross filling and weighing units with analogue read-out and automatic taring, twin-head sewing machines, turners and take-away conveyors, as well as a special sequencing and control system. A monorail weighing system will be supplied in conjunction with the lines, in order to check-weigh 1-tonne intermediate bulk containers (IBC) of sugar before processing of the contents. The system is an electronic one with digital display and print-out. A mobile IBC filling and suspended weighing system for raw sugar is being supplied to Plaistow Wharf; it will be provided with a printer and will be movable from the filling spout to provide filling access for bulk road tankers. A second IBC system will be supplied to Thames refinery to handle 1-tonne containers for delivery outside the plant; it will have a pneumatic platform unit with display and print-out.

Heat recovery from diffusion juice. — The first heat exchange belt conveyor patented by Extraction De Smet S.A. will be put into operation in France during the next campaign. Under the system, the temperature of the diffusion juice is reduced to 30°C by the cossettes, and the heat passed to hot water whence it is recovered.

Conveyor order from British Sugar Corporation. — Geo. Robson & Co. (Conveyors) Ltd. have won a £300,000 contract from the British Sugar Corporation for twin 1.2-m diameter worm conveyors to feed beet pulp to twelve presses at Bury factory. Each conveyor will be 47 m long and will be capable of handling 285 tonnes of pulp per hr; made of stainless steel and having shafts treated with glass fibre to resist the corrosive effects of the pulp, the conveyors will be powered by four 75-kW electric motors.

Sugar factory for Burma. — Hitachi Zosen have received an order from the Foodstuff Industries Corporation in Burma for construction of a new sugar factory of 1500 tcd capacity and for rehabilitation of an existing factory, also of 1500 tcd capacity, on the same site, thus providing a plant of 3000 tcd capacity, to be completed by April 1983. The location is on the outskirts of Pyinmana, about 380 km north of Rangoon. The existing factory was supplied by Hitachi Zosen in 1955. To date, Hitachi Zosen have received orders for 18 sugar factories, including three for Burma.

Yugoslavian sugar factory orders. — Technoexport, the Czechoslovakian organization, have signed a contract for the supply of two beet sugar factories, each of 4000 tonnes daily slice, to Yugoslavia. Start-up of both factories is scheduled for the 1983 campaign.

Canada sugar imports and exports, 1980[1]

	1980	1979
	— *tonnes, tel quel* —	
IMPORTS		
Raw sugar		
Australia	355,936	350,610
Cuba	276,299	314,032
Fiji	20,004	0
Guyana	41,548	71,700
Jamaica	0	31,706
Mauritius	0	13,874
South Africa	164,786	215,360
Thailand	0	11,495
Other countries	13	18
	858,586	1,008,795
Refined sugar		
USA	13,910	6,282
Other countries	1,114	1,024
	15,024	7,306
EXPORTS		
Bahamas	3,185	4,786
Bermuda	1,985	1,888
Dutch Antilles	1,472	3,065
Leeward & Windward Isl.	1,348	2,456
Puerto Rico	0	1,160
Trinidad & Tobago	1,871	5,251
USA	1,022	89,122
US Oceania	722	1,334
Other countries	1,346	1,211
	13,001	110,273

US beet area, 1981. — The USDA Crop Reporting Board announced that, based on its survey of August 1, growers expected to harvest 1,223,700 acres of beets in 1981, an increase of 2.96% above the 1,188,500 acres harvested in 1980. The most significant acreage increases are expected in California, Idaho, Oregon and Minnesota, while declines are expected in Colorado, Nebraska and Ohio.

Zambia fuel alcohol study[2]. — Indeco has awarded Jaeger and Associates of Zimbabwe a feasibility study contract on the establishment of a fuel alcohol plant. The proposed plant will produce ethanol from biomass raw materials such as molasses, cane juice and cassava to blend into petrol, which should lead to a saving of between 12 and 20% of Zambia's oil bill. The World Bank is to finance the study.

HFCS plant for Egypt[3]. — A new company to produce high fructose corn syrup from imported corn was formed in January 1981 and production is scheduled for early 1983. When completed, the new facility will produce 100,000 tonnes of HFCS.

Tanzania sugar loan[4]. — The Dutch Government has agreed to grant Tanzania a loan which, among other objects, will be used to develop the sugar industry.

Venezuela sugar problems[5]. — Initial forecasts for 1980/81 were for a total production of 380,000 tonnes of sugar in Venezuela. However, these forecasts had to be reduced drastically owing to lack of interest on the part of growers in developing new cane fields, because of bad weather and a disease which government researchers were unable to control. Weather conditions became so bad that around mid-May only two factories were working. As a result of torrential rains, production estimates were reduced to 300,000 tonnes so that, even if sugar consumption remains static in 1981, Venezuela will have a deficit of about 380,000 tonnes. Venezuela has agreements with the Dominican Republic to purchase 200,000 tonnes of sugar in 1981 and a similar agreement with Brazil is under study. Moreover, the country recently bought 100,000 tonnes of whites and 70,000 tonnes of raws on the free market.

Fiji sugar exports 1980[6]

	1980	1979	1978
	——— *tonnes, raw value* ———		
Canada	20,717	0	0
China	32,630	0	0
Japan	43,507	10,872	0
Malaysia	63,720	24,850	24,788
New Zealand	80,775	63,209	49,880
Singapore	16,574	16,567	16,525
UK	149,102	196,482	164,791
USA	42,399	123,048	40,770
	449,424	435,028	296,754

Peru cooperative central agency difficulty[7]. — Peru's debt-ridden Central Sugar Cooperatives agency, CECOAAP, has been hit by withdrawal of two profitable cooperatives. The government has already granted Paramonga the temporary right to market its sugar within Peru and industry sources predicted that Andahuasi would receive similar authorization. Paramonga and Andahuasi are two of only four of CECOAAP's 12 cooperatives to show a profit and were also the only ones to increase production in 1980. Their leaving is certain to create difficulties for CECOAAP which has debts totalling $65 million, of which $39 million is owed abroad.

Colombia diversification projects[8]. — The Colombian sugar industry, concerned about the possibility of a local disaster (insects, diseases, etc.) and also stimulated by attractive international alcohol prices, is planning to expand sugar cane production to other areas such as in the Atlantic coast region where production follows a harvest period of December-April. This project, in Luruaco district, would produce 80-90,000 tonnes of sugar annually and 4½ million gallons of alcohol from 20,000 hectares planted to sugar cane. The project will cost about $76 million and may be completed by 1985. Licores del Valle, a State liquor manufacturing agency, is planning to build in Buga, Valle, a factory to produce 9½ million gallons of alcohol per year. The project will cost $47 million and will use molasses as raw material. A similar project is contemplated for the Antioquia area with a capacity of 7 million gallons of alcohol and completion expected for 1984. The government agency Papelcol is also to invest in a bagasse paper factory to be built in Buga; it will produce 67,000 tonnes of cellulose and 87,000 tonnes of paper per year.

Increased cane mechanization in Mexico[9]. — The National Union of Sugar Cane Growers has said that mechanization of harvesting is to be accelerated in order to relieve the continuing shortage of cane cutters. Because of low wages, lack of social and labour protection, and very low standards in working conditions, the number of cane cutters has declined in the past two seasons from 110,000 to no more than 90,000 and the downward trend is continuing in spite of federal programs providing food and clothing for the cutters. Mechanization of harvesting in 1981 will require an outlay of $108.2 million, according to Union estimates, but, over the near middle-term, mechanization will enable Mexico to reach self-sufficiency in sugar, although other problems exist, including low cane yields and poor industrial efficiency, while rust disease is a real threat to the industry. Damage caused by rust in 1979/80 has been estimated at $8 million and damage could spread beyond the 4000 ha currently affected, despite federal control efforts.

Turkey sugar expansion loan[10]. — The World Bank has approved a $70 million loan to Turkey for projects designed to increase productivity of the three state enterprises concerned with sugar, iron and steel. The loan will permit Turkish Sugar Factories Ltd. to expand its Ankara and Susurluk plants and to complete a new factory at Ilkin.

Senegal sugar expansion[11]. — Production of sugar in Senegal in 1980/81 is estimated at 60,000 tonnes from 6000 hectares of irrigated cane. By 1983, however, production is planned to increase to 90-100,000 tonnes, making Senegal almost self-sufficient in sugar. This will be achieved by increasing the irrigated cane area by 2000 ha and raising the yield of sugar per hectare.

[1] C. Czarnikow Ltd., *Sugar Review*, 1981, (1539), 58-59.
[2] *Standard Chartered Review*, May 1981, 12.
[3] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 340.
[4] *Standard Chartered Review*, June 1981, 12.
[5] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 349-350.
[6] *I.S.O. Stat. Bull.*, 1981, **40**, (3), 39.
[7] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 366.
[8] *Westway Newsletter*, 1981, (91), 15-16.
[9] F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 384.
[10] *Westway Newsletter*, 1981, (91), 17.
[11] *World Sugar J.*, 1981, **3**, (12), 37.

Indonesia sugar imports, 1980[1]

	1980	1979	1978
		tonnes, tel quel	
Argentina	0	35,043	0
Brazil	0	23,300	120,000
China	50,004	16,550	0
Cuba	86,132	72,354	60,000
Czechoslovakia	0	0	23,098
EEC	11	23,000	25,500
Germany, East	0	0	26,650
India	8,050	246,053	136,361
Japan	12,600	0	0
Korea, South	94,545	41,250	23,700
Malaysia	150	0	2,772
Philippines	123,332	0	10,000
Poland	0	0	21,750
Taiwan	22,614	0	10,000
Thailand	0	0	4,750
Vietnam	0	0	5,701
Other countries	178	0	0
	397,616	457,550	470,282

Pakistan beet sugar crop, 1980/81. — The beet sugar campaign in Pakistan started in the first week of May and ended in the second week of July 1981. The four factories in the Peshawar Valley of the North West Frontier Province processed 448,199 tonnes of beet to yield 32,106 tonnes of white sugar. The area had been expanded by 29% from the previous year and reached 20,000 hectares. The yield of beet had declined, however, from 21.87 to 21.50 tonnes per hectare and the sugar % beet was also lower, from 8.73 to 7.03. Under Pakistan law the beet crop must be purchased by the factories at a uniform price of $26.79 per tonne, irrespective of the quality and quantity. Since June 1981 the selling price for sugar has been raised from $600 to $700 per tonne for domestic users and from $900 to $1000 per tonne for commercial users.

Cane alcohol research in Israel. — The feasibility of producing alcohol from sugar cane is under investigation in Israel, and preliminary data, including the results of field trials, indicate that up to about 80 tons of cane per acre could be grown and that certain areas of Israel are ideal for cane, better even than some of the tropical locations where it is now produced. During the summer, temperatures are favourable and insolation reaches high levels, with less humidity in the air than can often be found in the tropics. With an average sugar content of only 15%, an acre of cane could produce between 4800 and 6000 litres of alcohol to be used as such or in combination with petrol as a motor fuel. Alternatively, the cane juice could be subjected to other fermentation processes to yield butanol, glycerine or other materials. The bagasse remaining from juice extraction is, of course, an important factor in the energy balance for alcohol production. Under Israeli conditions, the most important constraint on a large-scale project is the relative lack of water. Large tracts of arable land in the northern Negev and elsewhere remain uncultivated because there is simply not enough fresh water to irrigate them. Planners do not think the problem insurmountable; the average annual water consumption for all irrigated crops in Israel is about 2320 m^3 per acre while sugar cane would require between 2400 and 3200 m^3, a large but not prohibitive quantity.

Guyana sugar production, 1980. — Official statistics issued by the Guyana Sugar Corporation Ltd. show that, in contrast to the earlier report[2], sugar production in 1980 was in fact lower than in 1979, at 269,634 long tons against 298,268 tons. By comparison production was 324,805 tons in 1978 and averaged 316,472 tons for the period 1969/78. The tonnage of cane crushed was lower than in 1979, at 3,600,898 tons *vs.* 3,891,049 tons and the TCTS figure continued its steady climb, reaching 13.18 against 12.88 in 1979 and 11.05 in 1969. The pol % cane figure was 9.50 against 9.59 in 1979 and 10.73 in 1969, while the fibre content was 17.87% against 17.48% in 1979 and 15.54% in 1969. In spite of this poorer quality raw material, reduced pol extraction reached 92.89% and actual extraction 89.19%, against 93.06% and 89.77% in 1979 and 94.04% and 92.32% in 1969, even though imbibition was reduced to 31.43% on cane against 31.7% in 1979 and 34.38% in 1969. Boiling house efficiency remained high at 98.62% against 98.83% in 1979 and 98.44% in 1969.

Argentina sugar exports, 1980[3]

	1980	1979	1978
		tonnes, tel quel	
Algeria	10,500	0	0
Chile	132,222	65,567	20,273
Egypt	0	23,499	39,889
Haiti	0	9,840	4,986
Indonesia	0	23,916	11,127
Iran	0	0	25,800
Jamaica	0	0	5,000
Morocco	0	13,971	0
Portugal	0	14,701	19,000
Senegal	0	0	6,000
Sudan	5,000	0	11,305
Sweden	0	9,602	0
Tunisia	10,000	0	0
Uruguay	6,358	20,447	0
USA	247,476	139,691	186,082
USSR	67,939	8,301	0
Venezuela	10,000	11,000	23,636
Zaire	0	0	499
	489,495	340,535	353,597

US beet sugar company challenge to EEC sugar export subsidies[4]. — The Great Western Sugar Company, a major US beet sugar producer and refiner, is reported to have lodged a complaint with the US trade representative alleging that EEC subsidies on sugar exports violate the General Agreement on Tariffs and Trade (GATT) and the US Trade Act of 1974. The company said that US sugar producers would lose $1733 million in 1981 through what it called the EEC's "unfair trade practices". EEC subsidies had drastically depressed the price of sugar on world and EEC markets and it will be cut by 12.43 cents/lb in the US this year, the company claimed. In filing its petition, Great Western requested the United States to join other countries — notably Australia and Brazil — who have already filed complaints challenging the subsidies' legitimacy under GATT regulations.

Chile sugar company bankruptcy[5]. — In June the Cía. de Refinería de Azúcar de Viña del Mar (CRAV) was declared bankrupt. Its sugar refinery had been closed[6] but it had been intended that the beet sugar plants would continue in operation. With liquidation of CRAV, it has been announced in a government statement that the state-owned Industria Azucarera Nacional S.A. (IANSA) will take over the contracts signed by CRAV with farmers for 780,000 tonnes of beet for the new campaign[7]. Industry sources said this implies that IANSA will operate the two CRAV plants as well as its own beet sugar factories.

PERSONAL NOTES

We regret to report the death on May 26 of **Norman J. King**, former Director of the Bureau of Sugar Experiment Stations in Queensland, and a member of our Panel of Referees from 1965 until 1972. After receiving his early education in Toowoomba, he qualified in industrial chemistry and joined the staff of the Bureau of Central Sugar Mills. Later, he was seconded from the Department of Agriculture and Stock to undertake a soil survey on behalf of the B.S.E.S. In 1937 he was appointed officer-in-charge of the Bundaberg Experiment Station and ten years later Assistant Director of the Bureau. In 1948 he became Director, following the resignation of Mr. E. R. Behne, and occupied that position for a record 24 years until his retirement in 1972. Mr. King had a long and active association with the Queensland and International Societies of Sugar Cane Technologists and both he and his work were well known all over the world. He was made an Honorary Life Member of the ISSCT in 1972 and was appointed O.B.E. in 1968 "for his contribution to the scientific advancement of the Australian sugar industry".

---

1 *I.S.O. Stat. Bull.*, 1981, **40**, (5), 51.
2 *I.S.J.*, 1981, **83**, 127.
3 C. Czarnikow Ltd., *Sugar Review*, 1981, (1541), 67.
4 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 538.
5 *Bank of London & S. America Rev.*, 1981, **15**, 146.
6 *I.S.J.*, 1981, **83**, 255.
7 *Reuter Sugar Newsletter*, July 27, 1981.

Index to Advertisers

page

Agrotechnip xiii

Balco Filtertechnik GmbH xx
Brasil Açucareiro xxiv
Braunschweigische Maschinenbauanstalt AG .. Outside Back Cover
Bünger Engineering Ltd. xviii

DIA-Prosim iv
Bryan Donkin Ltd. vii
Dorr-Oliver Inc. ii

Maschinenfabrik H. Eberhardt xxiii
Ewart Chainbelt Co. Ltd. xxiii

Ferguson Perforating & Wire Co. xviii
Fletcher and Stewart Ltd. ..... x, xi

GV-Separation A/S viii

Hein Lehmann AG v

Jeffress Bros. Ltd. xvii

Dr. W. Kernchen Optik-Elektronik-Automation ix

L. S. Miedema B.V. xxii

N. V. Norit xii

H. Putsch GmbH & Co. ..... Inside Front Cover

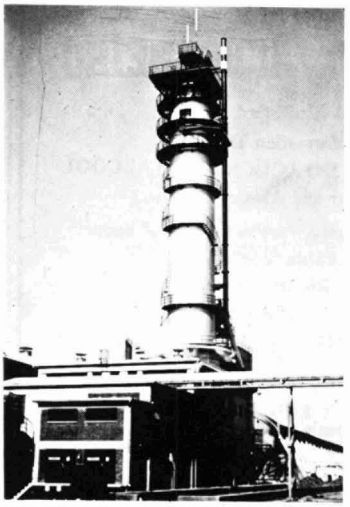
Sedis xix
Alex Stewart (Assayers) Ltd. xxi
Sugar Manufacturers' Supply Co. Ltd. vi
Sugar News xxiv

Taiwan Sugar xxiv
Tate & Lyle Agribusiness Ltd. i

Nils Weibull AB xvi
Western States Machine Co. ..... xiv, xv

Zuckerindustrie xxiv

WANTED – Assistant Field Superintendent for large domestic sugar cane farm in Louisiana. Apply with résumé to Box 509, *International Sugar Journal.*



Lime kiln in the beet sugar factory at Zupanja, Yugoslavia

The burning system of these new kilns, for outputs up to 350 tonnes CaO per 24 hr, includes coke mixture firing and forced air draught operation.

Construction features include:

Vertical skip hoist with maximum operating safety.

Rotating hopper for the limestone-coke mixture above the kiln top with special discharge conveyor trough for even distribution of material over large shaft sections without deviation (West German Patent DBP 1,758,155).

Platform installed in the upper part of the kiln with easy access as inspection and working platform for refractory liming. An officially approved winch can also by supplied for personal transport.

High working shaft corresponding to the requirements of the sugar and chemical industries.

Lime discharge through a double gate system, with 4-6 vibrating conveyors according to kiln size.

Level measurement by means of a gamma-ray device.

Fully automatic operation.

Heat consumption: <3750 kJ/kg burnt lime (<900 kcal/kg burnt lime).

The kiln produces lime with high reactivity, with less than 2% residual CO_2 in burnt lime and more than 40% by volume CO_2-content in waste gas.

GEGR. 1860

For further information write to:

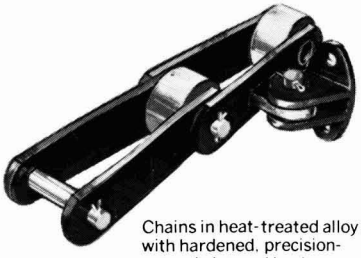
MASCHINENFABRIK H. EBERHARDT

P.O. Box 266, D-3340 Wolfenbuttel, Germany

Tel.: (05331) 4926 Telex: 95620 ebhdt d

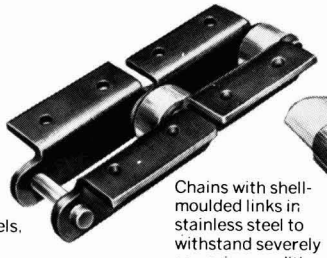
'Ewart-style' chains carry the world's sugar crop. The difference is that...

Ewart chains work harder—longer

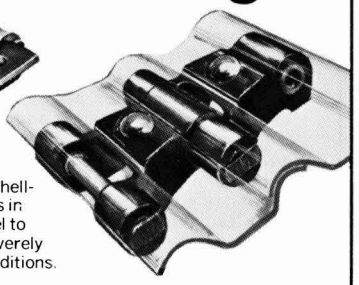


Chains in heat-treated alloy steels, with hardened, precision-ground pins and bushes.

Chains combining the advantages of malleable iron with steel.

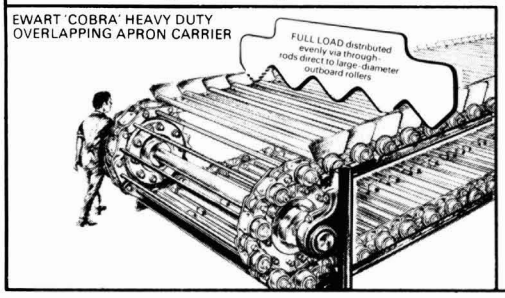


Chains with shell-moulded links in stainless steel to withstand severely corrosive conditions.



Chains of heat-treated pearlitic malleable iron.

EWART 'COBRA' HEAVY DUTY OVERLAPPING APRON CARRIER



ALL AVAILABLE WITH HARDENED STAINLESS STEEL PINS & BUSHES

For detailed literature, write to:—

EWART CHAINBELT CO. LTD
A Member of THE LEY Group
DERBY DE3 8LX ENGLAND
Tel: Derby (0332) 45451
Telex: 37575 Leyewt—G

EWART

DISTRIBUTORS IN MORE THAN 60 COUNTRIES

SUGAR BOOKS

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

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

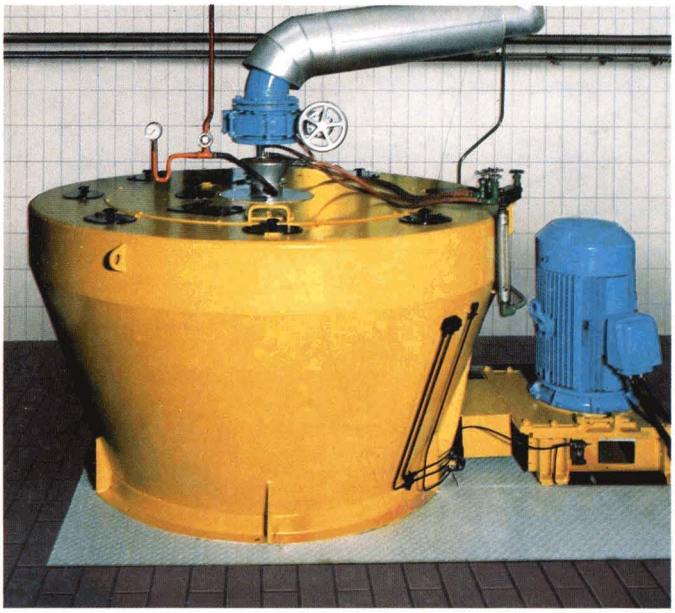
STANDARD FABRICATION PRACTICES FOR CANE SUGAR MILLS: *Delden*	(1981)	£26.65
THE EFFICIENT USE OF STEAM: *Ed. Goodall*	(1980)	£26.65
PROCEEDINGS, FUTURE OF SUGAR CONFERENCE.	(1980)	£45.00
AUSTRALIAN SUGAR YEARBOOK 1981	(1981)	£12.75
SUGAR ANALYSIS: ICUMSA METHODS: *Schneider*	(1979)	£13.50
CANE SUGAR HANDBOOK (10th ed.): *Meade-Chen*	(1977)	£46.55
PHYSICS AND CHEMISTRY OF SUGAR BEET IN SUGAR MANUFACTURE: *Vukov*	(1977)	£39.30
SUGAR CANE PHYSIOLOGY: *Alexander*	(1973)	£55.40
SUGAR BEET NUTRITION: *Draycott*	(1972)	£16.10
HANDBOOK OF CANE SUGAR ENGINEERING: *Hugot,* transl. *Jenkins*	(1972)	£98.30
BEET SUGAR TECHNOLOGY (2nd ed.): *McGinnis*	(1971)	£16.70
SYSTEM OF CANE SUGAR FACTORY CONTROL (3rd ed.): *International Society of Sugar Cane Technologists*	(1971)	£2.30
PROCEEDINGS 15th SESSION ICUMSA	(1970)	£5.50
" 16th " "	(1974)	£7.50
" 17th " "	(1979)	£22.00
ANALYTICAL METHODS USED IN SUGAR REFINING: *Plews*	(1970)	£18.00
SUCROSE CHEMICALS: *Kollonitsch*	(1970)	£6.00
LABORATORY MANUAL FOR QUEENSLAND SUGAR MILLS (5th ed.): *Bureau of Sugar Experiment Stations*	(1970)	£7.00
INTRODUCTION TO CANE SUGAR TECHNOLOGY: *Jenkins*	(1966)	£39.30
TECHNOLOGY FOR SUGAR REFINERY WORKERS (3rd ed.): *Lyle*	(1957)	£17.90

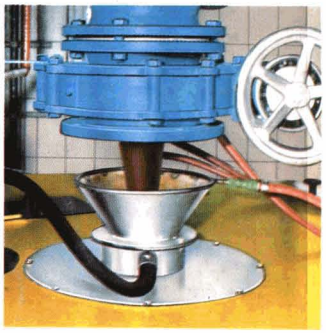
SUGAR BOOK DEPARTMENT

International Sugar Journal Ltd.

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

Our new continuous centrifugal K1500 will give you higher throughputs along with excellent technological results.





The K 1500 is the consistently developed version of our K 850 S and K 1100 machines, large numbers of which have been proving very successful in the beet and cane sugar industry of almost every sugar-producing country in the world.

This centrifugal, the basket of which has a diameter of 1,500 mm, is capable of handling raw-sugar affination massecuites, middle-product and after-product massecuites, and it is available as a mixing or melting machine, as well. It can be provided with an automatic feed control system for massecuite, mixing liquid or melting liquid as well as with a syrup separating device.

Special features

* A central massecuite feeding device ensuring gentle handling of the product
* The well-approved massecuite preparing device allowing the massecuite and the preparing media to be mixed in an ideal manner
* The solid-bowl basket with large screening surface and screened clamping ring for a high throughput at moderate use of wash water, giving excellent technological results
* Corrosion-resisting quality of all those parts coming into contact with massecuite precludes corrosion and material abrasion
* A specially carried V-belt transmission and a specifically developed rubber buffer suspension permit high drive powers along with particularly smooth operation
* Easy adaptation of the basket speed to the product to be handled by exchanging the V-belt pulleys

The K 1500 centrifugal is distinguished by its exceptionally good price to performance proportion.

For further details, please contact us.

BMA
Braunschweigische Maschinenbauanstalt AG
P.O. Box 3225 D-3300 Braunschweig
Federal Republic of Germany
Phone (0531) 804-1
Telex 952456 abemad

BMA world-wide at home