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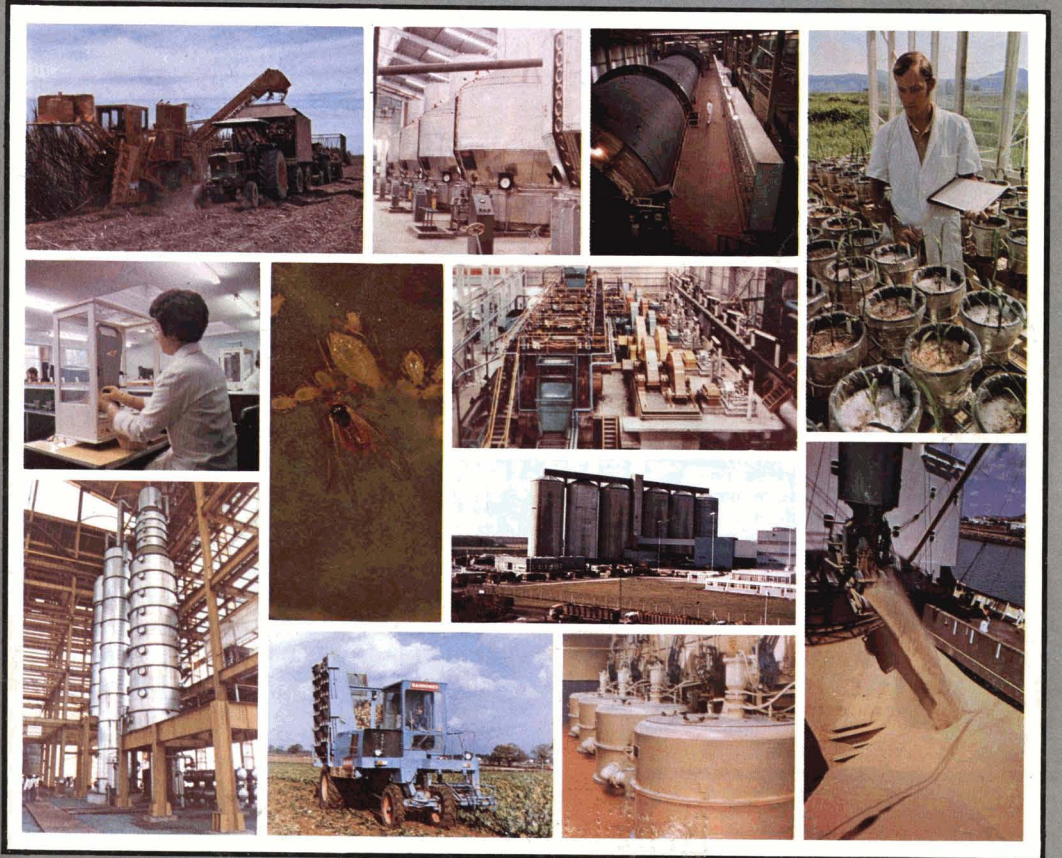

AUGUST 1979

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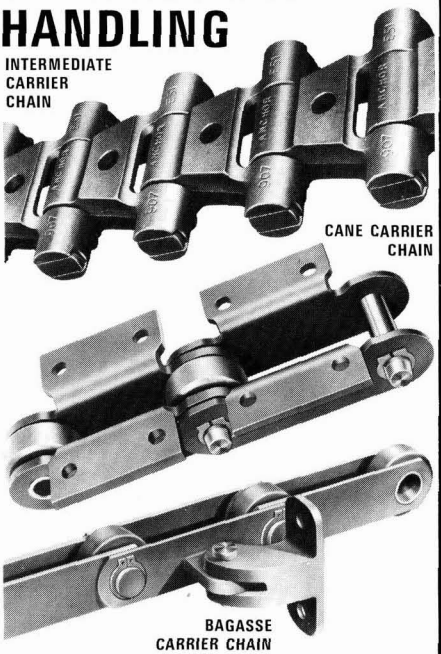

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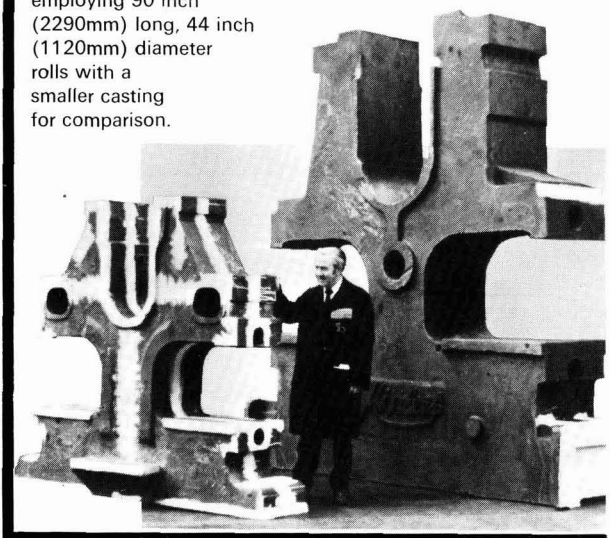

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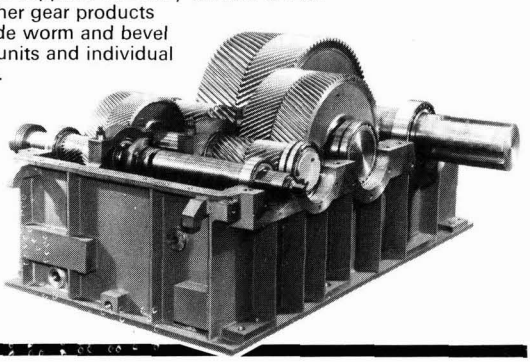
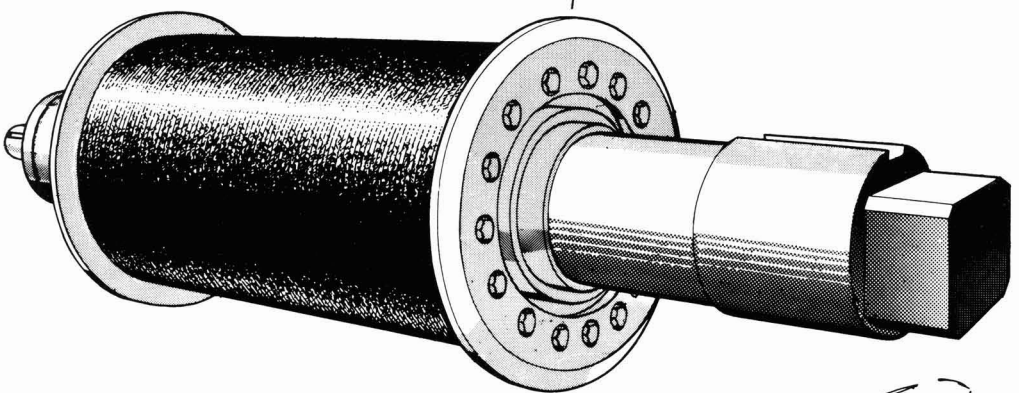


What is 'GRANO'?

Enlarged view of the surface of a 'GRANO' casting



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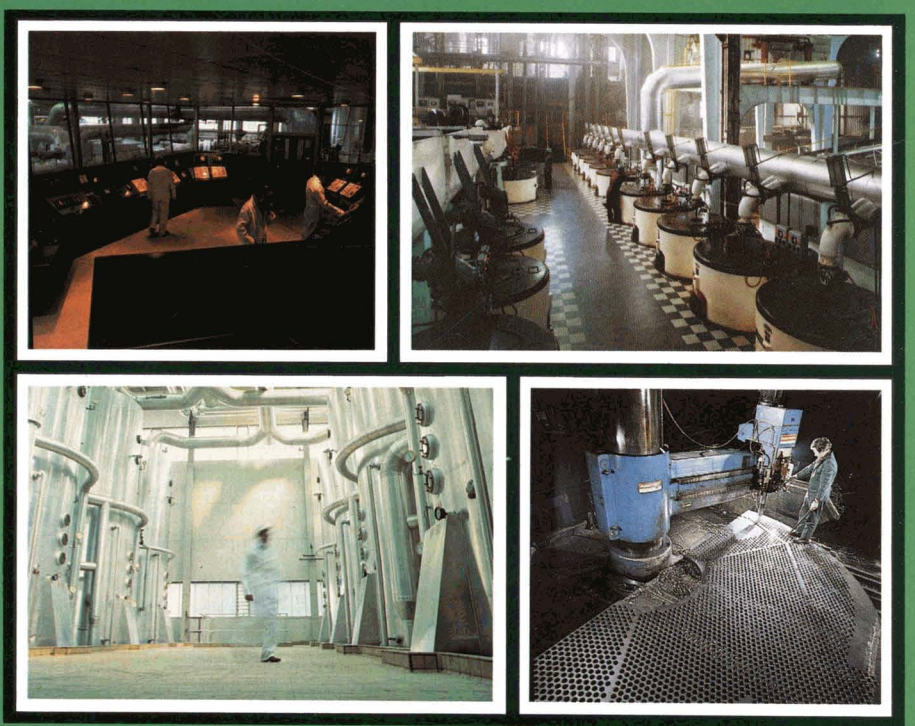

from other designers of several items, notable examples being the SRI Clarifier for which FS holds the worldwide manufacturing licence, the BMA continuous centrifugals and the Jord rotary vacuum filters, each of which enjoys a reputation for its excellence of design and for its particular suitability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

The ability of FS to maintain and develop its lead in processing machinery undoubtedly stems from its design and manufacturing facilities which have recently undergone a total transformation. Modern and extensive offices provide efficient working conditions for over 300 engineers, technologists, draughtsmen and other specialist personnel. The new works facilities are now contained in modern buildings with the layout designed to provide a streamlined production flow whilst incorporating the very latest methods of production and mechanical handling. A completely new foundry with a capacity in excess of 3,000 tons per annum provides FS with the capability of producing a complete range of ferrous and non-ferrous castings.

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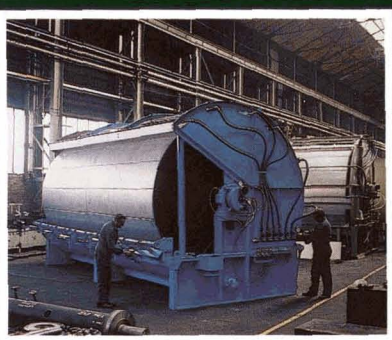

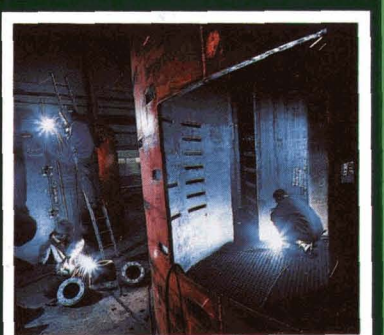

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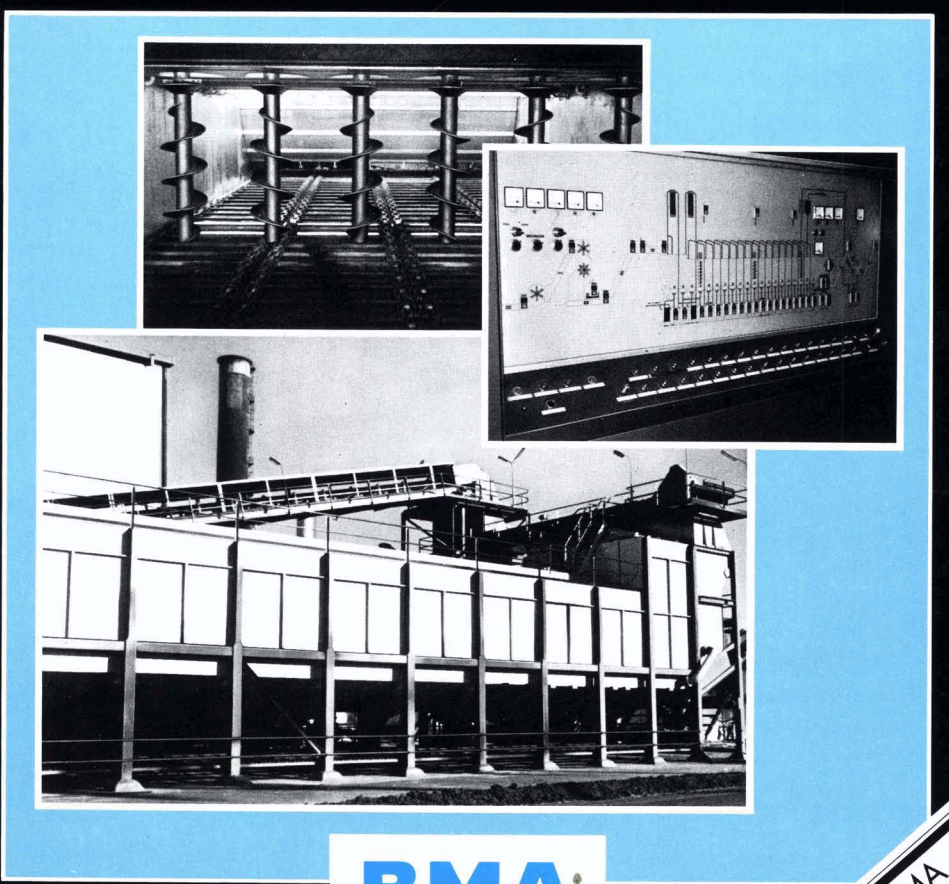

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JOHN DANCE has now joined the International Sugar Journal as Advertising Sales Manager.

He previously worked with a British engineering company as their Advertising and Sales Manager for the U.K. & Scandinavia. However, he has worked in the Advertising and Marketing divisions of a number of large multinational companies; including Bell & Howell, Wiggins Teape Paper Ltd., British American Tobacco Ltd., and British Petroleum. He has also worked in a number of top London Advertising agencies.

John is married to a Finnish girl and lives near Tunbridge Wells, Kent; and his hobbies include gardening and household D.I.Y.

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NOTES AND COMMENTS

International Sugar Organization

Meetings of the ISO Council committees began on June 7 and continued through the following week, with a full meeting of the Council on June 14 and 15. Among other decisions it was agreed that the quota of the Dominican Republic should be increased by 45,000 tonnes to 1,035,000 tonnes.

The Council again deferred the commencement of the Stock Financing Fee to October 1, with provision for a further deferment to December 1. The deadline for ratification of the Agreement was extended further, to December 31, 1979.

EEC common agricultural prices

New common prices were agreed by the Agriculture Ministers of the European Economic Community on June 22. Prices for milk were unchanged but all others were increased by 1.5%. Thus, for beet and sugar, the common prices which have applied since July 1 are:

Sugar beet (A-quota)	31.83 e.c.u. per tonne
White sugar target price	432.6 " " "
White sugar intervention price	410.9 " " "

At the UK's "green" rate of exchange, which had been devalued by 5% by agreement among the Ministers, these prices are equivalent to £18.50, £251.50 and £238.80 per tonne, respectively (£1 = l.72039 e.c.u.).

The storage levy, which for 1978/79 had been set at 19.8 units of account per tonne, which was equivalent to 23.94 e.c.u. per tonne, was reduced to 21.76 e.c.u. per tonne, to accord with actual costs.

The Ministers left the B-quota for sugar at 27.5% of the A-quota as they felt it was already too late in the year for any decision they might make to have an effect on 1979/80 production.[1] It was suggested, however, that the whole question of production quotas will be looked into before the 1980/81 campaign commences, as that will be the year in which sugar legislation is to be reviewed.

Following a subsequent meeting between representatives of the EEC Commission and ACP countires it was announced that the latter will also receive an increase of 1.5% for their sugar delivered under the Lomé Convention, bringing the guaranteed price to 341.3 e.c.u. per tonne c.i.f. European Community port. The basic quantity of sugar involved is equivalent in total to 1,304,000 tonnes, white value, but the Commission has recommended a few small downward adjustments in some cases following earlier non-fulfilment of quotas.

The EEC Farm Commissioner has also announced that manufacturers of high fructose corn syrup will receive production quotas in 1979/80. As with sugar there will be A and B-quotas, with the B-quota set at 27.5% of A-quota. Respective quantities covered for 1979/80 are 139,000 tonns of A-quota and 38,000 tons of B-quota.

World sugar balance, 1978/79

F. O. Licht recently published their third estimate[2] for the world sugar balance in the year ending August 31, 1979. The previous estimate was made some months ago and while adjustments to the figures for 1977/78 mean that initial stocks are set 160,000 tonnes higher, production is expected to be 680,000 tonnes lower than thought earlier, while consumption is set no less than a million tonnes higher, with a consequent reduction in the anticipated final stock figure of 1,260,000 tonnes. The figures appear below:

	1978/79	1977/78	1976/77
	tonnes, raw value		
Initial stocks	29,928,000	24,803,000	20,515,000
Production	92,562,000	92,482,000	88,426,000
Imports	25,855,000	28,046,000	27,490,000
	148,345,000	145,331,000	136,431,000
Exports	26,121,000	28,291,000	28,335,000
Consumption	91,195,000	87,112,000	83,293,000
Final stocks	31,029,000	29,928,000	24,803,000
" " % consumption	34.02	34.36	29.78

The highly significant increase in consumption expected is a consequence of an enormous increase in Indian offtake, from 4.7 to 6.6 million tonnes, or nearly 40%. Consumption in other parts of the world is expected to rise by only 2-3%.

The EEC and the ISA.

In May, at the 5th UN Conference on Trade and Development, the EEC Commissioner for Development, Mr. Chevsson, said that the Community would be prepared to join the International Sugar Agreement if it was offered "decent" export quotas; the quota allotment would need to be sufficient to support the guarantees it has given to African, Caribbean and Pacific countries[3]. The EEC had a duty to cane producers to cut its own production of beet sugar and is introducing inducements to bring this about, he said.

In June, however, when representatives of the ISO and EEC met, the latter could not accept the concept of fixed quotas[4]. A delegate said he had come to London to hold positive talks about the EEC adopting equivalent obligations to export quotas. The EEC had apparently indicated it would apply a percentage reduction to its exports of surplus production. The link between this percentage and cuts in other countries' export quotas and the size of reserve stocks the EEC should hold have not yet been discussed in detail.

World sugar prices

June - July is usually a dull time in sugar markets, with most cane crops ended but insufficient information available to make a reasonable guess as to the size of the beet crops to be expected from the campaign to start in September. It is not surprising, therefore, that in June, after an initial rise from £97 to £101 per tonne on optimistic reports of progress toward acceptable sugar legislation in the US, the London Daily Price for raw sugar should have been very steady, between limits of

[1] C.Czarnikow Ltd., *Sugar Review*, 1979, (1446), 125.

[2] *International Sugar Rpt.*, 1979, **111**, 283

[3] *Public Ledger*, May 12, 1979.

[4] *ibid.*, June 16, 1979.

£99 and £103 and ending the month at £102 per tonne.

White sugar prices were even more stable, varying between £103.50 per tonne, at which the month started, and a peak of £108.50 but closing at £105 per tonne which represents a premium of only £3 per tonne over raw sugar.

Concering the future, E.D. & F. Man, writing on June 30, consider:

"There is little doubt that the new campaign will see a better supply/demand balance both in the broad world market definition and in the narrower ISA context. Production declines will be seen in the USA, Brazil, India, the USSR, Thailand and possibly the EEC, whilst increases are expected only in Cuba and China. The market has already anticipated these changes, and the forward quotations for 1980 shipments already envisage an average spot price for the year of 10.50 cents per lb, which, in a non-ISA context, already discounts these developments.

"It is unfortunate that the area of most uncertainity on production is the area upon which the ISA most depends for the success or failure of its price control mechanism, for it is the non-member EEC, whose crop appears to be in good condition but with four months still to harvest, who will finally determine the balance within the ISA price mechanism. A good crop there will keep the ISA framework over-supplied and thus not in need of further supplies. A poor crop will leave the ISA framework in short supply, and the spot price will need to rise to the 11 to 13 cent trigger points to seek more sugar.

"It is for this reason that the EEC first sugar beet tests, to be drawn at the end of July, will be of the greatest importance to the market. It will be these which enable the trade to estimate the EEC prospects with some objectivity, and thence the likely trend for prices."

US sugar import fee[1]

In June US Dept. of Agriculture announced it would raise the sugar import fee by 0.60 cents per lb, to 3.36 cents for raws and 3.88 cents for white sugar. The fee is set quarterly on a basis of average world prices during a 20-day base period during the previous quarter, plus Customs duties, freight and insurance charges, etc., and is intended to bring this average up to the domestic price objective of 15 cents per lb.

US sugar loan programme for 1979

A loan support programme for 1979 had not been launched up to May because of hopes that new legislation could be enacted in time to act as a framework for such measures. In the absence of legislation, however, the US Department of Agriculture proposed a loan programme under existing law with a support level for 1979 crop raw sugar at a minimum of 13.00 cents per lb[2]. This compares with the 1978 programme support level of 15.00 cents and the level proposed for 1979 under the Sugar Bill passed by the House Agriculture Committee of 15.80 cents. The obvious difference between this and the proposed support price should provide an added incentive to producers to work towards a swift conclusion to a new Sugar Bill.

The new programme was still under study at the end of June but in the meantime the Department announced that it was to develop a programme to sell sugar forfeited to the Commodity Credit Corporation under previous loan programmes[3]. At present this amounts to only 200,000 short tons of 1977 crop raw sugar but it is believed that a substantial quantity of 1978 crop raws will also be forfeited. Should this sugar be marketed at the 13.00 cent price level, even with a further 1.00 cent to cover carrying charges, etc., the availability of such sugar would reduce the demand by US buyers for world market sugar.

US sugar legislation

Continuing efforts have been made to find a break-through in the impasse facing the Administration in regard to sugar legislation. A domestic sugar bill was passed by the House Agriculture Committee and Rep. Vanik, Chairman of the Trade Sub-Committee of the House Ways and Means Committee, announced that he intended to introduce a bill authorizing the ratification of the International Sugar Agreement as a separate measure from domestic legislation.

However, full ratification depends on the Senate Foreign Relations Committee whose Chairman, Senator Church of Idaho, a beet-growing state, had avowed that he would keep the ISA ratification in Committee until satisfactory domestic legislation had been concluded. The Foreign Relations Committee began hearing testimony on the question of US ratification in the second half of June. Several witnesses hoped that progress would be made and Senator Church was quoted as giving his opinion that it was possible that ratification might be achieved within July. He has proposed that the limit on the US sugar import fee, now set at 50% of the Caribbean f.o.b. price, be removed in an attempt to protect the domestic sugar industry if current legislation facing Congress encounters insurmountable trouble. He said that he would drop his opposition to ISA ratification if the new approach succeeds but again claimed that the ISA could not work in the absence of a successful US domestic programme[4].

The Trade Sub-Committee under Rep. Vanik passed a bill incorporating this removal of the 50% limit on import duty, and the full House Committee was to consider the bill after the July recess.

South African sugar crop, 1978/79[5]

In 1978/79 in South Africa a total of 18,926,099 tonnes of cane was crushed, against 19,009,030 tonnes in the previous season. The sugar output was 2,081,940 tonnes, a slight reduction on the 2,083,867 tonnes produced in 1977/78. Average crushing rate was about 5% higher at 233.6 tch against 221.4 tch, closing of the small mill at Melville Sugar Estates contributing to this rise.

Cane quality was slightly poorer than for the previous season as shown by the recovery figure of 10.84% on cane against 10.89% in 1977/78. A lower pol content (12.64 *vs.* 12.83 % cane) was mainly responsible for the difference, since fibre % cane was lower (15.13 *vs.* 15.79% cane) and mixed juice purity higher (85.36 *vs.* 84.39) than in the previous season.

Factory performance was good with an average extraction of 96.63% against 95.87% and a boiling house recovery of 89.58% against 88.62%. Molasses purity (37.99) and weight % cane (3.53) were better than in 1977/78 (38.31 and 3.83, respectively), and resulted in pol losses of 8.16% on pol in cane as compared with 8.77% in the previous season. Undetermined losses were 1.44% on pol in cane against 1.68% in 1977/78.

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[1] *Public Ledger*, June 23, 1979.

[2] C.Czarnikow Ltd., *Sugar Review*, 1979, (1439), 92.

[3] *ibid.*, (1445), 122.

[4] *Public Ledger*, June 23, 1979.

[5] *S. African Sugar J.*, 1979, **63**, 138.

Central Jiboa sugar factory

El Salvador's newest cane sugar factory, Central Jiboa, is located on the lower slopes of an extinct volcano known locally as Chinchontepeque, a few kilometres south of the small town of San Vicente in the Jiboa valley and roughly in the centre of the country.

The contract to build the sugar factory, the first under public ownership and the largest and most up-to-date in El Salvador, was awarded to Fletcher and Stewart Ltd., in October 1974. The contract, worth about $25 million, constituted the largest single order ever received by a British company for El Salvador and covered the design, manufacture and supply of all process equipment and turnkey erection of the factory/refinery complex including ancillaries The initial design capacity of the factory was 3,500 short tons of cane per day, to produce in the region of 350 short tons of high quality raw sugar, of which about 125 short tons would be refined *in situ.* Provision was also made for the easy extension of capacity to 6,400 short tons cane per day with proportionate increases in the production of raw and refined sugars. The customer was Instituto Salvadoreño de Fomento Industrial (INSAFI), the Government corporation responsible for the development of selected industries. Consultants for INSAFI were HVA International of Holland.

Prior to this project being instigated, the sugar industry in El Salvador consisted of 13 privately owned factory units with a total combined production of about 240,000 tonnes of raw sugar per annum. Thus the planned output of raw sugar from the new factory represented an increased national capacity of approximately 25%. When extended to its full capacity the output will be equivalent to half the country's combined pre-Jiboa production.

Sugar cane has been grown for many years in the Jiboa valley but this was either transported long distances by road to other existing sugar factories or else it was used by smallholders in the area to produce "panela", a crude form of sugar.

The decision to build a sugar factory in the Jiboa valley has provided a direct source of employment for local people and has encouraged further settlement in the area. As a direct consequence of the factory project, new roads have been built and more modern transport methods introduced for the benefit of other produce.

As in other parts of the world, the establishment of the factory will act as the focus for the further development of the area through the introduction of industries to service the needs of the sugar factory and the increased populace.

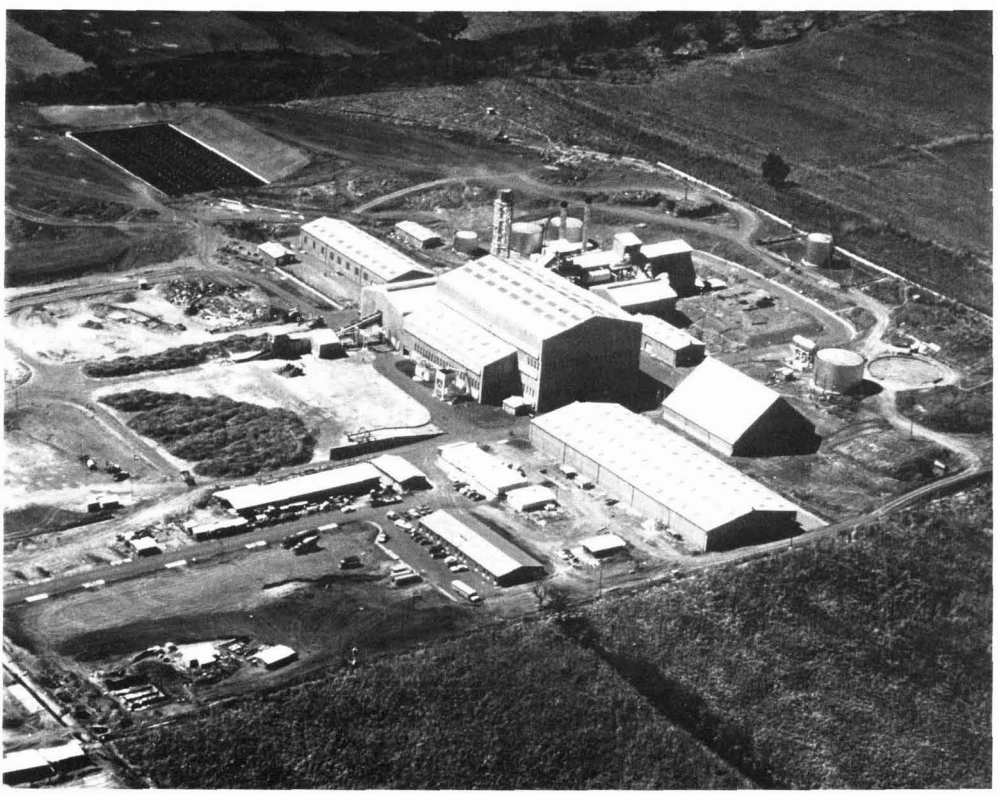

Fig. 1. Central Jiboa

Central Jiboa sugar factory

Fig. 2. Loading cane for the factory

The cane season at Jiboa is approximately from November to May.

Following reaping and loading by hand the cane is brought into the factory by trucks and is then weighed by one of two 50-tonne road vehicle platform scales with ticket printing facilities. Cane to be crushed immediately is either tipped directly on to the inclined feeder carrier or stored on one area of the yard for later recovery.

The cane feeder carrier is 2.4m wide and driven by a 50hp hydraulic variable speed motor, and has a kicker cane leveller mounted over the head shaft. Cane is transferred to a 2.13m wide cane carrier which is driven through a variable speed hydraulic unit above which are leveller and heavy duty cane knife sets each running at 600rpm and driven by a 1200hp single-stage steam turbine.

Extraction is by four 996mm x 213mm 3-roller mills with underfeed force feed rollers and capable of running up to 5.73rpm. At the initial capacity the mills will run at 3.1rpm. Each unit is driven by an 800hp single stage geared turbine via a triple reduction gearbox and a set of single reduction machine cut spur gearing. Hydraulic accumulator assemblies are gas/oil pattern and there is a central lubrication system. Intermediate carriers are of the apron type. A drag-type mechanical strainer/bagacillo elevator is installed to handle 1st and 2nd mill juices, with the subsequent juices being transferred by chokeless pumps.

Raw juice is weighed on an automatic liquid scale with a capacity of 3.5 tonnes per tip. There is provision for cold and hot liming, but the latter is preferred, with the cold unlimed juice being heated, flashed and transferred to the liming tank before flow to the clarifier. Two rotary vacuum filters, 2.44m dia. x 4.88m long, handle the muds.

The quadruple-effect evaporator has a total heating surface of 3,470m^2, the tubes being of 70/30 brass, 44.4mm in diameter.

The raw house vacuum pans are each 4.67m diameter parallel-side calandria pattern with a heating surface per pan of 264m^2 and stainless steel tubes 102mm o.d. x 16BSW wall thickness. Tube length is 0.914m over the tubeplates and strike volume is 45.4 cubic meters.

There are two air-cooled receivers for *A* and *B* strikes and five water-cooled/reheated crystallizers for *C*-massecuites.

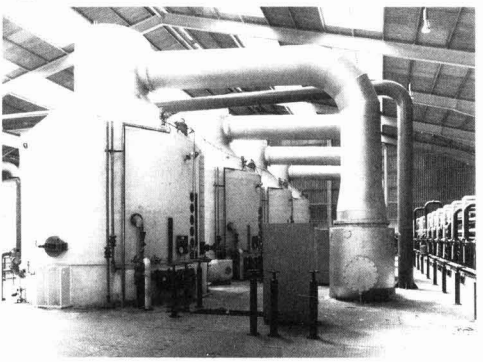

Fig. 4. Vacuum pans at Central Jiboa

All massecuites are single-cured, the *A* and *B*-massecuites using five 1220mm x 762mm batch centrifugals spinning at up to 1200rpm. *C*-massecuites are purged with 1000mm continuous machines, two for normal use with one as standby. The mingled *C*-sugar is pumped to a magma receiver on the pan floor for use as *A* and *B*-massecuite footings. The raw product sugar is stored in bulk, part being transferred en route to the built-in refinery.

Steam generation is by two water-tube boilers each with MCR of 52 tonnes/hour and designed for firing bagasse on a dump grate spreader stoker. 100% oil firing facilities are also incorporated. Steam leaves the boiler superheater at 24kg.cm^{-2} and 350°C, and all prime movers exhaust at 1.4kg.cm^{-2}. There is a comprehensive water treatment plant to supply both boiler quality and potable water at a total capacity of 79.4m^3.hr^{-1}.

Electricity is supplied by two 1750kW 2400V 60Hz alternators driven by multi-stage back pressure geared steam turbines.

Owing to its high quality, the raw sugar destined to be refined does not need the affination which is a pre-requisite to normal refinery processing. The sugar is

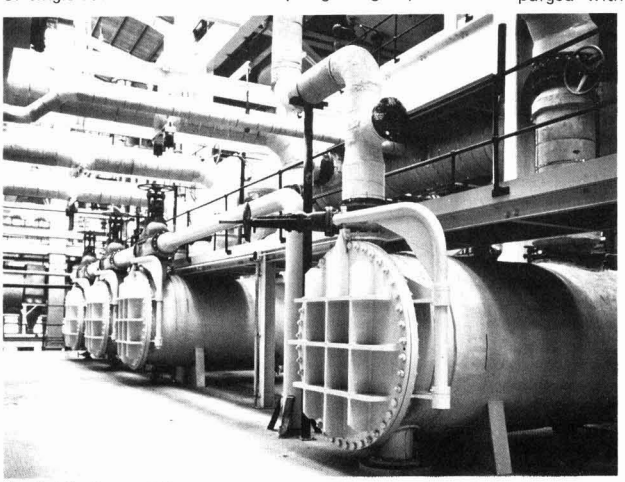

Fig. 3. Juice heater station

Broadbent get around with their Centrifugals...

...around the World

It is a well known fact that Broadbent Centrifugals are in continuous operation in over 55 countries. This widespread use must mean that they have some very special features:

* Motor specially designed to meet end-user's power requirements.
* Special suspension assists in dampening effects of out-of-balance loads.
* Plough operation ensures free discharge and completely cleared basket: reduces factory sugar recirculation: cycle time kept to a minimum since sugar discharge is in same direction of rotation.
* Automatic Feed Valve and Limiting Sensor arrangement ensures consistent feeding independently of variations in massecuite.
* High unimpeded output special Discharge Valve.
* Automatic sequence controls programmed for step by step operation throughout the cycle.

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LTS9

DDS Crystallizer Pat pending

Type A and B

Advantages:

- Continous operation
- Compact space saving system
- Easy to install
- Minimum retention time required to obtain a certain exhaustion
- Due to the hydraulic drive, the motor cannot be overloaded
- No need for water dilution
- Effective agitation
- High cooling surface/volume ratio
- Rapid cooling without risk of fine grain formation
- The system is easy to extend
- Can be placed outdoors
- Simple and reliable automation

Standard Design

The equipment consists of

- DDS crystallizer type A and B
- Cooling water pump
- Hydraulically operated reciprocating agitator

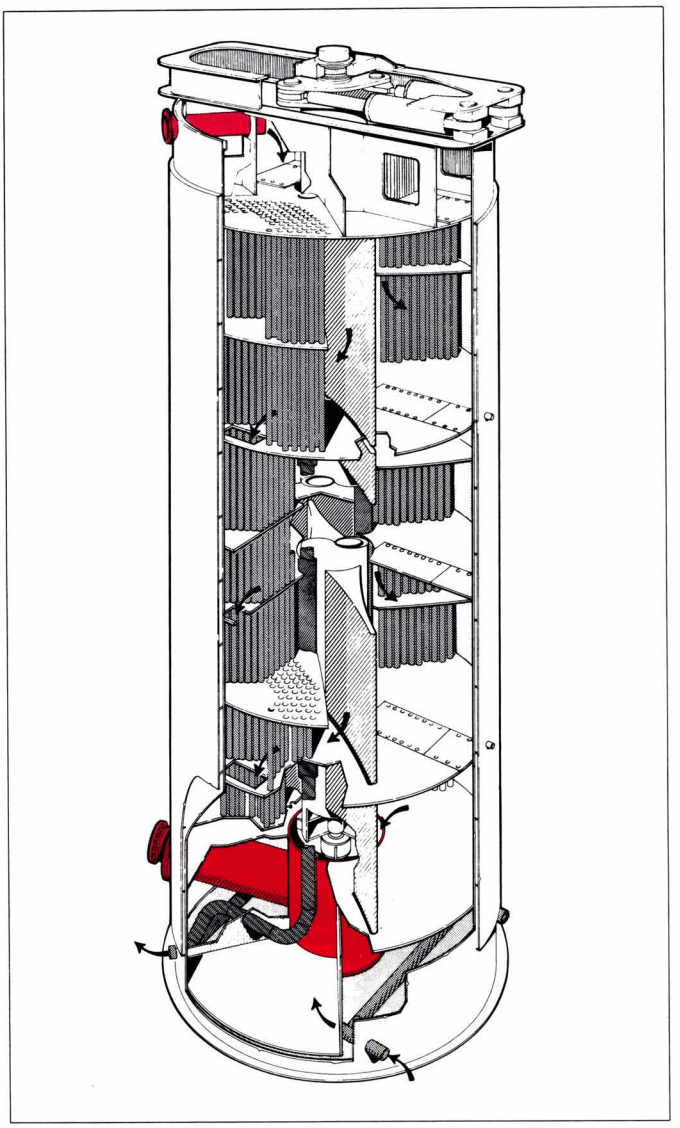
Specifications

	Type A	Type B
Diameter – m	4.0	4.0
Height – m	12.9	13.4
Weight – tons	60	55
Massecuite vol. m^3	100	100
Cooling surface m^2	480	250

Installation Examples

Afterproduct Massecuite (tons/24 hours)	**400**	**600**
Inlet temperature (°C)	80	80
Outlet temperature (°C)	35	35
Total number of crystallizers	**2**	**3**
Corresponding retention time (hours)*	18	18
Total number of crystallizers	**3**	**4**
Corresponding retention time (hours)**	27	24

*) For usual exhaustion requirements, corresponding to raffinose corrected molasses purity of 59–60 in Danish factories.
**) For obtaining molasses purities 0,5–1,5 below usual exhaustion requirements as mentioned above.



DDS

Aktieselskabet De Danske Sukkerfabrikker
Engineering Division, 5 Langebrogade, DK-1001 Copenhagen K, Denmark
Phone: 1 54 61 30, Telegrams: ddsengineering, Telex: 31 436 DDSENG DK

with powdered activated vegetable carbon and filtered through two precoat filters, each 74.3m² in size. The filter cake is slurried and sweetened off, while the clear filtrate from the carbon treated precoat filter is finally polished and pumped to a refinery fine liquor tank.

Fletcher & Stewart worked closely with INSAFI's appointed commissioning consultants, International Planning Services of Louisiana.

Within the first month of the operation the factory achieved its design capacity and has since consistently exceeded throughput and the efficiency targets envisaged in the original design parameter.

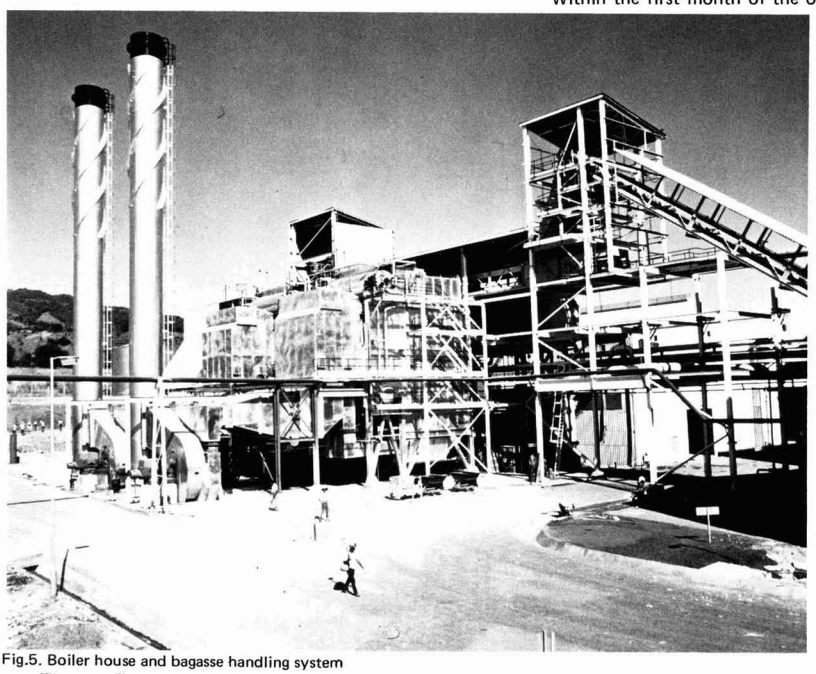


Fig.5. Boiler house and bagasse handling system

Summary

An illustrated description is given of Central Jiboa, the latest cane sugar factory to be built in El Salvador. The factory, constructed by Fletcher and Stewart Ltd., has an initial design capacity of 3500 short tons of cane per day, with possibility of expansion to 6400 tcd.

La sucrerie central Jiboa

On donne une description illustrée de la sucrerie central Jiboa, la dernière sucrerie de canne qui a été construite au

The refinery has a single 3.66m diameter vacuum pan with a capacity of 25m³ and heating surface of 149m², the masse-cuites being cured immediately using two automatic batch centrifugals. The refined white sugar is dried, blended and bagged-off for storage in 100lb bags. Run-offs are reboiled to yield 3 or 4 crops of recovery sugar, the final run-off going back to the raw house.

The entire programme of work incorporating stringent provisions against earthquake damage was completed in two years, and the production of commercial sugar began on schedule in January 1977. During the commissioning period of the factory,

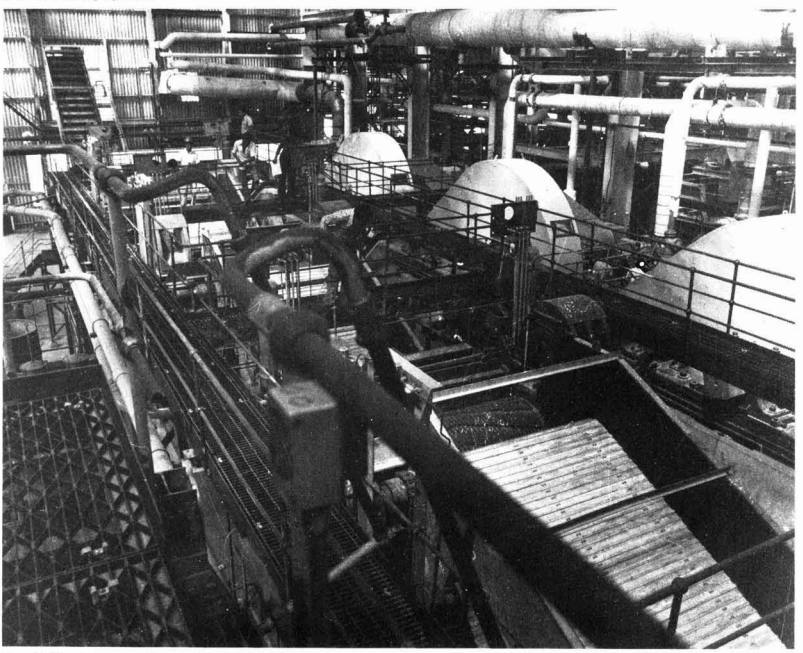


Fig. 6. Final stages of assembly within the mill house

Central Jiboa sugar factory

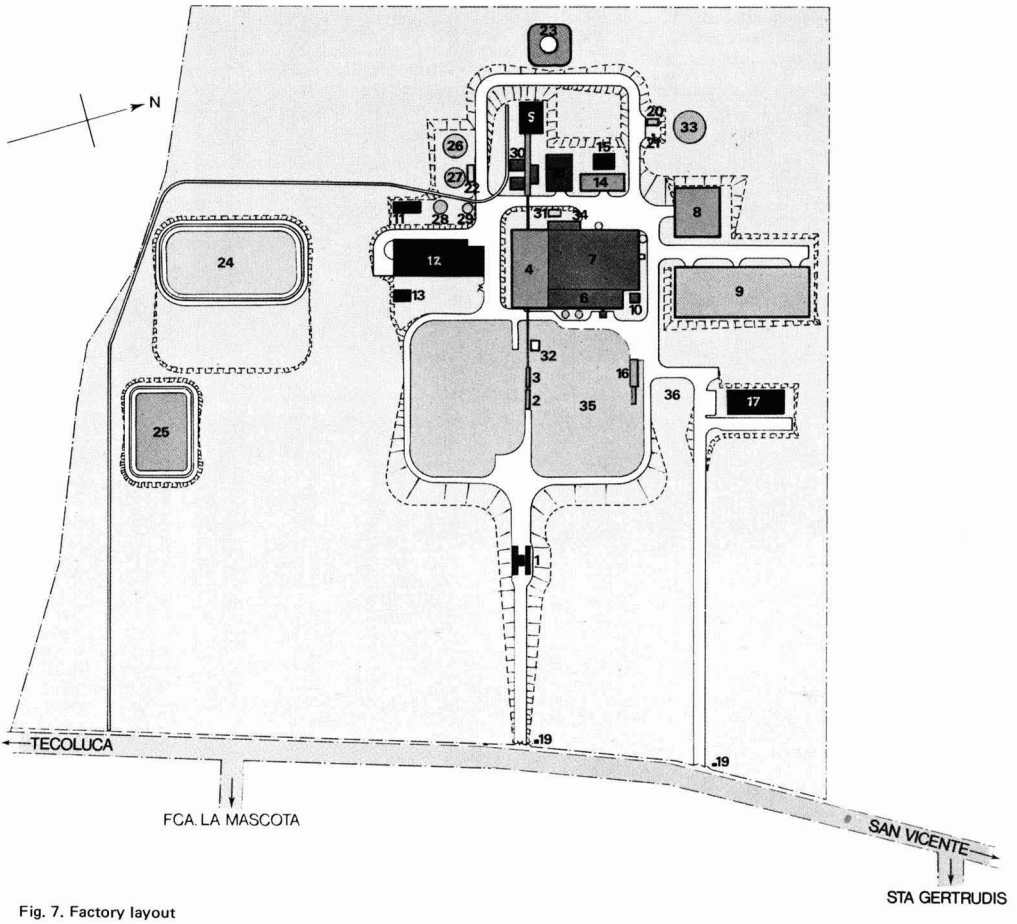


Fig. 7. Factory layout

1 Scale house
2 Cane dumping – ramp to rail
3 Inclined feeder carrier
4 Mill house
5 Bagasse store
6 Clarification and filtration lean-to
7 Boiling house
8 Raw sugar warehouse
9 Refined sugar warehouse
10 Carbon and filter aid preparation building
11 Employees facilities
12 Shops and warehouse building
13 Oil house
14 Chemical storage building
15 Utility sub-station
16 Cane dumping ramp to storage
17 Main office
18 Power house
19 Gate house
20 Overhead molasses tank
21 Pump motor control house
22 Water treatment plant
23 Bunker 'C' fuel oil tank
24 Cooling water spray pond
25 Acid waste tank
26 Potable water tank
27 Excess condensate tank
28 Fire fighting water tank
29 Elevated cold water tank
30 Boilers
31 Cooling tower
32 Conveyor control room
33 Molasses storage
34 Pump lean-to
35 Cane storage area
36 Filling station

El Salvador. L'usine construite par Fletcher and Stewart Ltd., a une capacité nominale de 3500 tonnes courtes de cannes par jour, avec possibilité d'extension à 6400 tc/j.

Zentral-Zuckerfabrik Jiboa

Eine illustrierte Beschreibung der Zentrale Jiboa, der neuesten Rohrzuckerfabrik in El Salvador, wird gegeben. Die Fabrik, die von Fletcher & Stewart Ltd. gebaut worden ist, hat eine geplante Verarbeitungskapazität von 3500 short tons Rohr je Tag mit der Möglichkeit der Erweiterung auf 6400 sht/d.

Central Azucarera Jiboa

Se presenta una descripción ilustrada de Central Jiboa, la fábrica de azúcar de caña la más recientemente construido en El Salvador. La fábrica, construido por Fletcher and Stewart Ltd., tiene un inicial capacidad proyectada de 3500 toneladas cortes de caña por día, con la posibilidad de expansión hasta 6400 toneladas por día.

The effect of burning cane on capacity and performance of a milling tandem

by J.P. LAMUSSE

(Sugar Milling Research Institute, Durban.)

Paper presented to the 2nd Congress ARTAS, 1978.

Introduction

As part of a wider investigation into the cost of processing dirty cane, a series of test runs were carried out at Tongaat to compare the performance of the milling tandem when crushing burnt cane and unburnt cane. Burnt cane was considered to be the practical equivalent of clean cane while trashed cane as supplied to Tongaat factory was largely falling into the category of dirty cane.

A literature survey showed that the numerous references on the effect of extraneous matter on the milling of cane are mostly based on laboratory-scale experiments and on calculations of the effect of fibre in trash on extraction and capacity. Notable exceptions are the work of Keller & Schaffer[1] on the experimental mill at Louisiana State University and, more recently, experiments carried out by Scott[2] at Felixton and Mount Edgecombe in Natal. Scott produced a series of equations by which the effect of trash % cane on milling capacity can be calculated.

The tests carried out at Tongaat were more industrially orientated than those of Scott. The runs were made on random cane supplied by growers and by the Tongaat fields and no attempt was made to ensure that comparative tests were carried out on cane from the same fields. Similarly, there was no interference in the normal setting or operation of the mills. The tests were of sufficient length to ensure that the inevitable short variations in throughput which occur during milling were evened out and have probably not affected average results.

The milling tandem at Tongaat consists of seven 2134 mm mills, all with feeder rollers and individually driven by steam turbines or vertical steam engines. The first and last units incorporate Walker pressure feeders. Cane preparation is by three sets of electrically driven knives followed by a heavy-duty, turbine-driven shredder.

Most of the cane crushed during the tests was delivered by Hilo trailers and discharged by a spiller. A small proportion was bundled cane delivered by lorries or tractors.

Procedure

When this series of tests was started in October 1977, each run was of about 8 hours' duration, with burnt and unburnt cane processed on successive days. Rain interfered with cane burning, with the result that, of the nine runs carried out, only three pairs were on successive days.

The tests were continued in June and July 1978 and were shortened to about four hours so that both burnt and unburnt cane could be processed on the same day.

Cane carrier speed was automatically controlled by cane level in the first mill chute and no change was made between successive burnt and unburnt runs. Similarly imbibition rate and temperature were kept constant and were recorded.

During the 1977 tests, power consumption by the cane knives was calculated by averaging readings of motor ammeters taken at ten-minute intervals. For the second series of tests in 1978 totalizing wattmeters were fitted to the motors of all cane knives. Turbine horsepower at the shredder and first mill was estimated from curves supplied by the manufacturers. Nozzle pressures and turbine speed were read at ten-minute intervals and used with the curves.

Throughout the tests, cane was sampled for analysis of trash and tops content. An armful of cane was taken at random from the feeder table. The cane was weighed, stripped of all leaves and weighed again. The top was then broken off at the natural breaking point and the clean stalk weighed. About seven cane samples were analysed each hour.

Brix, pol and fibre in cane were determined by direct analysis of shredded cane samples. Moisture and pol were determined in final bagasse and suspended solids in mixed juice. Ash % cane and final bagasse were determined as a measure of field soil content of cane.

Discussion

The results of the three pairs of tests carried out in 1977 and the six pairs of 1978 have been summarized in Tables I and II.

Data from all 21 runs carried out during both seasons have been used to prepare Tables III – VIII, on which comments are made below.

Average trash content for each run varied from 3.2% to 14.0% on clean cane. Results of individual determinations are spread over a much wider range with values of over 20% trash logged several times in some runs. The higher values recorded for some of the burnt cane were due to some unsatisfactory burns in wet weather.

Average trash content for all burnt cane tests was 7.4% compared to 12.2% for unburnt runs. The decrease in trash due to burning was about 65%.

The percentage of tops averaged 2.4 and 2.5% for all burnt and unburnt runs respectively. Run average weights varied from 1.5 to 4.3%. As could be expected, burning did not affect the proportion of tops.

Ash content of shredded cane averaged 1.17% for unburnt cane as against 1.21% for burnt cane. There was therefore no significant effect due to burning.

Suspended solids in mixed juice % cane (Table I) were always lower with burnt cane than with unburnt. The averages for the 1977 runs were 0.51% for burnt and 0.67% for unburnt cane. For the 1978 runs comparative figures were 0.65% and 0.78%, respectively.

---

[1] *L.S.U. Eng. Expt. St. Bull.*, 1951, (25).

[2] *Proc. 51st Congr. S. African Sugar Tech. Assoc.*, 1977, 164-166.

TABLE I. Results of burnt and unburnt cane tests, 1977

RUN No.	1	2	3	4	5	6	7	8	9
Date	Oct. 6, 1977	Oct. 13, 1977	Oct. 18, 1977	Nov. 2, 1977	Nov. 16, 1977	Nov. 17, 1977	Nov. 29, 1977	Dec. 7, 1977	Dec. 8,1977
Burnt or Unburnt	Burnt	Unburnt	Unburnt	Unburnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt
Tonnes cane per hour	240.8	186.4	183.7	171.6	188.5	204.2	178.1	220.4	175.2
Tonnes fibre per hour	34.8	31.9	30.9	30.7	31.6	31.2	29.4	33.3	29.8
Tonnes imbibition per hour	69.6	86.9	93.2	94.0	76.1	88.1	91.5	87.0	75.4
Net duration of run (hr)	5.57	5.70	6.63	6.83	7.58	6.98	6.87	6.08	7.53
Pol % cane (Dac)	13.57	12.48	12.90	12.08	12.46	13.06	12.16	13.05	12.46
Fibre % cane (Dac)	14.47	17.13	16.83	17.87	16.75	15.26	16.52	15.12	17.01
Brix % cane (Dac)	16.00	14.94	15.44	14.45	14.75	15.31	14.75	15.34	15.00
Non-pol % cane (Dac)	2.43	2.46	2.54	2.37	2.29	2.25	3.25	2.29	2.54
Insoluble solids in M.J. % cane	0.39	0.60	0.78	0.67	0.60	0.57	0.78	0.58	0.61
Trash % cane	11.6	12.7	13.0	12.5	11.9	5.0	13.6	8.1	12.9
Tops % cane	1.5	2.2	2.3	2.0	1.7	1.5	3.0	2.4	2.4
Ash % cane	0.82	1.25	1.05	1.13	1.22	1.02	1.00	1.12	0.92
Pol % bagasse	1.61	1.40	1.41	1.29	1.26	1.43	1.25	1.36	1.31
Brix % bagasse	3.17	2.81	3.34	2.76	2.98	2.96	2.83	2.98	2.94
Fibre % bagasse	43.98	43.56	44.62	42.23	45.66	44.08	42.12	39.26	38.77
Moisture % bagasse	52.85	53.63	52.04	55.01	51.36	53.00	55.05	57.76	58.24
Ash % bagasse	2.11	2.27	1.68	1.72	1.59	1.21	1.31	1.71	1.17
Extraction (Dac)	96.20	95.74	96.09	95.65	96.42	96.34	96.13	96.15	95.55
Corrected reduced extraction,	95.66	96.18	96.31	96.35	96.71	96.12	96.37	95.86	95.97
Imbibition % fibre	212	254	302	306	241	285	327	272	262
Tonnes cane per Hilo trailer	21.95	18.81	20.43	18.42	19.78	21.09	20.16	22.69	19.15

TABLE II. Results of burnt and unburnt cane tests, 1978

RUN NO.	10A	10B	11A	11B	12A	12B	13A	13B	14A	14B	15A	15B
Date	June 22, 1978		June 29, 1978		July 18, 1978		July 19, 1978		July 20, 1978		July 21, 1978	
Burnt or Unburnt	Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt
Tonnes cane per hour	186	180	221	171	195	165	178	168	192	170	190	178
Tonnes fibre per hour	24.3	28.8	28.8	26.5	27.3	26.6	25.4	26.3	27.2	27.9	26.3	27.6
Tonnes imbibition per hour	70	70	71	71	70	70	70	70	70	70	70	70
Net duration of run (hr)	3.68	3.72	3.80	3.30	3.45	3.50	3.90	2.75	3.90	2.81	4.00	3.50
Pol % cane (Dac)	12.8	12.1	13.0	12.4	12.9	12.8	13.2	12.9	13.4	12.4	14.0	12.7
Fibre % cane (Dac)	13.1	16.0	13.1	15.5	14.0	16.1	14.3	15.6	14.2	16.4	13.8	15.4
Brix % cane (Dac)	15.1	14.7	15.4	15.0	15.5	15.4	15.7	15.4	15.9	15.1	16.4	14.4
Non-pol % cane (Dac)	2.3	2.6	2.4	2.6	2.6	2.6	2.5	2.5	2.5	2.7	2.4	1.7
Insoluble solids in M.J. % cane	0.65	0.81	0.64	1.00	0.87	0.85	0.43	0.63	0.60	0.59	0.75	0.77
Trash % cane	11.50	10.50	3.24	9.40	6.99	11.88	8.51	12.11	4.63	11.40	7.24	13.98
Tops % cane	1.80	3.00	3.71	4.27	2.50	2.78	2.98	2.00	2.62	2.08	2.64	2.06
Ash % cane	-	-	2.52	2.51	0.80	0.80	1.00	1.20	1.40	1.00	1.00	0.80
Pol % bagasse	1.11	0.98	1.05	0.84	0.93	0.98	1.01	0.92	1.00	0.88	1.01	0.96
Brix % bagasse	2.50	2.36	2.22	2.22	1.94	2.23	1.96	0.96	1.92	1.95	2.06	2.05
Fibre % bagasse	45.42	45.61	43.43	43.84	45.36	46.77	44.54	45.68	45.28	44.76	43.60	46.23
Moisture % bagasse	52.08	52.03	54.35	53.94	52.70	51.00	53.50	53.36	52.80	53.29	54.34	51.72
Ash % bagasse	-	-	2.18	2.06	1.20	1.40	1.20	1.00	1.80	1.40	1.20	1.40
Extraction (Dac)	97.50	97.16	97.54	97.58	97.78	97.43	97.58	97.60	97.66	97.42	97.71	97.48
Corrected reduced extraction	96.99	97.42	97.00	97.65	97.51	97.54	97.32	97.63	97.36	97.66	97.26	97.50
Imbibition % fibre	288	243	247	268	256	263	276	266	257	251	266	254
Tonnes cane per Hilo trailer	20.37	18.96	20.36	18.33	21.05	17.90	20.64	18.48	19.24	18.50	18.32	17.93

One of the more noticeable effects of burning cane was the higher average weight of Hilo trailers. This was found to be 1.73 tonnes per vehicle and this weight must be added to the reduced weight of extraneous matter when transporting burnt cane.

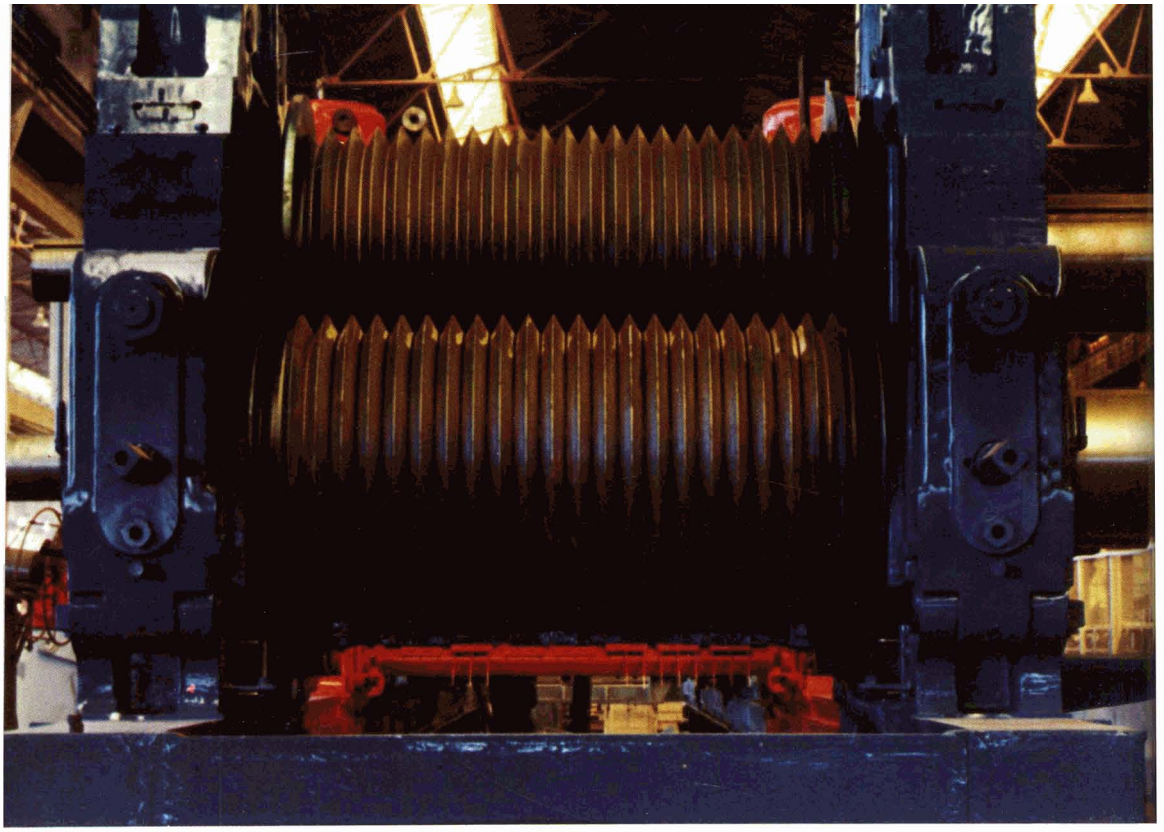
For the average South African mill, which processes about one million tonnes of cane in a season, the saving, if all the cane were transported in Hilo trailers, is estimated at about R150,000.

The average increase in cane throughput when processing burnt cane was 26.7 tonnes of cane per hour or about 15%. For the six pairs of tests carried out in 1978, average increase in capacity was 21.7 t.c.h. which was equivalent to 13%.

The milling rate was higher in 1977 than in 1978 and it is not surprising that the effect of trash was greater at the higher crushing rate.

Comparison on the basis of tonnes of fibre per hour indicates that the higher throughput with burnt cane is due to the lower fibre content of the cane. In fact fibre throughput was 0.7 tonnes per hour higher for unburnt cane in 1978 and 3.1 tonnes per hour higher for the average of 1977 and 1978 runs.

The increased milling capacity and lowered weight of cane to be processed, if cane is burnt, would have an



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La tecnología Farrel incorporada a los equipos Zanini está presente en los mayores centrales azucareros del mundo. Los trapiches Zanini - Farrel ya demostraron su eficiencia y rentabilidad en el Brasil, Argentina, México, Estados Unidos, Venezuela, República Dominicana, Colombia y otros países.

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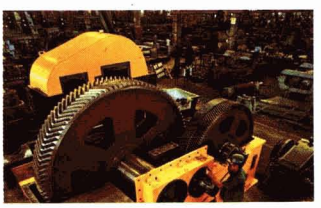

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30" x 60"	37" x 78"	44" x 96"
34" x 66"	42" x 84"	

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TABLE III. Extraneous matter in cane

Run No.	Trash % cane		Tops % cane		Ash % cane	
	Burnt	Unburnt	Burnt	Unburnt	Burnt	Unburnt
1977						
1	11.6		1.5		0.82	
2		12.7		2.2		1.25
3		13.0		2.3		1.05
4		12.5		2.0		1.13
5		11.9		1.7		1.22
6	5.0		1.5		1.02	
7		13.6		3.0		1.00
8	8.1		2.4		1.12	
9		12.9		2.4		0.92
1978						
10A	11.5		1.8		-	
10B		10.5		3.0		-
11A	3.2		3.7		2.52	
11B		9.4		4.3		2.51
12A	7.0		2.5		0.80	
12B		11.9		2.8		0.80
13A	8.5		3.0		1.00	
13B		12.1		2.0		1.20
14A	4.6		2.6		1.40	
14B		11.4		2.1		1.00
15A	7.2		2.6		1.00	
15B		14.0		2.1		0.80
General Average	7.4	12.2	2.4	2.5	1.21	1.17
1978 Average	7.9	11.6	2.7	2.7	1.34	1.26

	Total Extraneous matter % cane	
	Burnt	Unburnt
General Average	11.01	15.87
1978 Average	11.94	15.56

TABLE IV. Loading of Hilo trailers

Run No.	Tonnes cane per Hilo		
	Burnt	Unburnt	Difference
1	21.95		
2		18.81	3.14
3		20.43	
4		18.42	
5		19.73	
6	21.09		1.31
7		20.16	
8	22.69		
9		19.15	3.54
10A	20.37		
10B		18.96	1.41
11A	20.36		
11B		18.33	2.03
12A	21.05		
12B		17.90	3.15
13A	20.64		
13B		18.48	2.16
14A	19.24		
14B		18.50	0.74
15A	18.32		
15B		17.93	0.39
General Average	20.63	18.90	1.73
1978 Average	20.00	18.35	1.65

TABLE V. Cane throughput

Run No.	Tonnes cane per hour		
	Burnt (B)	Unburnt (U)	Diff. B-U
1	241		
2		186	55
3		184	
4		172	
5		189	
6	204		15
7		178	
8	220		
9		175	45
10A	186		
10B		180	6
11A	221		
11B		171	50
12A	195		
12B		165	30
13A	178		
13B		168	10
14A	192		
14B		170	22
15A	190		
15B		178	12
General Average	203.0	176.3	26.7
1978 Average	193.7	172.0	21.7

Run No.	Tonnes fibre per hour		
	Burnt (B)	Unburnt (U)	Diff. B-U
1	34.8		
2		31.9	2.9
3		30.9	
4		30.7	
5		31.6	
6	31.2		-0.4
7		29.4	
8	33.3		
9		29.8	3.5
10A	24.3		
10B		28.8	-4.5
11A	28.8		
11B		26.5	2.3
12A	27.3		
12B		26.6	0.7
13A	25.4		
13B		26.3	-0.9
14A	27.2		
14B		27.9	-0.7
15A	26.3		
15B		27.6	-1.3
General Average	28.7	29.0	-0.3
1978 Average	26.6	27.3	-0.7

appreciable effect on the length of the season. Assuming a 15% increase in crushing rate and a reduction in trash content of 5%, it can be shown that for the average South African mill, the season would be reduced by 48 crushing days, from 266 to 218.

Milling efficiency

Results listed in Table VI show that both in 1978 and for the average of all runs, pol % cane and moisture % cane were higher when milling burnt cane. In the case of pol % bagasse this is true for 8 out of the 9 pairs of comparisons while for moisture % bagasse all tests carried out in 1977 showed a higher moisture for unburnt cane while the reverse was true for all but one of the 1978 tests.

Extraction averaged 97.16% for all runs on burnt cane and 96.69% on unburnt cane. The pattern was the same for the 1978 tests with 97.63% for burnt and 97.45% for unburnt cane.

Corrected reduced extraction showed a completely different picture and was higher for unburnt than for burnt cane. This fact and the higher pol in bagasse with burnt cane indicates that the higher extraction is due to the lower weight of bagasse produced as a result of the lower fibre content of burnt cane.

Only the 1978 results have been tabulated. Power was recorded by totalizing wattmeters and is therefore accurate. The 1977 results were based on instantaneous readings of ammeters and are only rough estimates.

The power taken to knife unburnt cane was higher than for burnt cane by 18% for the bottom knives, 20% for the middle knives and 16% for the top knives. Most of the additional power taken was due to the higher fibre content of unburnt cane.

When power is expressed in terms of kWh/tonne of fibre, the comparative figures were:-

bottom knives	3%
middle knives	5%
top knives	3%

It seems therefore that the "quality" of fibre from unburnt cane had only a marginal effect on the power taken by the knives.

TABLE VI. Milling efficiency

Run No.	Extraction		Corrected reduced extraction		Pol % bagasse		Moisture % bagasse		Pol lost in bagasse % cane	
	Burnt (B)	Unburnt (U)	Burnt (B)	Unburnt (U)	B	U	B	U	B	U
1977										
1	96.20		95.66		1.61		52.85		0.54	
2		95.74		96.18		1.40		53.63		0.57
3		96.09		96.31		1.41		52.04		0.51
4		95.65		96.35		1.29		55.01		0.53
5		96.42		96.71		1.26		51.36		0.45
6	96.34		96.12		1.43		53.00		0.48	
7		96.13		96.37		1.25		55.05		0.47
8	96.15		95.86		1.36		57.76		0.50	
9		95.55		95.97		1.31		58.24		0.55
1978										
10A	97.50		96.99		1.11		52.08		0.32	
10B		97.16		97.42		0.98		52.03		0.34
11A	97.54		97.00		1.05		54.35		0.33	
11B		97.58		97.65		0.84		53.94		0.33
12A	97.78		97.51		0.93		52.70		0.29	
12B		97.43		97.54		0.98		51.00		0.34
13A	97.58		97.32		1.01		53.50		0.35	
13B		97.60		97.63		0.92		53.36		0.31
14A	97.66		97.36		1.00		52.80		0.31	
14B		97.42		97.66		0.88		53.29		0.32
15A	97.71		97.26		1.01		54.34		0.32	
15B		97.48		97.50		0.96		51.72		0.32
General Average	97.16	96.69	96.79	96.94	1.16	1.12	53.71	53.39	0.38	0.42
1978 Average	97.63	97.45	97.24	97.57	1.02	0.93	53.30	52.56	0.32	0.33

TABLE VII. Power consumption by cane knives

Run No.	Lower Knives				Middle Knives				Top Knives			
	kWh/tonne cane		kWh/tonne fibre		kWh/tonne cane		kWh/tonne fibre		kWh/tonne cane		kWh/tonne fibre	
	B	U	B	U	B	U	B	U	B	U	B	U
1978												
10A	0.70		5.31		0.56		4.25		0.89		6.80	
10B		0.85		5.33		0.63		3.96		1.15		7.18
11A	0.65		4.96		0.53		4.05		0.92		7.00	
11B		0.79		5.11		0.68		4.40		1.09		7.00
12A	0.82		5.82		0.61		4.36		1.02		7.31	
12B		0.93		5.80		0.70		4.37		1.16		7.25
13A	0.87		6.09		0.64		4.51		1.06		7.44	
13B		0.92		5.92		0.70		4.50		1.13		7.25
14A	0.81		5.69		0.58		4.07		1.02		7.13	
14B		1.06		6.51		0.80		4.92		1.30		7.95
15A	0.83		6.02		0.60		4.35		1.01		7.33	
15B		0.96		6.21		0.72		4.64		1.22		7.92
Average	0.78	0.92	5.65	5.81	0.59	0.71	4.27	4.47	0.99	1.18	7.17	7.42

Power taken by the turbine drives of the shredder and first mill were calculated from readings of nozzle pressure and rotational speed taken at 10 minute intervals, and curves supplied by the turbine manufacturers. The data listed are therefore only of comparative value. The higher values for kWh/tonne fibre in 1978 are due to an inaccurate tachometer on the shredder drive turbine which was changed after the 1977 season. For the mill the higher kWh/tonne fibre is the result of a closer mill setting in 1978. Data for 1977 and 1978 have therefore been averaged separately.

Shredder power was 28% higher with unburnt cane in 1977 and 23% higher in 1978. Expressed in kWh/tonne of fibre the corresponding values were 12 and 8%. The influence of the higher fibre content of unburnt cane was preponderant but the effect of "quality" of fibre from unburnt cane was more marked than for the knives.

In the case of the first mill the results for the two seasons were very similar. Unburnt cane required 13% and 12% more power per tonne of cane for the two seasons but, on the basis of kWh per tonne of fibre, burnt cane required marginally less power. It can be concluded that "quality" of fibre had no effect on mill power.

TABLE VIII. Power consumption by shredder and first mill

Run No.	Shredder kWh/tonne cane		Shredder kWh/tonne fibre		First Mill kWh/tonne cane		First Mill kWh/tonne fibre	
	B	U	B	U	B	U	B	U
1977								
1	2.88		19.94		0.91		6.32	
2		3.61		21.13		1.17		6.86
3		3.34		19.87		1.21		7.18
4		3.53		19.74		1.29		7.20
5		3.21		19.15		1.29		7.69
6	2.85		18.65		1.30		8.53	
7		3.28		19.90		1.22		7.38
8	2.15		14.29		1.12		7.42	
9		3.16		18.62		1.23		7.28
1978								
10A	-	-	-	-	1.42		10.80	
10B	-	-	-	-		1.56		9.70
11A	3.04		23.26		1.41		10.80	
11B		3.95		25.35		1.73		11.19
12A	3.20		22.94		1.60		11.45	
12B		4.11		25.52		1.75		10.83
13A	3.57		24.94		1.74		12.13	
13B		4.05		26.05		1.93		12.41
14A	3.36		23.58		1.58		11.08	
14B		4.17		25.54		1.88		11.53
15A	3.18		23.03		1.58		11.48	
15B		3.85		25.00		1.77		11.46
General Average	3.03	3.66	21.34	22.35	1.41	1.50	10.00	9.23
1978 Average	3.27	4.03	23.55	25.49	1.56	1.77	11.29	11.20
1977 Average	2.63	3.36	17.62	19.74	1.11	1.24	7.42	7.27

Conclusions

The conclusions that can be drawn from the series of tests carried out at Tongaat on the milling of burnt and unburnt cane are:

(1) The average trash content of burnt cane (7.4%) was 65% lower than that of unburnt cane (12.2%).

(2) Burning did not affect the percentage of tops in cane which averaged 2.5%.

(3) The ash content of cane was about the same for burnt and unburnt cane but the level of suspended solids in juice increased by 20 to 30% for unburnt cane.

(4) The average load of a Hilo trailer was 1.73 tonnes higher when transporting unburnt cane. The savings in transport cost which could result are estimated at R150,000 per season for an average-size South African sugar factory.

(5) The increase in mill capacity when processing burnt cane was 13% and 15% for the two series of tests. There was no increase in fibre throughput. The increase in crushing rate, coupled with the lower weight of cane to be processed, would reduce the length of the season by 48 days for an average South African mill.

(6) Pol % bagasse was higher when processing burnt cane but, because of the lower weight of fibre, extraction was higher with burnt (97.16%) than with unburnt cane (96.69%). The reverse was true of corrected reduced extraction.

(7) Power per tonne of cane was about 18% higher for knifing unburnt cane. Shredder power was about 25% higher and first mill horsepower 12% higher. The larger power requirement was due to additional fibre loading rather than quality of fibre.

Acknowledgements

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Summary

Burnt and unburnt cane were milled separately in the milling tandem at Tongaat. The trash content of burnt cane was 65% lower than that of unburnt cane and the load per Hilo trailer 1.73 tonnes greater. Throughput was increased by about 15% and extraction by 0.47 points when processing burnt cane.

L'effet du brûlage de la canne sur la capacité et les performances d'un tandem de moulins

A Tongaat, on a broyé séparément de la canne brûlée et non brûlée. La teneur en détritus de la canne brûlée était de 65% inférieure à celle de la canne non brûlée et le chargement par remorque Hilo était plus élevé de 1.73 tonne. La capacité était augmentée d'environ 15% et l'extraction de 0.47 point lors du travail de cannes brûlées.

Der Einfluß des Rohrbrennens auf Kapazität und Leistung eines Mühlentandems

Gebranntes und ungebranntes Rohr wurden getrennt in dem Mühlentandem in Tongaat verarbeitet. Der Trash-Gehalt des gebrannten Rohrs war um 65% geringer als der des ungebrannten Rohrs, und die Hilo-Anhänger faßten 1.73 t Rohr mehr. Bei der Verarbeitung von gebranntem Rohr war der Durchsatz ungefähr 15% höher und die Extraktion um 0.47 Punkte besser.

El efecto de quema de caña sobre capacidad y cumplimiento de un tandém de molinos

Caña quemado y no-quemado se ha molido distintamente en el tandém de Tongaat. El contenido de hojarasca en caña quemada estuvo 65% menos que en caña verde, y la carga por remolque Hilo estuvo mayor por 1.73 toneladas métricas. Capacidad de molienda se aumentó por unos 15% y extracción por 0.47 puntos cuando se molió caña quemada.

Small-scale sugar production

The first meeting organized by Intermediate Technology Development Group with participants from several countries to discuss research and development in small-scale sugar processing techniques was held in London on 10th May 1978[1]. At the conclusion of that meeting it was felt that a periodic exchange of views and information was desirable, now that there were a number of persons and groups in Europe and elsewhere actively engaged in R&D in this field. At the invitation of the French participants, the second meeting was held in Paris on November 15, 1978, coincident with the Second World Food Development Congress.

Following the pattern of the previous meeting, the discussion initially turned to possible improvements of the Indian open pan sulphitation (OPS) technology. At present, the essential features of Indian OPS khandsari plants are dry milling, evaporation under atmospheric pressure and crystallization by cooling-in-motion. These cannot match the corresponding large-scale processing techniques either in overall recovery or product quality. On the other hand, OPS technology has the advantage of relatively low capital costs per unit of output, and a large number of such units have been established in India.

The meeting was told that the Appropriate Technology Development Association in Lucknow had received a grant from the Uttar Pradesh government for the development of small-scale sugar processing techniques. As part of a three-year programme supported by the U.P. Council of Science and Technology, ATDA planned to field-test a screw press during the 1978/79 season. Whereas screw presses had been developed in the United States to dewater cush-cush or final bagasse in larger sugar factories, the idea here was to use this machinery for primary extraction in place of conventional mills in the hope of obtaining a higher juice extraction without imbibition or maceration. Experiments conducted with such equipment since 1965/66 by the Khadi and Village Industries Commission, the Planning Research and Action Institute, Lucknow, and more recently also by the National Sugar Institute, Kanpur, had served to identify a number of design problems. Further tests were required to show whether these had been successfully resolved and to establish the most suitable method of cane preparation. Comparative data on capital and maintenance costs, power consumption and extraction efficiency would then determine whether the equipment was preferable to conventional mills.

Present open-pan evaporation techniques entail considerable inversion losses because of high temperatures and long retention times. Moreover, supplementary fuel in addition to the bagasse is generally required. Boiling efficiency could probably be improved by the adaptation to small-scale cane juice processing of the type of open flow-pan evaporator used by North American maple syrup producers. ATDA plans to test such equipment as well as thin-film plate evaporators in the course of its three-year development programme. In the discussion of purification and evaporation procedures, several participants also drew attention to the importance of proper pH control. French investigators of Indian OPS techniques have been particularly concerned with the uncontrolled nucleation and consequent imperfect crystal formation observed in present boiling and crystallization practices, which make crystal yield and quality highly dependent on the experience and skill of the operators. Preparations had been completed, the meeting was told, for a laboratory study in France of nucleation and seeding in simulated OPS conditions. For its part, ATDA is interested in testing an ion exchange process to extract liquid sugar from molasses developed by the French company Applexion.

Parallel to the R&D aiming at the improvement of present OPS practices, the participants noted a growing

[1] See *I.S.J.*, 1978, **80**, 357-358.

interest in the design of alternative technologies for small-scale sugar manufacture. These range from intermediate solutions, such as the proposal of a multi-stage flue gas/vapour system of evaporation[2], to the miniaturization of large-scale sugar processing technologies. With the support of the West German government, Buckau-Wolf has designed a plant to process 300 tonnes of cane per day, featuring a standard 12-roll mill train with imbibition and conventional multiple-effect evaporator and vacuum-pan stations. The Dutch firm HVA has likewise entered the field of so-called mini-sugar factories. Interplan, of Hamburg, has designed a small-scale sugar factory in container modules with a conventional mill, while A/S De Danske Sukkerfabrikker has presented another version for 150 tonnes of cane per day, also in container modules but employing a diffuser for extraction, of which a pilot plant is currently being tested in Tanzania. Miniature diffusers are also being offered by the Belgian firm De Smet. The common characteristic of these systems is a capital cost per unit of output similar to that of large-scale modern sugar factories and hence far higher than that of Indian OPS plants. Against that, they offer the technical efficiency of large-scale factories without the bulkiness of investment associated with such installations. This could possibly make them a viable proposition for areas with a limited cane supply, small local market or where the creation of employment opportunities is not a primary consideration.

Still another approach with possible application to small-scale manufacture is the cane separation process which yields a low-fibre pith. To extract the juice from this material, the Canadian firm Intercane Systems is reported to have designed a new multi-barrel reciprocating hydraulic press, a prototype of which is about to be tested in a pilot plant. In connexion with this line of development, attention has also been given to processes and equipment to produce a dry amorphous powdered sugar without residual molasses. Meanwhile, Tate & Lyle Ltd. has patented a so-called "transformed sugar" process, whereby cane juice can be concentrated into a dry free-flowing microcrystalline brown sugar with no resulting mother liquor[3].

The next round-table meeting is planned to be held in Berlin, the exact date and arrangements to be fixed in further consultation. Interested parties should write to Intermediate Technology Development Group Ltd., 9 King Street, London, WC2E 8HN, England.

Canada sugar imports 1978[4]

	1978	1977
	— *tonnes, tel quel* —	
Raw sugar		
Australia	463,801	512,373
Belize	95	0
Brazil	5,250	0
Cuba	192,133	101,390
Guyana	54,626	20,552
Hong Kong	11	0
Jamaica	10,544	70,108
Mauritius	40,059	25,788
Peru	0	10,668
South Africa	262,284	301,735
Trinidad & Tobago	0	5,314
USA	5	2
Other countries	1	12,959
Total raw sugar	1,028,809	1,060,899
White sugar		
Belgium	1	0
China	26	16
Colombia	1	0
Holland	5	3
Hong Kong	221	28
Nicaragua	2	0
Puerto Rico	5	19
Surinam	5	0
UK	18	74
USA	723	2,333
Total white sugar	1,007	2,473
Total imports, raw value	1,029,904	1,063,577

Zaire sugar project[5]. — The Belgian company Sopex is to carry out a feasibility study for three sugar projects; one is at Luiza, West Kasai, a second at Lubilashi, Shaba, and the third at Mushie-Pentane, Bandundu. The projects are the result of the Government's decision to have a sugar factory in each of the eight Provinces of Zaire. Installation of a factory with a capacity of 50,000 tonnes of sugar per year in each of these locations is estimated to cost about 2000 million Belgium frances or some US $67 million.

Dominican Republic sugar statistics 1978[6]

		— *tonnes, tel quel* —
Initial stocks		148,791
Production		1,164,035
		1,312,826
Consumption		176,763
Exports:		
Morocco	4,040	
Puerto Rico	418	
Senegal	6,200	
USA	583,676	
USSR	45,399	
Venezuela	262,535	
West Indies	7,129	
		909,397
Final stocks		226,666

Nicaragua sugar factory destruction[7]. — Heavily armed Sandinist guerillas attacked national guard posts in five Nicaraguan cities and in one, San Antonio, blew up a sugar factory.

Thailand drought effects[8]. — Sugar production in Thailand in 1978/79 is expected to fall to 1,650,000 tonnes, raw value, down from the original forecast of 1,965,000 tonnes and only slightly above the 1,624,000 tonnes produced in 1977/78. The fall is a consequence of the country's worst-ever drought which has continued since October of 1978. Flash fires have occurred, requiring the prompt cutting and crushing of mature cane, and these have also damaged young cane beyond recovery, auguring impaired prospects for the 1979/80 crop.

[2] *Zuckerindustrie*, 1978, **103**, 757-761.

[3] Nicol, Vane & Daniels: *Proc. 37th Ann. Meeting, Sugar Ind. Tech.*, 1978, 396-409.

[4] F.O. Licht, *International Sugar Rpt.*, 1979, **111**, S93.

[5] *Westway Newsletter*, 1979, (65), 14.

[6] C. Czarnikow Ltd., *Sugar Review*, 1979, (1435), 73.

[7] F.O. Licht, *International Sugar Rpt.*, 1979, **111**, 194.

[8] *World Sugar J.*, 1979, **1**, (10), 12-13.

SUGAR CANE AGRONOMY

Studies on the growth model of sugar cane. I. Modelling the variation of sugar content and forecasting. T. L. Lin and W. H. Tung. *Rpt. Taiwan Sugar Research Inst.,* 1977, (78), 13-34 *(Chinese).* — Models of sugar content, as a function of temperature and evaporation, were obtained by the stepwise regression method. These and models for temperature and evaporation forecasting (studied by time series analysis) were used to predict cane sugar content. Very close agreement was found between true and predicted values for plant and ratoon cane of two varieties.

Tolerance of sugar cane varieties to herbicides. H. J. Yeh. *Rpt. Taiwan Sugar Research Inst.,* 1977, (78), 35-43 *(Chinese).* — Sixteen varieties were tested for their tolerance to a number of pre- and post-emergence herbicides. All but three (F 173, F 176 and F 178) were tolerant to the pre-emergence herbicides at rates of 1.2-2.0 $kg.ha^{-1}$; the adverse effects included growth retardation and leaf chlorosis. Most of the varieties were sensitive to post-emergence "Metribuzin" at 0.7-1.4 $kg.ha^{-1}$ and "Ametryne" at 1.2-2.0 $kg.ha^{-1}$, but only five suffered damage from "Asulam" + 2,4-D, while 2,4-D on its own, as pre- or post-emergence herbicide, had no adverse effect. Canes injured by post-emergence herbicides exhibited growth retardation and necrotic spots on leaves, followed by eventual death of the leaves. Generally, sensitive varieties recovered within 8 weeks of spraying with pre-emergence herbicides and within 6 weeks of post-emergence application.

A study on ripening of sugar cane plants. III. Reducing sugar decrease in cane stalks during the ripening period. T. T. Yang and T. S. Hsieh. *Rpt. Taiwan Sugar Research Inst.,* 1977, (78), 45-54 *(Chinese).* — The pattern of decrease in reducing sugars in the period from August 1976 to February 1977 was investigated and is shown in the form of graphs showing both the crude fibre and the reducing sugars contents in the cane internodes for each month. It is clearly seen that the maximum reducing sugars content, initially distributed in internodes 1-12, is gradually restricted to internodes 1-4 but at a lower concentration than initially, while the pattern and level of the crude fibre content remains practically unchanged throughout the growing period.

Chemical weed control in sugar cane adsali plantation. J. D. Chougule, S. S. Wandre and B. R. Patil. *Maharashtra Sugar,* 1978, **3,** (5), 45-49. — Field trials were conducted during two seasons in adsali cane (planted in the period from mid-July to mid-September and harvested 15-18 months later). Of the pre-emergence treatments, 2,4-D + "Diuron" at 2.5 litres + 1.25 kg per ha gave best results as regards tillering and yield (proving slightly better than manual weeding) while giving highest net return per ha (slightly below manual weeding). "Atrataf" was more effective than 2,4-D on its own. Hence, 2,4-D + "Diuron" or "Atrataf" are recommended under conditions of acute labour shortage and heavy monsoon rains.

The application of herbicides in sugar cane. V. I. Kolesnikov, Y. Damián and J. J. Rizo. *ATAC,* 1977, **36,** (5), 46-49 *(Spanish).* — Results of trials carried out in 1971-74 are reported which showed that a combined application of pre- and post-emergence herbicides ("Ametryne" and "Diuron") gave better control of weeds than separate applications. The cane yields corresponded to 2-3 manual weedings.

Sugar cane responds well to ammonium chloride fertilization. A. N. Singh. *Indian Sugar,* 1977, **27,** 543-546. Trials conducted in 1957-58 are reported which demonstrated the advantage of ammonium chloride over ammonium sulphate in terms of cane yield, sugar content and juice purity. Other benefits of ammonium chloride by comparison with other nitrogenous fertilizers are mentioned.

Physiological studies on manganese nutrition. I. Evaluation of manganese deficiency and toxicity symptoms in sugar cane raised in pure sand cultures. A. P. Gupta and G. S. G. Rao. *Indian Sugar,* 1977, **27,** 547-552. — In replicated trials carried out in 1975, Mn was applied to pot-grown cane plants (two plants per pot) at rates of 0.15, 0.25, 1.00 and 2.00 ppm and the plants harvested at three growth stages, *viz.* at 3, 5 and 7 months. In 1976, Mn was also applied at 100 ppm. The optimum rate was found to be 0.25 ppm. Symptoms of Mn deficiency and toxicity are described. It was found that the plants tolerated up to 2 ppm Mn.

Sugar technology in the past half-a-century in India. Gur production. S. Thangavelu and K. Sundaresan. *Indian Sugar,* 1978, **27,** 553-556. — A brief survey is presented of gur production and consumption in India from 1923 to 1974. The average yield of gur per acre is also given for each year, and information is also provided on the most suitable cane varieties.

Clonal method of sugar cane planting. R. G. Sharma. *Indian Sugar,* 1978, **27,** 563-566. — Advantages of the method devised by the author, in which lateral, secondary and tertiary shoots developed from the primary stalk left as stubble after harvesting are planted at 15-30 cm intervals in holes, are discussed. Water management is of major importance with clonal planting.

Studies on the chemical composition of cane juice as influenced by manuring and crop age. S. P. Dua and R. C. Singh. *Indian Sugar,* 1978, **27,** 569-572. — The effects of N, P and K application on the concentrations of these elements in cane juice were investigated; two rates of N were used, two of P and one of K as well as zero rates of each element, providing sets of eight concentrations for each month of the period October-April. The time pattern was thus established as well as concentration inter-relationships. Data are tabulated.

Response of sugar cane varieties to rates of nitrogen fertilization. J.P.Patil, V.S.Bavaskar and S.J.Ranadive. *Indian Sugar,* 1978, **27,** 581-584. — The responses of three Co cane varieties to N application rates of 200, 250 and 300 $kg.ha^{-1}$ are reported. While Co 740 was the most responsive as regards all three parameters investigated (sugar content, cane yield and sugar yield), Co 775 was the least responsive except with regard to sugar content, where Co 419 was third. Both yield parameters increased with rise in N application rate.

Modified method for estimating area of intact sugar cane leaves. U. S. Singh. *Indian Sugar,* 1978, **27,** 587-589. — The author's original method for estimating the area of intact cane leaves was based on the product of (leaf length x breadth) divided by 2. However, a simplification of the method was found necessary for those agricultural workers not able to plot a regression curve from the equation derived. Statistical evaluation of 20 sets of values yielded a constant *K* having a mean value of 1.3845, by which the approximate calculated area is multiplied to give a value comparable to that given by planimetric measurement.

Response of sugar cane to press mud cake (PMC). I. The effect of PMC on the yield and quality of cane. S. P. Patil, V. S. Bawasakar, S. J. Ranadive and G. K. Zende. *Indian Sugar,* 1978, **27,** 711-714. — Press filter cake is a valuable source of phosphorus as well as having a high organic carbon content. Trials were conducted in which application of PMC at 12.5, 18.5 and 25.0 tonnes.ha^{-1} was compared with 400:170:170 kg.ha^{-1} N:P:K as regards cane yield and quality. Results showed that the lowest application rate gave a lower yield but a higher sucrose content than did N-P-K, but the sugar yield was slightly lower than with the inorganic fertilizer. (These results were the best of those given by the PMC applications.) However, 12.5 tonnes.ha^{-1} filter cake was the most profitable of all four treatments.

Nitrogen and sugar cane. XIII. Relative mobilization of nitrogen in above-ground plant parts during different phases of crop growth. U. S. Singh. *Indian Sugar,* 1978, **27,** 715-719. — Studies with one cane variety showed that N mobility in aerial parts of the cane varied in proportion to unit dry weight during different growth phases, the leaf blade being the most efficient as regards N accumulation. All plant parts showed a fall in N content with age, the decrease being greater between the tillering and elongation phases than during the sugar accumulation phase. The leaf blade was least efficient in release of accumulated N for use in subsequent growth; the stem was best, followed by the leaf sheath. Leaves released large quantities of N (for growth purposes) as they aged; dry leaves contained relatively little N during all growth phases.

Anhydrous ammonia as a source of fertilizer for sugar cane. M. V. Dahiphale. *Maharashtra Sugar,* 1978, **3,** (6), 9-16. — The use of anhydrous ammonia as a nitrogenous fertilizer is discussed and trials conducted in India are reported. While it was as effective as other forms of N in terms of cane yield, it was the cheapest; however, it requires pressurized equipment for transport, handling, storage and application and thus calls for greater expertise.

Package of practices under low input conditions. P. K. Bose. *Maharashtra Sugar,* 1978, **3,** (6), 23-15, 29. Results of experiments to establish methods of increasing the effectiveness of fertilizers are discussed. A positive effect was obtained by mixing fertilizers with sawdust; the result was a considerable increase in cane and sugar yield by comparison with untreated controls at four sites. Also advocated is the application of organic manure as a means of ameliorating the soil and promoting biological activity. Green manuring is also recommended, as is replacement of some of the normal dosage rate of urea with gamma-BHC, which increased yield by comparison with results obtained with or without nitrogen. *Azotobacter* sp. culture also increased yield when applied with nitrogen. Also discussed are foliar application of urea and single superphosphate under waterlogged conditions, the advantage of autumn over spring planting and of trench planting over furrow planting, and the critical time of irrigation under water deficit conditions.

Nitrogen and sugar cane. XIV. Nitrogen removed by the sugar cane crop during different phases and its relation to cane yield. U. S. Singh. *Indian Sugar,* 1978, **27,** 753-758. — In experiments to determine the total amount of N removed by the aerial parts of cane, the rate of N uptake during different growth phases and N utilization per tonne of cane, it was found that maximum N uptake occurred during the tillering phase and constituted 58.7% of the total N uptake at harvest, compared with 32.2% during the elongation growth period and 9.1% during the sugar accumulation phase. However, the N utilized by the crop during the sugar accumulation phase did not increase yield. For an approximate cane yield of 78 tonnes.ha^{-1}, the crop removed 108 and 132 kg N per ha in the two years of the experiments (but the increase in the second year was absorbed during the sugar accumulation phase and was classed as "luxury" consumption); for this yield, the optimum N removal per tonne of cane was 1.37 kg.

Role of cultural practices in sugar cane. B. K. Mathur. *Indian Sugar,* 1978, **27,** 759-762. — The author examines and offers advice on seed cane selection, planting rate, pre-planting treatments, method and time of planting, intercropping, inter-row cultivation and laying of dry trash to suppress weeds and conserve soil moisture, earthing-up and tying of cane clumps, and time of harvesting on a maturity basis, with adjustment to minimize the time lag between harvesting and processing.

Effect of nitrogen and moisture levels on the water use parameters in Co 419 sugar cane. M. R. Reddy, S. C. Reddy and A. Venkatachari. *Indian Sugar,* 1978, **27,** 763-766. — Field experiments were conducted in 1976-77 with Co 419, a cane widely grown in Andhra Pradesh. The seasonal consumptive use (CU) of water rose with decrease in available soil moisture depletion (ASMD), the effect of ASMD being greater than the effect of nitrogen, although at each ASMD the CU rose slightly with N application rate. N had a considerable influence on the water use efficiency of the cane as well as on sugar yield, the maximum of which was obtained at 25 ASMD and 300 kg.ha^{-1} N. At these levels of ASMD and N application rate, the evapotranspiration ratio was the minimum of all treatments. It is suggested that there is need of greater quantities of water to improve utilization of higher quantities of N. In all moisture regimes, the maximum water extraction was from the top 30 cm of soil.

Let's raise cane yields to 30 tons per acre. B. Wilson. *Fiji Sugar,* 1978, **3,** (2), 15-17. — The field and information officer of the Fiji Sugar Corporation explains how, by paying attention to individual farm operations, it is possible to increase cane yields in Fiji from 20 to 30 tons.acre^{-1}.

Maryborough irrigation scheme key to stable crop production. J. Wright. *Cane Growers' Quarterly Bull.,* 1978, **41,** 95-97. — Wide fluctuation in cane yields from year to year in the Maryborough area of Queensland

have been caused by periodical droughts, and it is stated that future droughts will continue to have severe economic effects on non-irrigated farms – of the total assigned area of 8511 ha under cane, only 1700 ha are irrigated to some extent, while only a relatively small proportion is fully irrigated. While there are many potential benefits from cane irrigation in the area, the quantity and quality of water available are limited. Feasibility studies were therefore carried out on construction of a tidal barrage across the Mary River to conserve water for irrigation and for industry. The proposed scheme would give a storage capacity of 9200 megalitres (expandable to 15,000 megalitres if required), while construction of a tidal barrage on Tinana Creek would give 2400 megalitres of storage capacity. The result would be availability of irrigation water for 3264 ha of assigned cane land on 109 farms, and a further 3264 ha of expanded existing or new assigned cane land.

Why keep farm records? L. G. W. Tilley. *Cane Growers' Quarterly Bull.,* 1978, **41,** 98-99. – A system for recording cane farm production data which permits comparisons between blocks on the same farm and between farms is briefly described.

Sodium in the soil can render land useless for cane. P. K. Makepeace. *Cane Growers' Quarterly Bull.,* 1978, **41,** 107-108. – Soils of high sodium content produce symptoms in cane which are similar to the effects of severe drought, and affected areas often become covered with couch grass or purple top Rhodes grass, which are far more tolerant of high sodium content than is cane. The author explains the adverse effects of three soils characterized by sodium toxicity: alkaline soils (in which the exchangeable Na^+ content is sufficient to cause a breakdown of soil structure), saline soils (containing enough sodium chloride to limit plant growth by affecting the water uptake), and saline-alkaline soils which contain high quantities of both NaCl and exchangeable Na^+. In the Mackay region of Queensland, the problem results from underground streams which flow through decomposing rocks high in sodium and from sea water-affected underground water along low-lying coastal areas which leaves a salt crust on the soil surface when it evaporates, thus reducing surface permeability and so restricting drying. Addition of boiler ash or gypsum to displace sodium from the soil particles is one short-term measure mentioned, although the additives themselves will be displaced if sodium contamination continues.

Bundaberg grower installs integrated irrigation system. P. A. Jones. *Cane Growers' Quarterly Bull.,* 1978, **41,** 110-112. – An illustrated account is given of an irrigation scheme developed by a cane farmer which includes a 56 m deep borehole, a system of open drains and four dams, two built to one side of a creek and two built across it; the creek splits the farm into two cane areas, of nearly 22 and 63 ha, and has running water only in the wet season. Even at peak irrigation times, the entire system can be operated by two men.

Standover cane can be an economical proposition. T. G. Willcox. *Cane Growers' Quarterly Bull.,* 1978, **41,** 114-115. – In wet years, it is economical to stand cane over to the next season, but it must increase in yield during the standover period – a 50% increase was found in standover cane yields in the Cairns/Babinda area in 1973 and 1975. Points to be considered in selecting a block for standing-over are briefly discussed: drainage should be satisfactory; the cane should not have flowered; in the case of lodged cane (which, provided it is healthy, will stand-over satisfactorily) rat damage should be light; there is a marked difference in standover ability between varieties, although the ability is not governed by the crop "class", *i.e.* whether plant, young ratoon or old ratoon cane; and regular checking should be made for rat damage, since standover cane, being the only mature cane available during the early months of the year, is susceptible to this. The question of whether to apply nitrogen to standover cane or not is also discussed.

Round up your reed problems. A. I. Linedale. *Cane Growers' Quarterly Bull.,* 1978, **41,** 116-118. – The common reed, *Phragmites australis,* has been a persistent weed in many cane fields of southern Queensland. Attempts at chemical control have met with mixed success, since few herbicides had more than a short-term effect. The reed is noted for its aggressive growth habit both above and below ground; it spreads rapidly in moist situations and can form a dense mass which seriously impedes crop growth and disrupts cultivation and drainage. It has a prolific root system, with rhizomes capable of producing a whole new generation of shoots only a few months after the above-ground material has been killed. However, trials have shown that "Glyphosate" ("Roundup") at 4 $kg.ha^{-1}$ a.i. substantially reduces regrowth from rhizomes up to 19 months after treatment.

Response of sugar cane to press mud cake (PMC). II. Effects on soil properties and nutrition of sugar cane. V. S. Bawasakar, S. P. Patil, S. J. Ranadive and G. K. Zende. *Indian Sugar,* 1978, **27,** 807-810. – Experiments, described earlier[1], showed that incorporation of PMC at 12.5, 18.5 or 25.00 $tonnes.ha^{-1}$ generally increased the soil carbon content and the available P_2O_5 and K_2O contents at harvest (increases in the nutrient levels accompanied increases in the PMC application rate). The nitrate-N content was lower than with inorganic N-P-K fertilizer. PMC also reduced the total soluble salts content and generally increased N, P and K uptake by the crop. The lowest N:P_2O_5 ratio in juice of 1.1 was given by 18.5 $tonnes.ha^{-1}$ PMC, while inorganic fertilizer gave a ratio of 1.3.

Studies on water management in a seasonal (annual) crop of sugar cane (*Saccharum officinarum* L.). R. D. Phulare and U. C. Upadhyaya. *Indian Sugar,* 1978, **27,** 817-821. – In a field study on heavy soil, three cane varieties were subjected to four irrigation levels, *viz.* at 75, 125, 175 and 225 mm cumulative pan evaporation (CPE). The results showed that irrigation at 75 mm CPE gave the maximum cane yield and juice sucrose content of the four treatments. The number of irrigations required to give the maximum yield (112.96 $tonnes.ha^{-1}$) was 25, corresponding to a mean daily consumptive use of 1903.75 mm of water.

Influence of nitrogen and soil moisture levels on juice quality of sugar cane. M. R. Reddy, S. C. Reddy and A. Venkatachary. *Maharashtra Sugar,* 1978, **3,** (7), 9-17. – See *I.S.J.,* 1979, **81.**

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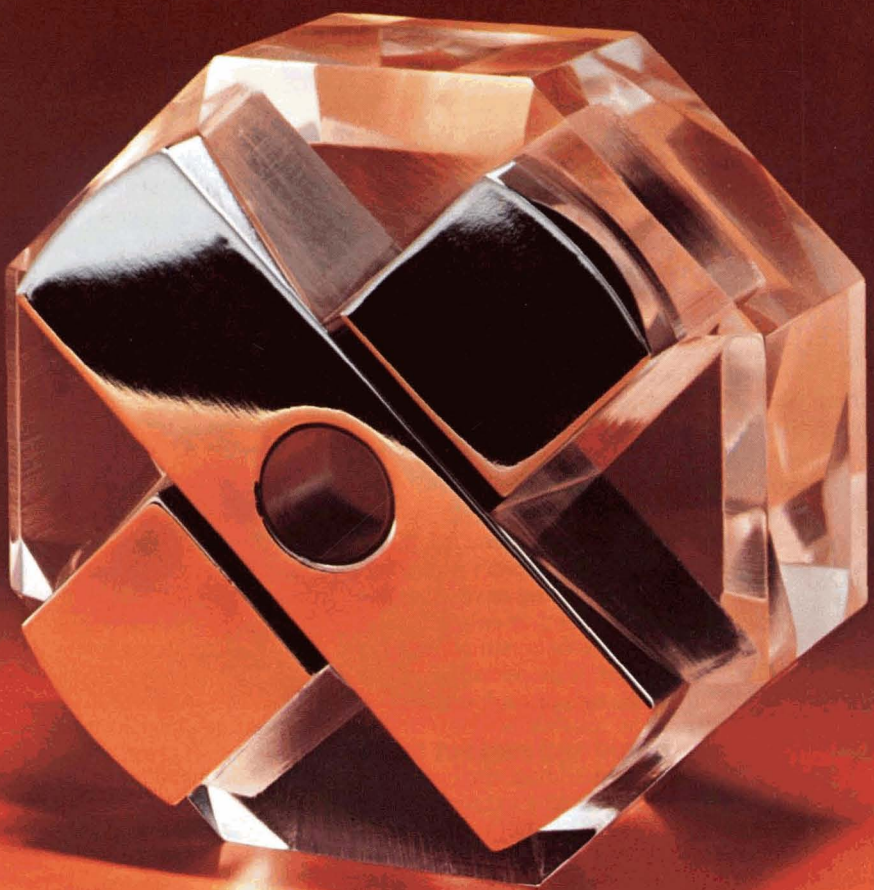
[1] Patil *et al.: I.S.J.,* 1979, **81.**



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Sugar in lumps. A

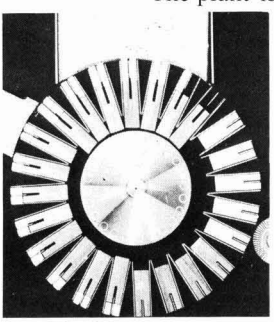
Sugar lumps are at present produced throughout the world by means of a technique perfected and modernised by MACHINES CHAMBON, who today offer entirely automatic lines for the moulding and conditioning of sugar lumps of all sizes.

The CHAMBON plants mould, dry and put into boxes according to type, 12, 24, 55, 80 or 100 tons* of sugar per day.

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

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

A rotary moulding unit.



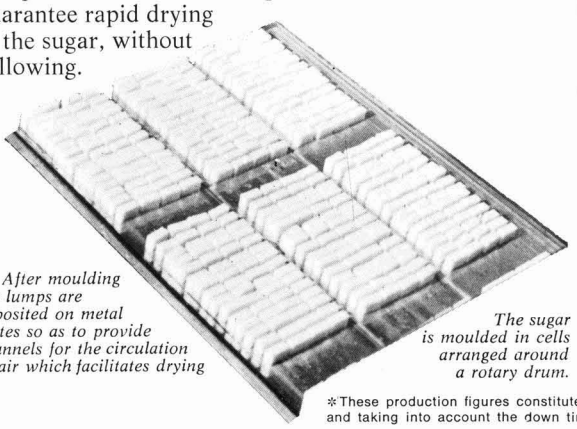
The plant is supplied with dry or humid sugar. Suitably mixed so as to be perfectly homogeneous, the sugar is fed evenly into moulds spead out around a rotary drum. The dimensions of these moulds vary according to whether one wishes to produce lumps of sugar of size 3, 4 or 5 or cubes.

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

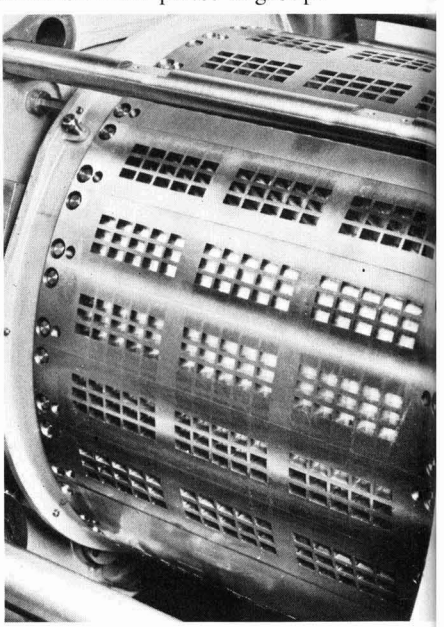
Rapid and perfect drying.

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

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



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



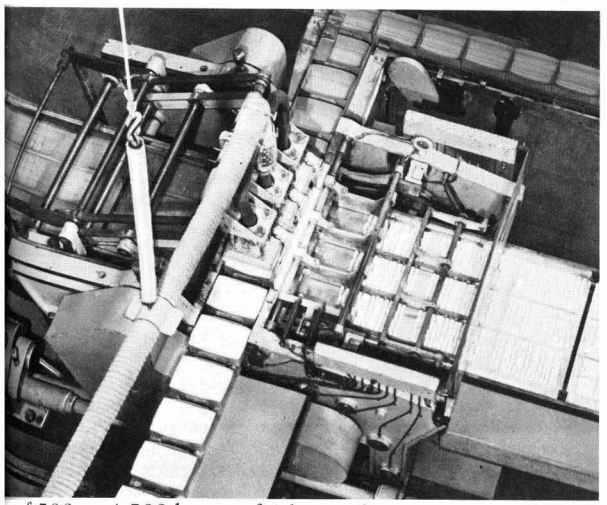
The sugar is moulded in cells arranged around a rotary drum.

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

simple product.

Automatic conditioning.

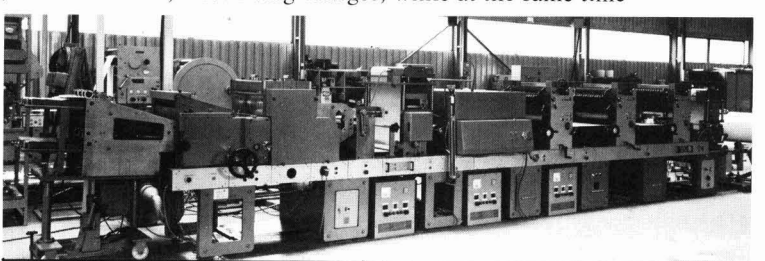
On leaving the drying units, the lumps are gathered and deposited by pneumatic fingers in three successive layers in the boxes, which are formed on a connected machine and automatically supplied to the conditioning line.
The full box is conveyed to the closing machine, which forms and glues the lid of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



A well-designed production unit.

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

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



The boxes are printed and formed in a single operation.

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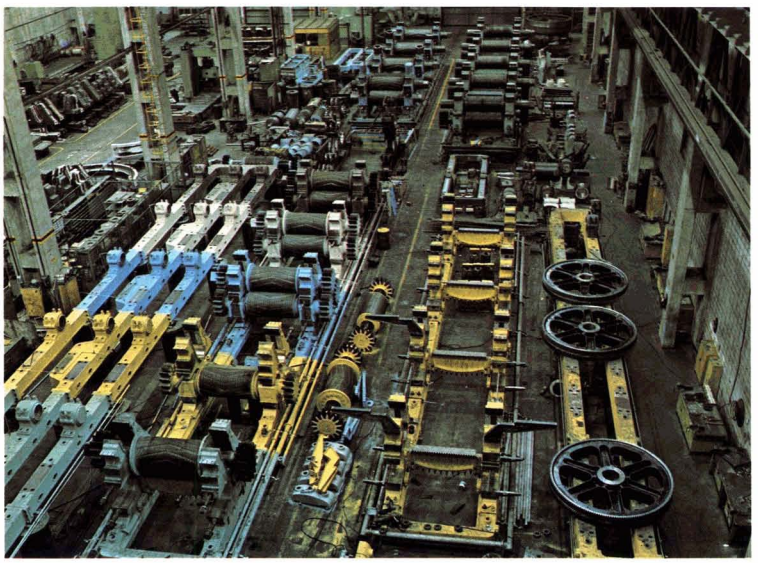

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SUGAR CANE MECHANIZATION

Study group's recommendations on harvesting of green cane. Anon. *S. African Sugar J.,* 1977, **61,** 587. See *I.S.J.,* 1978, **80,** 206.

Comparative economic and lost-time analysis of mechanical sugar cane harvesting. L. V. B. Gentil. *Proc. 16th Congr. ISSCT,* 1977, 2127-2150. — The problems of introducing mechanical harvesting of sugar cane have made it necessary to establish methods for time analysis with a view to determining and studying efficiency. Given that the initial capital investments are high, it is necessary for direct information on the indices and their percentages, together with lost time coefficients, to be available to the analyst so that decisive actions may be made. Consequently, after about nine years of preliminary work in conjunction with the sugar industry and its associates in all fields in Brazil, it has been possible to develop an ideal method for evaluation of lost time during the sugar cane harvesting process. This method is suggested in the paper by means of seven tables and a time loss model which includes such factors as types of lost time, quantitative participation in percentage of each factor, data interpretation, analysis and a general performance chart.

Measuring the cutting resistance of sugar cane stalks. C. S. Chang. *Proc. 16th Congr. ISSCT.* 1977, 2151-2157. Cutting resistance is not only related to mechanical properties of the cane stalk but is also affected by knife geometry and cutting speed. Information on this is important in designing and improving a sugar cane harvester, but such data are not available and to estimate them by existing measuring methods is difficult. The study reported used a special impact cutting test with an actual knife blade and preliminary results indicate that this cutting force distribution, shown by oscilloscope photographs, has a heavy skin effect on both sides of the stalk. The average cutting resistance per unit diameter of the first internode, using a knife blade with an edge sharpness angle of 14° and thickness of 3.06 mm, varies from 3.55 to 6.10 $kgf.cm^{-1}$ according to location on the stalk. The optimum maximum cutting speed at the moment of impact is about $6m.sec^{-1}$ for a stalk diameter of 3.5 cm.

The technical and economic significance of weight transfer tractor systems. H. G. Poole. *Proc. 16th Congr. ISSCT,* 1977, 2469-2484. — With increased rates achieved by mechanical harvesters, the amount of traffic involved in removing cut cane from the fields is greater if the load capacity of the individual units is not increased. Such traffic, with its attendant problems, can be limited by the use of higher individual loads per transport unit and, after a discussion of the engineering involved, it is shown that by use of a weight transfer system and high flotation tyres, the load capacity can be increased without requiring greater tractor power or causing greater soil compaction.

A lightweight harvester developed on the farm. Anon. *Producers' Rev.,* 1978, **68,** (1), 33-34. — Brief details are given of a home-made chopper-harvester which has operated very successfully in stony, hilly scrub country. It has four-wheel drive, weighs only 4-5 tonnes (and so is suitable for use in wet conditions), is provided with gathering tines for picking up cane and conveying it to the chopper knives (it being possible to raise or lower this part of the system independent of the floating base-cutter to ensure cane is picked up without stones or soil, regardless of ground or cane condition) and has provision for pre-setting of the basecutter so that it can cut cane at, above or below ground level. The cutting rate is 40 $tonnes.hr^{-1}$.

A lime applicator from Tully. *Australian Sugar J.,* 1978, **69,** 497, 536. — A lime applicator available from Tully Welding Works in Queensland is briefly described. Available in capacities up to 2 tonnes, it comprises a triangular-section trough mounted between two tyred wheels and attached by 3-point linkage to a tractor. A screw agitator running along the bottom of the trough between the two ends is operated by the two wheels. Holes in the floor of the trough, beneath the screw, are opened and closed by means of an easily operated hand lever attached to the front of the applicator.

Computer simulation of a sugar cane transportation system. O. S. Libunao and R. M. Lantin. *Sugarland* (Philippines), 1977, **14,** (6), 8-11. — A computer simulation model has been developed to test alternatives, strategies and decisions in cane transportation from field to factory, taking into account weather, equipment failure and capacities, distance of travel, queuing, service and unloading times; manual cutting and loading of the cane was assumed. Comparison of a computer run with actual operations confirmed the validity of the model.

Influence of agricultural equipment on cane root development. M. Fonseca and M. Dominguez. *ATAC,* 1977, **36,** (4), 51-65 *(Spanish).* — The study of plant roots and their variation with soil depth, age, etc. is discussed with reference to the work of a number of Soviet scientists.

Mid-mounted two-row planter. Anon. *Australian Sugar J.,* 1978, **69,** 547, 549. — A cane planter built by a Queensland farmer around a Massey-Ferguson tractor is described. It has a widened rear axle and lengthened chassis, with a single front wheel, four fertilizer boxes and two 400-litre fungicide tanks. The planter operates with 56 inches spacing between rows and the drill ploughs can be used independently or together, at different depths if required. The machine can plant 6 ha per day.

Influence of agricultural yield in mechanization of the cane harvest. E. Casanova and I. Robella. *ATAC,* 1977, **36,** (5), 56-65 *(Spanish).* — Factors requiring attention in cane harvest mechanization include the vegetative structure of the cane, the yield and erectness of the cane, and the variability of the millable stalk height. To avoid or minimize technical problems in milling, the cane should have as little trash content as possible, and, based on comparison between conditions in Australia and Cuba, a cane yield of 80-100,000 arrobas per caballería (68-86 $tonnes.ha^{-1}$). The stalk height should be as uniform as possible and the cane should not lodge, while its structure should be such as to give a minimum of extraneous material at the time of harvest.

CANE PESTS AND DISEASES

Sesamia **stem borers and a** *Telenomus* **egg-parasite in Iran.** M. Daniali, N. Baniabbassi and D. P. Gowing. *Proc. 16th Congr. ISSCT*, 1977, 755-758. – The egg-parasite, *Telenomus* sp., is an important natural enemy of the stem borers *S. nonagrioides* (Lef.) and *S. cretica* Led. in sugar cane at Haft Tappeh, Iran, the parasitism reaching 95% in late summer and higher in the autumn. The moths apparently prefer young sugar cane for egg deposition, but several weed species also serve as hosts for young borers, the grass *Echinochloa colonum* (L.) Link, being one of the more favoured. The wasp parasitizes the moth eggs wherever they are found, and one female wasp can parasitize 70 to 100 eggs. Extensive data indicate a very effective control of the borer. In the past few years only 0.3–0.5% of the internodes have been found bored at harvest, in contrast to nearly 2% bored under the previous plantation spray programme.

Effect of feeding on the longevity and fecundity of *Trichogramma* **adults.** A. F. H. El-Sherif and M. T. Kira. *Proc. 16th Congr. ISSCT*, 1977, 773-777. – In Egypt, *T.evanescens* Westw. is a dominant and efficient parasite on the egg of the purple-lined borer *Chilo agamemnon* Bles. in cane fields, but develops late in the season so that laboratory rearing is necessary to provide a supply for releasing in the cane fields early in the season. Examination of the effect of feeding on the longevity of adults and fecundity of females indicates that, in order to obtain more progeny for mass release, the adults should be fed continuously either on plain water or on 5-10% sucrose solution.

Utilization of *Trichogramma evanescens* **Westwood in the biological control of sugar cane borers: storage of parasitized eggs.** A. F. H. El-Sherif and M. T. Kira. *Proc. 16th Congr. ISSCT*, 1977, 779-785. – The egg parasite *T. evanescens* is used as means of controlling the purple-lined borer *Chilo agamemnon* Bles. in Egypt. Since the life cycle is short, many of the adults die if no borer eggs are available within a few days. Experiments were made to see if the parasites could be stored in their quiescent stage at low temperature, and it was found that storage could be extended by about 10 days without adverse effects on the emerged adults by keeping the parasitized eggs in a refrigerated cabinet at 1.5–3°C after an initial 4-5 days under laboratory conditions. Parasitized eggs which were stored for longer periods, up to 30 days, could be used successfully but not so efficiently in the laboratory mass rearing of the parasites.

Dispersal of *Trichogramma evanescens* **in sugar cane fields.** A. F. H. El-Sherif, M. T. Kira and M. H. Amin. *Proc. 16th Congr. ISSCT*, 1977, 787-795. – Parasitization of the purple-lined borer, *Chilo agamemnon* Bles., was achieved as far as 20 metres from the point of distribution of *T.evanescens* within 48 hours. The wind affected dispersion of the parasite but, in the absence of wind, dispersion was uniform and spontaneous in a circle of 5 metres diameter around the release point.

Further evaluation of fungicides for control of pineapple disease of sugar cane. G.R. Bechet. *S.African Sugar J.*, 1978, **62**, 85-88. – See *I.S.J.*, 1978, **80**, 146.

How sugar cane diseases rob us of our sugar. Anon. *Sugarland* (Philippines), 1977, **14**, (5), 11–12. – See *I.S.J.*, 1978, **80**, 338.

The species of *Xiphinema* **Cobb, 1913 (Nematoda: Longidoridae) in the sugar cane fields of Mauritius.** J.R. Williams and M.Luc. *Occ.Paper Mauritius Sugar Ind. Research Inst.*, 1977, (30), 19 pp.– Of 89 samples of soil taken from the regions of cane roots in Mauritius fields, 44 yielded *Xiphinema* spp. Details are given of the localities, altitudes, rainfalls and soil types involved in the 44 cases. Descriptions are then given of the five species *(X.brevicolle, X.elongatum, X.insigne, X.krugi and X.vulgare)*, followed by information on their distribution in relation to soil type, elevation and rainfall. *X.elongatum and X.krugi* are common in cane soils, the former occurring at lower altitudes and the latter in the central uplands. *X.insigne* does not often occur but is apparently relatively indifferent to the environmental factors affecting the first two; *X.brevicolle* is also rare in cane soils, while *X.vulgare* is restricted to sandy soil.

Some effects of the borer *(Diatraea saccharalis* **Fabr.) on the technological quaities of the juice and stalk of sugar cane.** O.Valsechi, E.R. de Oliveira and D.Barbin. *Brasil Açuc.*, 1977, **88**, 367 – 397 *(Portuguese)*. – Samples of CB 41–76 cane were collected between August and November from the cane areas of Piracicaba and Riberão Preto and relationships established between the extent of borer damage (which averaged 13.1%) and the Brix and pol of juice, reducing sugars and purity, glucose coefficient, stalk weight, fibre % cane, and pol % cane. An overall relationship was derived for the loss in available sugar % cane (Y) in relation to % borer damage (X): $Y = 14.8272 - 0.0563X$.

Immunofluorescent diagnosis of ratoon stunting disease. R.W.Harris and A.G.Gillaspie. *Plant Disease Reporter*, 1978, **62**, 193–196. – Details are given of the indirect fluorescent antibody technique (IFA), using anti-serum specific for a coryneform bacterium such as found to be associated with ratoon stunting disease. Comparison of results obtained by IFA with values given by phase contrast microscopy (PC) showed that the former method was up to 100 times more sensitive than the latter in revealing an organism morphologically similar to the RSD-associated bacterium in juice samples from five cane varieties exhibiting nodal symptoms of the disease. IFA cannot be considered as a quantitative method because of the uneven distribution of bacteria in the dry smear used and the possibility of loss during rinsing, but it is considered an excellent supplemental method. Micro–agglutination and bentonite flocculation were also tested as possible diagnostic methods, but neither was sufficiently sensitive to show a positive reaction with infected juice, even where a relatively high concentration of the bacterium was present.

Post–infection changes in the phenolic content of the nodal tissues of sugar cane. K.I.Wilson and D.N.Srivastava. *Indian Sugar*, 1978, **27**, 559–560. – Investigations on two red rot-susceptible and two moderately resistant cane varieties are reported. Some canes were inoculated with the red rot pathogen while others were not

inoculated but were deliberately injured. Random selections made 3 and 10 days after inoculation showed that the phenol content in the tissue of the node closest to the inoculation or injury spot was greater than in uninjured, healthy canes and rose with time, infection causing a greater increase than injury. The increase was greater in the resistant than in the susceptible varieties. Since the red rot pathogen gains entry chiefly via the nodal regions, the change in phenol content of the nodal tissue is considered a more suitable measure of degree of resistance than that of the stem juice.

Trash mulching, an alternative for chemical control of the sugar cane shoot borer, *Chilo infuscatellus* Snell. A.Subramanian, K.Kulasekaran and B.Velayautham. *Indian Sugar*, 1978, **27**, 575-578. – In two experiments, trash mulching was compared with chemical treatment for the control of *C.infuscatellus*. Results showed that trash mulching ten days after cane planting gave higher cane yield than did the best chemical treatment (in both experiments this involved a basal application of 10% BHC dust at 37.5 kg.ha–1 followed by two applications of "Endrin 20% EC" at 1875 $cm^3.ha^{-1}$ and almost doubled the cane yield obtained where no treatment was used.

Infection uptake of sugar cane smut for accurate rating of varieties. G.R.Singh. *Indian Sugar*, 1978, **27**, 591-595. The uptake of smut introduced by inoculation was determined for eight varieties over a 6-year period. It was found that the same variety could react differently in different years, but the mean % infection still fell within the range associated with the general behaviour of the cane towards smut, *i.e.* resistant or susceptible. A minimum of 3 years is thought necessary for an accurate rating of varieties. The physiological age of the bud was found to affect infection uptake, a higher uptake being obtained when the setts were from 8-months-old rather than 12-months-old cane, and where they were from the top rather than the bottom of the stalk.

Reactions of sugar cane varieties to the principal diseases in Brazil. Anon. *Brasil Açuc.*, 1978, **92**, 55–62 *(Portuguese)*. – A study has been carried out by the Phytopathology Section of Planalsucar and the results are reported in tabular form. They record the responses of 285 cane varieties to nine bacterial and fungal diseases.

Compatibility and pathogenicity of two races of *Ustilago scitaminea* Sydow in Taiwan. W.H.Hsieh and C.S.Lee. *Taiwan Sugar*, 1978, **25**, 46–48. – See *I.S.J.*, 1977, **79**, 196.

Vector–pathogen relationships of sugar cane white leaf disease. C.T.Chen. *Taiwan Sugar*, 1978, **25**, 50–54. Nymphs and adults of *Matsumuratettix hiroglyphicus* leafhopper were allowed to feed on white leaf-infected cane under laboratory conditions and were then transferred to healthy young cane, one insect per plant. The incubation period in individual vectors ranged from 14 to 40 days but was generally 25–35 days. After the incubation period, some 66% of the adult females and nearly 46% of the males appeared to posses infectivity; the others failed to transmit the disease. The shortest feeding period required for acquisition of the causal agent was 3 hours, and the rate of transmission was increased by extension of the feeding period.

A histological study on the infection of leaf blight of sugar cane. Z.N.Wang and C.S.Lee. *Taiwan Sugar*, 1978, **25**, 57–62. – A histological study of leaf blight infection by *Leptosphaeria taiwanensis* showed that the path of infection by the ascospores was through the stoma and epidermal layer. Appressoria, produced on the stoma or epidermal layer by germinating ascospores (1–2 days after inoculation), pushed out penetrating mycelia to enter the host tissue through guard cells or directly via the epidermal layer. The mycelia then spread intracellularly in the mesophyll, finally entering the xylem and phloem via the chlorophyll-bearing bundle sheath 4–7 days after inoculation. Somatogamous copulation between the two hyphae in the infected tissues and formation of primary perithecia occurred 8–10 days after inoculation. The matured perithecia discharged ascospores through a protruding ostiole. Penetration of the stomata and epidermal layer by the ascospores and completion of the infection cycle within 2 weeks of inoculation seemed to be a major factor in the rapidity of spread of the disease.

Grub damage? Haven't seen it for ages! W.A.C.Webb. *Cane Growers' Quarterly Bull.*, 1978, **41**, 100–102. – It is emphasized that while cane damage from grubs in Queensland has been light in recent years, there is risk of a dramatic increase in numbers of the adult beetles and hence in the grub population and resultant cane damage, unless BHC is applied to the soil as a preventive measure. Advice is given on treatment for control of one-year grubs of *Lepidoderma albohirtum* (greyback grubs) and of two-year *Lepidiota frenchi* (white grubs), which are generally more difficult to control than the greyback grub.

Wireworm damage in Innisfail district. A.A.Matthews. *Cane Growers' Quarterly Bull.*, 1978, **41**, 113. – Widespread damage to young cane crops in 1977 was attributed to the wireworm *Lacon variabilis*; the pest eats buds on germinating setts or ratoon stubble and can cause severe losses in both plant and ratoon cane. Application of 0.28 kg of "Aldrin" per ha gives control in plant cane.

Behaviour of ratoons towards the incidence of major pests of sugar cane in Uttar Pradesh. M.L.Agrawal and B.N.Pandey. *Maharashtra Sugar*, 1978, **3**, (7), 19–28. While ratooning has gained popularity among farmers in U.P., particularly because of the low costs of cultivating cane in the Co series as well as its early maturing properties and hence early harvesting potential, insufficient attention is paid to ratoon crops, which thus serve as breeding grounds for a number of cane pests. Investigations showed that populations of the black bug *Cavelerius excavatus* and white fly *Aleurolobus barodensis* were greater in ratoons than in plant cane, while numbers of the leafhopper *Pyrilla perpusilla,* shoot borers *Chilo infuscatellus and Raphimetopus ablutella* and top borer *Tryporiza nivella* were initially greater in ratoons but then became predominant in plant cane. The stalk borer *Chilo auricilius*, root borer *Emmelocera depressella* and termites *Odontotermes* spp. were found in larger numbers in plant cane than in ratoons. Manuring of ratoons affected numbers of specific pests, reducing them in the case of white fly and top borer, but increasing the population of termites.

CANE BREEDING AND VARIETIES

The flowering behaviour of latitudinally displaced sugar cane varieties. A. I. Allam, A. H. Nour and T. A. Fayed. *Proc. 16th Congr. ISSCT, 1977,* 283-290. – Cane varieties bred at centres of latitudes between 5°N and 30°N are able to initiate flowers naturally at Sabahieya, near Alexandria, Egypt (31°12'N). The flowering period generally starts in December (N:Co 310) and ends in June (Co 281, Co 290 and POJ 213), with a peak in January/February; this six-month period means that the flowering periods of many varieties overlap and indicates the possibility of using Sabahieya as a centre for flowering and crossing in the future. About 3000 full-grown selected clones have been sent as vegetative material to Mataana (25°N) for field trials and further selection under the prevailing natural conditions.

Varietal changes and their impact on yields of cane and sugar in Egypt. A. I. Allam. *Proc. 16th Congr. ISSCT,* 1977, 867-874. – Sugar yield has increased by 45% over the period 1950-1974 and this is the result of a combination of a 15% increase in cane tonnage and some 25% in the sugar content of cane. This has been brought about by substitution of older varieties with Co 413 in 1947 (now 11% of the cane area) and more especially with N:Co 310 (now 86% of the area).

Frost-tolerant varieties of sugar cane. S. D. Fasihi, K. B. Malik and B. A. Bukhtiar. *Proc. 16th Congr. ISSCT,* 1977, 1195-1202. – In February 1974 temperatures dropped as low as –3.3°C in the Punjab and the effects on a number of varieties were observed at the Lyallpur research institute. Response of varieties differed, L 118 and L 116 showing greatest resistance, with BL4 and L 124 also showing less damage than varieties CoL 54, CoL 44 and Co 564.

Sugar cane tissue culture research. R. C. Barba, A. B. Zamora, A. K. Mallion and C. K. Linga. *Proc. 16th Congr. ISSCT,* 1977, 1843-1864. – Callus formation on Philippine-bred varieties was observed using a modified Murashige & Skoog medium containing 0.05-5 $\mu g.cm^{-3}$ of 2,4-D. Supplementing the medium with protein extracts, coconut water and sucrose hastens callus formation. Nutritional requirements for differentiation of cane tissue cultures consisted of the base nutrient medium above, supplemented with combinations of sugar, coconut water, yeast extract and banana. On transfer to high (5.0 $\mu g.cm^{-3}$) 2,4-D medium, callus formation continued but showed reduced ability to differentiate shoots when transferred to a differentiation medium with low (0-05 $\mu g.cm^{-3}$) 2,4-D content. Colour variation occurred among the plantlets produced but could not be correlated with 2,4-D level. Substitutes for 2,4-D, i.e. 2-10 $\mu g.cm^{-3}$ of indole acetic acid and naphthoxy acetic acid, were unsatisfactory. On varying light intensity, differentiation of cultured cane callus was favoured by 200 and 700 footcandles. Plantlets exposed to 400 up to 1000 footcandles had a profusely branched root system, a high proportion of dry matter, a more vigorous stand and a higher percentage of survival when transplanted to soil. Potting experiments on newly harvested plantlets from tissue culture showed that misted conditions were more favourable to survival than ordinary greenhouse or moist chamber conditions. Compost, compost plus rice hulls, and white sand were the best potting media.

Mutation breeding of sugar cane in Taiwan. C. C. Lo. *Taiwan Sugar,* 1977, **24,** 450-456. – Work conducted at the Taiwan Sugar Research Institute in mutation breeding since 1966 is reviewed. A gradual decrease in sugar yields in Taiwan over the last 25 years and the need to obtain disease-resistant varieties (particularly those resistant to downy mildew and smut) have provided the impetus for the work. Important factors to be considered in mutation induction include the state of the buds selected for irradiation, the type of mutagen used, as well as its dosage and dosage rate, and methods of mutant selection, particularly the elimination of chimaeras and reduction in diplontic selection.

Studies on free proline association with drought resistance in sugar cane. K. C. Rao and S. Asokan. *Sugar J.,* 1978, **40,** (8), 23-24. – Considerable increase in the free proline content was found, during the early crop growth period, in pot-grown cane from which irrigation water was deliberately withheld for 12-14 days; no marked accumulation of proline was found in the later stages of crop growth, however. Drought-resistant varieties seemed to accumulate much more proline than drought-susceptible ones under moisture stress, so that the increase in proline content as an indication of varietal drought resistance is suggested.

Comparative study of 22 sugar cane varieties on the north coast of Villa Clara. R. Díaz M., A. Marín P. and A. Dávila I. *Centro Azúcar,* 1978, **5,** (1), 1-18 *(Spanish).* – Trials are reported of 22 varieties grown on a montmorillonitic brown plastic soil and a tropical gley soil typical of the north coast of Las Villas Province. The plant crop was grown for 21 months and ratoons harvested after a further 11 and 13 months, respectively. A statistical analysis was made of crop characteristics including yields of sugar and cane per hectare, sucrose % cane, plant population, crop height, etc., in order to select the best varieties, using B 4362 as the standard. Of the varieties tested, My 5450 proved best and is recommended for further extension work.

Q 96 – a variety to replace Q 63 in the Burdekin District. H. L. Boyle. *Cane Growers' Quarterly Bull.,* 1978, **41,** 103. – A description is given of Q 96, which is expected to replace Q 63 because of the latter's susceptibility to leaf scald, an outbreak of which has occurred in the Burdekin District of Queensland. Q 96 germinates well and has a fast early growth rate. While it does not ratoon well under dry conditions, with irrigation it produces excellent ratoon crops. It has a sucrose content potential at least equal that of Q 63. and in trials gave a much higher sugar yield per ha than did Q 63 or Q 80. It is adaptable to a wide range of soil types and is "reasonably" resistant to lodging. While it is susceptible to leaf scald (as well as chlorotic streak, basal stem rot and root rot), it is thought that the use of cold and hot water treatment and improvement in farm hygiene should ensure that any outbreak of leaf scald in the variety would not be as widespread as in Q 63.

SUGAR BEET AGRONOMY

Incorporation and metabolization of ^{15}N during sugar storage in beet. K.Koch. *Zuckerind.*, 1978, **103**, 308-311 *(German)*. — It is well know that nitrogen has an adverse effect on sucrose content during the sugar accumulation phase of beet growing, and it has also been established[1] that potassium stimulates ATP synthesis and CO_2 assimilation, this favouring sugar formation and the transport of assimilates to the storage organs. These effects were the subject of an investigation in which the uptake, distribution and metabolization of ^{15}N-labelled calcium nitrate in pot-grown plants during the storage period were determined under conditions of high K supply, *viz.* double or treble the concentration normally occurring in field-grown plants during the corresponding growth period. The labelled nitrate was applied over a 2-day period when already 83% of the complete root had formed and 68% of the total sucrose content had been synthesized, so that hardly any of the N was required for plant growth. Of the total labelled N taken up, 84.2% was incorporated in the leaves, 48% being rapidly converted from soluble compounds to leaf protein, a process which continued until harvest 6 weeks later. At the same time, some soluble N compounds were also displaced to the root, and rapidly converted to protein. Hence, in both leaf and root there was a constant fall in soluble N and a corresponding rise in protein N. Thus, in late summer, increased soil N availability (resulting from greater N mobilization) will not adversely affect beet quality and sugar content provided K availability is also sufficient to allow the formation of high-molecular protein as opposed to noxious amino-N compounds.

Preliminary reseach on the combined effects of herbicides and geodisinfectants on beet. G.Pritoni, S.Quaquarelli, P.Catizone and G.Venturi. *Ind. Sacc. Ital.*, 1978, **71**, 5-10 *(Italian)*. — Combinations of herbicides ("Metamitron" and "Pyrazone" at different rates) and geodisinfectants (commercial substances and experimental compounds) were applied to beet fields and it was found that, apart from transitory effects caused by "Phorate" and "Carbofuran" during emergence, there were no phytotoxic effects on the beet. At the same time, yields of beet, sucrose and extractable sugar were raised by the treatments, the effect varying with the geodisinfectant employed.

The elimination of weed beet and bolted beet. A.Vigoreux. *Le Betteravier*, 1978, **12**, (120), 10 *(French)*. — During May and the beginning of June, it is recommended to carry out two "attacks" on weed beet and bolters. The first step is to check for any beets that are out of alignment with the beet row or are clearly in the inter-row, inserting a marker at the point and then cultivating as close to the beet row as possible. Bolting must be avoided at all costs. The second step is therefore to check for bolters in the row and to remove the heads as soon as a flower stalk appears.

Imperial Valley tests monitor effectiveness of "herbigation". Anon. *Sugarbeet Grower*, 1978, **16**, (3), 22. — Mention is made of tests on application of "Ro-Neet" herbicide by irrigation sprinklers ("herbigation"). Of various methods tried, the most effective was 24-hour spraying of herbicide, although this was not as good as conventional mechanical spraying followed by 24 hours of sprinkler irrigation; 12 hours of "herbigation" before or after 12 hours of water application was less effective because of high daytime temperatures. There was little difference in phytotoxicity to beet between the various treatments, but there was greater phytotoxicity towards Sudan grass planted to a depth of ½-inch in alternate rows with the beet; the grass planted to a depth of 1½ inches was less affected, but most weed seeds occur in the top ½-inch of soil.

Disinfection of pelleted sugar beet seed. W.Hrubesch and F.Wieser. *Zuckerind.*, 1978, **103**, 400-407 *(German)*. The possible replacement of mercurial fungicides with other fungicides for beet seed pelleting was investigated with both healthy seed and seed infected with *Phoma betae* and *Fusarium* sp. Tabulated results indicate the effects of treatment on germination. While "Mancozeb" and TMTD were as effective as the mercurial compounds, neither "Benomyl" nor "Triforine" was suitable. "Tachygaren" was effective against *Pythium* sp. and *Aphanomyces cochlioides* and, when added to TMTD or "Mancozeb", had a positive effect on emergence. TMTD with "Mancozeb" alone had no effect on emergence, however.

Preventive and pinpointed spray applications of herbicides in sugar beet. W.R.Schäufele and C.Winner. *Zuckerind.*, 1978, **103**, 408-411 *(German)*. — The effects of various herbicide treatments as tested in 1974-77 are compared, particularly with regard to the influence of sowing time, soil preparation and spring weather. Because of the uncertainty of adequate control by pre-emergence treatment as a function of weather, it is suggested that perhaps it would be better to opt for a concentrated post-emergence treatment programme. The use of pinpointed spraying of weeds is also not considered of advantage since, for control of the greatest number of weeds, it must be delayed until relatively late in the season, by which time there is danger that many of the weeds will already be beyond the growth stage at which they are most vulnerable.

New techniques in beet cultivation. The combination of ultra-deep working of the soil with liquid fertilization will permit important increases in yields. T. Agosti. *Ind. Sacc. Ital.*, 1978, **71**, 52-54 *(Italian)*. — The advantages of very deep soil cultivation (80-90 cm), in combination with liquid fertilizer application, are discussed. Important increases may be obtained in yields, and the practice is particularly suited to dry Italian soils in order to obtain maximum utilization of the available water.

Nitrogen fertilization of sugar beet. J.Hébert. *Sucr. Franc.*, 1978, **119**, 239-246 *(French)*. — The role of nitrogen and the effect it has on the sugar beet are examined and an explanation given of the nitrogen cycle and the fate of N in the beet crop. The question of N requirement is discussed and reference is made to tests conducted with the aim of determining it.

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[1] Pflüger & Mengel: *Plant & Soil*, 1972, **36**, 417-425.

The production effects of sugar beet growing from precision seed. S.Krasucki and S.Siwicki. *Gaz.Cukr.*, 1978, **86**, 40-43 *(Polish)*. – A large number of trials were conducted during 1975 and 1976 on precision seed drilling to stand, in which the effects of increasing the inter-seed spacing from 6 to 9 or 12 cm were determined. The benefits of drilling to stand, particularly the savings in labour required for thinning, are discussed; it is stressed that the technique does call for higher quality of work, especially in the choice and use of herbicides to replace manual weeding, and in seedbed preparation.

A review of sugar beet research and prospects of sugar beet cultivation in Gujarat. M. H. Patel. *Indian Sugar*, 1978, **27**, 601-612. – A survey is presented of beet agriculture and processing, and cropping trials in India are reported.

Sugar beet cultivation in India. P.S.Arya and S.S.Saini. *Indian Sugar*, 1978, **27**, 615-617. – Recommendations are given on beet agriculture based on research in India.

Performance of sugar beet varieties under Hissar conditions. L. Bishnoi, R. S. Dhukia, N. L. Bhatia, A. D. Taneja and K. L. Behl. *Indian Sugar*, 1978, **27**, 725-726. – Results are given of beet varietal trials conducted at Haryana Agricultural University, Hissar, involving 18 varieties, of which Maribo "Monova 12724" proved the best in terms of sugar yield, closely followed by Maribo N, after which there was a noticeable reduction in sugar yield for the third beet variety, "Maribopoly".

Preliminary report on sampling of growing beet for purposes of yield predictions. M.Martens. *Publ.Trimest. Inst.Belge Amél.Betterave*, 1977, **45**, 179-195 *(French, Dutch)*. – A questionnaire was sent to organizations in 17 countries by the Institut International de Recherche Betteravière (IIRB) asking for information on beet sampling practices for yield prediction. The replies were used as the basis of a report, in which the techniques used are described. A prime feature of the report is the considerable variation between countries; it is suggested that the IIRB should help to standardize the practices and thus improve the accuracy of prediction.

Sugar beet yield and the effect of nitrogen on it as a function of rainfall and soil conditions. H.J.Müller. *Zuckerind.*, 1978, **103**, 488-493 *(German)*. – Investigations were conducted in 1966-73 in a dry and a wet area of Austria, the former being characterized by a winter rainfall of 130-310 mm and a summer rainfall of 180-575 mm, while in the wet area the winter rainfall is 150-400mm and the summer level 300-600 mm. In the dry area, rainfall in May, June and July had a close positive relationship with the positive effect of N on yield, whereas in the wet area there was a clear inverse relationship between N fertilization and winter rainfall, so that it was advisable to adjust N application rates to rainfall.

Preparation of the soil and sowing - operations which create conditions for complete mechanization in sugar beet cultivation. G.Clotan and N.Bria. *Prod.Veg., Cereale si Plante Tehn.*, 1978, **30**, (2), 19-24 *(Rumanian)*. Advice is given on optimum seedbed preparation (including herbicide spraying) and drilling (at an inter-seed spacing of 8-12 cm) as an aid to mechanical harvesting. The machinery used for the various operations is indicated in tables of data.

Results obtained with herbicides in demonstration plots of sugar beet. A.Ciorlaus. *Prod. Veg., Cereale si Plante Tehnice*, 1978, **30**, (2), 31-35 *(Rumanian)*. – Herbicide trials were carried out at a number of sites in various regions of Rumania in 1976 and 1977. The results are reported in the form of tables showing beet yields. Best results were generally given by "Ro-Neet", in combination with "Pyramin" or "Venzar", or by "Dual" in combination with "Pyramin" or "Venzar".

The need for irrigation. Some new views on the evidence. P.Draycott and A.Messem. *British Sugar Beet Rev.*, 1978, **46**, (2), 5-7. – Reference is made to beet irrigation trials in the UK over the last 30 years. It has been found that rainfall in the June-August period is significant – where it exceeds 150 mm, irrigation will give little or no increase in root yield, whereas irrigation has often increased yield considerably, particularly on sandy soil, when the rainfall has been <150 mm. After a dry summer, autumn rain often causes a drastic fall in sugar content, but this effect can be offset by irrigation earlier in the season. Contrary to popular belief, irrigation in June-August does not adversely affect sugar content and in some seasons may increase it. Of the four months June-September, the best as regards root yield increase under the effect of irrigation was July, which was only slightly better than June; August irrigation was slightly less effective than June irrigation, while September irrigation had no significant effect on yield. Root yield gains in October and November have proved to be the same with and without irrigation. Irrigation has no obvious positive effect where the plant population exceeds 70,000 per ha. Despite a widely-held belief that irrigated beets need more than 125 kg N per ha, experiments have shown that in dry summers the N requirement is lower when the crop is not irrigated, and maximum yields have been obtained where the N dosage rate is no more than 125 $kg.ha^{-1}$. Soil and plant analyses showed that irrigation water was needed to ensure that the crop used the N for growth early in the season – otherwise the N was taken up too late; this factor is of particular importance where soil leaching of N in the preceding winter is limited, since under normal winter conditions there is enough rainfall to remove most of the N remaining from a previous cereal crop. After a dry winter, beets have responded to applied N only when irrigated, and the sugar content has been greatly reduced. Investigations over a 11-year period have shown that roots extracted water to a depth of 65 mm by the end of June, thereby producing a water deficit. By the end of August, an average of 130 mm of water was removed to a depth of 140 cm; hence, irrigation may increase yield, even when the crop is growing in soil with considerable reserves of water.

Determination of sugar beet maturity. M.A.Dymko, I.G.Yaremchuk and O.I.Gulya. *Sakhar. Prom.*, 1978, (7), 59-63 *(Russian)*. – A description and instructions for use are given of a circular indicator disc, with rotatable segments, for determination of beet maturity on the basis of growth parameters as well as sucrose content and press juice purity. The "calendar" covers a 150-day growth period from emergence to the start of harvesting.

BEET PESTS AND DISEASES

Insecticide spraying sequences in the beet crop? G.Becker. *Die Zuckerrübe*, 1978, **27**, (3), 32-33 *(German)*. – Chemicals for control of specific pests or groups of pests are discussed and the benefits of an established programme of spraying indicated.

Occurrence of strains of *Cercospora beticola* resistant to triphenyltin fungicides in Greece. C.N.Giannopolitis. *Plant Disease Reporter*, 1978, **62**, 205-208. – Since 1961, when sugar beet was first grown as a commercial crop in Greece, there have been annual epidemics of *C.beticola* (leaf spot). Up to 1970/71, triphenyltin acetate (TPTA) and triphenyltin hydroxide (TPTH) were used for control of the disease; they were then replaced by "Benomyl", a benzimidazole fungicide, use of which was subsequently discontinued when strains of the disease were found which were resistant to it[1]. Triphenyltin compounds were then brought back into use and have been used exclusively since then, with satisfactory results. However, in 1976 and 1977, they gave inconsistent results, and, in trials, TPTA proved far inferior to another fungicide mixture, whereas in the previous three years both preparations had been equally effective. Studies on isolates from locations of differing fungicide histories revealed strains of the pathogen which were resistant or moderately resistant to triphenyltin fungicides, depending on the number of years the fungicides had been used. While the problem of resistance is not as serious as the resistance to benzimidazole fungicides, evidence suggests that the resistance will increase with time unless exclusive use of triphenyltin fungicides in Greece is discontinued.

The growth, pests and diseases of sugar beet in Belgium in 1976. L.van Steyvoort. *Publ. Trimest.Inst.Belge Amél. Betterave*, 1977, **45**, 159-175. *(French, Dutch)*. Details are given of the weather and beet growth behaviour in Belgium in 1976. Of beet pests mentioned, soil arthropods caused practically no damage to seedlings because of a considerable drop in their numbers as a result of general spraying with insecticides such as "Heptachlor" in previous years and because of the dry spell following drilling. Application of "Aldicarb" at sowing was effective in controlling the mangold fly *(Pegomya hyoscyami)*. This treatment, already applied to some 80% of the beet area in 1975, created a generally healthy crop, damage being minimal even in untreated fields. Caterpillars attacked beets in mid-July, much earlier than usual, but damage was not at an economic level. Aphids were severely affected by winter conditions and spring frosts, so that almost no green fly were found on winter hosts at the end of April. However, steady increase in aphid numbers occurred with the onset of warmer weather. In some 15% of fields not previously treated with "Aldicarb" there was need for aphicide spraying from May 15 with repeats every 12-14 days. "Aldicarb" gave satisfactory control up to the end of June, except in heavy clay soils (where absorption by the plants was reduced). Parasitism caused the disappearance of aphids by mid-July. Virus yellows incidence was relatively low in treated fields, and sugar losses caused by the disease were very low at an estimated 1.2% in contrast to 9.9% in 1975.

Control of the major sugar beet pests during the growth period and afterwards. V.Ciochia and M.Ionescu. *Prod. Veg., Cereale si Plante Techn.*, 1978, **30**, (2), 36-39 *(Rumanian)*. – Control of major soil-inhabiting pests of sugar beet such as millepedes, springtails, wireworm pygmy mangold beetle and nematodes is possible by means of good soil hygiene and application of a granular insecticide applied at drilling time. Where the numbers are still great or where granular chemicals cannot be used, application of "Lindatox 20" at 5 litres.ha^{-1} has been found to give good control, and is one of the chemicals found effective against caterpillars. "Heclotox" is not recommended because of its phytotoxicity to beet.

Beet cyst nematode. D.A.Cooke. *British Sugar Beet Rev.*, 1978, **46**, (2), 40-43. – Research into the beet cyst nematode and its potential danger to beet crops is discussed. While populations of the pest can increase at a considerable rate (two complete generations and sometimes a partial third generation occurring under UK conditions, while up to five generations may occur in warmer soils and with a longer growing season as in southern California), nematicides can prevent the larvae from invading the root system; as a result, the healthy and extensive root system can support a larger nematode population in the second generation, and a treated, infested field may give higher beet yields but have a larger final population of cyst nematodes than an untreated field. The pest may become a greater problem in the UK as a consequence of the lifting of statutory restrictions on the growing of host crops, which could lead to closer rotations and a resultant build-up of damaging nematode populations. Moreover, the proposed increase in beet growing in the UK would also lead to shorter rotations. Research at Broom's Barn Experimental Station is intended to increase knowledge on the relationship between the cyst nematode and its environment (as represented by host crop, soil type and climatic factors). Methods used to control the pest in beet-growing countries are examined; the main approach is through crop rotation, while there are no commercially available resistant beet varieties (and there is little prospect of any in the near future) and the amounts of granular nematicides and fumigants needed for control of the cyst nematode are so great as to be uneconomical.

Lesions on sugar beet roots caused by *Cercospora beticola*. C.N.Giannopolitis. *Plant Disease Reporter*, 1978, **62**, 424-427. – Roots of beet infected with leaf spot *(C.beticola)* were found to have sporulating lesions similar to those observed on the leaves. The lesions formed on those parts of the root above the soil and apparently were caused by conidia from the foliage. Since the disease reaches epidemic proportions in Greece almost every year, and excessive use of fungicides has led to resistant strains of the pathogen, most of the leaves become infected by August, so that inoculum is present at such levels that infection of the roots is inevitable. The percentage of infected roots at harvest was lower for a resistant than for a susceptible variety. Spraying with fungicide had little effect on disease incidence.

[1]Georgopoulos & Dovas: *I.S.J.*, 1974, **76**, 113.

CANE SUGAR MANUFACTURE

Process monitoring, instrumentation and control in the sugar industry. G.S.Varadan. *Electronics Information and Planning,* 1977, **4**, 789-828; through *S.I.A.*, 1978, **40**, Abs.78-462. – The present state of the sugar industry in India is outlined with tabulated statistics. Processes used in the manufacture and refining of raw cane sugar are described. The extent of instrumentation of individual processes in Indian cane sugar factories is indicated, and types of instrument and equipment which would enable improved control are described in more detail, with reference to the following stages of processing: cane weighing and unloading, juice extraction, juice weighing, clarification, evaporation, boiling in vacuum pans, crystallization, centrifugalling, weighing, packing and storage. Uses of bagasse, molasses and filter cake are summarized. In an appendix, an extensive specification prepared by the Directorate of Sugar of the Indian Ministry of Agriculture and Irrigation is given for a typical factory with a capacity of 1250 tonnes of cane per day to produce direct consumption white sugar.

Continuous first carbonatation process for cane juice clarification. S.L.Sang, C.H. Chen and J.F.Tong. *Rpt. Taiwan Sugar Research Inst.*, 1977, (78), 55-69 *(Chinese)*. – A continuous 1st carbonatation system is described in which juice, heated to 55°C, is treated in a series of four towers of identical dimensions, the first three being supplied with milk-of-lime and provided with automatic metering, and the last three receiving CO_2. The last two vessels are provided with automatic pH control means. Tests with a LiCl tracer showed that flow was almost plug-flow, indicating excellent mixing, while there was no significant difference between batch and continuous carbonatation in terms of juice colour, CaO content or filtrability; the continuous process led to an improvement of sugar colour.

New approach to efficiency calculations for bagasse-fired boilers. P. K. Hariharan. *Combustion*, 1977, **48**, (8), 14-16; through *S.I.A.*, 1978 **40**, Abs. 78-629. Since accurate weighing of large quantities of bagasse is difficult, an indirect method of calculating boiler efficiency is necessary. The carry-over of unburned fuel in the chimney can be calculated by weighing the material from the dust collector and assuming a value for dust collection efficiency. Other losses can be calculated or measured by known methods. An example is included showing that this method gives fairly accurate results.

Conditioning feed and boiler water. B.B.Khochare. *Maharashtra Sugar*, 1978, **3**, (5), 15-26. – The adverse effects of untreated boiler feedwater (scaling, corrosion and embrittlement of boiler parts and carry-over into the steam lines) are indicated, with descriptions of the specific salts and their roles. Methods of water treatment are then described, particularly ion exchange treatment, followed by standards which should be maintained for feedwater.

Finnsugar chromatographic separation process. H.Hongisto and H.Heikkilä. *Sugar y Azúcar*, 1978, **73**, (3), 56-61. – Details are given of the chromatographic separation process developed by the Finnish Sugar Corporation for sugar recovery from cane molasses[1].

Exhaustion of molasses – equipment to determine target purities. J.Bruijn. *S.African Sugar J.*, 1978, **62**, 151-152. See *I.S.J.*, 1978, **80**, 217.

Sugar losses in the tandem as an effect of micro-organisms. E.Duarte P. and J.L.Pérez. *ATAC*, 1977, **36**, (5), 37-45 *(Spanish)*. – The effects of microbial contamination in a mill on immediate sugar losses and subsequent losses in the process are briefly discussed, and an account is given of studies on a number of methods to reduce infection, *viz.* heating of imbibition water to 80-90°C, heating of third mill juice to 60-70°C and to 75-85°C, and the use of 20 ppm formalin, 25 ppm calcium hypochlorite and 20 ppm of an equal mixture of these, and the use of 25-30 ppm of F-100 disinfectant. The results were recorded in terms of reducing sugars formation, sucrose loss, counts of mesophilic bacteria, gumming bacteria and yeasts, as well as dextran content, and these are tabulated with corresponding data from untreated controls. The authors conclude that a disinfection system is necessary and that heating of maceration juices is highly advantageous, while the use of disinfectants gives improved results when the juice is heated only to 65°C.

Aspects of voltage in sugar factories and distilleries. C.Piedade, L.G.de Souza, S.H.Benez and W.Forastieri. *Brasil Açuc.*, 1978, **91**, 11-17 *(Portuguese)*. – Examination of conditions in the Brazilian sugar industry, in respect of the range of voltages employed and the need to rationalize, indicates that, for general distribution, the high voltage employed should be 13.8 kV for greatest economy, while for supply to motors, etc. it should be reduced to 380/440 volts against the 220 volts commonly used in Brazil.

The use of trisodium phosphate to avoid scale formation and corrosion in steam boilers. E.Frochlich. *Brasil Açuc.*, 1978, **91**, 18-23 *(Portuguese)*. – The advantages of the use of trisodium phosphate in the boiler house are briefly discussed and three methods of employing it are described, *viz.* prior addition as a softening agent to boiler feedwater, addition to the boiler to prevent formation of scale, and addition when scale has already formed – to soften and eventually remove it. A method is described for determing the phosphate content of boiler water.

Production of by-product power in the sugar industry to augment rural electrification. P. J. M. Rao. *Indian Sugar*, 1978, **27**, 695-709. – The possibility of surplus power generation by sugar factories in India for feeding to the public grid or for supply to villages (often too far removed from the public grid lines to make supply of small quantities of electricity economically justifiable) is discussed. Power for operation of irrigation pumps is of particular importance. Reference is made to practices in Australia, Hawaii and Mauritius, and mention is made of factories in India that at present produce surplus electricity.

[1] See *I.S.J.*, 1979, **81**, 181.

BEET SUGAR MANUFACTURE

Evaporator station standardized heat circuit for reduction of heat losses in sugar manufacture. D. Christoph and E. Manzke. *Die Lebensmittelind.*, 1978, **25**, 217-221 *(German)*. – Investigations in East German white sugar factories have shown that 49% of the steam consumed by an entire factory is represented by heat lost in various forms; 28.3% is lost in condenser water and 8.5% in condensate. While utilization of the heat in condenser water from mixing condensers, which has a temperature in the range 45-50°C, is considered unpractical, it is thought that a considerable reduction in the loss could be achieved by reducing the quantity of vapour to be condensed, *e.g.* by raising the thick juice Brix to 65°, increasing run-off Brix, not using water drinks in boiling, and making greater use of vapour heat. Ways in which the heat losses in condensate could be reduced are also listed. A heat scheme is described which includes complete utilization of secondary energy (expansion of condensate to a usable vapour quality and utilization of the vapour for heating processes, utilization of the residual condensate heat for water heating, and use of this water for diffusion). It is designed for use in conjunction with a DDS diffuser and is calculated to permit a 28% reduction in determinable heat loss. The economic effects for a factory of 2000 tonnes.day^{-1} slice operating on a 90-day campaign are tabulated.

Balance of a programme for combating pollution in beet sugar factories. J. P. Vellaud. *Sucr. Franc.*, 1978, **119**, 281-286 *(French)*. – In August 1973 an official instruction was issued by the French authorities regarding effluent treatment and disposal at sugar factories. In 1976/77 the activities of each factory in this sphere were examined. Details are given of the practices used for treatment and disposal of the waste from each factory process, with an indication of the quantities of water recovered and discharged for treatment prior to flow into watercourses. The COD, BOD_5 and MeS levels in the effluent from some 50% of the 66 factories in operation averaged 190, 90 and 35 g per tonne of beet processed, respectively, compared with official limits set of 250, 120 and 60 g per tonne. Conclusions drawn from the investigations are discussed.

Ring-type diffuser. N. N. Pushanko, B. D. Kovalenko and A. S. Dmitrash. *Sakhar.Prom.*, 1978, (6), 19-22 *(Russian)*. – Details are given of a ring-type diffuser designed by the authors for a daily throughput of 300 tonnes of beet. It comprises an outer stationary wall and an annular rotary section carrying, on a perforated bottom, a bed of cossettes having an initial height of 0.9-1.1 m. The rotary section is divided into 17 compartments. Cossettes are fed continuously via a steam-fed prescalder to a vertical chute and thence into the diffuser together with recirculated raw juice heated to 85°C, which is intended for final prescalding. Water is fed above the cossette bed in one of the sections, percolates through the cossettes to a tank from which it and the juice are pumped to above the next section opposite to the direction of movement of the diffuser. The tanks are of reducing height from the tail to the head sections in order to allow juice to spill over to the adjacent one when there is an excess. From the tank below the head section most of the juice is transferred to liming, while some is recirculated. The exhausted cossettes are removed by screw conveyor. Juice pumped to sections 1, 4, 9 and 15 is first heated to 78, 76, 72 and 65°C, respectively. Diffusion time can be adjusted within the range 45-100 min, optimum for healthy beets being 75-80 min and for frosted beets 60-65 min. Tests, in which the diffuser was operated in parallel with a twin-scroll DDS diffuser, showed that, under identical conditions (including a draft of 110-125%), the ring-type diffuser gave a juice purity 2.5 units higher than did the DDS and gave losses which were 0.1-0.2 units lower at 0.2-0.3% on beet weight.

A rotary water separator with self-cleaning separation screens. N. G. Lila. *Sakhar.Prom.*, 1978, (6), 28-29 *(Russian)*. – A beet-water separator is described which consists of an inclined rotary drum in which grids are formed of tapered pins fixed at one end only. As the mixture of beets and water passes from the flume to the drum, the acceleration created by the downward slope of the separator causes the beets to pass through the grids, while the water and solid impurities are retained. The use of a friction drive minimizes damage to the beets. The separator is being used at a number of Soviet factories.

Modernization of a KDA-30 diffuser. A. P. Parkhod'ko. *Sakhar.Prom.*, 1978, (6), 30-31 *(Russian)*. – The cossette transport system in a KDA-30-66 tower diffuser at a Soviet sugar factory was modified after it had proved defective with protracted use and considerably raised power consumption. Details are given of the modified system which operated satisfactorily in the 1977/78 campaign.

Making a seal for a disc filter. O. P. Marchenko. *Sakhar. Prom.*, 1978, (6), 31-33 *(Russian)*. – Details are given of the previously described rubber sealing ring and its preparation for use in a disc filter[1]. Modified filters at the author's factory operated satisfactorily for one campaign on 1st carbonatation juice and for two campaigns on 2nd carbonatation juice. Similar modifications to the seals on the shaft of a tower diffuser and prescalder also proved satisfactory.

Reduction of unknown losses – an important reserve for increasing the sugar yield from beet. A. Ya. Zagorul'ko, D. P. Oleinik, Yu. V. Tovstenko and V. D. Novoseletskii. *Sakhar.Prom.*, 1978, (6), 33-37 *(Russian)*. – Recommendations are given on ways in which unknown losses at each process stage throughout the factory can be reduced.

Errors in determination of active lime consumption – one of the causes of increased limestone consumption. L. M. Tuchinskii and B. P. Kuz'menko. *Sakhar.Prom.*, 1978, (6), 37-40 *(Russian)*. – While there are a number of factors responsible for increased lime consumption (including low limestone quality and poor kiln performance), at most factories recording abnormally high consumption the prime cause was inaccurate determination of the CaO content in limed juice. Guidance is given on the correct method of calculating a lime balance.

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[1] Kavun: *I.S.J.*, 1976, **78**, 344.

Corrosion prevention in the sugar industry. L. Zamecsnik. *Cukoripar,* 1978, **31**, 17-20 *(Hungarian).* – Causes of corrosion in a sugar factory, the typical degrees of corrosion (reduction in metal thickness) in specific equipment, and means of preventing or reducing corrosion (particularly by use of anti-corrosion coatings) are described.

An orifice-type flow meter. J.Komerec and V.Valter. *Listy Cukr.*, 1978, **94**, 106-111 *(Czech).* – Details are given of an orifice-type flow meter designed for measurement of flow up to 1.12 $m^3.min^{-1}$; the dimensions of six standard orifice plates were worked out by computer. The accuracy is better than ± 2.5%, and correlation between flow and reading is excellent.

Removal of non-sugars from thin juice by means of active carbon. H.Zaorska. *Gaz.Cukr.*, 1978, **86**, 49-51 *(Polish).* – Experiments on treatment of thin juice of known composition with "Carbopol" granular active carbon are reported. In the tests, 30-litre juice samples were treated with 80 g carbon for 17-20 minutes at 90°C. Tabulated results showed an average 8% reduction in non-sugars (of which 10% was carbonate ash), giving a 0.5 unit rise in purity to about 94.2. About 80% of the colouring matter was removed, giving an absorbancy of 0.2-0.275 at 420 nm. There was also a sharp fall in lime salts.

New type series of evaporators. K.Ubraniec, K.Wójcikowski, Z.Kisiel and E.Kaczmarski. *Gaz.Cukr.*, 1978, **86**, 53-54 *(Polish).* – Details are given of two standard types of evaporator based by their Polish designers on the conventional Robert type but, in one series, with a widened vapour space. Dimensions and application of each evaporator in the series are tabulated.

Utilization of a computer for product feed control. T.Kalityński. *Gaz.Cukr.*, 1978, **86**, 58-60 *(Polish).* – An explanation is given of a system of product feed control which uses a digital computer into which is fed information provided directly by telephone, so that the time lag between changes in information and alterations in the control requirements does not exceed 15 minutes. The system was tested at Lublin factory in 1974/75 campaign and, in a modified form, has been applied to boilers, pans, centrifugals, etc. in both Lublin and Krasnystaw factories.

Exhaustion of beet molasses. R.A.McGinnis. *Sugar Tech. Rev.*, 1978, **5**, 155-285. – Factors affecting beet molasses exhaustion are considered in detail and methods described for reducing molasses sugar by efficient operation of the vacuum pan, massecuite receiver, cooling crystallizer, mingler, reheater and centrifugals. Advice from the literature is given on optimum operation. Molasses exhaustion is governed by three factors, *viz.* area of crystal surface available for crystallization, time during which crystallization may proceed, and the crystallization rate; these factors are in turn dependent on other factors which are indicated. The causes of molasses formation are examined under their two main classifications: kinetic or mechanical, and thermodynamic or chemical. The melassigenic properties of various components are discussed and methods of determining melassigenic coefficients described. Methods considered which contribute to molasses exhaustion include, the pre-centrifugalling scheme of Grandadam[1] and high-temperature boiling. Methods for determination of dry substance and sucrose content as means of control of sugar house operations are listed, and guidance is given on establishment of balances from massecuite analyses. Examples of good molasses exhaustion are cited.

Heavy-duty electrical plant in the sugar industry. W.Goepen. *Zuckerind.*, 1978, **103**, 477-484 *(German).* With increase in automation and in the specific power requirements of sugar factory equipment, there is need for a corresponding increase in power supply. This has to be considered in relation to the technical and economic aspects, and one answer is the use of low- and medium-voltage electricity supply. The author examines the factors of importance in deciding on which type of voltage to use, and examines the power losses which occur with each: with low voltage, they are almost exclusively in the transmission sector, while with medium voltage they are mainly in the transformer. The effect of ambient temperature on transformer performance is discussed, and costs of the switch equipment (with and without cable laying) for both types of voltage are indicated. A detailed explanation is given of the mains technology involved, and calculation of the optimum cable diameter whereby heat losses to the environment are minimized. The advantages of 660 V A.C. for motors (as resolved by the IEC in 1967) over 380 V A.C. are discussed.

Microbiology of the sugar industry. A.Simonart and J. P. Dubois. *Sucr.Belge*, 1978, **98**, 201-215 *(French).* Principal means of preventing infection in the sugar factory are listed as: (1) establishment of as short an overall retention from beet to final product as is practical, ensuring that a minimum volume is in circulation and that there is no prolonged retention at any one individual stage; (2) maintenance (where possible) of process temperatures above the levels at which micro-organisms develop; (3) filtration; (4) use of disinfectants; (5) elimination of a maximum possible quantity of impurities; (6) suppression of possible accidental sources of infection, *e.g.* growth of moulds on finished products; and (7) regular microbiological control. Advice is given on application of these various methods to the individual factory processes, including the period between harvesting and washing of the beets and also covering liquid sugar production.

Experiences with an oil-fired lime kiln in Carlow. A.A.Connolly and V.G.Duigan. *Sucr.Belge*, 1978, **98**, 217-231. – See *I.S.J.*, 1978, **80**, 84.

Surface protection of the internal wall of white sugar silos. P.Godulla, M.Plath and H.D.Starke. *Die Lebensmittelind.*, 1978, **25**, 267-268 *(German).* – The use of PVC (polyvinyl chloride), epoxy resin and polyurethane coatings for protection of the internal concrete wall of a white sugar silo against the corrosive action of moist sugar and its decomposition products is discussed with reference to practices in East Germany.

Application of laminated pull chain in Russian Federation sugar factories. G.N.Stepanov. *Sakhar.Prom.*, 1978, (7), 29-31 *(Russian).* – Details are given of modifications to the chain used for the rake conveyors at Ust'-Labinskaya sugar factory.

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[1] *I.S.J.*, 1964, **66**, 360, 1967, **69**, 186.

LABORATORY STUDIES

The thermodynamics of aqueous sugar solutions. A. V. Zubchenko, A. Ya. Oleinikova and V. I. Buravleva. *Izv. Vuzov, Pischch. Tekh.*, 1978, (1), 47-50 *(Russian)*. The viscosity and density of aqueous solutions of sucrose, maltose, dextrose and levulose were determined at 303, 323 and 343°K and concentrations of 0.02, 0.04, 0.06 and 0.08 molar fractions; values of free energy ΔG (kJ.mole^{-1}), enthalpy ΔH (kJ.mole^{-1}) and entropy ΔS (kJ.mole^{-1}.°K^{-1}) were then calculated as a function of viscosity using as basis Eiring's theory of absolute reaction rates. Whereas values of ΔH were unaffected by temperature change in the case of sucrose, maltose and levulose, in the case of dextrose there was an abrupt change at 323°K as a result of alteration in the structure of the solution with change from monohydrate to anhydride, at which the structure became less sensitive to the effect of concentration. A similar trend was observed with ΔS.

Rheological properties of massecuites. III. Inclined flow and outflow from a vessel. J. Gebler, K. Číž and V. Hobíková. *Listy Cukr.*, 1978, **94**, 80-83 *(Czech)*. – The rate of flow of massecuite into e.g. a centrifugal, distribution trough or crystallizer, was studied in the laboratory under steady conditions. Model massecuites of varying crystal content and given crystal size were prepared and their flow rates determined as a function of temperature, angle of flow to the horizontal and height of the massecuite layer above the aperture. Experimental values *(a)* were compared with values *(b)* obtained on a basis of Bernoulli's theorem, and a flow coefficient obtained by dividing *b* into *a*. It was found that the higher the massecuite layer above the aperture the higher was the value of the coefficient, and that the value was in inverse relation to the angle of the slope.

The granulometry of white sugars. Determination of M.A. and C.V. G. Rens. *Sucr. Belge*, 1978, **97**, 169-174 *(French)*. – A method of calculating the M.A. and C.V. of white sugar samples is described, which is based on an empirical relationship between sieve mesh size x and the cumulative % weight of sugar passing through the sieves y. The resultant linear regression is used to plot a graph, for which a minimum of six successive sieves is required. While calculation of the factor z representing the linear value of y is relatively involved, the difficulty can be overcome by using a computer, reducing the time needed for the method to that of the Powers method.[1]

The industrial crystallization of sucrose in the framework of physical chemistry. V. Maurandi. *Ind.Sacc.Ital.*, 1978, **71**, 37-47 *(Italian)*. – The main physico-chemical parameters governing sucrose crystallization are reviewed, including the influence of temperature, saturation and supersaturation coefficients as well as crystallization enthalpy. The kinetics of crystallization are discussed mainly in respect of low-grade boiling. A theoretical equation is proposed which shows that crystal growth rate in relation to supersaturation passes through a maximum owing to the effect of high viscosity at the higher concentrations. Seeding at the start of the boiling process is discussed from the technological point of view, as are estimation of supersaturation from conductivity, boiling point elevation or rheometric measurements. The importance of the boiling programme in regard to white sugar storage in silos is discussed, while the usefulness of pre-centrifuging to increase low-grade massecuite retention time in the mixers and increase the massecuite crystal content is emphasized. The influence of K/Mg ion exchange and juice demineralization, combined with a correct crystallization programme, on the economics of the process is discussed with due regard paid to the costs involved in ecological protection.

Determination of the content of water in molasses and liquid sugars. C. A. Accorsi and G. Vaccari. *Ind.Sacc.Ital.* 1978, **71**, 48-51 *(Italian)*. – The water content of beet and cane molasses samples and of liquid sugars was determined by three methods: vacuum oven drying, refractive index measurement (direct and after 1:1 dilution), and the Karl Fischer titration method. Of the three, the last seems to be the most suitable for routine control.

Determination of silica in sugar factory products. P. Devillers, R. Detavernier, M. Groult and J. Roger. *Sucr.Franc.*, 1978, **119**, 231-237 *(French)*. – Descriptions are given of two methods used to determine silica in sugar factory products: (i) atomic absorption using a Perkin Elmer 300 unit, and (ii) a colorimetric method based on reaction of ammonium molybdate with silica and phosphate to form heterogeneous acids, followed by addition of oxalic acid to destroy phosphomolybdic acid and addition of amino-naphthol sulphonic acid to reduce silicomolybdic acid, whereupon the colour changes from yellow to blue. Tests were conducted on dilute silicon solutions and on juices, syrups and white sugar solutions, and the results expressed in graph and tabular form. It is concluded that method (i) is preferable for determination of higher silica contents ($\geqslant$ 5ppm), while method (ii) is more suitable for low silica contents ($\geqslant$ 0.2 ppm). The methods are of comparable accuracy under ideal conditions.

Boiling point elevation of pure sugar solutions. E. Šárka, M. Pražák and P. Kadlec. *Listy Cukr.*, 1978, **94**, 111-117 *(Czech)*. – Physico-chemical analysis was made of the relationship between BPE on the one hand and sucrose concentration of the solution and total pressure above the solution on the other. The equation derived by Nicol[2] on the basis of the Dühring rule, $\Delta T = AT_W + B$, in which ΔT is BPE, T_W is temperature of the water vapour in equilibrium (at identical vapour pressure) with the solution, and A and B are linear functions of molality, has proved suitable for concentrated sucrose solutions. Apparatus was constructed for measuring BPE of concentrated sugar solutions as a function of external pressure and concentration. Its basis was an ebulliometer specially designed by Tuzhilkin for concentrated sugar solutions. Experiments with it confirmed the validity of equations describing the dependence of active water in the solutions on sucrose concentration and on the boiling point of water within the limits of independent variables.

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[1] *I.S.J.*, 1948, **50**, 149-50.

[2] *ibid.*, 1968, **70**, 199-202.

BY-PRODUCTS

Distribution of organic matter during molasses alcohol fermentation and feed yeast cultivation on the slop. L.H.Wang, Y.C.Kuo and C.Y.Chang. *Rpt. Taiwan Sugar Research Inst.*, 1977, (78), 71-80 *(Chinese)*. Determination of the carbon content of ether-soluble, methanol-precipitable and methanol-non-precipitable fractions of organic matter during molasses alcohol and yeast fermentation showed that, although the C content in the fractions was almost the same as in the sugar (dextrose) consumed, it was not possible to predict fermentation efficiency from the C content of the fractions. The sugar provided only about one-quarter of the total C requirement for yeast cell production, the major requirement being met by the organic matter in the methanol-non-precipitable fraction. Again, prediction of yeast cell production was not possible from the C contents of the fractions. When equal volumes of vinasse and molasses were used for yeast cultivation, utilization of the organic matter in the vinasse was much greater than when it was used alone as the C source. The waste stream from yeast cultivation still contained 13-21% of the initial BOD: since cellulolytic enzyme treatment of the waste stream was found to increase the reducing power of the organic matter, the presence of organic components having β-glucosidic bonds was indicated. Hence, the cellulolytic enzymes must be included for effluent treatment.

Potash fertilizer from distillery waste. A.C.Chatterjee, B. M. Dutt and A. P. Lad. *Chemical Age of India*, 1976, **27**, 1036-1038; through *S.I.A.*, 1978, **40**, Abs.78-569. A process which has been tested on a pilot plant scale is outlined with a flow diagram. It involves neutralization of the vinasse with lime, triple-effect evaporation and drying in a rotary drum dryer.

Poultry feed and mixed fertilizers from distillery waste. B.B.Paul. *Chemical Age of India*, 1976, **27**, 1039-1041; through *S.I.A.*, 1978, **40**, Abs. 78-570. – Problems of vinasse disposal in India are outlined. The recommended method is to concentrate the vinasse from 9-10% to 80-84% dry solids in a triple-effect evaporator, with reverse flow, i.e. from the coolest to the hottest body, so that the increase in viscosity is counteracted by the increase in temperature. Material withdrawn from the third body of the evaporator is centrifuged to remove the nitrogenous material, which is dried in a coating pan with crushed grains to obtain poultry feed. Concentrated vinasse leaving the first body is mixed with urea or ammonium sulphate to produce a fertilizer.

Wealth from agrowaste. K.Mannivannan. *Chemical Age of India,* 1976, **27**, 1055-1057; through *S.I.A.*, 1978, **40**, Abs. 78-581. – Among the agricultural wastes briefly discussed are bagasse, which could be used for making alcohol by saccharification and fermentation, and molasses, the storage and utilization of which in India should be improved to increase the output of alcohol and to produce e.g. yeast.

Dried beet pulp. A. M. Paulais. *Elevage Bovin*, 1978, (69), 39-43; through *S.I.A.*, 1978, **40**, Abs. 78-432. The composition of dried pulp is given and its fodder value is compared with that of other feedstuffs. A short account is given of studies by other workers on the use of dried pulp in feeding dairy or beef cattle.

Liquid carbonatation mud. Anon. *CSM Informatie*, 1978, (323), 12; through *S.I.A.*, 1978, **40**, Abs. 78-435. – At Halfweg factory, Holland, the mud is diluted to 47-52% dry solids content and conveyed by road tankers, from which it is pumped to vehicles which distribute it on the fields.

Comparative economic value of by-products of the sugar industry. J.M.Paturau. *Maharashtra Sugar*, 1978, **3**, 9-14. See *I.S.J.*, 1979, **81**, 59.

The alcohol industry in perspective. M. K. Patil. *Maharashtra Sugar*, 1978, **3**, (5), 41-44. – Of the alcohol produced from cane molasses in India, 85% is used for industrial purposes; however, there is uncertainity as regards government policy on alcohol manufacture, with the result that more than 60% of the distilleries in Maharashtra have closed or are near to closing. With sugar production ahead of consumption in India, the author suggests following the example of Brazil and producing alcohol not only from molasses but from cane juice. The advantages of juice as feedstock and the economics of alcohol manufacture from it are discussed.

The industrial uses of bagasse and its fuel value as compared with fossil fuels. J.E. Atchison. *Sugar y Azúcar* 1978, **73**, (3), 39-44. – Factors to be considered in establishing the basic purchase price of bagasse are discussed. The most important factor is the cost of alternative fuel, and while the cost of such fuel has risen sharply over the past few years, thus raising the price of bagasse, so too has the fuel value of other fibrous materials used for manufacture of pulp, paper or particle board. Modern trends to which reference is made include bulk storage (particularly wet storage) of bagasse, and partial depithing at the sugar factory, which leads to appreciable savings in handling, transport and storage costs while permitting the pith to be returned to the bagasse boilers for use as fuel.

The industrialization of derivatives as a support for the economy of sugar production. H.Noa S. *Revista ICIDCA* 1977, **11**, (2/3), 8-26 *(Spanish)*. – A review is presented of the opportunities available to cane sugar producing countries for utilization of sugar industry derivatives in the manufacture of commercially valuable products which can augment the income of those countries from sugar.

The production of pulp and paper from bagasse. P.L. Gutiérrez. *Revista ICIDCA*, 1977, **11**, (2/3), 27-32 *(Spanish)*. – The value of bagasse as a source of pulp and paper is discussed with reference to the Cuba 9 project for its utilization[1].

The products of the sugar industry as a source of animal fodder in the tropics. O.Almazán. *Revista ICIDCA*, 1977 **11**, (2/3) 32-54 *(Spanish)*. – A general survey is presented of the potential of sugar industry by-products as a source of fodder for cattle.

[1] See *I.S.J.*, 1979, **81**, 222.

Development of the production of furfural from bagasse. G. Ocampo S., G. Blanco C., M. A. Young and R. Suárez R. *Revista ICIDCA*, 1977, **11**, (2/3), 55-81 *(Spanish)*. The development of furfural manufacture from pentosan-containing agricultural wastes is briefly discussed and a survey presented of the applications of the product. The current and prospective situations for world production of furfural are reviewed and economic aspects of the utilization of bagasse for its manufacture considered. The authors consider that furfural production should be very profitable.

Problems associated with the preparation and supply of bagasse to the derivatives plants. P.López G. *Revista ICIDCA*, 1977, **11**, (2/3), 82-91 *(Spanish)*. – A review is made of factors relevant to the provision of bagasse for utilization, *i.e.* the substitution of a different fuel in the sugar factory, methods of preparation according to the subsequent use, transport to the derivatives plant, and storage.

Investigations on the kinetics of beet pulp drying. J. Malczewski. *Gaz. Cukr.*, 1978, **86**, 28-30 *(Polish)*. Tests were conducted on beet pulp drying in a laboratory-scale unit which consisted of a gas diffuser leading to a tube housing an electric heater after which was a rotary tube section with an axial fan at the end. Air or a steam-air mixture of known temperature and moisture content was passed at a given velocity through the pulp, and the fall in pulp moisture determined at 5-min intervals up to about 40 min. Results are given in graph form.

A comparison between grass silage and sugar beet tops silage for dairy cows. B. Frank. *Socker Handl.*, 1978, **29**, 17-32. – No significant differences in milk yield and quality were found between Friesian cattle fed on a ration containing grass silage and cows fed on a ration containing beet tops silage of the same weight as the grass silage. On the basis of equivalent metabolizable energy or organic matter weight, the beet tops silage was slightly cheaper than the grass silage.

Efficiency of removal of colouring matter from molasses during its complex processing in the alcohol industry. V. N. Shvets, E. I. Knogotkova, T. P. Slyusarenko, L. N. Pavlyuchenko and A. O. Abdykerimov. *Izv. Vuzov, Pishch. Tekh.*, 1978, (2), 106-111 *(Russian)*. – Investigations were conducted on the effect of molasses solution decolorization by resin on the activity of saccharomycetes and fodder yeast cultures, as well as on the effect of molasses wort decolorization on glycerine formation by the yeast cells and on yeast biomass synthesis. An average 74% reduction in the colouring matter (represented primarily by invert sugar alkaline degradation products, melanoidins and caramelan) considerably increased the yeast yield and zymase and maltase activity and reduced the colour of the yeast. Decolorization had no effect on accumulation of higher alcohols, organic acids, esters or glycerine, while the aldehyde content in the finished wort fell sharply. The colouring matter in the vinasse was found to have no negative effect on fodder yeast manufacture from *Candida utilis*, yield of which was raised by 20-30% when a two-stage process was used which was based on decolorized vinasse as feedstock. The colouring matter did have a strong inhibiting effect on growth of *Trichosporon cutaneum*.

Ethyl alcohol – the automobile fuel of the future. W. H. Kampen. *Sugar y Azúcar*, 1978, **73**, (4), 18-30. The properties and uses of ethyl alcohol are summarized and the possibility of producing it from cane juice by fermentation and distillation is discussed. Details are given of a general scheme, with more detailed descriptions provided of a continuous fermentation system and a multi-column continuous distillation system (the rectifying column controls being shown in a diagram). Disposal of the waste, of high organic content, is discussed and the economics of alcohol manufacture examined.

Low-cost, low-labour silage. D. Stacey. *British Sugar Beet Rev.*, 1978, **46**, (2), 49. – Details are given of the system used on a Herefordshire farm in which one man harvests the beets and collects the tops for ensilage at minimum soil contamination and minimum cost. In the first season, the silage had a crude protein content of 17.8%, and the cattle found it more palatable than high-quality grass silage; the ration was one-third beet tops silage to two-thirds grass silage.

Basic data on continuous alcoholic fermentation of sugar solutions and of mashes from starch-containing raw materials. W.Engelbart and H.Dellweg. *Paper presented at Int. Symposium on Alcohol Fuel Technology, Methanol and Ethanol*, 1977, 8 pp; through *S.I.A.*, 1978, **40**, Abs.78-686. – For continuous fermentation, it is desirable to use a one-stage process in order to inhibit bacterial growth and to minimize the effects of disturbances in *e.g.* feed rate. This requires a yeast which can grow and ferment at high ethanol concentrations (7-10 vol. %). Tests on the continuous fermentation of glucose solutions by a special agglomerating strain of *Saccharomyces carlsbergensis* are described. Under optimum conditions, ethanol yield was $>$ 98% of theoretical. With molasses substrates, yeast growth was strongly inhibited at ethanol concentrations $>$ 5 vol.%, possibly owing to the presence of caramel. This inhibition did not occur with beet juice as substrate.

Direct production of ethanol from sugar cane. K.Rudolph, R.Owsianowski and W.Tentscher. *Paper presented at Int. Symposium on Alcohol Fuel Technology, Methanol and Ethanol*, 1977, 3 pp; through *S.I.A.*, 1978, **40**, Abs.78-718. – The feasibility of producing ethanol from cane in separate factories was investigated. The substrate fermented may be juice extracted by a simplified method (process 1) or cane disintegrated by a hammer mill (process 2). The optimum process involves steam treatment of the cane for ½ hr at 110°C and the b.p. in processes 1 and 2, respectively. The cane:water ratio in process 2 should be between 1:1 and 1:2, giving a sugar concentration in the mixture $<$ 5%, and a final ethanol concentration of 2.5%. In process 1 these concentrations can be approx. 10% and 5%, respectively. In pilot-scale tests, the juice from 1.5 tonnes of cane per hr was fermented to produce approx. 3000 litres absolute ethanol per day. If cane is to be fermented directly, treatment with dilute molasses instead of water is recommended, in order to increase the carbohydrate concentration in the substrate to 18%.

Direct processing of sugar cane to ethanol. H. Brüschke. *Paper presented at Int. Symposium on Alcohol Fuel Technology, Methanol and Ethanol*, 1977, 3pp; through

S.I.A., 1978, **40**, Abs.78-719. – If the end-product from cane is to be ethanol instead of sugar, the operating conditions can be entirely different, since it is unnecessary to prevent inversion or extraction of non-sucrose. Cane which is over-ripe, frost-damaged or has dried out during transport can be used. On fermentation with baker's yeast of cane which had been partially disintegrated so that its bulk density was 550-600 $kg.m^{-3}$ and mixed with water in the ratio 1:1, approximately all the sugar was converted to ethanol in 48 hours. However, a more economical process involves hammer milling of the cane so that its bulk density is 350-450 $kg.m^{-3}$, heat treatment and juice extraction to obtain a clear, sterile solution in which the sugar concentration is not much lower than in the cane. This solution is fermented without further treatment; tests showed that non-sucrose did not interfere and that > 99% of the volatile fermentation products consisted of ethanol. The total energy requirements could be met by combustion of about two-thirds of the bagasse produced.

Economics of treatment and disposal of distillery wastes. V.Hanumanulu and P.V.R.Subrahmanyam. *Seminar on Treatment and Disposal of Effluents from Sugar and Distillery Industries* (India), Distillery Section 1-10; through *S.I.A.*., 1978, **40**, Abs.78-700. – Indian distilleries discharge about 15 litres spent wash (vinasse) per litre of rectified spirit produced. Properties of vinasse from three distilleries are tabulated. The recommended method of purification is two-stage anaerobic lagooning to decrease the BOD from about 40,000 mg per litre to about 2400 $mg.litre^{-1}$; this may be followed by activated sludge treatment in an oxidation ditch to decrease the BOD to approx. 100 mg. $litre^{-1}$. Effluent from the first process can be used for irrigation; that from the second process can be diluted with condensate if necessary and discharged to a watercourse. Costs of treatment by one or both processes are estimated.

Studies on treatment of distillery wastes. S.T.Kale. *Seminar on Treatment and Disposal of Effluent from Sugar and Distillery Industries* (India), Distillery Section 11-18; through *S.I.A.*, 1978, **40**, Abs.78-701. – Problems involved in processing distillery wastes are described. Yeast residues from the fermentation tanks can be treated with bacteria to disintegrate the gums, then diluted and flocculated; the sludge is settled in a continuous clarifier and dried to give a powdered yeast which can be used in cattle feed. A suitable method for treating the vinasse involves digestion by bacteria at 54-55°C and pH 6.8-7.2 to produce a gas which contains 60-65% methane, 30-35% CO_2 and 4-5% H_2S and may be used as fuel. The BOD of effluent from this process is 2000-3000 ppm; mechanical aeration is necessary to decrease it further to 500-700 ppm.

Nutritive value of distillery effluent and its effect on soil properties. M.L.Agarwal and S.P.Dua. *Seminar on Treatment and Disposal of Effluents from Sugar and Distillery Industries* (India), 1976, Distillery Section 26-29; through *S.I.A.*, 1978, **40**, Abs.78-702. – Vinasse was diluted twentyfold and applied to experimental plots in amounts equivalent to 100, 200 and 300 kg N per ha. The two lower levels increased the yield of cane per ha but decreased the available sugar % cane; however they increased the calculated yield of sugar per ha. Application at 300 $kg.ha^{-1}$ N caused all these parameters to decrease.

Biochemical purification of highly concentrated effluents from molasses-alcohol factories. V.A.Vitkovskaya, Yu.M.Kravets, E.S.Adamenko *et al. Mikrobiologich. Metody Bor'by s Zagryazn. Okruzhayushchei Sredy*, 1975, 24-26; through *S.I.A.*, 1978, **40**, Abs.78-703. Vinasse typically has a BOD of 20-50 $g.litre^{-1}$; 90-95% of this can be removed by two-stage methane fermentation at a loading of 1.84-2.35 kg BOD per $m^3.day^{-1}$, while > 98% of the residual BOD can be removed by activated sludge in two aerobic tanks with a regenerator, at a daily loading of 800-2000 mg BOD per litre. Some details are given of the compositions of the intermediate water, purified water and activated sludge.

Pulping technique for agricultural fibres. A.J.Ernst and T.F.Clark. *IPPTA*, 1973, **10**, (1), 29-32; through *S.I.A.*, 1978, **40**, Abs.78-722. – Laboratory tests were carried out on the effects of pressure and NaOH concentration on the mechano-chemical pulping of bagasse and wheat straw. At atmospheric pressure, a "Hydrapulper" and a "Dynapulper" gave pulps with similar properties. With increasing pressure in the range 0-30 $lb.in^{-2}$, the lignin content of the bagasse pulp decreased, while the screened yield was a maximum of 69% at 10 $lb.in^{-2}$. The chlorine consumption in bleaching decreased markedly as pulping pressure increased. Strength characteristics of the pulps obtained are tabulated.

Resolution of crude sugar cane wax alcohols and sterols by urea column. B.Y. Rao, S.B.Joshi, S.U.Lakhani and C.V.N.Rao. *J.Oil Tech.Assoc. India*, 1976, **8**, (2), 31-34; through *S.I.A.*, 1978, **40**, Abs.78-725. – The unsaponifiable compounds in crude cane wax were separated from the saponifiables; the former were separated into hydrocarbons (22.8% on wax) and alcohols + sterols (40% on wax). The alcohols and sterols were acetylated and subjected to urea column chromatography, and the fractions were examined by thin-layer chromatography. The percentages of these compounds in the crude wax were: sterols, 10.8%; alcohols below C_{26}, 1.4%; C_{26} alcohols, 13.7%; C_{28} alcohols, 7.7%; and C_{30} alcohols, 6.4%.

Alcohol from sugar cane in Louisiana. H.S.Birkett and J.A.Polack. *Sugar J.*, 1978, **40**, (12), 9-11. – The authors examine the economics of ethyl alcohol production from sugar, from cane and from molasses. Under Louisiana conditions, only manufacture from molasses could be economically attractive, provided the distilleries operated throughout the year. The amount of alcohol which could be produced annually from 1 million, 1.65 million and 3.3 million tons of cane (3000, 5000 and 10,000 tod, respectively) and the corresponding monetary returns are calculated. The results show that only the molasses from 3.3 million tons of cane could give a return on the alcohol produced from it, but that the quantity would still be much smaller than required for use as a 1:9 alcohol gasoline blend. Since petrochemical plants producing alcohol from ethylene in the USA are at present operating at below full capacity, it is considered that molasses alcohol would not be readily accepted for use as chemical feedstock. Mention is made of factors which have not been considered in the cost analysis, but it is felt that the amount of cane in Louisiana is not adequate to make any sizeable contribution to the energy situation in the USA.

Tanzania sugar statistics[1]

	1978	1977	1976*
		tonnes, raw value	
Initial stocks	14,849	13,382	10,060
Production	135,537	107,521	110,386
Imports	35,615	19,400	11,933
	186,001	140,303	132,379
Consumption	140,444	114,464	94,902
Exports	13,608	10,990	24,095
Final stocks	31,949	14,849	13,382

* tel quel.

New Pakistan sugar factories[2]. — A new sugar factory, the 32nd in Pakistan, was inaugurated at Pasrur in Sialkot District on February 21, 1979. The factory, completed at a cost of Rs. 190 million, has a crushing capacity of 1500 t.c.d. Another factory, at Thatta, in Sind Province, had been inaugurated a week earlier; it has a production capacity of 135 tonnes daily, to be raised to 218 tonnes by June 1980.

Argentina bagasse paper plant[3]. — The Argentina Government has authorized a US$175 (equivalent) investment by Papel de Tucumán, for the setting-up of a newsprint plant (the second one in the country) in Lules, Tucumán, to use bagasse as its raw material. The plant is expected to begin operations in 1981 with a total capacity of 105,600 tonnes a year.

Cane planter manufacture in Cuba[4]. — In November 1978 production of a new cane planter began at a factory in Camagüey city. Tractor-drawn, the planter can work on wet and slippery soils; it opens a furrow, cuts the cane into billets, sows them, applies fertilizer and covers the cane, all in one operation. The new machines were expected to plant more than 50,000 hectares of cane land for the 1979 crop.

Morocco sugar production 1978/79[5]. — In 1977/78, production of sugar suffered from prolonged drought conditions. As a result output declined to 239,523 tonnes, compared with 285,412 tonnes in 1976/77. However, improved conditions helped to increase sugar production in 1978/79 to 397,636 tonnes, according to an announcement from the Ministry of Commerce and Industry.

Computerized commodity data bank. — A new, exclusive service, provided jointly by Eurocharts Information Service and the I. P. Sharp Associates international time-sharing network, enables direct dialling at low cost into what is described as one of the world's most advanced computer banks of commodity price data. Eurocharts' London commodity data base includes detailed current and historic price information on all major commodities traded in London and is stored in a form suitable for manipulation by conventional methods of technical analysis. A library of purpose-designed programmes is available, while users can devise alternative techniques. The Sharp network has access points throughout North America, Europe and Australia. A telephone call to the local access point links the subscriber direct to the data base. Using his own terminal, or even an ordinary telex machine, and Sharp's specially designed APL language, the subscriber can analyse past and present commodity market behaviour. Further information may be obtained from Eurocharts Information Service, 194/200 Bishopsgate, London EC2M 4NR, England.

New Indian sugar research facility. — The co-operative sector of the sugar industry in the Indian state of Maharashtra has established the Deccan Sugar Institute at Pune with the object of carrying out research on field and factory problems, as well as the study of by-products utilization and provision of advisory, extension and information services to member factories and also training in cane cultivation, sugar technology and engineering, instrument maintenance and sugar industry management. A progress report recently published describes the work of the Institute.

Czechoslovakia sugar exports[6]

	1978	1977	1976
		tonnes, tel quel	
Algeria	30,130	6,315	0
Germany, West	2,209	1,059	435
Indonesia	0	25,107	0
Italy	1,262	43	0
Jordan	45,680	2,173	542
Kenya	0	11,717	0
Lebanon	5,092	4,826	0
Norway	3,936	2,317	10,054
Saudi Arabia	162,930	110,949	26,174
Singapore	2,609	0	0
Sri Lanka	5,185	4,598	0
Sudan	22,826	0	0
Switzerland	0	1,457	900
Syria	17,120	0	0
USSR	0	0	31,522
Yemen, South	5,429	0	1,087
Other countries	1,693	173	782
	306,101	170,734	71,496

Süddeutsche Zucker-AG campaign results, 1978. — Because of heavy rainfall during the harvest, beet deliveries were delayed and dirt tare was high, and average slicing rate was reduced from 59,300 tonnes per day in 1977 to 57,800 in 1978. Despite a 6% reduction in area, from 109,000 to 103,000 hectares, and a reduction in yield from 52.9 to 49.3 tonnes.ha^{-1}, production of sugar amounted to 759,000 tonnes (against 786,000) by reason of the unexpectedly high sugar content. Total beet slice was 5,077,000 tonnes against 5,768,000 tonnes in 1977. The method of paying beet growers according to beet quality, introduced in the 1978 campaign, proved to be a success and will be continued in 1979. The beet area for 1979 will be unchanged.

EEC Commission proposals for high fructose corn syrup[7]. Following the decision of the European Court of Justice in October 1978 that the levy on HFCS was too high[8], the Commission proposed that the levy for 1979/80 should be similar to that for beet sugar, with a levy-free A-quota, a B-quota subject to a production levy and a C-quota which can be sold only outside the EEC without any export subsidy. The proposed levy would be the same as that borne by EEC sugar producers, i.e. only 40% of the levy raised on B-quota sugar because the remaining 60% is passed on to the sugar beet growers. The Commission also proposed that the A-quota for HFCS should be based on recent production levels. Belgium supports the Commission's proposals and the UK is also keen to ensure that a new regime does not discriminate against HFCS, while Holland and Ireland, among other countries, do not think any advantage should be granted to HFCS. Several countries, led by France, consider that the proposals are too generous and that the A-quota should be smaller and that manufacturers should pay the full levy on B-quota instead of 40%.

Philippines project for alcohol from cane juice[9]. — Under a Philippines Government scheme, 6000 hectares of cane are to be set aside for production within two years of 100,000 litres a day of anhydrous alcohol for admixture with gasoline for use as motor fuel, and a site is being sought for installation of the first plant to be used for production of "alcogas" from cane juice.

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[1] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, S80.

[2] *World Sugar J.*, 1979, **1**, (11), 31.

[3] *Bank of London & S.America Review*, 1979, **13**, 154.

[4] *Cuba Economic News*, 1978, **14**, (89), 10.

[5] *World Sugar J.*, 1979, **1**, (9), 30.

[6] I.S.O.; through C. Czarnikow Ltd., *Sugar Review*, 1979, (1436), 76.

[7] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 273.

[8] *I.S.J.*, 1978, **80**, 384.

[9] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 196.

Peru sugar exports[1]

	1978	1977	1976
		tonnes, raw value	
Canada	0	10,668	0
Chile	11,989	87,706	32,785
China	0	25,948	0
Colombia	0	4,501	0
Korea, South	13,650	0	0
Portugal	0	26,600	13,000
USA	240,254	256,409	238,215
	265,893	411,831	284,000

EEC sugar dumping in the US[2]. – The International Trade Commission, by a unanimous vote, found that the US domestic sugar industry had been injured by imports of sugar dumped, i.e. sold at prices below that prevailing in the home market, by the EEC, as alleged by Florida sugar interests[3]. Future sugar imports from the EEC will become liable to additional duties. The EEC has not reacted to the action since only C-quota sugar exported by individual European sugar companies is involved and the amounts involved are insignificant.

CSR Ltd. annual report, 1979. – The CSR Group's seven Queensland mills crushed 5,740,000 tonnes of cane to produce 776,200 tonnes of raw sugar (829,700 tonnes in the previous year). This was 27% of the Australian total. Mill plant operated very efficiently and the high 1977 crushing rates were maintained. The lower outturn was due to the restrictions placed on Australian production by International Sugar Agreement quotas. The five Australian refineries made 704,500 tonnes of refined sugar products, 11,800 tonnes less than in the previous year. The New Zealand refinery made 148,000 tonnes, 1800 tonnes less than in the previous year. Capital expenditure in the Group's seven mills was $A 18.3 million, part of the programme of capacity increase and up-grading begun in 1975 which has cost $A 110 million so far. When the programme is complete next year milling capacity will have been raised by about 40%. Capital expenditure on the six Australian refineries amounted to $A 9.8 million against $A 9.4 million in the previous year. The three New South Wales mills were transferred to a co-operative company as from March 31, 1978, under an agreement concluded in July 1978. Operating staff and technical services will continue to be supplied by CSR until 1983. The three distilleries producing ethanol from molasses increased sales and profits.

Ethanol from molasses in Hawaii[4]. – The state of Hawaii is now in the start-up phase of a project to produce ethanol from molasses. The state's interest stems from a desire for an in-state source of motor fuel, the fact that the technology is well-established and reliable, and because there are idle facilities available to convert the molasses. If ethanol production is preferred, some of the current practices – burning of bagasse, for instance – may change; another programme of plant breeding to optimize both cellulose and sucrose yields will be necessary as will the conservation of plant material now burnt off. The biggest change will be the diversion of molasses from animal feeds to ethanol production, however. The current project is making use of a rum plant that operated until the middle 1960's and produced up to 3600 proof gallons per day. Considerable renovation of the facilities is necessary. The ethanol will be produced by fermentation with *Saccharomyces cerevisiae* and it is estimated that a short ton of molasses will produce about 73 gallons of 95% ethanol over 72 hours by a batch process. Projections indicate a cost of $1.25 per gallon for the 95% ethanol. For blending with gasoline the delivered cost would be raised by transport and handling costs.

Great Western Sugar Co. HFCS plant[5]. – The Great Western Sugar Co. is converting a monosodium glutamate plant in Johnstown, Colorado, to produce high fructose corn syrup. The plant is expected to handle an estimated 8000 bushels of corn per day and 70% of its production will be the "second generation" 55% fructose product with the balance 42% fructose syrup. The Company is considering production of 90% fructose syrup at some time in the future.

Cuba sugar statistics[6]

Cuba sugar statistics[1]

	1978	1977	1976
		tonnes, raw value	
Initial stocks	608,768	412,655	557,429
Production	7,661,546	6,953,284	6,150,797
	8,270,314	7,365,939	6,708,226
Consumption	552,006	519,009	531,919
Exports:			
Albania	20,997	8,370	13,169
Algeria	175,633	51,145	35,191
Angola	68,059	51,063	31,881
Bulgaria	189,623	218,585	232,042
Canada	279,021	139,058	149,041
China	533,853	228,087	254,315
Colombia	0	41,936	0
Congo	4,342	0	0
Czechoslovakia	84,850	67,374	109,172
Denmark	0	0	21,739
Egypt	122,712	71,893	23,006
Ethiopia	0	11,430	0
Finland	88,197	131,166	71,411
France	0	0	15,100
Germany, East	200,717	228,940	194,868
Hong Kong	0	12,035	13,332
Hungary	58,424	51,416	70,007
Indonesia	105,159	140,991	0
Iraq	191,421	86,591	83,003
Ireland	0	0	10,581
Jamaica	11,102	0	0
Japan	530,096	183,452	149,941
Korea, North	11,838	18,542	21,999
Lebanon	0	5,708	0
Libya	27,073	0	0
Malaysia	64,401	0	18,861
Malta	0	0	4,096
Mongolia	4,678	2,283	2,083
Morocco	132,366	166,052	108,777
New Zealand	0	17,435	34,990
Poland	60,209	31,099	16,642
Portugal	141,771	25,582	92,011
Rumania	0	25,868	39,303
Senegal	0	0	46,175
Spain	0	158,948	114,519
Sudan	0	24,003	0
Surinam	2,654	3,972	1,098
Sweden	0	35,349	2,097
Switzerland	1,453	2,750	108,291
Syria	87,044	109,476	106,222
Tunisia	10,647	10,897	0
USSR	3,936,133	3,790,424	3,035,566
UK	0	0	138,756
Venezuela	2,479	1,760	0
Vietnam	82,468	67,680	124,538
West Indies	1,799	0	0
Yugoslavia	0	12,573	266,360
Other countries	0	4,229	3,769
	7,231,219	6,238,162	5,763,652
Final stocks	487,089	608,768	412,655

PERSONAL NOTES

Dr. M. Matic, Director of the Sugar Milling Research Institute, Durban, South Africa since 1967, has retired from this post but will continue to be associated with the Department of Chemistry of the University of Natal, where the Institute is located. He has been replaced, from 1st May, by **Dr. A. Bernard Ravnö** who has served with the Hulett Group since 1971, originally as a Process Engineer at Ngoye Paper Mills Ltd. but subsequently as Chief Development Officer for Huletts Sugar Ltd. and from February 1978 as Consulting Technologist for the Group.

Stephen Stachenko has resigned his post as Vice-President of Redpath Industries Limited, to become President and General Manager of a new agri-business company, a subsidiary of Technip of Paris. He was with Redpath for 25 years and is replaced, from July 1979, by **Jean de Chazal**, previous Vice-President of Redpath Consultants International Ltd., who will continue to be based at Abidjan, Ivory Coast.

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[1] I.S.O. *Stat. Bull.*, 1979, **38**, (3), 77.

[2] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 278.

[3] *I.S.J.*, 1979, **81**, 159.

[4] *Chem. & Eng. News*, 1979, **57**, (16), 38-39.

[5] F. O. Licht, *International Sugar Rpt.*, 1979, **111**, 257.

[6] *I.S.O. Stat. Bull.*, 1979, **38**, (5), 29-30.

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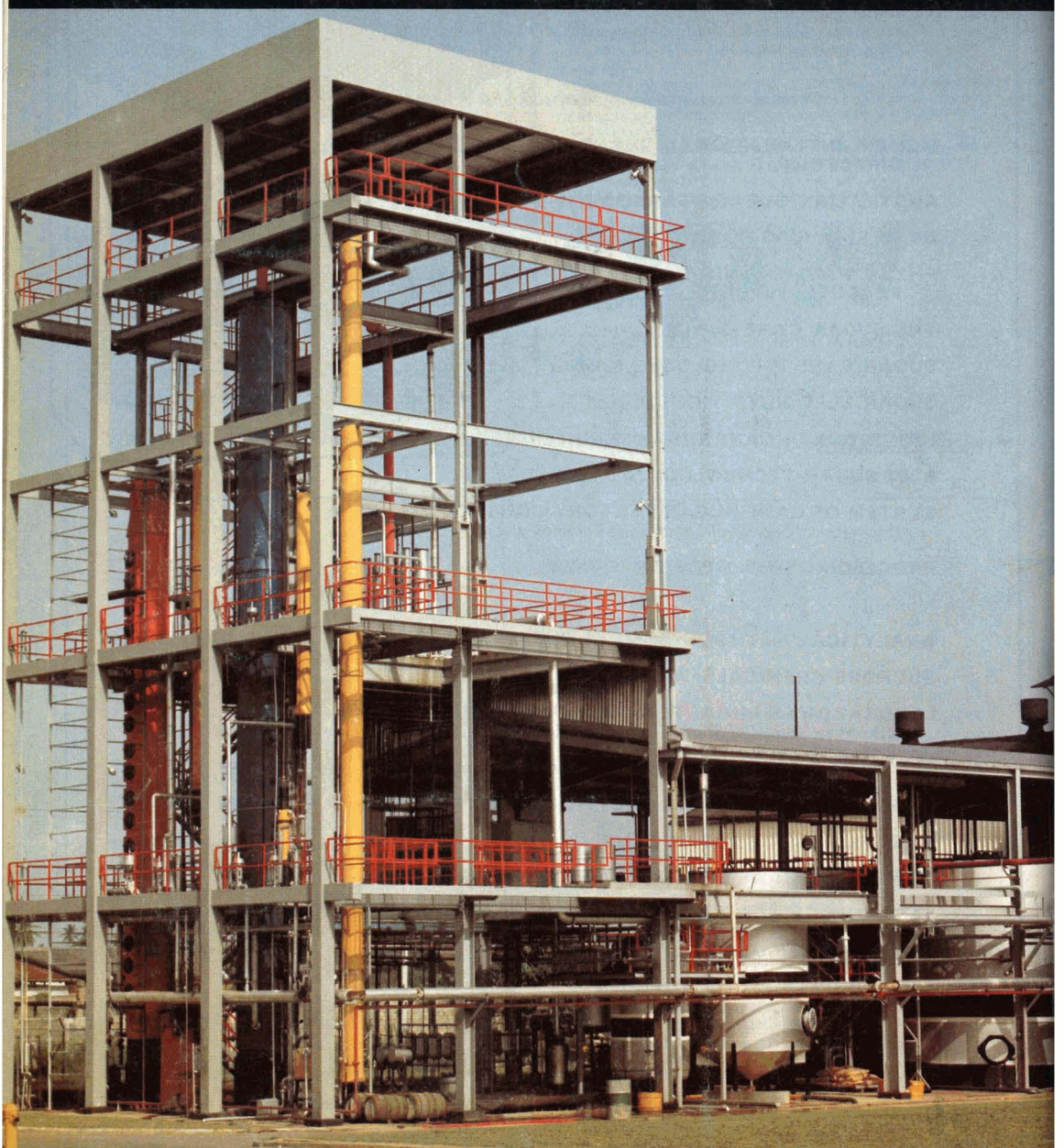

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