THE International Sugar Journal

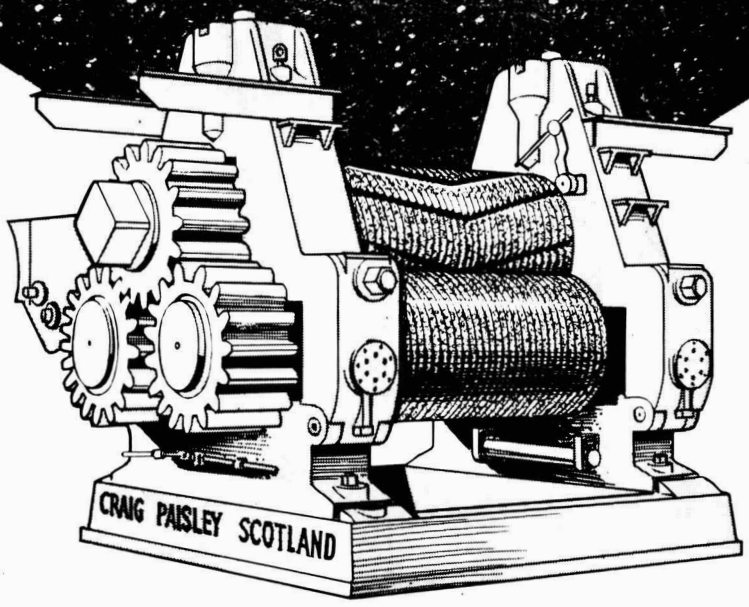
NOVEMBER 1974

FOUNDED 1838

FLETCHER AND STEWART OF DERBY ENGLAND

Manufacturing Engineers and Designers to the World's Sugar Industry.

WHAT is 'Grano'?



Enlarged view of the surface of a 'Grano' casting

'Grano' is the heart of the mill...

The main part of the Milling Plant is the 'MILL'

The main part of the Mill is the 'ROLLER'

The main part of the Roller is the 'SHELL' and the Mill Roller Shell is 'GRANO'

'GRANO' in the very heart of the mill is a cast iron metal with hard opened grained characteristics with a rough surface specifically evolved to facilitate good cane feeding, throughout the life of the Shell

Complete Cane and Beet Sugar factory projects designed manufactured and supplied as a comprehensive service to the sugar industry

A. F. CRAIG & CO. LTD.

CALEDONIA ENGINEERING WORKS PAISLEY PA3 2NA

Telephone: 041-889 2191 Telex: 778051

London Office: 727 Salisbury House, London Wall, London EC2M 5QQ
Telephone: 01-628 3964

RENOLD

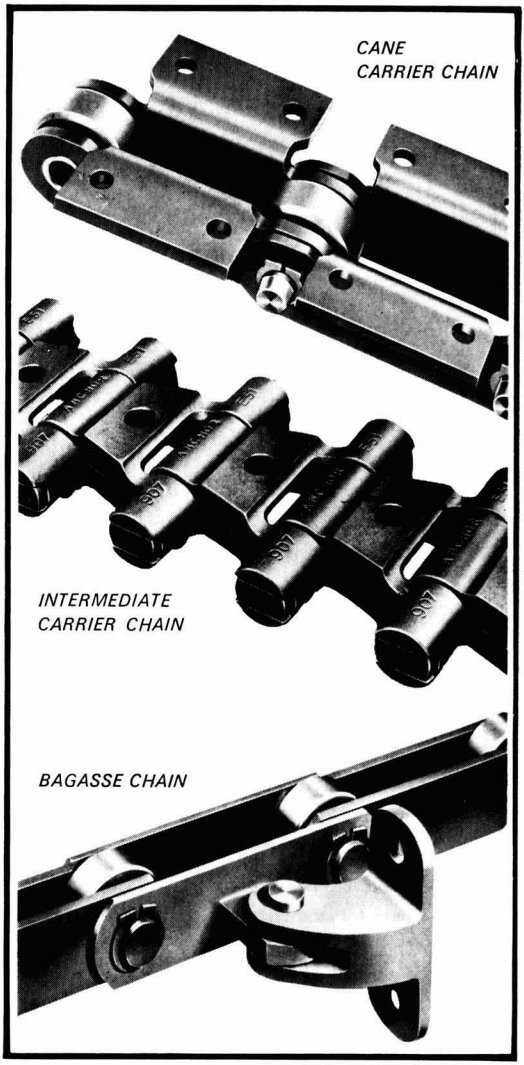
serving the cane sugar industry

CHAINS FOR MECHANICAL HANDLING

Specialised Renold chains have been supplied to the cane sugar industry since 1920.

90 years of precision chain manufacture ensure a product combining high strength with compactness, minimum weight and low cost for long life and trouble free operation.

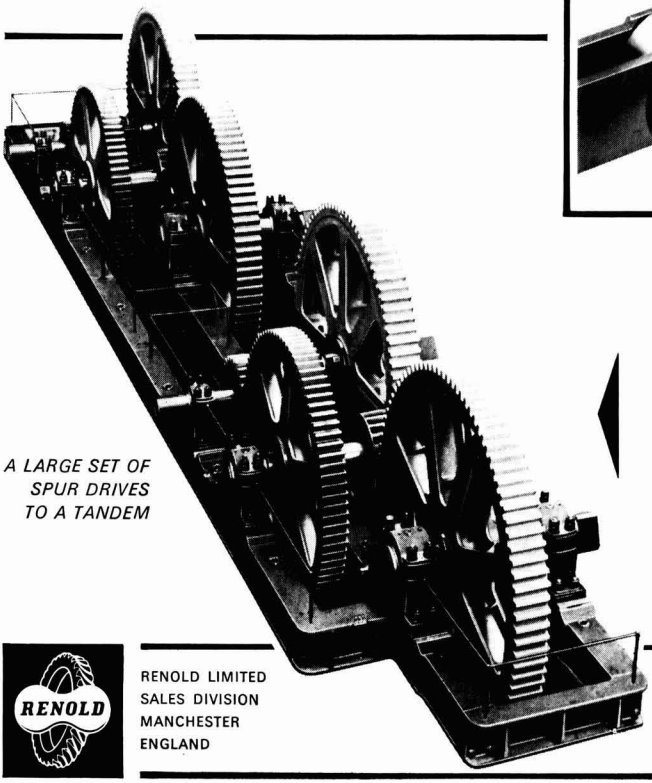
Precision power transmission chains and wheels are also available for all applications.



CANE CARRIER CHAIN

INTERMEDIATE CARRIER CHAIN

BAGASSE CHAIN



A LARGE SET OF SPUR DRIVES TO A TANDEM

POWER TRANSMISSION GEARING

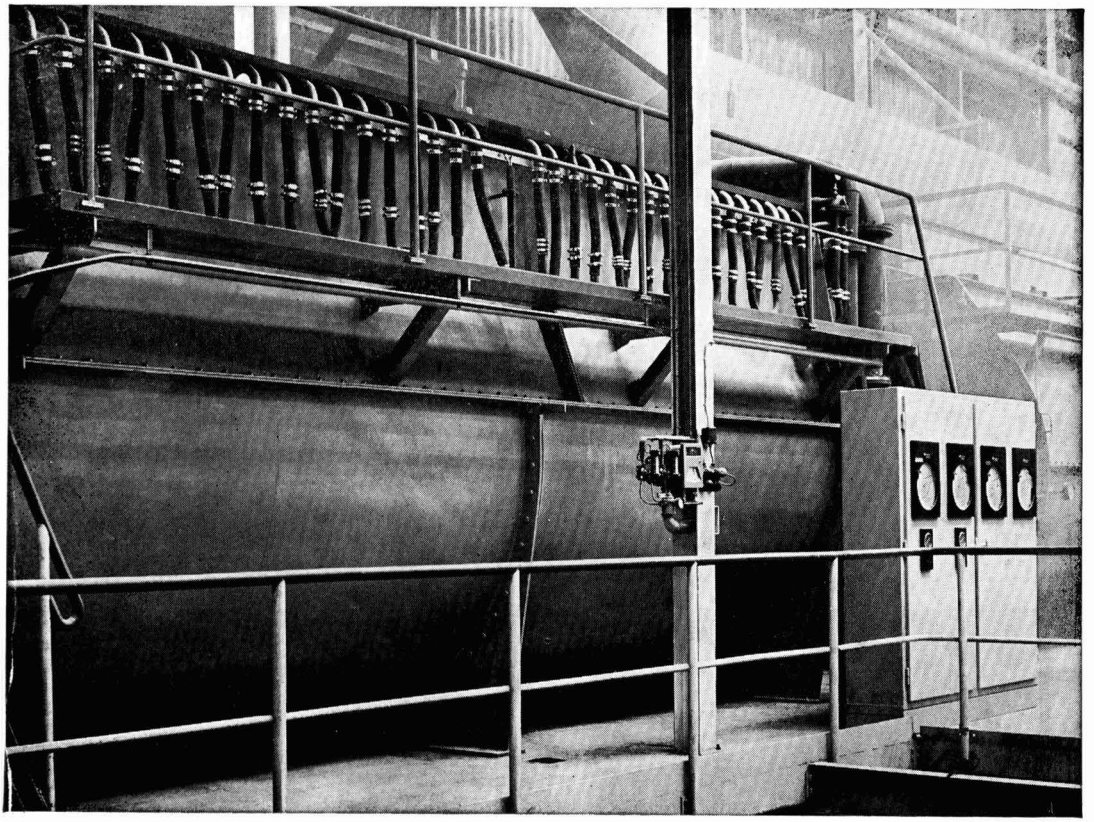
Spur gears up to 127mm circular pitch, 760mm face and 4700mm diameter can be supplied for heavy tandem drives.

Other gear products include worm, spur, helical and bevel gear boxes and individual gears.

RENOLD

RENOLD LIMITED
SALES DIVISION
MANCHESTER
ENGLAND

Other Renold group products:
PRECISION ROLLER CHAINS AND WHEELS
HYDRAULIC AND MECHANICALLY OPERATED VARIABLE SPEED SYSTEMS
COUPLINGS, CLUTCHES AND BRAKES
POWER TRANSMISSION ANCILLARIES



Continuous... rapid

Consider the advantages of the Werkspoor Rapid Crystallizer and you will understand why we are proud of our invention.

Over 700 units operate all over the world in cane- and beetsugar factories, as well as refineries. They have not only proven to be outstanding for low-grade massecuites, but equally for high and intermediate strikes.

Recently, we adapted the design of the Werkspoor Rapid Crystallizer to the latest technological developments. Results are even better now.

This uncrowned king of crystallizers brings more sugar in the bag, reduces investments and operating costs, saves a lot of space and lowers steam consumption.
Let us show you how!

STORK-WERKSPOOR SUGAR

sugar industry engineers

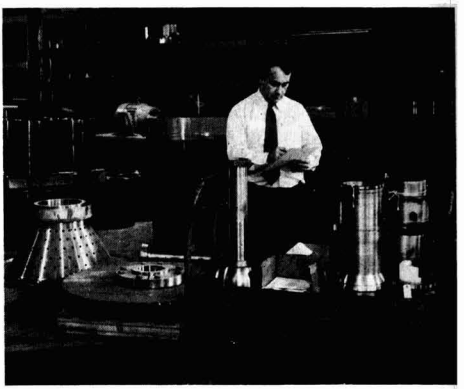
P.O. Box 147 Hengelo (O) - the Netherlands

Member of VMF/Stork-Werkspoor

Cables: Stowesugar Telex: 44485 Tel.: 05400 - 54321

think SERVICE

"Level is level" . . . that's a favorite expression of our Service Manager, Tom Boughen. It means do the job right the first time—halfway is no good. With Tom Boughen and his compatriots, your centrifugals will be "level".



Bill Madaffari, Spare Parts Manager, has a new middle name: "Rush". When you need parts in a hurry he knows how to get your order on the next truck or airplane.

think Western States

Keeping your Western States centrifugal in operation, especially during crop and peak seasons, is a vital concern to everyone at Western States . . . time of day (or night) is not.

Service is a factor that should be considered when making the purchase decision. Let's face it, no matter how high the original standards of design and manufacturing, the day will come when service is required . . . certain moving parts do wear out and need to be replaced. That's the day service becomes imperative.

Western States has a reputation of being "johnny-on-the-spot" when it comes to service . . . and we have every intention of maintaining that reputation. This service philosophy is especially important during crop and peak operating periods. We don't want you "out-of-business" for the need of a part. Men like Tom Boughen and Bill Madaffari will do everything possible to make sure you're not. Contact Mr. James Coleman, General Sales Manager.

THE WESTERN STATES MACHINE COMPANY
Roberts Centrifugals
Hamilton, Ohio, 45012, U.S.A.

Do you suffer evaporators?

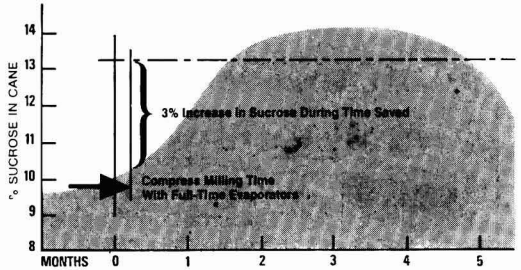
FABCON · I-12S with S.I.Control

Evaporator scaling causes part time evaporators in almost all sugar factories resulting in time losses up to 10% when lost time for juice room, milling slowdowns before cleaning, overall slowdowns due to steam shortage and the actual time required for evaporator cleaning are included.

Today, hundreds of sugar factories use Fabcon I-12S to restore full-time performance to their evaporators by minimizing scale formation at the outset. They are cutting in half the normal time and effort required to clean their evaporators quickly and thoroughly, and frequently extending the time period between cleanings.

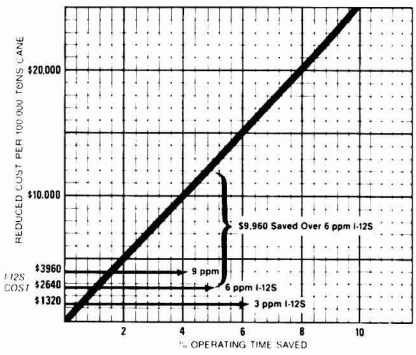
A spare set of evaporators, used by factories in some parts of the world, may not be today's answer! More evaporators mean more capacity to be sure. It also means more surface to scale up. Therefore, more chemicals, tools and labor are required to clean the evaporators. Chemicals, tools and labor are increasingly expensive today. And what is equally important they are harder—sometimes impossible—to obtain.

Compress milling time around maximum cane ripeness



Now you can take up to 10 days off total milling time, compressing your grinding time around the period of maximum cane ripeness by metering Fabcon I-12S continuously to your evaporators. With full-time evaporators you have more grinding capacity. You can use more water for maceration, or for increased filter washing, or for increased dilution of your lime slurry; all of which means direct increases in sugar recovery for you. The first chart shown approximates the curve of sucrose content in cane, and illustrates the dramatic sugar savings possible when you compress the grinding season around maximum cane ripeness.

Reduce factory operating costs at the same time



Production time lost is of course expensive. The fact that I-12S usage costs only from ¼ to ¾ of 1% of typical factory operating cost is a big reason why hundreds of factories use it regularly. Many of them in fact, have been using I-12S for as long as ten years.

The second chart shows the relative savings to be achieved from factory operating costs alone, compared with I-12S cost at several dosage levels. I-12S is metered con-

from part-time

estores full-time performance

tinuously to those evaporator bodies where scaling is most serious. Low dosage levels typically reduce cleaning-time without extending the operating cycle. Higher dosage levels extend the time between cleanings 3 or more times. In fact, in many areas today, with Fabcon's Scaling Index Control, evaporators can be operated throughout the crop *without* cleaning.

Example of typical increase in revenue

A. Compressed milling time

Basis 5% reduction in time to mill equal amounts of cane
10% Sucrose in cane at crop start or end
13% average Sucrose in cane throughout crop.
For 100,000 tons cane

100,000 TC x .13 Sucrose x .85 BHE x .93 extraction x .05 of total time = 513.8 tons
sucrose produced at overall average sucrose content
100,000 TC x .10 Sucrose x .85 BHE x .93 extraction x .05 of total time = 395.2 tons
sucrose at crop beginning or end
Additional sugar produced
118.6 tons additional sugar x $250.00/ton estimated sugar price = $29,650

B. Reduced operating cost

Basis 100,000 tons cane
$2.50 per ton cane average factory operating cost
5% reduction in time

100,000 TC x $2.50/TC x .05 time saved = $12,500.00

C. Cost of I-12S usage

Basis 100,000 tons cane
6 ppm overall average I-12S usage

600 kilos I-12S used. Approx. delivered cost $26.40 per 1,000 tons cane = $2,640.00
Less 50% of current cleaning cost
Cleaning cost estimated at $25.00 per 1,000 tons cane less $1,250.00
Net additional I-12S cost = $1,390.00

ADDITIONAL REVENUE FROM I-12S USAGE per 100,000 tons cane =$40,760.00

What is Scaling Index Control?

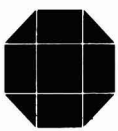
Scaling Index Control is a convenient analytical technique to determine accurately the amount of scale actually forming in the evaporator. When the Scaling Index shows scales are forming, I-12S dosage is increased to restore scale-free operation. If the index is unusually low, I-12S dosage is reduced for increased economy.

I-12S chemically holds calcium soluble and deactivated in the juice preventing precipitation of the calcium salts. It is these calcium salts which act as the matrix, cementing together the scale-forming components directly onto heat transfer surfaces.

When you combine I-12S usage with S.I. Control you get predictable performance day by day, despite variations in cane condition, variety or weather. If you can obtain reliable cane delivery and operate the factory without stopping for 2, 5, 8 even 10 weeks, except for part time evaporators, Fabcon's I-12S is your answer. If your evaporators work full-time, only occasionally falling victim to unexpected scaling conditions or inefficient cleaning, Fabcon's I-12S is also the answer; together with S.I. Control. A minimum I-12S maintenance dosage keeps evaporator scale light and soft. The Scaling Index blows the whistle when more I-12S must be used to prevent an unusual scaling condition —all at a very low average cost for I-12S.

With metering pumps, mixers and technical service provided by Fabcon, it is the most efficient way to maintain your evaporators. With the increasing cost and scarcity of cleaning chemicals, labor and materials, it is certainly the *least expensive* way to maintain your evaporators. Considering today's high sugar prices the regular use of I-12S should help increase total revenue significantly.

If you suffer from part time evaporators, Fabcon has the cure. Let us prove it to you! Buy I-12S for three months usage or longer and we will supply the equipment and technical service during this usage without charge. Call your local Fabcon Service Engineer or representative, or write for additional details on I-12S usage with S.I. Control today.



Fabcon: a world of service to the sugar industry

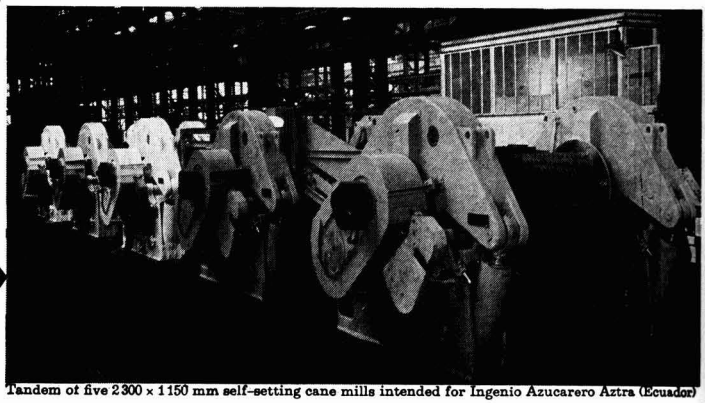
with the Fives-Cail Babcock self-setting cane mill

- **Easy pre-setting of the feed/discharge opening ratio.**
- **Constant opening ratio during operation.**
- **Easy lifting of top roller (rotating motion).**
- **Improved extraction.**
- **Increased capacity.**
- **Reduction of power peaks.**

The originality of this system lies in the fact that the top roller does not move in a vertical slide, as in all the conventional mills, but is supported by a hinged upper half housing forming a lever arm. The result of it is, on the one hand, a constancy in the ratio of the feed and discharge openings and, on the other hand, a very easy lift of the top roller, involving an improved efficiency.

already more than 50 mills of this type in the world

THE BIGGEST IN THE WORLD



Tandem of five 2300 x 1150 mm self-setting cane mills intended for Ingenio Azucarero Aztra (Ecuador)

FIVES-CAIL BABCOCK

7, rue Montalivet - PARIS 8e ☎ : 265-22.01 and 742-21.19

Cables : FIVCAIL-PARIS - Telex : FIVCAIL 65 328

Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks., England.
Telephone: High Wycombe 29408
Cable: Sugaphilos, High Wycombe

* * *

Annual Subscription: £3.00 or $10.00 post free
Single Copies: 40p or $1 post free

* * *

UK ISSN 0020-8841

International Sugar Journal

November 1974

Contents

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Commission internationale pour l'uniformisation des méthodes d'analyses du sucre, 16e Session, 1974. 1e Partie. *p.* 323–326

On présente le texte des recommandations adoptées au cours de la 16e session d'ICUMSA qui a eu lieu en Turquie au mois de juin. Dans cette partie on trouve les recommandations des sujets 1 à 15A. On peut espérer la publication du compte-rendu dans un avenir assez rapproché.

Sauf pour le sujet 1, qui traite la Constitution, les recommandations se rapportent en général aux techniques particulières qui se trouvent dans les stades intermédiaires avant leur adoption officielle. On traite aussi du besoin pour des études plus poussées au sujet de ces techniques, des spécifications pour les réactifs, des caractéristiques du saccharose pur, des plaques de contrôle en quartz, etc.

* * *

L'acide oxalique dans les betteraves sucrières. M. BURBA et U. NITZSCHKE. *p.* 326–330

On donne des détails pour la détermination de l'acide oxalique dans la râpure et dans le jus brut, léger ou dense. Au moment normal de l'arrachage, la teneur dans la betterave était comprise entre 100 et 380 mg d'acide soluble % matières sèches réfractométriques. On observait des différences suivant les variétés. Pendant la période de croissance on assiste à une réduction de la teneur. Vers mi-octobre on ne trouve plus que la moitié de la teneur observée fin juillet. Des doses croissantes d'engrais azoté augmentent la teneur. L'influence de la variété fut moins importante que celle de la période de croissance et de l'engrais azoté. La racine contient plus d'acide oxalique soluble que le collet. Les feuilles par contre en contiennent beaucoup plus que la racine. Le jus léger ne renfermait que 5 à 41 mg % Brix d'acide oxalique, tandis que le sirop n'en contient pas.

---

16. Sitzung 1964 der Internationalen Kommission für einheitliche Methoden der Zuckeruntersuchung. Teil I. *S.* 323–326

Für die Referate 1 bis 15A wird der Text der auf der 16. Sitzung der ICUMSA im Juni in der Türkei angenommenen Empfehlungen zur Ueberbrückung der Zeit bis zum Erscheinen der "Proceedings" veröffentlicht.

Mit Ausnahme von Referat 1, das "Verfassung und Satzung" benannt ist, beziehen sich die Empfehlungen auf spezielle Analysenmethoden in den verschiedenen Stadien bis zur Annahme als offizielle Methoden, die Notwendigkeit des weiteren Studiums solcher Methoden, Spezifikationen für Reagentien, Eigenschaften der reinen Saccharose, Quarzkontrollplatten usw.

* * *

Oxalsäure in Zuckerrübenwurzeln. M. BURBA und U. NITZSCHKE. *S.* 326–330

Es werden Einzelheiten angegeben über die Bestimmung von Oxalsäure in Rübenbrei, Rohsaft, Dünnsaft und Dicksaft. Der Gehalt in zum normalen Termin geernteten Rüben lag zwischen 100 und 380 g lösliche Säure pro 100 g refraktometrische Trockensubstanz (RDS), wobei Unterschiede bei den einzelnen Sorten zu verzeichnen waren. Der Wert sank jedoch während der Wachstumsperiode ab, so dass die um die Mitte des Oktober beobachteten Werte halb so hoch waren wie die Ende Juli gefundenen. Der Gehalt erhöhte sich auch mit steigender Stickstoffdüngergabe. (Die Rübensorte zeigte einen geringeren Einfluss als die Wachstumsperiode und die Stickstoffdüngung.) In der Rübenwurzel wurde mehr lösliche Oxalsäure gefunden als im oberen Teil der Rübe, während die Blätter wiederum beträchtlich mehr enthielten als die Rübenwurzeln. In den Dünnsaftproben fanden sich nur 5 bis 41 mg Oxalsäure pro 100 g RDS, und der Dicksaft enthielt überhaupt keine lösliche Oxalsäure.

16a Sesión de la Comisión Internacional para Métodos Uniformes de Análisis de Azúcar, 1974. Parte I. *Pág.* 323–326

El exto se presenta de las recomendaciones adoptado por la 16a Sesión de esta Comisión (ICUMSA), celebrado en Turquía en junio, para Sujetos 1 a 15A, como medida interina antes de publicación de la Memoria en algún tiempo del futuro bastante próximo. Aparte de Sujeto 1, que trata de "Constitución y estátutos", las recomendaciones se refieren a técnicas individuales en las varias etapas dirigido a su adopción como métodos oficiales, la necesidad de estudio adicional de tal técnicas, especificaciones para reactivos y características de sacarosa pura, planchas de control en cuarzo, etc.

* * *

Acido oxálico en los raices de remolacha azucarera. M. BURBA y U. NITSZCHKE. *Pág.* 326–330

Se presentan detalles de la determinación de ácido oxálico en remolacha desagregado y en jugo crudo, jugo ligero y jugo denso. El contenido en remolacha al período normal de cosecha extendía entre 100 y 380 mg de ácido soluble per 100 gramos de sustancia seca refractométrica (RDS), con diferencias entre variedades. Sin embargo, el nivel cayó durante el período de vegetación de modo que, a medio-octubre, los valores observado fueron un mitad de éllos encontrado al fín julio. El contenido creció también con aplicación aumentado de fertilizante nitrógenoso. (La variedad tuvo un efecto más pequeño que período de vegetación y N-fertilizante.) Había más ácido oxálico soluble en el raíz que en la corona, mientras las hojas contuvieron mucho más que los raices. Las muestras de jugo ligero no contuvieron más de 5–41 mg ácido oxálico por 100 g RDS, mientras jugo denso no contuvo ácido oxálico soluble.

THE

INTERNATIONAL SUGAR JOURNAL

VOL. LXXVI NOVEMBER 1974 No. 911

Notes & Comments

World sugar production, 1974/75

There is so much pressure for information on the current status of the world sugar market that F. O. Licht K.G. have decided to publish their first estimate of world sugar production at a relatively early date[1]. Because of this, there will clearly need to be substantial amendments as the year progresses.

Total European beet sugar production is expected to be about 2·5% lower at 26,444,000 metric tons, raw value, as against 27,136,000 tons last campaign. The West European drop of 599,000 tons accounts for most of this reduction and represents over 4% lower sugar output, the largest proportionate decreases being set for Belgium, Holland, Italy, the UK and Spain. On the other hand, increases are expected in the sugar outturns in France, Denmark, Sweden, Yugoslavia, Greece and Turkey.

In East Europe, fairly small changes are forecast for most countries but it is interesting that Licht sets the USSR figure at 9,500,000 tons as against 9,680,000 tons in 1973/74. So early in the year, the lack of information from the Soviet Union usually means that it is considered prudent to allow in the first estimates for the same level of production as in the preceding season; Licht's information would seem to show that the USSR has not escaped the backward crops and diseases engendered by the very dry spring and poor growing conditions experienced elsewhere in Europe this year.

A small decrease (0·66%) is expected for non-European beet sugar producers, largely owing to a drop in US beet sugar output. World beet sugar production is set at 2·24% less than in 1973/74 although this is more than compensated by the expected rise in cane sugar production.

This increase arises mainly from Australia and countries of the Western Hemisphere, particularly Argentina and Brazil. The South African crop seems likely to be a record, but Africa as a whole is expected to have only slightly higher output owing to reduced crops in Mauritius, Réunion, Angola and Mozambique. Additional increases are expected in the Philippines, Thailand and India, while a fall is expected from the high Taiwan output of 1973/74.

Discussing these estimates in the light of the variation between initial estimates and final figures for previous years, F. O. Licht conclude[2]: "We are presently inclined to believe that the assessment of sugar production in a set of countries has been somewhat too optimistic. Nevertheless we are of the opinion that the overall estimate will be fairly close to the actual output".

While there has been a steady increase in *per caput* consumption, especially in the developing countries, the impact of high sugar prices and of high oil prices on the foreign exchange reserves of such countries will affect their ability to import their sugar requirements, especially if these were to increase. The growth rate in sugar consumption is thus likely to slow down in 1974/75. The average increase from 1964/65 to 1973/74 has been around 4% but over the last three years has been around 3%. Continuing in this way would indicate a consumption of 83·7 million tons in 1974/75 but, in view of the factors inhibiting consumption increase, Licht foresees a likely figure of more like 82·5 million tons. "It becomes apparent that in 1974/75 demand and supply will be balanced on a knife-edge and that presently a deficit seems to be more likely than a surplus".

* * *

UK–Guyana sugar purchase agreement

Guyana refused to supply her quota of sugar to the UK under the Commonwealth Sugar Agreement and the British Minister of Agriculture, Fisheries and Food flew to Georgetown to negotiate resumption of supplies. As a consequence, Guyana has agreed to supply 85,000 tons of her quota but at a price of £140 per ton instead of the negotiated price of £83.50. The balance of her quota—51,000 tons—has been bought by Tate & Lyle Ltd. at a price just under £200 per ton.

Naturally, other supplying members of the Agreement have demanded parity of treatment, and a meeting is to take place between all parties; it is anticipated that additional payments of £60 a ton will be required for Commonwealth supplies and cannot

[1] *International Sugar Rpt.*, 1974, **106**, (26), 1–4.
[2] *ibid.*, (27), 1–3.

reasonably be withheld by the UK since, it will be claimed, a gap of this magnitude between the price of Guyana sugar and that of other suppliers cannot be justified.

Since the quotas for countries other than Guyana total some 1,570,000 tons, the additional cost may reach some £90,000,000 and the total cost of purchasing the Guyanese sugar is thus much larger than if the 85,000 tons had been bought on the world market and the negotiated price maintained for the Commonwealth suppliers.

Apologists for the transaction have pointed out that Guyana's price was less than half that on the world market, as if the world price were the normal price instead of a wildly fluctuating value set on only a small residual fraction of world production. But the Commonwealth Sugar Agreement was designed expressly to insulate trade between the UK and Commonwealth sugar producers from the world market. By offering a price agreed between the parties concerned and calculated to give a reasonable profit for guaranteed amounts of sugar, the UK provided a stable market for large proportions of the output of the sugar producers while ensuring for herself adequate supplies. Suppliers in the Commonwealth had no complaint during the almost twenty years when the CSA negotiated price was well over the world price and the UK did not use the latter as a means of forcing down the CSA price.

Now that Guyana has successfully broken her part of the agreement, we would consider that the UK has no moral obligation to protect her interests so far as access to the EEC is concerned, and the same should apply to any other supplier seeking a similar CSA-breaking price increase or refusing to meet CSA quotas in favour of selling on the world market.

* * *

UK sugar supplies

The British Sugar Corporation recently announced that, on the basis of crop tests, output this campaign was likely to be some 20% lower than last, with sugar production between 730,000 and 780,000 long tons, white value, compared with 948,000 tons in 1973/74. Root weights are low as are plant population and sugar content, while virus yellows infection is the worst for ten years. The Corporation expects to supply its normal deliveries to retail stores but industrial customers are likely to receive less sugar in 1975.

Beet sowings for next campaign should rise, however, as a result of the acceptance by the British Government of the full EEC price structure, including the recently-agreed 5% price rises, which will provide a better return and greater inducement to farmers to sow beet. Under the EEC rules consequent increases in the cost of the sugar produced must be passed on to the consumer and this will raise the wholesale price by £29 per ton. No decision has yet been made as to whether the extra cost of purchasing Guyana sugar will be passed on to the consumer or covered by a subsidy.

The poor crops forecast for Europe have indicated some difficulty in covering British requirements for 1975 and negotiations have been undertaken with Australian representatives, who have offered a five-year contract for 350,000 tons a year. The price was originally equivalent to £180 a ton with an annual price escalator but, with the Australian dollar devaluation on the 25th September, this may have reduced the initial price to £160 per ton, although whether it has done is not yet clear.

The EEC is not in a position to provide such an amount, although EEC producers have wanted to exclude Australian supplies after the CSA ends in December 1974. The EEC farm commissioner has made an attractive counter-offer, however, whereby the EEC would secure supplies from the world market but sell to the UK at the EEC price of £130 per ton. The difference would be met by export levies on sugar or directly from the EEC farm fund, and it would have to be agreed by the other members of the Community who would be subsidising the British consumer.

The offer has placed the UK Government in a quandary since many of its anti-EEC members will not relish having to acknowledge a benefit to the UK arising from membership of the Community; at the same time, the refiners in Britain will obviously prefer to have imports of Australian raws coming into the country rather than white sugar which does not need to pass through their hands.

* * *

World sugar price

The price of sugar on the London Terminal market fell further from its record level of £370 and hovered around £330 for a time in early September. Subsequently, with a report of hurricane damage to the Louisiana cane crop, initially set at 25% but later amended to 10%, prices revived and at the end of the month had reached £360, increasing to £365 in early October. Further improvement raised the price to the record level of £390 per ton at which it stands at the time of writing.

* * *

US sugar supply quotas 1974

On the 25th September the US Department of Agriculture declared deficits of 200,000 tons in the Domestic Beet quota, 350,000 tons in the Mainland Cane quota and 100,000 tons in the quota for Hawaii. At the same time earlier deficits declared for Puerto Rico were reduced by 50,000 tons so that there was a total of 600,000 tons for redistribution among foreign suppliers.

This had virtually no effect on the sugar market whereas formerly it would have been a strengthening factor. In fact, it remains to be seen whether any of the recipients of the increases will take them up since there is little incentive for them to do so; there is a greater return to be made by selling sugar on the world market at present prices and the producers are not hazarding their US quotas for the future since the US Sugar Act is due to expire at the end of 1974 and no replacement legislation is in sight.

International Commission for Uniform Methods of Sugar Analysis

16th Session, 1974

PART I

IT is hoped that the Proceedings of the 16th Session[1] will be published at about the end of 1974. This book will again be available direct from the General Secretary of ICUMSA, P.O. Box 35, Wharf Road, Peterborough, PE2 9PU England. In the interim, it may be helpful to know the text of the Recommendations adopted during the 16th Session; these are given below.

RECOMMENDATIONS ADOPTED

Subject 1. Constitution and bye-laws

(1) In future, the costs, either in whole or in part, of providing simultaneous translation during Sessions shall be met from the central funds of ICUMSA.
The Officers, in collaboration, shall decide what sum of money can be allocated for this purpose and no other person shall have authority to enter into any financial commitment in excess of the amount specified by the Officers.

(2) ICUMSA is recognized as the ultimate authority on matters relating to sugar analysis and the prestige which it enjoys must be jealously guarded. A Committee of Action shall be appointed [as set out in Article V(4) of the Constitution and consisting of the members of the Administration and three Chairmen of National Committees selected by the President] to examine the matters raised by Dr. F. G. CARPENTER as well as those outlined in the Appendix to the Subject 1 Report which are put forward by the Cuban National Committee through their Chairman, Professor J. C. GONZÁLEZ MAÍZ (Note: Such a Committee of Action was appointed and its findings will be published in the *Proceedings* of the 16th Session).

Subject 2. Laboratory apparatus

(1) The specifications for selected laboratory apparatus and equipment, as presented in the Referee's Report (Appendix 1), are officially adopted.

(2) Cooperation with the Referees of other subjects, with a view to the elaboration of specifications for further laboratory apparatus and equipment, should be continued in accordance with Recommendation 2 adopted at the 15th Session of ICUMSA (*Proc. 15th Session ICUMSA*, 1970, 14).

Subject 3. Weighing, taring and sampling of sugars

(1) For consignments of white sugar, ten samples shall be taken in a random manner. These ten samples shall be combined and mixed and a sub-sample analysed. The result represents the average quality of the consignment.

(2) Studies should be continued to establish the variability of sugar products in respect of other Codex specifications. On the basis of these studies, recommendations can be made on sample sizes to give desirable confidence limits to mean values, or assurance that specifications are met.

(3) Further information should be acquired on current sampling procedures for bulk sugar to establish the most efficient method.

Subject 4. Specifications and tolerances for pure sucrose and reagents

(1) The colour of pure sucrose should be determined by method 4 (*Proc. 15th Session ICUMSA*, 1970, 255).

(2) In addition to the specification limits adopted for pure sucrose at the 15th Session (*Proc. 15th Session ICUMSA*, 1970, 35) there should be added on a tentative basis:

Colour in ICUMSA units	not more than 15
Raffinose (anhydrous), %	not more than 0·05

(3) In relation to pure sucrose, studies on the following should be undertaken:
(*a*) Determination of water by the method of SCHNEIDER, EMMERICH & TICMANIS, parallel with the method for loss on drying currently in force.
(*b*) The determination of insoluble matter using membrane filters (of porosity 8 or 0·45 μm as measured by the mercury intrusion method) in parallel with the method currently in force.
(*c*) Measurement of turbidity in solution.

(4) Studies should be undertaken on the measurement by chromatography (gas and liquid) of sugar and of the impurities present in pure sucrose.

(5) The enzymatic method of SCHIWECK & BÜSCHING for the determination of raffinose should be examined with a view to defining the detection limit and the error for raffinose contents of less than 0·01% in pure sucrose.

(6) The levels of iron normally present in the "analytical reagent" products usually used in the preparation of Fehling's and Müller's solutions are satisfactory (levels of the order of 3 mg/litre of solution).

(7) A maximum level of nitrilotriacetic acid (NTA) of 0·05% in EDTA is tentatively adopted. The manufacturers of this reagent should be contacted by the National Committees with a view to specifying the maximum level of NTA present in their "analytical reagent" products.

(8) The basic lead acetate reagent should be further studied.

(9) Aluminium sulphate and other reagents for defecation should be further studied.

Subject 5. 100°S point of sugar scale

(1) The "normal sugar solution" is defined as 26·0160 g of pure sucrose weighed *in vacuo* and dissolved in pure water at 20·00°C to 100·000 cm^3. This corresponds to a concentration of 26·0000 g of sucrose weighed with brass weights in air under normal conditions (1013 mbar pressure, 20°C, 50% relative humidity) in 100·000 cm^3 of solution at 20·00°C. (Officially adopted at the 13th Session, 1962.)

(2) The basis of the 100°S point of the "International Sugar Scale" is the optical rotation of the "normal sugar solution", as defined in Recommendation 1, at the wavelength of the green line of the mercury isotope ^{198}Hg (λ = 546·2271 nm), 20·00°C and 200·00 mm tube length. (Officially adopted at the 14th Session, 1966.)

(3) The rotation value for the 100° S point under the standard conditions specified in Recommendation 1 and 2 is tentatively accepted as:

$$\alpha \begin{matrix} 20{\cdot}00°C \\ 546{\cdot}2271\ nm \end{matrix} = 40{\cdot}777° \pm 0{\cdot}001°$$

(Tentatively adopted at the 16th Session, 1974.)

(4) For fixing the 100° S point at other wavelengths, equation [1] of the 1966 Report (*Proc. 14th Session ICUMSA*, 17) for the rotatory dispersion is valid. Until further notice the range of wavelengths is limited for practical polarimetry to 540 to 590 nm. (Officially adopted at the 15th Session, 1970.)

(5) The mean effective wavelength of spectrally filtered yellow sodium light is adopted as
λ = 589·4400 nm

[1] See *I.S.J.*, 1974, **76**, 259–260.

(officially adopted at the 15th Session, 1970). At this wavelength, according to Recommendations 3 and 4, the 100°S point will be

$$\alpha^{20{\cdot}00°C}_{589{\cdot}4400\ nm} = 34{\cdot}626° \pm 0{\cdot}001°$$

(tentatively adopted at the 16th Session, 1974).

(6) The sugar scale, corresponding to the re-definition in Recommendations 3 and 5, is called "International Sugar Scale 1974" and saccharimeters, as well as standards calibrated according to this, are to be characterized by °S(74). (Tentatively adopted at the 16th Session, 1974.)

(7) The dependence of the optical rotation value of pure sucrose solutions $\alpha(p, T, \lambda)$ on temperature (18 to 30°C), concentration (0 to 65 g/100g), and wavelength (λ = 480 to 647 nm) is given by combining formulae [1] and [2] in the present Referee's Report. (Tentatively adopted at the 16th Session, 1974.)

(8) Quartz control plates used to check saccharimeters should fulfil the conditions adopted under Subject 6. (Officially adopted at the 14th Session, 1966.)

(9) Quartz control plates have the sugar value of 100·00°S(74) at a given wavelength if their rotation is equal to the values given in Recommendations 3 and 4 for that particular wavelength. (Tentatively adopted at the 16th Session, 1974.)

(10) A plate which shows the same optical rotation as the normal sugar solution under the standard conditions defined in Recommendation 2 is called "normal quartz control plate". (Officially adopted at the 14th Session, 1966.)*

(11) Quartz control plates of the sugar value of 100·00°S(74) for saccharimeters equipped with quartz wedge compensation with an effective wavelength of 587·0000 nm have the following rotation values:

$$\alpha^{20{\cdot}00°C}_{546{\cdot}2271\ nm} = 40{\cdot}704° \pm 0{\cdot}001°$$

$$\alpha^{20{\cdot}00°C}_{589{\cdot}4400\ nm} = 34{\cdot}629° \pm 0{\cdot}001°$$

(Tentatively adopted at the 16th Session, 1974.)

(12) Saccharimeter scales and quartz control plates calibrated according to the ICUMSA definition existing up to the present time show sugar values which are too high to the extent of 0·029%. (Tentatively adopted at the 16th Session, 1974.)

(13) The values for the 100°S point and the International Sugar Scale 1974 according to Recommendations 3, 5, 6, 11 and 12 above are tentatively adopted (16th Session, 1974) with the intention that they should come into force at the 17th Session in 1978.

(14) Saccharimeter scales should be linearly divided. (Officially adopted at the 14th Session, 1966.)

(15) The scales of saccharimeters with smaller angles of rotation than those fixed in Recommendations 2, 3 and 4 should be divided so that the normal sugar solution (according to Recommendation 1) in tubes with a length of less than 200 mm belonging to these instruments shows 100°S. (Officially adopted at the 14th Session, 1966.)

(16) Saccharimeters with an angle of rotation which, at the 100°S point, is not smaller than 2° related to a wavelength of 546 nm are to be checked with quartz control plates which correspond to Recommendations 8 to 12 above. (Tentatively adopted at the 16th Session, 1974.)

(17) Saccharimeters with an angle of rotation of 2·5° or less at the 100°S point, at a wavelength of 546 nm, may be calibrated with a solution of pure sucrose under the conditions described in Appendix 3 to the Referee's Report. (Tentatively adopted at the 16th Session, 1974.)

(18) For the dependence of the rotation value of pure sucrose solutions on temperature (up to 90°C) within the concentration limit of the "normal sugar solution" and at λ = 546 nm, formula [3] in the present Referee's Report shall be used. (Tentatively adopted at the 16th Session 1974.) The dependence on temperature at other concentrations and other wavelengths should be further studied.

(19) The rotatory dispersion of technical sugar solutions outside the range of 540 to 590 nm should be further studied, especially at higher wavelengths.

(20) The dependence of the optical rotation of impure sugar solutions on temperature (if possible up to 90°C) should be further studied.

(21) The rotatory dispersion of sugar solutions after acid inversion or treatment with enzymes should be studied.

(22) The use of standards which are stable for a limited period, for the calibration of saccharimeters, as proposed by DEVILLERS, should be studied.

(23) The use of invariable standards other than quartz should be studied.

* Normal quartz plates which have the same rotation as the normal sugar solution of Recommendation 2, Subject 5, 15th Session 1970 will have a slightly smaller rotation than those corresponding to Recommendation 2, Subject 5, 16th Session 1974. To avoid confusion it is recommended that the two types of plates be described as

"Normal quartz control plate 100°S"
and
"Normal quartz control plate 100°S (74)".

Subject 6. Quartz control plates

(1) For a small angle rotation standard, proposals a, b, c and d obtained by the work of R. J. KING and tested by comparative measurements at NPL and PTB should be adopted.

(2) Measurements of the rotatory dispersion of quartz blocks of different origins should be continued with a view to confirming the information given in Table 2 of the Report to the 15th Session (*Proc. 15th Session ICUMSA*, 1970, 46).

(3) The exchange of quartz control plates between as many National Institutes as possible should be continued.

(4) Several pieces of quartz (which should be as long as possible) should be sent to the PTB for comparison with the PTB standard quartz block in order to determine the effective wavelength of various light sources.

Subjects 7 and 8. Sucrose in factory and refinery products excluding beet, cane and crystalline sugars

(1) The isotopic dilution method should be tentatively adopted for the measurement of true sucrose.

(2) Methods based on gas-liquid chromatography should be further studied.

(3) The DUTTON method for the determination of sucrose by polarization should be tentatively adopted.

(4) The method of MACKAY, the Tate and Lyle and Canadian Committee method, and the LANE & EYNON method and its modifications should be further studied.

(5) A standard procedure should be developed to measure the correction due to invertase.

(6) More attention should be paid to correction for substances other than raffinose, kestose, etc. in the determination of sucrose in cane molasses.

(7) More enzymatic methods for the measurement of apparent sucrose should be included in the next evaluation programme.

(8) Methods tested under Subjects 7 and 8 should be made compatible with those studied under Subject 14.

Subject 9. Sucrose in sugar beet

(1) The question of the extent to which hot water digestion gives too high results should be further studied.

(2) The double extraction method and the isotope dilution methods should be comparatively studied.

(3) The isotope dilution method of HÖRNING & HIRSCHMÜLLER (1959) and that of SIBLEY, EIS & MCGINNIS

(1965) should be adopted as official methods (the latter method modified with a double volume of digestion water for the determination of sucrose in beet).

(4) Work on the applicability of nuclear magnetic resonance spectroscopy for the determination of sucrose in sugar beet should be continued and the results thus obtained compared with those obtained by a suitable reference method in order to determine their validity.

(5) Investigation of the applicability of enzymatic techniques for the determination of sucrose in sugar beet should be continued and the results so obtained evaluated against a suitable reference method.

(6) The applicability of high pressure liquid chromatography for the quantitative determination of sucrose in sugar beet should be investigated.

(7) The gas-liquid chromatographic method of KARR & NORMAN for the determination of sucrose in the standard basic lead acetate filtrate from brei should be tentatively adopted.

(8) The use of alternative, non-toxic reagents for clarification should be studied.

Subject 10. Sucrose in sugar cane

(1) Direct comparisons should be carried out between (*a*) core sampling and grab sampling of whole cane with (*b*) hatch sampling of prepared cane in order to establish their respective suitability for technical control.

(2) Further comparisons of cane analysis by the disintegrator and the hydraulic press methods should be undertaken.

(3) The isotope dilution method for determination of sucrose in the disintegrator extract and in press juice should be officially adopted.

(4) A uniform way of calculating polarization % cane from basic analytical data should be established.

(5) The title of Subject 10 should remain "Sugar in sugar cane".

Subject 11. Polarization of raw sugars

(1) The last sentence of the introduction to the official ICUMSA method (*Proc. 15th Session ICUMSA*, 1970, 95 to 99) should be replaced by:
"It is applicable to all raw sugars."

(2) To clause 8.1.4 of the official ICUMSA method should be added:
"preferably in a water bath, temperature controlled at 20 ± 1°C."

(3) In clause 8.3.3 of the official ICUMSA method, after the word "filtrate", should be added:
"in the tube,"

(4) The precise definition of "Horne's dry lead" should be sought and manufacturers' specifications as to their products obtained.

(5) Replicate routine polarization data should be forwarded to the Referee for Subject 11 for statistical analysis and the establishment of a recommended tolerance.

(6) Further study of the question of centrifugation *versus* filtration should be undertaken. In particular, the following points need to be examined:
(*a*) A specification of centrifugation force in terms of a *g* value should be arrived at.
(*b*) The precise magnitude of the difference between the methods should be established through a careful statistical analysis of the results.

(7) To clause 1 of Appendix 2 of the 1970 Report (*Proc.* 15th *Session ICUMSA*, 1970, 99) should be added:
"Side-filling tubes may be used if desired."

(8) Collaborative studies on specifications for containers for raw sugar polarization samples should be undertaken.

(9) The relevant qualities of filter papers for raw sugar polarizations should be studied and clearly specified.

(10) Intensive efforts should continue to seek improved methods of polarization of raw sugar samples.

(11) The influence of polarization of the temperature effects on non-sucrose substances should be studied.

(12) The effect of higher than ambient temperatures in the cell compartments of some modern polarimeters should be studied.

Subject 12. Refractive index

(1) The absolute values of the relationship between refractive index and the concentration of sucrose in aqueous solution, between 0 and 85% concentration, between 18 and 40°C temperature and between 546 and 589 nm wavelength should be calculated from the polynomial of equation (1) in the Referee's Report. In this way the refractive index values are corrected to vacuum and have a precision of $\pm 3 \times 10^{-6}$ in the range of 0 to 65% solids and $\pm 2 \times 10^{-5}$ in the range of 65 to 85% solids.

Subject 13. Dry substance in sugar products other than sugar

(1) Karl Fischer titration methods should be collaboratively studied with a view to establishing a procedure which gives precise results for dry substance.

(2) A detailed procedure for refractometric measurements (including the removal of suspended solids at least for some sugar products) should be defined with the aim of proposing a tentative method.

(3) Collaborative studies should be undertaken in such a way as to provide a series of results obtained using the same procedures.

(4) Methods for the determination of water using gas-liquid chromatography, nuclear magnetic resonance and near infra-red spectroscopy should be studied.

(5) The corrections to convert refractometer solids to true solids, as developed by the British National Committee and described in Appendix 1 to the Referee's Report, should be further studied.

(6) Efforts should be made to specify the essential features of vacuum ovens used for the determination of solids content.

Subject 14. Reducing sugars

(1) The MUNSON & WALKER method should be deleted as an official ICUMSA method for the determination of reducing sugars.

(2) The constant volume modification of the LANE & EYNON method for high levels of reducing sugars should be tentatively adopted but further studies should be undertaken to compare the constant volume modification with the classical procedure of the LANE & EYNON method.

(3) The use of EDTA as a calcium sequestrant may replace potassium oxalate in the LANE & EYNON method when this is applied to cane molasses. An amount of 4 cm^3 of a 40 $mg.cm^{-3}$ solution per g of molasses is tentatively recommended but further studies should be undertaken to confirm this figure.

(4) Because of the comparatively high value of its sucrose correction, the LANE & EYNON method should be restricted to solutions with a relatively high reducing sugars content. In any event it should never be used for beet molasses because of the high colour of this product. Further studies should be undertaken with a view to defining the limits of applicability of the LANE & EYNON method.

(5) The OFNER method and the Berlin Institute method should be maintained as official ICUMSA procedures for the determination of medium levels of reducing sugars (up to 10%). Detailed statistical examination of both these methods should be undertaken with the aim of retaining only one as the official ICUMSA method. Particular attention should be given to the corrections to be used in the OFNER method.

(6) Studies should be undertaken to establish a lower limit of reducing sugars content below which the OFNER and

Berlin Institute methods should not be used but replaced by more accurate methods such as that of EMMERICH or of KNIGHT & ALLEN.

(7) Studies should be undertaken to compare enzymatic methods for the determination of specific reducing sugars with methods using gas-liquid chromatography. Colorimetric procedures suitable for automatic analyses deserve particular attention.

Subject 15. Raffinose, other oligosaccharides and glycosides

(1) The modified thin-layer chromatographic method for the determination of raffinose as developed by the British Sugar Corporation Research Laboratories and described in Appendix 1 to the Referee's Report, using cellulose-coated plates, should be tentatively adopted in place of the original method.

(2) The enzymatic-spectrophotometric method of McCREADY for the determination of raffinose should be tentatively adopted but further work should be initiated to replace *o*-tolidine eventually by an alternative, non-carcinogenic chromogen.

(3) The enzymatic-spectrophotometric method of SCHIWECK & BÜSCHING for the determination of raffinose should be retained on a tentative basis but further work should be initiated to study its applicability to low raffinose levels, as in white sugars.

(4) The possible precipitation of raffinose by basic lead acetate in low purity sugar solutions should be investigated, with special regard to basicity, density and method of preparation, particularly in connexion with the enzymatic methods referred to in Recommendations 2 and 3.

(5) Methods based on gas-liquid chromatography for the determination of raffinose, and particularly kestoses, should be further studied.

(6) Methods based on high-pressure liquid chromatography should be investigated.

(7) The method of SCHIWECK & BÜSCHING for the determination of galactinol should be thoroughly investigated with regard to its accuracy and reproducibility in the presence of raffinose.

(8) Further efforts should be made to find practical procedures for preparing kestoses in reasonable quantities.

Subject 15A. Pectins and polysaccharides

(1) Further comparative collaborative studies should be undertaken of the methods of CARRUTHERS & OLDFIELD and of SCHNEIDER, EMMERICH & LAUDIEN for the determination of pectic acid.

(2) Comparative studies on the Brunswick Sugar Institute method for the determination of polysaccharides should be undertaken.

(3) The method, based on thin-layer chromatography, of the British Sugar Corporation for the determination of laevan should be retained on a tentative basis.

(4) The method, based on thin-layer chromatography, of the British Sugar Corporation for the determination of dextran should be retained on a tentative basis with the alternatives of oxalic acid or hydrochloric acid pre-treatment of the juice samples and, if necessary, of the dextran standards as recorded in Appendix 1 to the Referee's Report.

(5) The method, based on thin-layer chromatography, of the British Sugar Corporation for the determination of araban as recorded in Appendix 1 to the Referee's Report should be tentatively adopted.

(6) Methods for the determination of starch in raw cane sugars should be studied and compared.

(7) Haze analysis techniques for the estimation of dextran in cane products should be further studied.

(8) The method of LEAL GARCÍA & KARA-MURZA, based on polyacrylamide gel separation, for the determination of total polysaccharides in cane products should be further studied.

(*to be continued*)

Oxalic acid in sugar beet roots

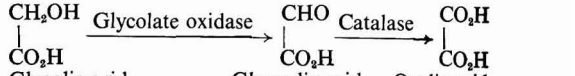
By M. BURBA and U. NITZSCHKE

(Institute of Plant Breeding, Department of Chemistry and Biochemistry, Kleinwanzlebener Saatzucht AG, Einbeck, West Germany)

Introduction

OXALIC acid, like citric acid and malic acid, is very common in higher plants[1,2]. In several crop plants it can amount to more than 15% of the dry weight. At higher concentrations, however, if affects prejudicially the nutritional physiological value of the plants owing to its toxicity. According to the studies of WALLENSTEIN and BOHN[3] it also occurs in sugar beet and belongs to the N-free organic acids which are present in larger amounts and which are primarily responsible for the acid reaction of the cell sap; a fact that was to be expected with Chenopodiacae (classic oxalate plants). Although oxalic acid is one of the plant acids that have been known for the longest period of time (in sugar beet since 1831)[4], it was only possible relatively recently to explain the biosynthesis of this compound.

According to RICHARDSON and TOLBERT[5] and SEAL and SEN[6] it is produced from glycolic acid through oxidation with glycolate oxidase in the presence of catalase:



Glycolic acid — Glyoxylic acid — Oxalic acid

Oxalic acid is thus formed in a side reaction of the glycolate pathway, the links of which (glycolic acid, glyoxylic acid, glycine and others) occur in larger amounts after an active photosynthesis. Oxalic acid arises as a by-product of the glycolate oxidase, particularly in the case when a sufficient amount of glyoxylic acid is present.

Divergent from this biosynthetic pathway CHANG

[1] "Encyclopedia of Plant Physiology", Ed. W. RUHLAND. Vol. XII/2. (Springer Verlag) pp. 890–993.
[1] "Plant Physiology", Ed. F. C. STEWARD. Vol. IV B. (Academic Press, New York) pp. 119–262.
[3] *Zeitsch. Zuckerind.*, 1963, **88**, 125.
[4] RÜMPLER: "Die Nichtzuckerstoffe der Rüben in ihren Beziehungen zur Zuckerfabrikation," (F. Vieweg-Verlag, Braunschweig) 1898.
[5] *J. Biol. Chem.*, 1961, **236** 1280.
[6] *Plant and Cell Physiol.*, 1970, **11**, 119.

and BEEVERS[7] ascertained that in red beet oxalic acid can be formed from oxaloacetate, a possibility which had been discussed earlier by LYNEN and LYNEN[8]:

$$\text{Oxaloacetate} \longrightarrow \text{Oxalate} + \text{Acetate}$$

The authors assume that in colourless tissues as in the roots of sugar beet, which have no glycolate oxidase and no glycolic or glyoxylic acid, oxalic acid is probably synthesized in this way.

As the formation of oxalate and the protein biosynthesis run to a large extent on parallel lines, large amounts of oxalic acid are found, particularly with rapid plant growth[9].

The content of oxalic acid does not fluctuate in general with the time of day, so that its actual concentration is determined by the relative rates of its production and its consumption.

In many species, including sugar beet, the quantity of the oxalic acid produced in water-insoluble form is determined by the quantity of the calcium absorbed, and it is just the content of oxalic acid which may be the cause of a particularly urgent calcium need[10,11,12].

The content of oxalic acid is likewise influenced by the kind of N nutrition (competition for the preliminary glyoxylate and oxaloacetate stages), i.e. in general the oxalate content diminishes considerably if ammonium salts are given to the plant instead of nitrates[13]. This was confirmed by JOY[14] for the soluble oxalic acid in sugar beet.

Oxalic acid, which has a relatively high dissociation constant ($pK_a = 1{\cdot}23$ at 25°C) for organic acids and the lowest free energy ($\Delta G° = 60{\cdot}1$ kcal/mol) of all carbonic acids in plants, is partly accumulated in water-soluble form as potassium salt, or, less frequently, as sodium salt or free acid; it is partly deposited as an insoluble calcium and magnesium salt crystallized in the vacuoles[15] and it is generally not degraded any more (it is often an end product of metabolism).

However, enzymes such as oxalate decarboxylase and oxalate oxidase are known which degrade oxalic acid. In sugar-beet leaves oxalic acid might be oxidatively decarboxylated relatively quickly through oxalate oxidase into carbon dioxide and hydrogen peroxide[16]:

$$HO_2C-CO_2H + O_2 \xrightarrow{\text{Oxalate oxidase}} 2\,CO_2 + H_2O_2$$

In the course of sugar manufacture oxalic acid is eliminated almost completely during juice purification[17]. In spite of this the tubes and walls of the evaporators are often covered with scales which consist mainly of calcium oxalate[18,19,20] and lead quite frequently to difficulties in the evaporating station.

Furthermore, the so very important natural alkalinity of the technological juices is based essentially on the oxalate content of the beet, for in the course of juice purification the oxalate anion, as well as citrate and malate and others, is to a great extent exchanged against OH^- and therefore acts indirectly as a supplier of alkalinity.

The following enzymatic determinations of oxalate have been carried out in view of this last-mentioned relationship with the alkalinity of sugar factory juices, and therefore they relate solely to the physiologically efficient oxalic acid which is present in sugar beet roots in dissolved form.

Experimental

The analysis of the sugar beet field trials which are more fully described in the foot notes of the Tables I–VI was done in such a way that approx. 100 beets per replication were ground to brei with a beet saw. From this brei press juice was produced by means of a juice centrifuge under standard conditions. This press juice was either used immediately for the determination of oxalic acid or kept as frozen juice. The oxalic acid content of the frozen press juice (as well as of brei) showed no significant changes during storage for 4 weeks.

The oxalic acid was determined with oxalate decarboxylase EC 4.1.1.2. (Sigma No. 0-3500) in a Warburg apparatus at a temperature of 37°C through the measurement of the released carbon dioxide[21,22,23,24]. For this purpose the enzyme was dissolved in 1M citrate buffer of pH 3·0 and 0·1 cm³ of the solution with an enzyme quantity of 4 U.cm^{-3} which was found to be optimum in preliminary experiments, was utilized for the test which was carried out with 0·5 cm³ press juice in a total volume of 2·0 cm³.

With raw juices 1 g was utilized for the oxalate determination. Thin juices were evaporated *in vacuo*, and of the residue 2 g was used for the analysis (the same was done with thick juice). Betaine was determined according to the method of FOCHT *et al.*[25] in the press juices which were purified with lime and phosphoric acid according to the method of CARRUTHERS and OLDFIELD[26]; all other organic non-sugars were determined enzymatically by methods described

[7] *Plant Physiol.*, 1968, **43**, 1821.
[8] *Liebigs Ann. Chem.*, 1918, **560**, 149.
[9] BORNKAMM: *Flora*, 1965, **156**, 139.
[10] LÖTSCH and KINZEL: *Biochem. Physiol. Pflanzen*, 1971, **162**, 209.
[11] GRÜTZ: *Landw. Forsch.*, 1956, **7**, 121.
[12] SCHARRER and JUNG: *Z. Pflanzenernähr., Düng., Bodenkunde*, 1954, **66**, 1.
[13] PAECH: "Biochemie und Physiologie der sekundären Pflanzenstoffe", (Springer Verlag, Berlin) 1950.
[14] *Ann. Bot.*, 1964, **28**, 689.
[15] AL-RAIS, MYERS, and WATSON: *ibid.*, 1971, **35**, 1213.
[16] FINKLE and ARNON: *Physiol. Plant.*, 1954, **7**, 614.
[17] CARRUTHERS and OLDFIELD: *Paper presented to the 12th Tech. Conf., British Sugar Corp.*, 1959.
[18] VUKOV: "Physik und Chemie der Zuckerrübe als Grundlage der Verarbeitungsverfahren" (Akadémia Kiadó, Budapest), 1972.
[19] MCGINNIS: "Beet Sugar Technology", 2nd Edn. (Beet Sugar Dev. Foundation, Fort Collins) 1971.
[20] HASHMEY: *Listy Cukr.*, 1971, **87**, 82.
[21] "Methoden der enzymatischen Analyse". Ed. U. BERGMEYER. Vol. II. (Verlag Chemie, Weinheim) 1970.
[22] JACOBY: *Methods in Enzymology*, 1962, **5**, 637.
[23] SHIMAZONO and HAYAISHI: *J. Biol. Chem.*, 1957, **227**, 151.
[24] BENGTSSON: *Anal. Biochem.*, 1967, **19**, 144.
[25] *J. Agric. Food Chem.*, 1956, **4**, 546.
[26] *I.S.J.*, 1961, **63**, 72, 103, 107.

earlier[27, 28, 29]. The separation and determination of the soluble and insoluble oxalic acid from freeze-dried sugar beet brei could be done according to BENGTSSON[23].

The average standard deviation of the oxalic acid determination calculated from 5 independent press juices amounted to ($\bar{x}$ = 8·85 ± 0·1 μ mol·cm^{-3}) S.E. = ± 0·22 (CV = ± 2·5%).

All oxalic acid contents determined in this paper are expressed in mg per 100 g of refractometric dry substance (*RDS*); they refer to the acid dissolved in beet press juices.

Results and discussion

The importance of oxalate for the natural alkalinity of technical sugar beet juices has already been pointed out. In this connexion it was of interest to obtain more detailed information on the genetic and environmental variability of the soluble oxalic acid content of sugar beet.

It is seen from the variety trials listed in Tables I and II that sugar beets contain at the time of the regular harvest between 100 and 380 mg of soluble oxalic acid per 100 g of RDS with optimum NPK fertilization. The differences between varieties grown under comparable conditions, even of the most divergent breeding types and origins, were not significant so that chances of selection for a change in the oxalate content of sugar beet for an improvement of their natural alkalinity are rather remote on this basis. However, it seems that some monogerm varieties (Table II, varieties IV–VI) have higher and one variety (Table I, variety V) significantly lower contents of oxalic acid in these particular trials.

The oxalic acid content of fodder beet (Table III) is, however, only higher than that of sugar beet because of the lower dry substance values.

In the course of growth the oxalic acid content of sugar beet decreases markedly, and by the middle of October it has fallen to half the values observed at the end of July (Table IV, Fig. 1). This corresponds to the behaviour of other N-free organic acids like citric acid and malic acid[28] with the difference that during the growing season in question, the oxalic acid adjusted itself only in the middle of October and then only for a short time (until the end of October) to constant minimum values of 225 mg/100 g RDS on average, and tended to increase again in November.

Consequently oxalate and other N-free organic acids accumulate in beet roots particularly in the presence of a high percentage of insoluble nitrogen (with intensive protein biosynthesis).

Table I. Oxalic acid content of various sugar beet varieties (Variety trial Einbeck 1973)

Variety	*Oxalic acid, mg per 100 g RDS*
I	138
II	136
III	152
IV	163
V	105
VI	132
VII	163
VIII	139
IX	142
X	161
LSD, 5%	40

Means of 3 replications

Table II. Oxalic acid content of various sugar beet varieties (Variety trial Einbeck 1973

Variety	*Oxalic acid, mg per 100 g RDS*
I	240*
	225
II	260
	231
III	218
	218
IV	348
	306
V	342
	315
VI	383
	319
VII	273
	241
LSD, 5%	31

* Harvested on 2nd and 16th October 1973, respectively, means of 3 replications

Table III. Oxalic acid content of various fodder beet varieties (Variety trial Einbeck 1973)

Variety	*Oxalic acid, mg per 100 g RDS*
I	447
II	461
III	451
IV	452
V	314
VI	439
VII	519
VIII	467
IX	506
X	562
XI	431

Harvested on 26th September 1973

Table IV. Oxalic acid content of sugar beet during the growing season (Field vegetation trial Einbeck 1973)

	Varieties			
Harvest Date	I	II	III	*x*
	—(*Oxalic acid, mg per 100 g RDS*)—			
31st July 1973	451	480	436	456
7th August	362	389	417	389
14th August	344	373	345	354
28th August	344	364	330	346
4th September	310	351	329	330
11th September	281	340	307	309
18th September	288	299	267	285
25th September	264	287	266	272
2nd October	240	260	218	239
16th October	225	231	218	225
30th October	213	237	226	225
13th November	227	242	237	235
LSD, 5%	48	48	48	28

Means of 3 replications per variety

[27] BURBA and KASTNING: *Zucker*, 1971, **24**, 386.
[28] BURBA and NITZSCHKE: *ibid.*, 1972, **25**, 509.
[29] *idem ibid.*, 1973, **26**, 356.

Table V. Influence of an increased N-fertilization on different sugar beet constituents. (Trial with increasing nitrogen rates, Einbeck, 1973)

Variety	Fertilization kg N.ha^{-1}	Sugar % on beet	Root yield dt.ha^{-1}	Dry matter (RDS) % on juice	Potassium meq per 100 g beet	Sodium meq per 100 g beet	Amino-N mg per 100 g beet	Marc content % on beet	Glucose mg per 100 g RDS	Fructose mg per 100 g RDS	Galactose mg per 100 g RDS	Malic acid mg per 100 g RDS	Citric acid mg per 100 g RDS	Raffinose mg per 100 g RDS	Oxalic acid mg per 100 g RDS	Glutamine mg per 100 g RDS	Glutamic acid mg per 100 g RDS	Betaine mg per 100°S	C/N	Q_i %
Kaweprecopoly	0	20·02	364	24·0	4·39	0·32	8·8	4·71	347	119	231	58	251	483	100	126	21	1001	2418	89·8
	150	18·77	502	23·5	4·33	0·47	33·4	4·97	361	132	307	61	353	554	181	517	25	1259	615	87·6
	300	17·78	526	22·4	4·45	0·60	51·0	4·73	456	181	366	72	419	618	226	1051	40	1410	355	86·3
Kawepoly	0	18·78	376	22·9	4·47	0·27	8·6	4·40	284	88	218	61	285	557	122	130	23	984	2272	88·4
	150	17·74	567	22·3	4·34	0·63	29·4	4·55	341	117	326	67	371	620	180	442	25	1139	658	87·2
	300	16·39	626	20·9	4·89	0·86	47·6	4·41	423	163	453	91	485	742	253	1564	33	1330	350	84·2
Kawegigapoly	0	17·68	378	21·4	4·98	0·39	10·0	4·40	277	79	203	74	353	571	147	185	30	964	1945	87·1
	150	16·49	625	20·9	4·96	0·77	41·2	3·95	358	132	375	86	411	639	247	834	33	1117	441	84·8
	300	15·20	661	19·7	4·85	1·26	56·1	4·23	377	143	420	95	595	762	268	1492	55	1317	276	81·1
LSD, 5%		0·56	41	0·6	0·56	0·17	9·1	0·65	66	38	57	10	130	80	43	567	15	132	368	1·6
Means of all varieties	0	18·83	373	22·8	4·61	0·33	9·1	4·50	303	95	217	64	296	537	123	147	25	983	2212	88·4
	150	17·67	565	22·2	4·54	0·62	34·7	4·49	353	127	336	71	378	604	203	598	28	1172	571	86·5
	300	16·46	604	21·0	4·73	0·91	51·6	4·46	419	162	413	86	500	707	249	1369	42	1352	327	83·9
LSD, 5%		0·32	24	0·4	0·32	0·10	5·3	0·37	38	22	33	6	75	46	25	327	8	80	212	0·9

Q_i = KWS quality index, see BURBA[30]; From marc content to betaine 3 replications per variety, the rest 6, 1 location. Remaining fertilization in kg.ha^{-}: K_2O = 200; P_2O_5 = 180; Plant density: 75,000.ha^{-}; Sown: 14th April; Harvested: 17th October

With increasing nitrogen fertilization (calcium ammonium nitrate) the content of oxalic acid of sugar beet is augmented (Table V). Citric acid and malic acid behave analogously. This had been observed during an earlier investigation[28] and applies also to glucose, fructose, galactose and raffinose[29].

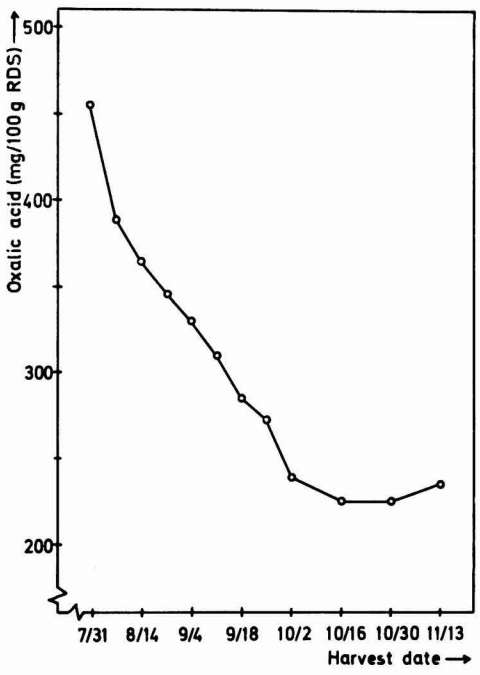


Fig. 1. Oxalic acid content of sugar beet during the growing season (Field vegetation trial Einbeck 1973)

Owing to the higher production of organic acids under the influence of increasing nitrogen fertilization, the cation-anion balance (cation excess) which is disturbed by the nitrate assimilation to organic nitrogen is probably readjusted.

The trial furthermore shows quite impressively the influence of the N-fertilization on the different substances which govern the quality of the sugar beet and on the technical quality of the beet in general (Q_i) as well as on some other less-often analysed non-sucrose constituents such as betaine, glutamine, glutamic acid, and marc content, the last not being influenced by N-fertilization.

The decreasing technical quality of the beet which occurs with increasing N-fertilization is above all due (as is well-known) to the rise of N-containing non-sugars (particularly glutamine—see Table V) with decreasing sugar content.

MILFORD and WATSON[31] established that with increasing N rates more sucrose as energy supplier is required in the root for growing processes. There is neither a specific effect on the sucrose storage nor reduced sucrose transport to the root. Since with the increased N rates the size of the storing cells also increases, there is consequently a dilution of the residual sucrose in the root.

The correlation between sugar content and amino-N content, viz.: $r = -0{\cdot}74$ ($n = 144$), is highly significant

[30] BURBA: *Zucker.*, 1971, **24**, 103.
[31] *Ann. Bot.*, 1971, **35**, 287.

in this trial (Table V), the results of which have been calculated over a period of three years (1971–73).

The contrary behaviour of carbohydrates and organic N compounds which is not confined to sugar beet[32] can be explained by metabolic processes; namely that the C frame of the α-ketoglutaric acid which originates from carbohydrate decomposition is used by means of NH_4^+ for the synthesis of glutamic acid and glutamine[33] which together make up approx. 50–60% of the amino-N content of the sugar beet[27].

The carbohydrate : N ratio (organic N) could therefore be utilized for the characterization of trials with increasing N-rates or of beet which are fertilized with different N-rates.

When for the trial with increasing nitrogen rates of the Table V the carbohydrate : N ratio is simply derived from the sugar and amino-N content of the beet (in Table V briefly designated as C/N ratio), the above-mentioned linkage of carbohydrate and N metabolism is quite impressively shown by the quotient which dropped by 82% (from 1531 to 281, maturity-retarding effect of increasing N fertilization) with 0 to 300 kg N per hectare on the average of three years. For the C/N ratio defined above there were in detail values between 200 and 2500 with an optimum range from < 550 and > 350.

The average ratio of the quantitatively most important N-free organic acids in sugar beet (citric acid: oxalic acid: malic acid) amounted on average in this trial to 5·2 : 2·6 : 1.

WALLENSTEIN and BOHN[3] found—as far as comparable—a value of 4 : 1·3 : 1 for this ratio.

The oxalic acid content of sugar beet was not affected by potassium and sodium fertilizer usage. This observation was made from a trial in Holland in 1973 with increasing potassium and sodium rates (Table VI).

When we compare our results so far indicated with the total oxalic acid determinations by LÜDECKE and FEYERABEND[34], hitherto the only systematic investigations in sugar beet, there is agreement on the following facts: the extreme breeding types and varieties (except for some monogerms) cannot significantly be distinguished by the content of oxalic acid; the content of oxalic acid of beet roots is relatively high at the beginning of growth and decreases more or less markedly in the course of the growing season and it is independent of the potassium fertilization.

However, we cannot confirm the non-significant influence of the N-fertilization on the oxalate content of the beet root.

In contrast to most other non-sugars the beet root contains considerably more soluble oxalic acid than the tops of the beet (Table VII). However, the test had to be carried out on mother beet which had been stored at + 4°C in cold storage for approximately 4 months.

Table VI. Influence of potassium and sodium fertilization on the oxalic acid content of sugar beet (Trial with increasing K and K-Na rates respectively, Holland, 1973)

Fertilization, kg.ha⁻¹ K_2O	Na_2O	*Oxalic acid, mg per 100 g RDS*	*Remarks*
0	—	261	
160	—	233	as K-60 %
320	—	247	
320	—	260	as K-50 %
LSD, 5%		45	
284	0	227	
213	46	244	
142	92	240	as K-60% and
71	138	241	NaCl-50%
0	184	254	
LSD, 5%		40	

Means of 4 replications.
Remaining fertilization in kg.ha^{-1}:
N = 138, P_2O_5 = 138 for the K trial.
N = 140, P_2O_5 = 100, MgO = 50, Borax = 5 for the K-Na trial.

Table VII. Distribution of different non-sugars in press juices of tops and roots of the sugar beet

	Top	*Root*	*Increase or decrease, %*
RDS (% on juice)	22·9	22·8	0
Potassium (meq/100 g juice)	5·15	4·07	— 21
Sodium ,,	0·55	0·30	— 45
Amino-N (mg per 100 g juice)	30·5	20·9	— 31
Glucose (mg per 100 g RDS)	208	187	— 10
Fructose ,,	70	34	— 51
Galactose ,,	372	426	+ 15
Raffinose ,,	692	529	— 24
Citric acid ,,	545	544	0
Oxalic acid ,,	183	279	+ 66
Malic acid ,,	113	89	— 21

Means of 2 determinations

According to studies by BAKER and EDEN[35] the percentage of soluble oxalic acid in sugar beet tops of the total oxalic acid content amounts on average to 42% with constantly decreasing values between the end of July and mid-January, whereby the oxalic acid in the leaves is four to eight times as high as that contained in the root[34]. Older leaves always contain more oxalic acid than younger ones.

The oxalic acid content of 8 raw juices of a sugar factory varied between 115 and 435 mg per 100 g RDS in the course of the 1973 campaign; in the thin juice it ranged between 5 and 41 mg per 100 g RDS with an average "purifying effect" of about 96%. This is in good agreement with the radioactivity measurements of CARRUTHERS and OLDFIELD[17]. According to the studies at hand the variations in oxalate content of the raw juices are less attributable to varietal differences than to cultivation influences. Thick juices contained, in general, no soluble oxalic acid. Closer investigations of the oxalate content of raw and thin juices might give interesting insights in the juice purification work of sugar factories.

Summary

The soluble oxalate content of sugar beet roots was analysed enzymatically in relation to the variety, time of harvest, and fertilization. It was ascertained that the oxalate content is in general less influenced by the variety than by the state of development and the N-fertilization of the beet.

[32] NIGHTINGALE: *Bot. Rev.*, 1937, **3**, 85; 1948, **14**, 185.
[33] PRICE: "Molecular Approaches to Plant Physiology" (McGraw-Hill, Toronto) 1970.
[34] *Zucker*, 1956, **9**, 569.
[35] *J. Agric. Sci.*, 1954, **44**, 394.

Sugar cane agriculture

Tracpaction. ANON. *Sugar y Azúcar*, 1973, **68,** (11), 8, 10, 14.—Tracpaction, or soil compaction resulting from passage of wheel or tracked machines, may affect the physical nature of the soil to such an extent that cane yield is only half that which could otherwise be attained. The function of the root system is explained as is the way in which it is affected by soil compaction. It is recommended that traffic patterns be established for farm machinery to limit the areas subject to compaction.

* * *

Quantity of organic material and nutrients which are incorporated in the soil with the renewal of sugar cane stools. F. A. FOGLIATA. *La Ind. Azuc.*, 1973, **80,** 127–129.—Analysis and calculation showed that when a harvested field is ploughed-in for re-planting, the 10,663 kg of stools per ha contribute 157·8 kg of N, 177·8 kg of K_2O, 64·2 kg of CaO, 34·6 kg of P_2O_5 and 35·4 kg of MgO to the nutritional status of the soil.

* * *

How to reduce the loss of cane by frosts. R. P. HUMBERT. *La Ind. Azuc.*, 1973, **80,** 138–139.—See *I.S.J.*, 1974, **76,** 273.

* * *

Irrigation research in Jamaica. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 6–13.—Cost analysis showed that, for areas exceeding 150 acres, use of several small portable sprinkler units may be more economical and practical than a single large unit. Irrigation scheduling was studied and the interval timing based on a water budget modified by also considering the age of the cane. Experiments were made to determine the effects of soil moisture stress on cane growth and it was found that irrigation of alternate rows increased water use efficiency and reduced costs. Soil salinity studies showed low levels which, however, increased during the crop but had negligible effects on the cane. Work has started on establishing salt tolerance of two cane varieties. Design criteria were studied for furrow irrigation on sandy loam soil at Caymanas; there was no significant difference between field slopes of 0·3 and 0·4% but water use efficiency was greater with smaller stream size (80 *vs.* 120 and 160 gpm) and longer furrow length (6 *vs.* 4 and 2 chains).

* * *

Sett germination improvement. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 13–15.—Greenhouse and field experiments were made to assess the effect of various chemicals on germination. "Tillex" and "Fertex" organomercurial compounds and "Cycocel" improved germination but the rate of stalk population increase was lower than with untreated setts so that at 4 months the stalk population of the controls was almost as good as the treated cane.

* * *

Top rot disease at Worthy Park. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 20.—A form of top rot was observed at Worthy Park and symptoms are described. A bacterium was isolated from diseased tissue and had characteristics very similar to those described for *Xanthomonas rubrilineans*, the causative organism of red stripe disease. Specimens have been sent for positive identification.

* * *

Juice quality in young internodes of cane. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 20–21.—The results of analyses of samples from the various internodes of canes of different varieties over a period of time showed that the juice quality of younger internodes was better than that of older internodes as the period of peak juice quality was approached, and that there were differences in juice quality of young internodes of different varieties at the same age.

* * *

Cane ripening trials in Jamaica. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 21–24.—E 8728, "Cycocel" and GS 4921 had little effect on juice quality while the response to "Ethrel 68-250" was inconsistent. "Racuza" showed poor performance but this may not reflect its true properties as the application recommendations have been changed. Late in the crop "Pesco 1815" did not retard loss of pol but early in the crop its beneficial effects were as noted earlier[1]. Pol % juice of cane treated with GS 241 improved relative to the control, optimum response being obtained 4–6 weeks after spraying. WL 1773 successfully prevented loss of pol late in the crop. "Polaris" performed consistently well and was the only one to justify mill-scale trials.

* * *

Pest control in Jamaica. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 24–30. The attempted mass rearing and use of *Apanteles flavipus* parasite for biological control of the small

[1] *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1964.

moth borer, *Diatraea saccharalis*, is described; however, borer attack at Frome was unexpectedly light and further trials will be made at Innswood. Preliminary trials were made on control of the jumping borer, but the level of attack was low and the effectiveness of the chemicals difficult to assess. "Azodrin" and "Birlane" did not appear effective, while "Bux" may have affected predators more than the borer itself. Early irrigation improved germination and cane vigour but did not affect the number of dead hearts resulting from the jumping borer. Termite attacks were noted in two areas and the feasibility of chemical control is being studied. A small attack of grey aphis, *Longiunguis sacchari*, was observed but control measures were not needed, while, except for one, no estate needed to spray against cane fly.

* * *

Extraneous matter and mechanical loading in Jamaica. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 30–34.—Factors influencing the cleanliness of mechanically-loaded cane are summarized and relate to operating practice, field conditions, the nature of the cane, and loader design. A number of pushpilers and a heap loader have been built and tested, their design being intended to minimize introduction of soil and stones with the cane. Comparisons are tabulated between the work of a Broussard push pile loader and a Toft self-propelled heap loader.

* * *

Stool cultivation. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 35–36.—In an experiment, the use of a "Culticane" stubble shaver interrow cultivator was compared with the use of two mouldboard plough bodies for off-barring; re-growth was poor where the former machine was used and much better where off-barring was employed.

* * *

Mechanical harvester trials in Jamaica. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 36–45.—Detailed accounts are given of studies using MF 201 and Don Mizzi 740 chopper harvesters and a Cameco whole-stalk harvester to obtain a realistic cost of operation of the machines and to familiarize estate personnel with them. The operating costs, maintenance records and performances of the machines are tabulated.

* * *

Cane varieties in Jamaica. ANON. *Ann. Rpt. Research Dept. Sugar Man. Assoc. (Jamaica) Ltd.*, 1972, 45–76. The principal variety grown is still B 4362 but its proportion (31%) is continuing to decline as it is replaced with newer varieties. The varietal choice in the various areas of the island are summarized as are the results of trials on new varieties. Tabulated data are given on the seedlings produced in the cane breeding programme.

* * *

The effect of consecutive fertilization and trash mulching on the yield of fourth ratoon cane. T. P. PAO. *Rpt. Taiwan Sugar Research Sta.*, 1973, (60), 1–11.—Compared with control plots, yields of fourth ratoon cane crops were 10% higher in sandy loam soil if each of the three preceding ratoons had been mulched during germination with trash which was later ploughed-in. Applications of 300:150:150 kg.ha^{-1} of N-P-K to the three first ratoons grown in sandy loam soil gave 11% higher fourth ratoon yield than when the N-P-K rate was 150:75:75 kg.ha^{-1}, while 10% higher yield was given by application of 225:112:112 kg.ha^{-1}. The highest N-P-K application gave only 6% higher yield than the lightest with cane grown in clay soil. Heavy fertilization plus trash mulching gave 14% higher yield than light fertilization without mulching in sandy loam and 7% in clay soil.

* * *

Entomogenous fungi on important sugar cane insects. Z. N. WANG and L. S. LEU. *Rpt. Taiwan Sugar Research Sta.*, 1973, (60), 13–24.—*Isaria sinclairii*, an entomogenous fungus, was found to attack nymphs of two cicadas, *Mogannia hebes* and *M. kashotoensis*, inducing 15% mortality of the latter in field trials. *Metarrhizium anisopliae* was found to attack adults, pupae and larvae of white grub, *Alissonotum impressicolle*, and was found to have infected a wireworm, *Melanotus tamsuyensis*, causing 25% and 35% mortality, respectively, in these 3 months after application in ratoon cane fields. *M. anisopliae* also attacked wireworms *Lacon musculus* and *Platynchus formosanus*, weevils *Episomoides albinus* and *Phytoscaphus formosanus*, the longhorn beetle *Dorysthenes hydropicus*, grasshopper *Patanga succincta* and hawk moth *Leucophlebia lineata*. The fungus *Beauveria bassiana* attacked the two *Mogannia* cicadas above, inducing 10% mortality in field trials, as well as the hawk moth larvae, grasshopper and the prominent moth *Anticyra combusta*.

* * *

Insect transmission of sugar cane white leaf disease by single leafhoppers *Matsumuratettix hiroglyphicus* Matsumura. C. T. CHEN. *Rpt. Taiwan Sugar Research Sta.*, 1973, (60), 25–33.—Experiments on the transmission of the disease from infected plants to a susceptible variety by single leafhoppers showed that a minimum of 3 hours' feeding time was required to render the leafhopper infective and 30 minutes to inoculate the disease into the new plant. Minimum incubation time was 14 days and the maximum 40 days. Of the adults tested, 65·6% of females and 45·8% of males appeared to possess infectivity.

* * *

Control of the nymphs of *Mogannia hebes* Walker by parasitic fungi in Taiwan. Z. N. WANG and L. S. LEU. *Rpt. Taiwan Sugar Research Sta.*, 1973, (60), 35–49. An account is given of pot tests in which nymphs of *M. hebes* were dipped in suspensions of *Isaria sinclairii* ($1{\cdot}5 \times 10^6$ conidia per ml); three months after inoculation the nymphs were all dead. The same result was observed using *Metarrhizium anisopliae* suspensions of 3×10^6 conidia per ml. Fungus cultures were mixed with sand or soil and placed in furrows

10 cm deep, using 25, 50 and 75 litres per ha. Mortality was greatest with the two higher amounts, reaching 71–82·5% nymph mortality where the fields were wet. Application on a total of 156 ha of cane fields gave 17·9, 22·0, 18·9, 18·8 and 8·8% nymph mortality respectively 3, 6, 9, 12 and 24 months after application. The fungi were at their most pathogenic when applied in wet soil, but this was probably not affected by fertilizers or change in soil temperature.

* * *

Effect of zinc-iron balance on the growth and nutrient uptake of young sugar cane. C. C. WEI, T. C. JUANG and C. H. CHANG. *Rpt. Taiwan Sugar Research Sta.*, 1973, (60), 51–59.—Cane grown under water culture showed highest stalk dry weight and length with 1 ppm Zn and 4 ppm Fe. The highest zinc uptake was found with 1·0 ppm Zn and 0·25 ppm Fe, while the highest Fe uptake was with 4 ppm Fe and 0·5 ppm Zn. Thus there was significant antagonism and interaction between the two as affecting growth and nutrient uptake. The leaf blade Zn, Fe and Mn contents were in accordance with uptake. Analyses and dry weights from the experiments were used as bases for multiple regression analysis by computer in order to develop a means of predicting stalk dry weight.

* * *

Effects of "Terracur P" and "Thimet" on parasitic nematodes and yield increase of sugar cane. C. H. HU and T. K. TSAI. *Rpt. Taiwan Sugar Research Sta.*, 1973, (60), 61–75.—Ten new nematicides were laboratory- and field-tested for control of nematodes and effect on cane yield. Based on counts of survivors, "Nemafos" gave best control, with only 2·6% nematodes surviving, followed by "Terracur P", "Fumazone 70E", "Lirofume", "Nemagon" and "Thimet". In the field, "Terracur P" showed the most significant yield increase with spring-planted cane (27·2% and 74·6% for two crops) while "Thimet" also produced higher yields than the control (21·3% and 50·2%). Other chemicals produced insignificant increases apart from "Fumazone" and "Vorlex" in the second crop which produced increases of 40·4% and 37·0%, respectively. The "Terracur P" treatment also contributed to control of the woolly aphid. Its cost would be a limiting factor to its use, however, although "Thimet" is competitive with "Fumazone" and could be used as a substitute.

* * *

Australian sugar cane research. O. W. STURGESS. *Ann. Rpt. Bureau of Sugar Expt. Sta.*, 1973, 79 pp.—The Director of the Bureau of Sugar Experiment Stations in Queensland, in his report to the Minister for Primary Industries, provides a comprehensive account of conditions—weather, pests, diseases, etc.—affecting the 1972 harvest; advisory services provided by the Bureau in regard to cane cultivation, farm management accounting, raw sugar manufacture and publications; research by the various divisions—Soils and Agronomy, Entomology, Pathology, Plant Breeding and Mill Technology; and also of the activities and facilities of the local experiment stations serving the Mackay, Lower Burdekin, Tully, Meringa and Bundaberg areas.

* * *

McLean 4-WD bogey trailer. L. G. VALLANCE. *Australian Sugar J.*, 1973, **63,** 339–341.—An illustrated description is given of a cane trailer made by McLean's Engineering Works at Murwillumbah, Queensland. It is fitted with side-tipping bins of 4, 5 or 6 metric tons capacity and is driven from the tractor p.t.o. With two differentials and a Leyland power-divided hub reduction bogey, and suspension allowing considerable up-and-down movement, the bin remains level irrespective of the terrain, and excellent traction is afforded under slippery in-field conditions.

* * *

Pneumatic system for cane trash removal. W. C. HEDICK, J. CLAYTON, G. N. FRANKS and D. B. CHURCHILL. *Sugar J.*, 1973, **36,** (6), 10–13.—Cane in Florida tends to be recumbent and is fed into harvesters in piles rather than continuously. Blower or suction fans remove the trash from the top of the cane mat but not lower, so that cane is delivered by the harvesters containing 7–15% trash. A system has been designed in which the cane passes over a conveyor comprising a series of rotating spike-tooth cylinders under a closed housing provided with a duct to a trash removal fan; soil and some of the trash fall through the gaps between the teeth of the cylinders to below the conveyor, while more trash is sucked into the duct before the cane is discharged over the top of the conveyor. Trials showed the desirability of a second fan, and other factors investigated include the conveyor angle, cylinder speed and use of a blower fan beneath the conveyor. Results are tabulated for experiments with unburnt cane in 9- and 18-inch billets, and unburnt, untopped mechanically harvested cane; in the latter, the trash content was reduced from 22·7% to 7·0%, with a cane loss through the cylinders of 1·3%.

* * *

Cane agriculture research in South Africa. W. J. F. CHANCE and J. WILSON. *Ann. Rpt. S. African Sugar Assoc. Expt. Sta.*, 1972–73, 52 pp.—The authors, Chairman of the Experiment Station Committee and Director of the Station, respectively, provide a detailed account of the work of the Station and activities of its staff and the extension and other services it provides. Research includes studies on nematode control and treatment of zinc-deficient soils, use of filter cake as fertilizer and reclamation of saline soil, stool eradication, trials with a Santal cane harvester from Brazil, testing of other machines including ploughs and cane loaders, and development of an asphalt barrier-laying machine. Agronomy research has included work on plastic mulching and variety trials for a number of areas in South Africa, fertilizer and varieties × water stress experiments, chemical control of weeds and the use of Monsanto's "Roundup" for chemical roguing of cane stools, as well as study of root damage by cultivators. Other studies described include soil P fixation, use of de-

waxed filter cake, N determination, etc., control of pests including *Eldana* borer, trash caterpillars, white grub and nematodes, photoperiod studies, use of radio-cobalt to induce mutation in cane plants, raising of seedlings, determination of the effects of spacing on cane yield, the relationship between water stress and ratoon stunting, fungicide trials, investigation of the reappearance of red rot, disease resistance trials, study of leaf scald and the effect of hot air treatment on germination, yield variability and the use of gibberellic acid and chemical ripeners, the design of drainage pipes, and photosynthesis.

* * *

Cane load indicators for sugar company in Trinidad. C. COOK. *World Farming*, 1973, **15**, (11), 6, 8.—See *I.S.J.*, 1974, **76**, 312.

* * *

Dodder (*Cuscuta campestris*), a new vector for transmitting spike and grassy shoot virus diseases of sugar cane. –. JHA, H. C. PRASAD and B. MISHRA. *Indian Sugar*, 1973, **23**, 515–516.—Dodder is a plant parasite which can be used to transmit the viruses causing the diseases and is thus suitable for aiding a search for alternative hosts in the study of the diseases.

* * *

Organization of cane supply with reference to sugar recovery. P. V. V. G. K. MURTY. *Indian Sugar*, 1973, **23**, 519–523.—A record recovery was obtained in the 1969/70 season at Thandava sugar factory and it is acknowledged that this was due to high cane quality since factory performance was constant. For this season, however, rainfall had been higher than in previous years of low recovery and it had also been evenly distributed. Cane of variety Co 997 had suffered less damage than Co 419 cane following a severe cyclone and it also proved less susceptible to drought. Methods are outlined for replacement of inferior varieties with plant cane of better material and also of planting at monthly intervals to ensure a supply of cane to the mill, all of which is 12 months old and of peak quality throughout the crushing season.

* * *

Sugar cane irrigation in Ivory Coast. R. BARAN. *Agron. Trop.*, 1973, **28**, 916–924.—An account is given of irrigation experiments to determine water requirements at Ferkessédougou where other conditions favoured establishment of a sugar cane area.

* * *

Investigations on sugar cane chlorosis in Uttar Pradesh. IV. Influence of iron, manganese and nitrogen applied as foliar spray on growth, yield and juice quality of chlorosis-affected crop. U. S. SINGH and L. SINGH. *Indian Sugar*, 1973, **23**, 525–528.—Cane chlorosis in Uttar Pradesh in 1968 was thought to be due to deficiency in Fe, Mn and N, and trials were made on treatment of an affected crop with single and combined sprays of 2% $FeSO_4$, 0·5% $MnSO_4$ and 2% urea. All treatments proved beneficial, the most successful being a combined Fe-Mn-N spray which improved cane weight by 159·1% and sucrose content by 50·6%; as a result of a reduction of 26·9% in reducing sugars, sugar recovery on cane was 65·2% higher.

* * *

Integrated control of sugar cane pests and diseases. P. N. AVASTHY and K. SINGH. *Indian Sugar*, 1973, **23**, 529–532.—Sugar cane is subject to the attack of many pests and diseases throughout its growth, and it is believed that an integrated control system can be applied which incorporates complementary measures designed to overcome the effects of a wide range of the hazards. The measures extend from selection of seed cane from healthy plots and heat treatment and dipping of the seed pieces, to application of insecticide to the furrows, roguing of diseased and borer-infested plants, application of BHC against pyrilla and white grubs, spraying with "Malathion" against scale insects and aphids, release of the parasite *Isotima javensis* against borers, etc.

* * *

BO 34—a dependable new mid-cane for East U.P. B. K. MATHUR and A. SINGH. *Indian Sugar*, 1973, **23**, 535–537.—Deterioration of BO 17, grown widely in east U.P., requires its replacement and trials have shown BO 34 to be suitable, producing more tillers, more millable stalks and higher cane yields, while juice quality is only slightly inferior to BO 17. The new variety ratoons well with good yield.

* * *

Use of "Eptam" alone and in combination with 2,4-D in a sugar cane crop. I. D. VERMA, M. M. S. SAXENA and R. P. SINGH. *Sugar News* (India), 1973, **5**, (5), 5–6. Trials were made with "Eptam" alone and with 2,4-D in pre- and post-emergence and in pre- plus post-emergence treatment to determine its effect on perennial weeds *Cyperus rotundus* and *Cynodon dactylon*, as well as other weeds. Best results with *C. rotundus* were obtained using the combined herbicides for both pre- and post-emergence treatment; none of the treatments controlled *C. dactylon*.

* * *

Cane breeding in Barbados. ANON. *Ann. Rpts. W. Indies Central Sugar Cane Breeding Sta. and Barbados Sugar Cane Variety Testing Sta.*, 1969/70, 70 pp.—A detailed account is given of achievements in the breeding programme which is intended to broaden the genetic base of the parent collection as quickly as possible. The results involve noble canes, first nobilizations and backcrosses. The testing stations raised about 150,000 seedlings in the 1969 crossing season and first selections were made from the 1968 seedlings as the B 71 series. Variety trials on the B 69 and earlier series are reported and an account is given of work on the control of flowering and of mutation experiments, a modified technique for counting chromosomes, and work on morphological and physiological bases of differences between cane clones with special reference to flowering.

Techniques in reducing sugar cane production costs. V. V. ELLIOTT. *Sugar News* (Philippines), 1973, **49,** 300–306.—Reduction of cane production costs may be achieved by reduction of waste caused by failure to achieve maximum return on the resources employed. Methods and principles for such waste reduction are outlined for a number of aspects of cane agriculture, including land preparation, cane variety selection, cane planting, weed control, fertilizer usage, cultivation, harvesting, transportation and turn-round time. The importance of costs statistics and cane quality assessment are mentioned as are aspects of factory management.

* * *

Factors of production in sugar cane farming at C.S.E. (Canlubang Sugar Estate). E. B. PUYAOAN and R. A. CRUZ. *Sugar News* (Philippines), 1973, **49,** 308–314. Computer analysis of data compiled over seven consecutive crop years indicated that the importance in production limitation of a number of factors was in the following descending order: solar radiation, rainfall, soil pH, Ca, K, organic matter, N, Mg and P. Soil potassium has been depleted and greater K application should be undertaken as should maintenance of soil Mg, P and organic matter, as well as pH adjustment.

* * *

Potassium fertilization of sugar cane and *Chloris gayana* in Réunion. J. FRITZ. *Agron. Trop.*, 1973, **28,** 1035–1048.—Cane crops remove 50–400 kg.ha^{-1} of K_2O per year from the low potassium reserves of the volcanic soils in Réunion; consequently serious deficiencies have occurred with stunting, and the cane responds to added potash which need not be very much higher than levels needed for maintenance of soil K, i.e. 1·5 kg K_2O per ton of cane.

* * *

Sugar cane yield and juice quality effect of N-P-K. D. N. GUPTA. *Sugar News* (India), 1973, **5,** (6), 15–17. Studies on the effect of N, P and K on the yield and juice quality of cane were made at 17 experimental centres in western U.P. during 1965/66 and 1966/67. Increasing amounts of N raised the cane yield but reduced juice purity, while phosphate addition proved beneficial only at the higher levels of N fertilization. Potassium did not produce any beneficial effects. It was concluded that optimum fertilizer treatment was 150 kg N and 75 kg P_2O_5 per ha.

* * *

A progress report on the sugar cane tissue and cell culture programme. M. C. LIU and W. H. CHEN. *Taiwan Sugar*, 1973, **20,** 209–215.—Up to December 1971 some 4600 plants had been developed from callus tissue on 58 clones. Owing to limitations of time and cost, further studies were limited to 1500 plants from the best 8 clones, and selection for 2nd-year propagation has reduced the number to 34 plants from 4 clones. The differences between the asexually-produced plants and the donors of the callus tissue have been studied, the greatest frequency arising with auricle length and dewlap. Genetic studies showed the variable effect of difference in chromosome number on morphology. The new plants showed a greater variability in juice Brix and sucrose than the donor plants and this might be of value for selection of the high-sucrose clones. Experiments have been made in induction of mutation by use of colchicine and also ethyl methane sulphonate, as well as gamma rays; the first produced remarkable increases in chromosome numbers while the last demonstrated the sensitivity of the plants to radiation and indicated the need to study the dose needed to produce genetic change without tissue damage. Calluses grown in liquid media containing arginine showed considerable effects on cell growth. Experiments have been made to identify the origin and processes of shoot formation in callus tissue and it has been found that a mass of cells is generated from the cambium-like tissue between the xylem and phloem at the site of the wound.

* * *

The 1974 crop; how to get the most from it. ANON. *Producers' Rev.*, 1973, **63,** (11), 44.—Recommendations are made in regard to fertilizers, cane pest and weed control, and disease control treatment to be applied in Queensland to ensure maximum cane production in 1974 without putting the 1975 crop at hazard.

* * *

Effect of trash on plant growth and pest incidence in sugar cane ratoon during hot weather. N. L. SINGH, B. N. PANDEY and R. DAYAL. *Sugar News* (India), 1973, **5,** (6), 18–20.—Trash burning was found to supply considerable nitrogen and organic matter to the soil and improved tillering by 17% and dry matter yield by 57%. Nitrogen uptake by the ratoon crop was increased by 33 kg.ha^{-1} but, while burning of trash resulted in successful control of the black bug, incidence of shoot borer increased 3–8 times.

* * *

The rôle of micronutrients in cane cultivation. G. K. ZENDE. *Sugar News* (India), 1973, **5,** (6), 21–27.—A review is presented of the literature on the micronutrient status of cane soils in India, deficiency symptoms, micronutrient contents of cane tissues and their rôle in the development of cane and sugar accumulation, their effect on dipped setts development and the uptake of mineral nutrients from the soil, as well as the response of ratoon crops.

* * *

The Toft "Robot 300", a new medium-size cane harvester. L. G. VALLANCE. *Australian Sugar J.*, 1973, **65,** 389, 392–393.—An illustrated account is given of this new machine which is under trial in Queensland. It includes elevators, extractors, topper, and base cutters similar to those used in the Mk .I and Mk. II "Robot" harvesters but uses two chopping blades on a rotating drum instead of a swinging single blade for cutting of billets. This permits a wide and shallow blanket of cane which is likely to benefit trash removal.

Continued studies on weed control in sugar cane. M. V. SANT and S. K. LAD. *Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I), A.1–A.8. Screening trials on a range of herbicides, used singly and in combination, showed no advantages for these over the standard pre-emergence treatment with "Atrazine".

* * *

Co 6415, a promising variety of cane for North Karnatak. R. R. PANJE and A. L. SARPOTDAR. *Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I—Addendum), A.14–A.19.—This new variety has been shown in trials to be a suitable early cane for the area, giving yields and juice quality as good as or better than the standard Co 740. It is fairly drought-resistant, is self-trashing, and in regard to disease resistance is about as good as Co 740.

* * *

Water requirements of sugar cane—a review. P. N. CHOUDHARY and M. LALL. *Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I—Addendum), A.20–A.28.—The literature on water requirement of cane in India is surveyed and an account given of techniques for its determination. Measurement of evapotranspiration/pan evaporation ratio is simple, reliable and rapid and can be used for scheduling irrigation.

* * *

Effect of plant densities on yield components in sugar cane. R. R. PANJE. *Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I—Addendum), A.46–A.51.—Cane planting distances were varied between 30 × 30 cm and 90 × 90 cm and the effect determined on number of millable stalks, weight and length of stalks, and yield of cane per ha. The number of canes per clump was higher with the wider spacing but the number of plants was fewer and the overall number of stalks and the cane weight per ha was lower than with closer spacing.

* * *

Chemical control of sugar cane scale insects and mealy bugs in the South Gujarat area. A. H. SHAH, V. J. JORA, K. P. GODHANIA and D. M. SUTHAR. *Proc. Seminar on Crop Protection in Sugar Cane* (Deccan Sugar Tech. Assoc.), 1973, 9–12.—Trials are reported where control of scale insects and mealy bugs was attempted by soil and foliar application of a range of chemicals. Of the soil-applied chemicals, "Carbofuran" at 3 kg a.i. ha^{-1} proved most effective, giving the highest cane yield, while among the sprayed chemicals, "Monocrotophos" and "Methidathion", both at 3 litres a.i. per ha, gave equal highest cane yield but the latter gave lowest pest incidence.

* * *

Control of sugar cane nematodes by DBCP ("Nemagon"). G. VARADHARAJAN, A. S. SATHIAMOORTHY, G. ARJUNAN and S. D. RAJAN. *Proc. Seminar on Crop Protection in Sugar Cane* (Deccan Sugar Tech. Assoc.), 1973, 13–16.—Treatment with "Nemagon" (dibromochloropropane) in two equal doses of 19 litres.ha^{-1} when cane was 6 and 7 months old reduced the nematode population without harming the cane which, on the contrary, gave yields higher by 23·1–24·4%.

* * *

Pest problems of sugar cane in Bihar and measures evolved for their control. M. M. SINHA. *Proc. Seminar on Crop Protection in Sugar Cane* (Deccan Sugar Tech. Assoc.), 1973, 17–22.—A survey is presented of the pests attacking cane in Bihar, with recommendations and experience recorded in their control. The pests include shoot borer, top borer, stem borer, termites, pyrilla, white fly, mealy bugs and scale insects, army worm, grasshoppers, beetle grub, black beetle and mites.

* * *

New dimensions of the root borer, *Emmalocera depressella* Swinh. O. P. SINGH, Y. P. MADAN and S. R. YADAV. *Proc. Seminar on Crop Protection in Sugar Cane* (Deccan Sugar Tech. Assoc.), 1973, 23–26. The root borer has been known in India since 1895 and has been found to attack the underground part of the cane. In 1971/72, however, a number of cases were found where the larvae were collected from up to 157 cm up the cane height and it is indicated that the pest may be adapting itself to the aerial part of the stalk, and its harmful character would thus be increased. It also appears to be associated with wilt disease, and when associated with this and stalk borer attack is causing appreciable losses.

* * *

Problems of sugar cane diseases in Gujarat. H. U. JOSHI. *Proc. Seminar on Crop Protection in Sugar Cane* (Deccan Sugar Tech. Assoc.), 1973, 27–33.—Bacterial diseases, including gummosis and red stripe, fungal diseases (rust, brown spot, black rot, red rot, wilt and smut) and virus diseases (grassy shoot and mosaic) as well as the occurrence of plant parasites such as *Striga* sp. have been reported in Gujarat and are described. Suggested control measures are briefly discussed and emphasis given to the provision of disease-free, heat-treated seed cane treated with fungicide, combined with control of vectors by insecticides, etc.

* * *

Important diseases of sugar cane and their control measures. K. SINGH and V. P. AGNIHORTI. *Proc. Seminar on Crop Protection in Sugar Cane* (Deccan Sugar Tech. Assoc.), 1973, 65–76.—A survey is presented of diseases affecting cane, indicating causes, symptoms and control measures. They include red rot, wilt, pineapple disease, smut, rust, grassy shoot, ratoon stunting, mosaic and red stripe. Also discussed are nematodes associated with cane and their control.

* * *

Menace of the white grub. I. G. R. RAO, D. V. DIVEKAR and S. L. DABEER. *Proc. Seminar on Crop Protection in Sugar Cane* (Deccan Sugar Tech. Assoc.), 1973, 95–97.—White grubs attack the living roots of cane and can cause severe damage. Control by the use of soil insecticides and collection of grubs by digging-out is explained; the latter, while laborious, is a sure and effective method of control.

Sugar beet agriculture

The value of beet infected with virus yellows and stored in piles. M. KUBACKA-SZMIDTGAL. *Gaz. Cukr.*, 1973, **81**, 300–302.—Tests covering 1970–72 are reported in which beets infected with virus yellows were stored for an average of 50 days with forced ventilation and their quality compared with that of healthy beets under identical conditions. It was found that sugar losses and invert sugar content were higher and juice purity lower in the infected beet than in the healthy beet. The diseased beets were also subject to more intense rotting. The point is made that, since virus yellows symptoms are only found in the leaves, it is desirable to isolate the infected beet in the field from healthy beet, as otherwise once the leaves are removed the infected beet can transfer the disease to healthy beet with which they come into contact.

* * *

The British sugar beet industry. O. S. ROSE. *Sucr. Belge*, 1973, **92**, 437–447.—Following a brief résumé of sugar beet production statistics from 1936 to 1971, the author draws attention to the wide range of soil types in Great Britain and to trends in fertilizer usage during the past ten years. Progress in the improvement and use of polyploid multigerm and genetical monogerm varieties is outlined and reference is made to the rapid adoption of pelleted seed, particularly "Filcoat". Seed bed preparation techniques, drilling at wide seed spacings and the control of weeds, pests and diseases are discussed. The author briefly surveys the types and performances of mechanical harvesters, and finally gives details of some of the factors that affect beet quality and juice purity standards.

* * *

The problem of bolting beet. V. STEHLÍK, L. SCHMIDT and R. ŽELEZNÝ. *Listy Cukr.*, 1973, **89**, 241–250. Causes of bolting in beet are discussed. It is pointed out that while the usual approach is ecological or physiological, genetic factors having a bearing are often ignored. Reference is made to the findings of a number of authors. Investigations have demonstrated the greater weight and ash content and lower sugar content of bolters compared with normal beet, and data indicate the further deterioration in bolters with age.

* * *

Mechanization of spring work in beet cultivation. –. LAHBIB. *Sucr. Maghrebine*, 1973, (8), 6–10.—A summary is made of spring work in various beet-growing countries on the basis of contributions made to the 36th Winter Meeting of the IIRB in February 1973. Topics covered include seed bed preparation, the importance of the beet seed, sowing and planting equipment, row spacing, chemical weed control and the labour saving from mechanization.

* * *

Advantages and disadvantages of certain seed forms with regard to the technical possibilities of precision drilling. E. BORNSCHEUER. *Zucker*, 1973, **26**, 644–647. The size distribution and shape of graded monogerm seed, seed for precision drilling and pelleted seed were compared, and pelleted seed found to be more suitable with the drills normally used than unpelleted seed. Graded monogerm seed prove particularly difficult with precision drilling because of their unsuitable ratio between diameter and thickness, a factor which varies considerably between varieties and origins.

* * *

Crop density and some characteristics of sugar beet. P. STATICESCU. *Ind. Alimentara*, 1973, **24**, 241–245; through *Abs. Rom. Sci. Tech. Lit.*, 1973, (4), 1092. Both the weight and root diameter of sugar beet were found to be inversely correlated with the sugar content. A direct correlation of weight with root diameter was noted. The sugar content undergoes a gradual decrease between light roots (100 g) and heavier roots; the values of the regression coefficient are higher where the number of plants grown per hectare is small.

* * *

Approval and use of chemicals for plant protection in root crops within the framework of legal requirements. H. ORTH. *Zucker*, 1974, **27**, 27–30.—The legal aspects of agricultural chemicals application in West Germany and toxicological problems created by e.g. mixing certain herbicides with pesticides are examined. A number of chemicals for use in beet agriculture are mentioned.

* * *

Development of beet quality during the 1972/73 campaign. P. DEVILLERS, C. CORNET, P. GORY, M. LOILIER and J. ROGER. *Sucr. Franç.*, 1973, **114**, 536–541; 1974, **115**, 30–36.—The availability of automatic equipment for large number of analyses in tarehouses has provided the opportunity of studying the results of such analyses and the relationships between the constituents, beet quality as assessed by the WIENINGER & KUBADINOW formulae[1] and corrected industrial results. Analyses were made at six factories of pol % beet and

[1] *Zucker*, 1971, **24**, 599–604; *I.S.J.*, 1972, **74**, 88.

K, Na and amino-N % beet, K, Na, (K + Na) and amino-N % sucrose. Variations in these quantities during the campaign are tabulated and illustrated with graphs, as are the true and calculated values of thin juice purity and yield. It was found that the loss to molasses could be calculated from the Na, K and amino-N % beet with an accuracy of ± 5%. The WIENINGER & KUBADINOW formulae take no account of reducing sugars content, however, and while the latter is insignificant with fresh beet, the presence of reducing sugars in deteriorated beets can cause anomalous results. The formulae are suitable for comparison between beets which may give extremes of 100–200% variation in beet quality against which the 5% precision is small. Automatic analysis can thus be of great benefit in regard to beet breeding, fertilizer trials, etc., and the study of optimum growing and harvesting conditions.

* * *

Choice and decision in population density. A. FLEURY. *Hautes Etudes Betterav. Agric.*, 1973, **5**, (22), 14–25. The yield of beet is not directly proportional to the number of roots per unit area, i.e. the population density, and the effect of a number of factors is considered.

* * *

Beet growing in Greece in the face of disease and parasitic infections. T. STROUTHOPOULOS. *Hautes Etudes Betterav. Agric.*, 1973, **5**, (22), 27–34.—An introduction is given to the history of the modern beet sugar industry in Greece, dating from 1961, and a survey made of problems currently facing it, including pests, particularly nematodes, and diseases, including *Cercospora*, yellows, etc. Measures taken are described and prospects for the future discussed.

* * *

Fertilizer needs of sugar beet. Y. SINGH and S. P. SINGH. *Fertilizer News*, 1973, **18**, (10), 36–38.—Fertilizer trials at Pantnagar are reported. There was no response to K, and a response to P was recorded in only one year. With N, however, the response varied with the plot and the season. A beet crop of 61·5 metric tons.ha^{-1} was obtained and this removed 120 kg.ha^{-1} of N; time of nitrogen application was important, the maximum yield being obtained when the total dose was applied in three equal parts (one at sowing, and the others one month and two months after sowing). Ammonium sulphate, calcium ammonium nitrate and urea were found to be equally good forms of N.

* * *

Comparison of monogerm sugar beet varieties. J. ZANA. *Cukoripar*, 1973, **26**, 206–209; 1974, **27**, 10–15.—Comparative tests on twenty-five Hungarian and non-Hungarian monogerm beet varieties conducted at three locations during 1971/72 are reported. Outstanding as regards sugar content and yield per ha was the Hungarian Beta Monopoly N. Differences were found in the results for the same beets at the different sites. A number of the imported varieties did well as regards root yields per ha. Little difference was found with regard to susceptibility to *Cercospora beticola*.

* * *

Sugar beet cultivation in Rumania. J. POPOVICI, V. PLATON, Z. STANESCU and G. RIZESCU. *Cukoripar*, 1974, **27**, 16–18.—A survey is presented of beet agricultural practices in Rumania, including varieties grown, yields, fertilization and weed, pest and disease control.

* * *

Control of powdery mildew of sugar beet. A. D. KARVE, A. C. BHALERAO and V. G. MHAISKAR. *Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I), A.9–A.15.—Powdery mildew, a fungal disease caused by *Erysiphe betae*, was first observed in India in 1968/69, and can cause a 20–25% reduction in yield. Experiments showed that, while sulphur dusting or spraying with wettable sulphur gave satisfactory control, the best treatment was with 250 g a.i. per ha of "Oxythioquinox".

* * *

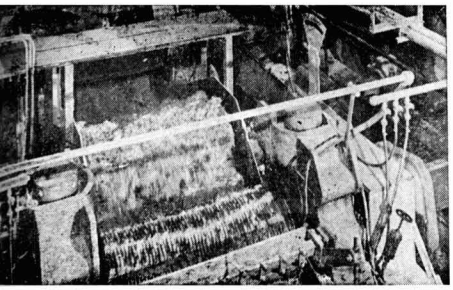
Sugar beet irrigation on heavy soils. K. H. MARTIN. *Zucker*, 1974, **27**, 79–85.—Irrigation trials over a 6-year period on two soil types are reported. While irrigation was not economically justifiable in the case of the deep silty para-brown soil since root yield was only very slightly increased, in the case of the relatively shallow pelosoil of high clay content, dry periods in 4 of the 6 years so restricted growth that irrigation at 50% utilizable water capacity caused an increase in growth beyond the average for the 6 years.

* * *

Root diseases of plants. Importance of the study of phytopathogenic fungi in the soil. J. LOUVET. *Hautes Etudes Betterav. Agric.*, 1974, **6**, (23), 7–14.—The subject is discussed generally, with some mention of the fungal diseases of beet roots, under the headings of diagnosis, soil characteristics affecting development of the diseases, the behaviour of the pathogens in the soil, relations between the plant host and the pathogens, and latest methods of control.

* * *

Systemic nematicide control of *Heterodera schachtii* on sugar beet. G. D. GRIFFIN and T. G. GESSEL. *Plant Disease Reporter*, 1973, **57**, 942–945.—In trials with a number of granular systemic nematicides and soil fumigants, "Aldicarb" at 40 lb.acre^{-1} had greatest beneficial effect, in one field giving a yield of 21·58 tons.acre^{-1} compared with 12·52 tons.acre^{-1} in the untreated control. Application of 200 lb.acre^{-1} of 1,3-D 14 days before "Aldicarb" at 40 lb.acre^{-1} gave excellent results in terms of yield which easily offset the slight reduction in beet sugar content compared with the control. DD fumigant and "Carbofuran" and "Ethoprop" granules proved toxic to beet (the last-mentioned very phytotoxic), although the two granular nematicides did give beneficial results where fields received 2½ inches of rain before the beets were planted. "Oxamyl" had an apparent short residual period which reduced its effect.



Cane sugar manufacture

Factory trials of modified mother liquor sampler—an instrument for studying the exhaustion of mother liquor during various stages of pan boiling. K. K. GUPTA, R. K. DIXIT and A. B. LAL. *Indian Sugar*, 1973, **23**, 295–303.—Trials are reported at four sugar factories on the best location, use and reliability of a sampler which is able to extract samples of massecuite and mother liquor from within a pan whereby it is possible to determine the degree of exhaustion of the mother liquor.

* * *

An arrangement using batch crystallizers as continuous. A. C. CHATTERJEE and C. SHYAMSUNDER. *Indian Sugar*, 1973, **23**, 305–310.—Formerly massecuite was dropped into a bank of five Blanchard-type crystallizers of 40 tons capacity, air-cooled from about 65°C over about 3 hours, and then cooling water started in the heat exchange elements, where the supersaturation was maintained in the metastable zone and the temperature was brought to about 47°C in 3–4 hours before passing to a pug mill where it was reheated to 50–52°C with third vapour before purging. The system was changed so that the crystallizers were connected end-to-end in series, the first unit being air-cooled (as in the strike receiver) and the next four cooled by water. Massecuite is passed through these to a header where it is reheated with hot water before discharge to the pug mill. The cooling became more uniform, so increasing the purity drop, while the capacity was increased. The use of a header also ensured even flow to the centrifugals.

* * *

Optimal control of batch raw sugar crystallization. J. A. FREW. *Ind. Eng. Chem. Process Design Dev.*, 1973, **12**, 460–467.—Batch raw sugar crystallization is studied using optimum control theory. Control policies are obtained that enable crystals of specified size to be produced in minimum time without forming false grain by nucleation. Feeding with both syrup and molasses is considered. The optimal control policies for feed and evaporation rates may be rationalized into operating principles which form the basis of a readily implemented algorithm. One of these principles, that of withholding feed less pure than the pan contents, represents an innovation in the field.

* * *

Bagasse press and magnet for recovering sugar from bagasse. ANON. *Sugar y Azúcar*, 1973, **68**, (10), 58. Bagasse from the last mill at St. Mary Sugar Coop. Inc., Louisiana, is passed beneath an Eriez magnetic tramp iron separator, treated with maceration water at the rate of 150% on dry fibre, and fed to a French press which reduces the moisture content to 48–50% from an original 54%. At the same time the pol % bagasse is reduced from 4–4·5% to 2·75–3%.

* * *

Polymer flocculants in mud filtration. J. C. P. CHEN and R. W. PICOU. *Sugar J.*, 1973, **36**, (6), 8–9. Comparative trials are reported on the use of "Percol LT-26" and "Nalco 41A06" against "Separan AP-30" as standard for cane mud flocculation, the muds being filtered on two "Eimcobelt" filters with polypropylene cloth, switching feeds to the filters alternately to eliminate the effect of other variables. The results are tabulated. Both polyelectrolytes reduced the pol loss on solids, "Nalco 41A06" by 13%, using about a quarter less dosage.

* * *

Production of high quality raws. E. R. DE LUZURIAGA. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 24–40.—See *I.S.J.*, 1974, **76**, 149.

* * *

"Hi-Extraction" process—a high extraction washing-rinsing-squeezing process for the separation of juice from sugar cane. J. W. BERSCH. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 153–165.—The Honiron "Hi-Extractor" cane diffuser is described.

* * *

Hard-facing as applied to the sugar industry. J. C. MESSINGGER and M. B. PARREÑO. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 169–184.—Hard-facing (application, by welding, of an alloy to a metal part to produce an abrasion-resistant surface) is described and its use in the case of various pieces of cane sugar factory and agricultural equipment illustrated.

* * *

Bagasse boiler design. ANON. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 185–198.—Details are given of the types of bagasse-fired furnaces and boilers and their controls manufactured by Takuma Co. Ltd. and supplied to sugar factories in a number of countries.

* * *

Improving clarification by flocculants in the Indonesian sugar industry. M. MOCHTAR. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 199–212.—Laboratory and factory tests on "Separan AP-30", "Separan AP-273", "Zuclar 106", "Primafloc S-112" and

"Sedipur T1" are reported and the results obtained in some 30 Indonesian factories since 1971 with the use of two of them (mostly "Separan AP-273" but also "Zuclar 106" were used) are discussed generally, showing that addition of 1–3 ppm flocculant to juice increased purification efficiency by 25–30%, while addition of 5 ppm to muddy juice gave better filtration and mud structure, a decrease in mud pol, reduced retention time in batch clarification, etc.

* * *

Continuous sugar cane diffusers in the Philippines sugar factories. H. A. NAQVI, D. J. SUERTE and R. SAMANIEGO. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 213–220.—See *I.S.J.*, 1974, **76**, 24.

* * *

Tracing the causes of high ash in sugar and molasses. E. B. PUYAOAN and R. A. CRUZ. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 240–244.—Investigations into causes of high ash contents in mixed juice (906–2192 ppm) and clarified juice (700–1932 ppm) as well as molasses are discussed and the improvement brought about by more efficient clarification with greater juice P content is described. Increase in juice Ca content was ascribed to increased liming.

* * *

Philippine perlite filter aids and their use in the sugar industry. C. M. MADRAZO and C. L. MADRAZO. *Proc. 20th Ann. Conv. Philippines Sugar Tech.*, 1972, 245–250.—Properties of perlite are presented and the chemical compositions of Philippine and US perlite compared. Use of perlite as precoat in syrup and Oliver filtrate treatment is briefly discussed with reference to some preliminary tests.

* * *

Deterioration of raw cane sugar. II. Microbial contamination. S. JOLY and J. P. STUPIELLO. *Brasil Açuc.*, 1973, **82**, 346–352.—Samples from three batches of raw sugar were examined before and at intervals during one year of storage, and counts of fungi, bacteria and yeasts determined. Different samples of the same sugar were found to have different levels of contamination, and during the storage period, counts of mesophilic organisms (bacteria and moulds) varied irregularly. The numbers of thermophilic acid-forming bacteria were practically constant but anaerobic H_2S-forming bacteria numbers were not. Some sugar samples would not have been acceptable because their mesophilic or thermophilic (or sometimes both) bacterial levels were higher than established limits.

* * *

Industrial cane juice in the defecation phase. C. BAYMA. *Brasil Açuc.*, 1973, **82**, 373–384.—The composition of cane juice is discussed with tables of data for 1st, 2nd and 3rd mill juice from Cheribon, Borneo and Red cane. Variations in composition as a result of imbibition are calculated and compared with actual figures. Measurement of the quantity of juice in a tank is explained and the means of correcting a Brix value for temperature variation indicated. Definitions are given for 1st mill juice, mixed juice, etc., and also means of calculating imbibition water, purity, glucose coefficient, etc.

* * *

Sugar cane production returns to Texas. A. N. HULL. *Sugar y Azúcar*, 1973, **68**, (11), 21–26.—A detailed and illustrated account is given of the W. R. Cowley raw sugar factory near Santa Rosa, Texas, and the sugar cane area surrounding it. Rio Grande Valley Sugar Growers Inc., the cooperative owning the factory, includes 118 members with a planted area of 24,700 acres for the 1973/74 crop, all of which is irrigated. The factory, designed by F. C. Schaffer & Associates Inc., has a designed crushing capacity of 8000 t.c.d. with a six-mill Dibert, Bancroft & Ross tandem.

* * *

Evaluation of the efficiency of cane diffusers by transfer units. G. V. GENIE. *S. African Sugar J.*, 1973, **57**, 601–607.—The general principles of sugar extraction by mass transfer in a counter-current extractor are explained and it is suggested that the efficiency of cane diffusers be evaluated in terms of transfer units analogous to theoretical plates in distillation columns. The number of transfer units of a practical diffuser is the number of perfect counter-current batch extractions that would be necessary to produce the same juice from the same material with equal losses. A method for computing that value is outlined and difficulties arising from juice and press water recirculation to the diffuser are discussed.

* * *

Rational sizing of individual evaporator bodies. A. J. MARGABHANDU. *Indian Sugar*, 1973, **23**, 513–514. Since scaling is heaviest in the last bodies of a multiple-effect evaporator, which have the same heating surface as the earlier bodies, it is argued that scaling would be proportional if the later heating surfaces were larger. Calculations are made of appropriate areas, evaporation rates, vapour produced, and vapour available for bleeding with such a system.

* * *

A survey of fuel economy during the month of December 1972. P. NARAIN. *Sugar News* (India), 1973, **5**, (5), 7–13.—Manufacturing and steam data are tabulated for the author's factory and recommendations made for achieving improved boiler efficiency and steam economy.

* * *

Rôle of mill sanitation, ERQV values, etc. for maximization of sugar production. H. H. N. SAXENA. *Sugar News* (India), 1973, **5**, (5), 14–18.—The use of ERQV (relating mixed juice to primary juice purity) and mill sanitation factors for assessment of microbial contamination in mills is discussed, as is the control of mill sanitation and prevention of inversion loss by the use of steam, hot water and chemicals.

* * *

Corrosion in the sugar industry. II. D. J. MEHTA. *Sugar News* (India), 1973, **5**, (5), 19–23, 26.—Means are suggested for minimizing corrosion in boilers,

steel chimneys, mills, tanks and pipelines, evaporators, pans, crystallizers and centrifugals, and other machinery. Removal of rust and selection and application of paint are mentioned and the effect of anti-corrosion practices on the life of sugar machinery discussed.

* * *

Boiling house operational techniques. V. H. LOPEZ. *Sugar News* (Philippines), 1973, **49**, 280–282.—A number of operational factors to be considered for attaining optimum factory performance are discussed; these include maintenance of adequate contact time during liming and the use of lime of at least 65% purity, maintenance of the proper temperature of 218–220°F at the juice heater station, and an adequate clarifier retention time of 2–3 hours for effective settling. Conditions permitting efficient operation of vacuum filters are listed, and a note given on boiling techniques; at Binalbagan Isabela Sugar Co. boiling of *A*-strikes on syrup only has raised solids recovery by 5% and improved sugar quality. Recommended procedures for crystallizer operation in the Philippines are outlined with the object of securing good exhaustion of *C*-massecuite.

* * *

Proposed programme for reduction of bagasse consumption in sugar centrals. M. F. GLORIA. *Sugar News* (Philippines), 1973, **49**, 288–298.—In order to leave more bagasse available for utilization, the proportion used as fuel should be minimized, and methods of doing this are reviewed. They include reduction of bagasse moisture at the mills, reduction of steam and heat losses, proper supervision in the boiling house to prevent surges in steam demand and high temperature drops or other conditions leading to high steam back-pressures, checking on steam consumption using flowmeters to ensure no abnormal levels, and improvement of boiler plant operations such as minimization of scale by water treatment, etc.

* * *

Condensate flashing, its effect on steam economy and evaporation capacity. V. R. RAO. *Sugar News* (India), 1973, **5**, (6), 6–9, 4.—From theoretical calculations it is concluded that condensate flash vapour utilization will reduce steam consumption but that maximum steam economy and full utilization of evaporation capacity can only be achieved where the bodies to which the flash vapours are directed can absorb the extra heat. Where there is no vapour bleeding, and where extra vapours cannot be utilized, steam economy will be improved by condensate flashing but evaporation capacity will be reduced; it should be avoided, therefore, where evaporator capacity is marginal unless vapour bleeding can be introduced at the same time.

* * *

Technical problems of the Indian sugar industry. D. P. KULKARNI. *Sugar News* (India), 1973, **5**, (6), 10–14. The Indian sugar industry badly needs varieties of cane which will mature at different times so that the crushing season can be extended from its present 120–150 days to 200–220 days; drought-resistant varieties are also required to suit areas subject to frequent water shortage. Farm mechanization is necessary but machines and implements should be appropriate to the small farms supplying cane. Extension work is needed to ensure efficient fertilizer application and water management. Payment for cane on a quality basis should be introduced so that sugar factories can exercise control over this and encourage improvement in the sugar content. In factories, there should be more willingness to try out modern ideas in milling, diffusion and maceration, use of ion exchange resins for juice treatment, processing of beets in cane sugar factories, extraction of palm sugar, and utilization of by-products. In gur manufacture, extraction should be improved by replacement of animal-driven wooden mills by electrically-driven crushers and examination of the use of diffusion. Research should be carried out on clarification as well as on packing and preserving of gur and its quality standardization.

* * *

An arrangement using batch crystallizers as continuous. A. C. CHATTERJEE and C. SHYAMSUNDER. *Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I), M.1–M.6—See *I.S.J.*, 1974, **76**, 339.

* * *

Applicability of the ion exchange process for demineralization of cane juice in Deccan sugar factories. S. MUKHERJEE and S. K. SRIVASTAVA. *Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I), M.7–M.27.—Mixed-bed and direct-bed systems of ion exchange were applied to laboratory experiments on the demineralization of cane juice, the purity rise and colour removal also being measured as well as the effect on invert sugar and sugar recovery. The economics of an industrial-scale plant are calculated for a direct-bed system which appears more suitable for cane juices from the low-ash area concerned. Such a plant would be profitable, it is considered, and other advantages would accrue which are not quantified, e.g. reduced cleaning time, potassium salts recoverable as fertilizer, etc.

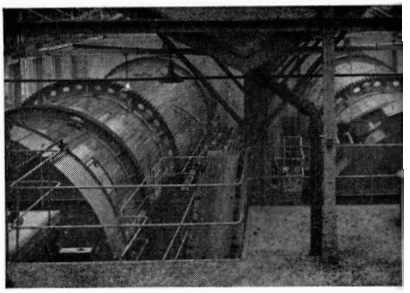
* * *

Double curing of *C*-massecuite in Kolhapur Sugar Mills Ltd. P. V. S. SASTRY *et al. Proc. 25th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1973, (I), M.28–M.32.—Double purging of *C*-massecuite at Kolhapur resulted in less total boiling because of lower non-sugar recirculation, improved purging quality of *C*-sugar because more time was allowed for *C*-boiling and movement water circulation was provided, uniform sugar quality throughout the season and increased crushing rate.

* * *

Review of Réunion Island sugar industry. G. BAX. *S. African Sugar J.*, 1974, **58**, 39–44.—A survey is presented of the Réunion sugar industry, covering cane agriculture and factory processing.

Beet sugar manufacture



Results of precise chemico-technical control and calculation of lime in beet sugar manufacture. A. YA. ZAGORUL'KO *et al. Sakhar. Prom.*, 1973, (10), 57–61. Details are given of the system introduced at Yagotinsk sugar factory which has resulted in reduced lime consumption through more efficient usage and decreased losses.

* * *

Developments in the field of molasses sugar extraction by the RT saccharate process. R. PIECK and R. VANDEWIJER. *Zucker*, 1973, **26**, 575–580.—See VANDEWIJER: *I.S.J.*, 1973, **75**, 181, 292.

* * *

The effect of beet juice sulphitation before progressive Dedek-Vašátko preliming on purification efficiency. A. DANDÁR, J. VAŠÁTKO and A. RAJNIAKOVÁ. *Zucker*, 1973, **26**, 593–597.—See *I.S.J.*, 1972, **74**, 116.

* * *

Arcuate screens and their application in the sugar industry. S. BEDNARSKI. *Gaz. Cukr.*, 1973, **81**, 289–297.—A survey is presented of concave screens for removal of suspension from water, milk-of-lime and juice, particular mention being made of Dorr-Oliver, BMA and Vickerys equipment. Guidance is given on calculation of desired screen parameters.

* * *

Reducing water consumption and amount of waste water. L. HARASZTI. *Cukoripar*, 1973, **26**, 216–219. Reference is made to the Hungarian sugar industry's approach to the problem of reducing fresh water consumption by recycling treated flume water, and a brief description is given of the system used at Selyp factory involving use of a conical tray-type flotation clarifier.

* * *

Measurement of sugar factory solution pH with a bismuth electrode. I. BADER and J. PATAKI. *Cukoripar*, 1973, **26**, 220–222.—Tests with a bismuth electrode showed that it registered changes in the pH of carbonatation juice continuously subjected to CO_2 gassing with reasonable promptness and precision, the time taken to indicate the change depending on the pH range. Reproducibility was good even after a large number of runs.

* * *

Decomposition of reducing matter in main liming and removal of decomposition products in carbonatation. V. A. GOLYBIN and S. Z. IVANOV. *Sakhar. Prom.*, 1973, (11), 12–15.—Tests with model juices containing 12% sugar and 0·3–0·5% reducing matter (by weight) showed that although the lowest reducing matter content was obtained at the highest of the three liming temperatures used (70, 80 and 90°C), at this temperature optical density was also highest. These results were observed to be practically constant during the last half of the 20-minute liming period. Colorant adsorption by $CaCO_3$ in carbonatation was greater the higher the liming temperature. In view of the results, it is suggested that the juice should be subjected to cold liming followed by prolonged heating of the juice and subsequent hot liming.

* * *

Optimum temperature conditions in 2nd carbonatation. V. A. KOLESNIKOV and D. M. LEIBOVICH. *Sakhar. Prom.*, 1973, (11), 15–20.—Factory juice of low alkalinity (0·018% CaO) was gassed at 20–90°C to required pH values, the mud filtered off and 0·2% pure $CaCO_3$ added to the filtrate, which was then boiled for 10 min to effect complete decomposition of the bicarbonates and precipitation of the $CaCO_3$. The lime salts were determined before and after boiling, the difference representing that amount of lime capable of being deposited as scale on decomposition of the bicarbonate. Major factors affecting the amount of such calcium were carbonatation temperature, juice pH and degree of oversaturation. $CaCO_3$ precipitation occurred at a pH near to optimum when the temperature was 20°C, but with rise in temperature the pH at which precipitation took place fell well below the optimum and the quantity of scale-forming lime increased considerably. Hence, it is considered inadvisable to heat juice to 102°C before carbonatation as in the conventional scheme used in the USSR. Instead, a temperature of 85–90°C is recommended, and advantages of this are listed.

* * *

The rôle of colloids in molasses formation. N. P. SILINA, E. A. GRIVTSEVA and L. P. REVA. *Sakhar. Prom.*, 1973, (11), 24–26.—Experiments to establish the effect of the colloid content in molasses on molasses properties showed that viscosity rose above that of standard molasses when the colloid and lime salts content was relatively high. But a drop in viscosity could be caused by a reduction in colloid + lime salts content or by increase in the chloride and reducing matter contents at constant colloid content. Increase in the colloid content was accompanied by increased sugar content. In all the samples of molasses examined, there were more reversible than irreversible colloids and more electrolytes than non-electrolytes.

Examination of the durability of milled beet knives. M. U. KATSEL'SON, E. V. OSTROVSKII, B. M. SERGEEV and M. R. AZRILEVICH. *Sakhar. Prom.*, 1973, (11), 26–28.—Determination of static deflection and natural oscillation frequency of two Soviet beet knives (ribbed and ribless) and an imported ribless knife is reported. The imported knife was found to have greatest strength in the deflection tests, while all three were considered more or less equal in the dynamic tests. The use of ribless knives in rotary drum slicers is considered of advantage as regards ease of maintenance.

* * *

Mass transfer coefficients of granulated sugar. M. A. VOLKOV and V. D. MIKHAILOV. *Sakhar. Prom.*, 1973, (11), 29–31.—Measurements of moisture and temperature distribution throughout a 6·18 kg sample of white sugar first adjusted to a given moisture content before 6–8 hours' retention in a chamber with a heater at one end and a cooler at the other showed migration of moisture from the layer next to the heater to the sugar out of range of the heater's influence, so that moisture distribution was expressed by a sinusoidal curve with the maximum amplitude of moisture fluctuation occurring in the centre of the model. The effects of the pattern of behaviour on sugar heat and mass transfer coefficients are discussed mathematically.

* * *

Experimental investigation of the dynamics of a tower diffuser in respect of basic control channels. B. N. VALOVOI. *Sakhar. Prom.*, 1973, (11), 36–40.—The relationships between juice draft and (i) Brix and (ii) losses have been examined and the results expressed in graph form as a contribution to process control. The transient nature of the diffusion kinetics is approximately expressed by 1st order time lag components for which numerical values have been obtained for use in simulation studies.

* * *

Automatic system for counting sugar on a conveyor. A. M. CHERNYI, K. V. KONOVALOV and V. V. BAYAN. *Sakhar. Prom.*, 1973, (11), 40–43.—Details are given of an automatic system developed for counting 50- or 100-kg bags of sugar on a continuous conveyor irrespective of the distance between the bags and conveyor speed. Tests at a sugar factory have proved successful.

* * *

Remote-controlled transistorized electro-thermometer. M. B. YARMOLINSKII. *Sakhar. Prom.*, 1973, (11), 48–49.—Information is given on a Soviet thermometer which is fully transistorized with six semi-conductor sensors and is designed to register temperatures within a given range (4 scales are available) on a remote console. Possible applications are listed.

* * *

Disinfectants and means of applying them in the sugar industry. L. FASSATIOVÁ. *Listy Cukr.*, 1973, **89**, 254–260.—The bacteriological actions of disinfectants as used in the sugar industry are surveyed and reference made to a number of more recent preparations which are replacing the most commonly used types (formalin and chlorine compounds). Optimum dosing is examined from the bacteriological and economic aspects.

* * *

Waste waters in the beet sugar industry. F. SANCHEZ-CASTILLO. *Quim. e Ind.* (Bilbão), 1972, **18**, (6), 4–8; through *S.I.A.*, 1973, **35**, Abs. 73–1421.—Methods of treatment of liquid effluents from beet sugar factories are outlined. The main groups of effluents considered are flume and wash water, process waters and condensates. The last group is very clean and may be used for diffusion or discharged directly. Most of the impurities in flume and wash water are insoluble and may be removed by either sedimentation or flotation; settling aids, such as Al^{+++} compounds, can be added if necessary. Process waters pose the most difficult problem. Pulp water and pulp press water are treated by removing the pulp with a vibrating screen and by biological digestion. Filter cake wash water and dilution water are purified by cycloning and biological treatment. Water from washing carbonatation gas, which has a low pH, can be used in diffusion.

* * *

Sugar manufacture with thick juice storage. I. Results of laboratory experiments. K. BOHN, F. DEPOLT, E. MANZKE and G. MÜLLER. *Die Lebensmittelind.*, 1973, **20**, 509–515.—Details are given of laboratory tests on storage of thick juice samples from different sources. The results indicate that in order to minimize losses and reduction in quality the thick juice should be stored at a mean temperature below 15°C at a Brix of 67–69° and a pH of 8·5–9·0. Results of deviation from optimum temperature and Brix are indicated. Storage should be carried out in the absence of oxygen to avoid development of osmophilic hyphomyzetes (*Aspergillus* and *Penicillium* spp.) which were found to be the most important thick juice degrading micro-organisms.

* * *

Dependence of molasses viscosity norm on low-grade massecuite crystal composition. A. I. GROMKOVSKII, S. Z. IVANOV and N. A. REMIZOVA. *Sakhar. Prom.*, 1973, (12), 12–15.—Investigation of the effects of various factors on viscosity of final molasses and hence on low-grade sugar quality showed that low-grade massecuite crystal size had considerable influence although it is a factor usually ignored. The experiments also showed that the optimum viscosity varied with the type of centrifugal. Empirical formulae are presented for viscosity norm calculation.

* * *

Determination of optimum non-sugars load on ion exchange resins during run-off purification in beet sugar manufacture. V. N. BELOUS and K. P. ZAKHAROV. *Sakhar. Prom.*, 1973, (12), 16–22.—Demineralization tests involving a strongly acidic cation

exchange resin in H^+ form followed by a medium basic anion exchanger used to treat beet juices, run-off and molasses showed that the non-sugars load should be that at which maximum adsorption of mineral and nitrogenous compounds is achieved with betaine break-through only at the very end of the cycle. Mathematical evaluation of results obtained with molasses and reported in the literature is used to derive equations for calculation of optimum loading in terms of the mineral cations and total N as proportions of the total non-sugars.

* * *

Calculation of (the parameters of) an electroplasmolyser for electrical treatment of vegetable raw material in the form of a juice-pulp mixture. A. YA. PAPCHENKO. *Sakhar. Prom.*, 1973, (12), 27–32.—Details are given of plasmolysis tests in which samples of beet pulp-juice mixtures were heated (to a temperature within the range 20–70°C) by passing between electrodes followed by pressing. Treatment increased the juice yield to 82% compared with 67% without treatment. Energy consumption was determined as a function of temperature, pulp:juice ratio, degree of initial pulp crushing, time lag between heat treatment and pressing, pulse capacitance and voltage. A plasmolysis unit was constructed on the basis of the results and tested on apple pulp.

* * *

The latest in planning heat schemes for beet sugar factories. M. L. VAISMAN and A. A. KNYAZEV. *Sakhar. Prom.*, 1973, (12), 43–49.—Full details are given of a scheme for a quadruple-effect evaporator which is intended to provide maximum heating economy (concentration of juice to required Brix without steam draw-off to the condenser) and maximum possible use of bled vapour for reheat.

* * *

Comparison of juice deliming methods. H. ZAORSKA. *Zucker*, 1973, **26**, 654–659.—See *I.S.J.*, 1974, **76**, 182.

* * *

Staff locator radio systems in the sugar industry. K. WENDORFF. *Zucker*, 1973, **26**, 660–661.—The operation of staff locator radio systems and the various types of equipment available are described and their advantages for the sugar industry discussed.

* * *

Progress in refractories for lime kilns in the last decade. L. CINI. *Ind. Sacc. Ital.*, 1973, **66**, 127–136. Parameters and relations which affect the physico-chemical resistance of refractory materials are examined. The different types of refractory used in lime kilns are examined and the principal tests and the importance of installation of the refractories discussed.

* * *

Cathodic treatment of sulphited 2nd carbonatation juice. D. M. LEIBOVICH and V. A. KOLESNIKOV. *Izv. Vuzov, Pishch. Tekh.*, 1973, (4), 78–81.—Tests showed that electrodialysis of sulphitation juice adjusted the pH and SO_2 concentration to the level required for evaporation[1] without affecting the colour of the juice.

* * *

Mass transfer in a KDA-25-59 tower diffuser. V. G. DRYNOV and V. M. LYSYANSKII. *Izv. Vuzov, Pishch. Tekh.*, 1973, (4), 132–135.—Investigation of sugar extraction from cossettes in a tower diffuser showed that the operation could be divided into three sections, in each of which the value of the mass transfer coefficient was governed by scroll speed and diffuser load. The behaviour of the coefficient is indicated in graph form. The values of the governing factors are given at which mass transfer was maximum and the diffuser throughput only slightly below the rated value.

* * *

Certain relationships in the 2nd carbonatation process in a trickling juice film. I. M. FEDOTKIN, S. A. ZOZUL'YA and A. S. ZAETS. *Izv. Vuzov, Pishch. Tekh.*, 1973, (4), 170–172.—Studies of falling film carbonatation showed that mass transfer of CO_2 gas to juice increased with increase in Reynolds' number of the juice and with increase in gas flow above 6–7 $m.sec^{-1}$. Highest mass transfer efficiency occurred with turbulent juice flow.

* * *

Planning and prognosis in the sugar industry. H. WIRNER. *Zeitsch. Zuckerind.*, 1973, **98**, 669–673. Planning with the aim of optimizing factory operation and capacity in accordance with optimum beet harvesting and transport is discussed and prognostication of factory product expansion and diversification considered.

* * *

New Nordzucker liquid sugar factory at Lehrte. ANON. *Zeitsch. Zuckerind.*, 1973, **98**, 675–679.—Information is given on equipment, processes, liquid sugar products and their analyses at the Lehrte factory of Norddeutsche Zucker GmbH & Co. KG.

* * *

Sugar and alcohol in the Azores. H. KAMPF. *Zeitsch. Zuckerind.*, 1973, **98**, 680–684.—Details are given of beet agriculture and sugar production at Santa Clara sugar factory in the Azores as well as alcohol production from molasses at Lagoa distillery which produces 15,000 hectolitres per year of 120 days. The 96% alcohol is mostly used by the pharmaceutical and chemical industries on the island of São Miguel, only a small quantity being supplied to Portugal.

* * *

Purification and cooling of carbonatation gas in a foam-type scrubber. Z. KALATA and A. SZYSZKA. *Gaz. Cukr.*, 1973, **81**, 326–330.—A foam-type gas scrubber is described and results of tests on carbonatation gas reported. Advantages of the scrubber over other types (plate, cascade and packed columns) are listed.

---

[1] *I.S.J.*, 1974, **76**, 150.

SATURNE
DIFFUSER

complete counter current maceration process

The Saturne diffuser at Saint-Antoine Sugar Factory (Mauritius)

if you are looking for :

- a simple and sturdy machine
- negligible maintenance costs
- a completely automatic diffuser
- low power consumption
- no stoppages due to the diffuser
- high mixed juice purity and, of course, an extraction above the best from an 18 roll mill tandem

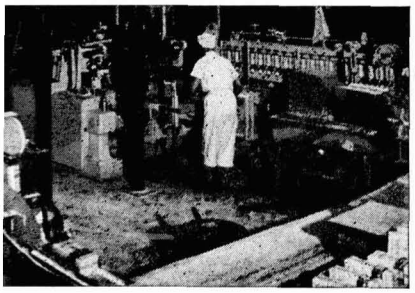
the brilliant conception of the Saturne is what you need.

The full 1973 results of our diffusers at Umfolozi (South Africa) and Saint-Antoine (Mauritius) may be obtained from :

SUCATLAN

18, Av. Matignon - 75008 PARIS - FRANCE
PHONE: 266.92.22
TELEX: 29017 (SUCATLAN-PARIS) - CABLE ADDRESS:SUCATLAN - PARIS.

SAGAL Publicité - Paris - 706



Sugar refining

Improving sugar refinery production with computerized process control. ANON. *Sugar y Azúcar*, 1973, **68**, (8), 42–44.—Information is given on the computerized control system at the Toronto refinery of Redpath Sugars Ltd. where all stages before the char filters are controlled, including raw sugar mingling with syrup, affination and Sweetland filter station operation. Advantages of the system are briefly discussed.

* * *

New sugar refinery in Korea. ANON. *Sugar J.*, 1973, **36**, (4), 23–24.—The Inchon refinery of Cheil Sugar Co. Ltd. was built in 1970 and has a melt capacity of 500 metric tons per day. It initially used a combination of carbonatation and decolorization by both powdered carbon and ion exchange resins, but the powdered carbon is being replaced by a granular carbon process, and capacity is being raised to 650 tons/day. Details and illustrations are given of the plant and process.

* * *

Development of a new resin having high decolorization capacity. II and III. K. SUZUKI and Y. UTSUNOMIYA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1973, **24**, 1–5, 6–11.—(II) The resin developed by SUZUKI *et al.*[1] has been tested in a sugar refinery on liquor which had been carbonatated and decolorized with active carbon. It was found that the resin's decolorizing properties were superior to those of other resins and it was also able to withstand greater physical pressure and maintain its porosity with prolonged use. Contamination was lower than with conventional resins and contaminated resin was more easily regenerated. The decrease in ion exchange capacity was the same as with conventional resins. (III) The resin was used to treat carbonatated liquor by a two-stage process using static columns of resin. The second column was filled with new resin and the first with once-used resin. The colour of the liquor, originally 4–7°St, was reduced to 0·4–0·8°St after the first column and to 0·2–0·3°St after the second. Comparative costs of the process and other methods are tabulated.

* * *

Removal of fatty acids in sugar solution with anion exchange resin in chloride form. H. OKUYAMA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1973, **24**, 19–24.—Samples of 35 ion exchange resins were tested for their effectiveness in removing formic and butyric acid from sugar solutions; those with a high selectivity coefficient were strongly basic and had a low degree of cross-linking in the matrix, whether they were of gel-porous or macroreticular type. When the degree of cross-linkage was in the range 10–14, the distribution coefficient reached a maximum; resins showing a high distribution coefficient below the above range were strongly basic and highly cross-linked, whether gel-porous or macroreticular. Resins suitable for removing fatty acids from raw sugar liquors should have a high selectivity coefficient and distribution coefficient; such resins included "Amberlite IRA-401", "Diaion SA-11A" and "Diaion SA-21A".

* * *

Qualitative and technological reasons for the use of liquid sugar in the food industry. F. X. KAMMERER. *Zeitsch. Zuckerind.*, 1973, **98**, 555–560.—After a brief examination of the merits and demerits of liquid and crystal sugar for use in the food industry and descriptions of the more important types of liquid sugar, the author briefly explains the production processes and indicates the various branches of the food industry where liquid sugar is used.

* * *

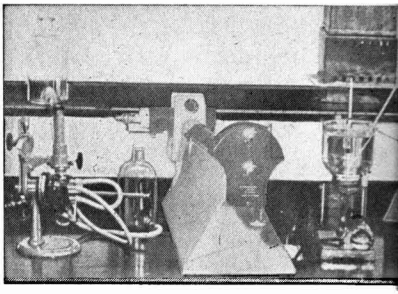
Decolorizing capacity and ion exchange properties of AGS-3 and AGS-4 carbons as a function of regeneration conditions. D. N. STRAZHESKO, L. S. IVANOVA, R. K. STOROZHUK, YA. O. KRAVETS and M. V. DVORNICHENKO. *Sakhar. Prom.*, 1973, (11), 20–23. Comparison of the two Soviet carbons after steam treatment for 1 hr at 400, 700 and 800°C showed that AGS-3 had greater decolorizing capacity than AGS-4, that highest decolorizing efficiency was achieved after regeneration at 800°C and that both carbons were equally effective as ion exchangers as determined by potentiometric titration which showed them to be in the same category as a mixture of acids and bases of varying strength.

* * *

Carbon adsorbents—oxygen reaction. C. C. CHOU. *Sugar J.*, 1973, **36**, (6), 21–26.—The kinetics of bone char oxidation have been examined and the order of reaction found to be approximately one-half at 300–450°C, with activation energies of 20 kcal.mol^{-1} in the region affected by mass transport and 36 kcal.mol^{-1} in the chemical control region. It is suggested that the inorganic content of the bone char functions as a catalyst of bone char oxidation. Some characteristics of the bone char carbon are elucidated from the oxidation data and it was calculated that the active surface area is about 7·3% of the total carbon surface area, and that the average diameter of a carbon crystallite is about 62 Angstroms.

[1] *I.S.J.*, 1970, **72**, 342.

Laboratory methods & Chemical reports



Two improved methods for the determination of soluble carbohydrates. A. E. FLOOD and C. A. PRESTLEY. *J. Sci. Food Agric.*, 1973, **24**, 945–955; through *S.I.A.*, 1973, **35**, Abs. 73–1232—Improved versions of the periodate and ferricyanide methods for the determination of carbohydrates are described. In the improved periodate method, the H_2SO_4 concentration was increased to 1·5N; under these conditions the di- and oligosaccharides were simultaneously hydrolysed and oxidized. The fructose, which consumes four-fifths of the periodate consumed by an aldohexose molecule, was estimated separately by destroying with hot acid and determining the remaining sugars. In the improved alkaline ferricyanide method, the reducing sugars were determined by oxidation with ferricyanide and the ferrocyanide formed was determined colorimetrically after reaction with arsenomolybdate. When used in conjunction, the two methods give reliable values for reducing sugars, sucrose, fructose and sugar alcohol concentrations without a need for chromatographic separations.

* * *

Importance of the determination of moisture in prepared cane. I. G. VILLON. *Bol. Técn. Inst. Central Investig. Azuc.*, 1973, **2**, (1), 49–62.—In Peru, mechanically-harvested cane passes through a wet cleaner to remove the extraneous matter and this is calculated by the difference in weight between gross cane and clean cane. It is pointed out, however, that the cane absorbs part of the washing water so that the calculated extraneous matter is lower than the true figure; thus, the moisture content of the gross cane and clean cane should be measured so as to permit calculation of the amount of water absorbed and hence the amount by which the calculated extraneous matter is under-recorded.

* * *

Effect of ammonia and ammonia compounds in decalcification of 2nd carbonatation juice. M. I. BARABANOV. *Sakhar. Prom.*, 1973, (10), 16–18.—Tests in which 10% sugar solutions containing 0·5 g acetic acid per litre were gassed with CO_2 after addition of varying quantities of KOH, NaOH, ammonia, glycine and asparagine, respectively, showed that, while the lime salts content increased with glycine and asparagine addition compared with the absence of additive, KOH and NaOH addition reduced the content, while best results were achieved with addition of 0·10% NH_3 (0·25% and 0·05% NH_3 also giving lower lime salts contents than did alkali addition). It has been found previously that ammonia and its compounds make up 20–40% of the total alkalinity of 1st carbonatation juice.

* * *

Effect of electrolytes in sugar factory products on the nature of changes in concentration of hydrogen and hydroxyl ions with temperature. L. D. BOBROVNIK, A. P. KOZYAVKIN, A. R. SAPRONOV and R. FAJARDO G. *Sakhar. Prom.*, 1973, (10), 23–26.—It has been found possible to establish the effect of the electrolyte component of the non-sugars on the concentrations of the H^+ and OH^- ions in beet sugar factory products and hence on pH; this is demonstrated by data for green syrup subjected to electrodialysis, showing the change in character of the electrolytes and their buffering action.

* * *

The melassigenic property of $Al_2(SO_4)_3$. A. A. LIPETS, I. A. OLEINIK and I. A. PRIKHOD'KO. *Sakhar. Prom.*, 1973, (10), 27–29.—Laboratory tests showed that, although slightly melassigenic, aluminium sulphate added to increase sugar extraction during beet diffusion (at the rate of 0·06–0·08% on weight of beet) had practically no adverse effect by increasing the melassigenic coefficient nor did it affect standard molasses purity.

* * *

Abnormal apparent purities of sugar house products. S. BOSE, P. N. GANGULY, K. C. GUPTA and S. MUKHERJEE. *Indian Sugar*, 1973, **23**, 447–448.—Apparent purities higher than true purities in various sugar house products at a factory in North Bihar proved to be due to the presence of a dextran-type polysaccharide. After precipitation of the latter with alcohol, the apparent and true purities assumed their normal relationships.

* * *

Model studies on the Maillard reaction in technical sugar juices. E. REINEFELD, F. SCHNEIDER, K. WESTPHAL, K. TESCH and H. G. KNACKSTEDT. *Zucker*, 1973, **26**, 581–588.—See *I.S.J.*, 1974, **76**, 186.

* * *

Modern methods of water analysis. G. STEINLE. *Zucker*, 1973, **26**, 589–592.—Conditions which should be observed in water analysis are briefly set out and a survey given of methods for determining phenols, detergents, surface-active agents, hydrocarbons, pesticides, saccharides and inorganic ions in water and effluent (with 27 references to the literature).

Measurement of ammonia in defecation reagents based on lead acetate. G. RENS. *Sucr. Belge*, 1973, **92**, 449–452.—The Courtonne reagent, currently used in Belgium, is a basic lead acetate which should contain 10·83 g of NH_3 per litre; a distillation method has been devised for measurement of the ammonia content in this and other materials, and has shown that samples of the Courtonne reagent from various sources contained differing quantities of ammonia.

* * *

Degree of sucrose hydration in aqueous sugar solutions. S. E. KHARIN, G. S. SOROKINA and A. A. KNIGA. *Izv. Vuzov, Pishch. Tekh.*, 1973, (4), 75–77.—An empirical equation for calculation of the degree of hydration of sucrose, α, ($= \frac{5{\cdot}0}{n_2}$ mole/mole, where n_2 is the number of sucrose moles per litre of solution) is shown, by calculation of osmotic pressure using an equation in which calculated values of α are substituted, to be of satisfactory accuracy, giving a value very close to that of FINDLAY[1]. While α was found to be considerably affected by sucrose concentration, it was unaffected by temperature. Calculated and experimental values of osmotic pressure are tabulated together with values of α.

* * *

Beet laboratory of the American Crystal Sugar Company. ANON. *Zeitsch. Zuckerind.*, 1973, **98**, 684–686.—A description is given of the Menway Engineering central beet laboratory installed at the East Grande Forks, Minnesota, sugar factory of American Crystal Sugar Co. in which 6 workers can process up to 240 samples per hour. The system employs a small in-line computer for data processing, and polarimeter readings are printed-out on identification cards.

* * *

Effect of betaine on formation of colouring matter in sugar manufacture. V. A. KOLESNIKOV and D. M. LEIBOVICH. *Izv. Vuzov, Pishch. Tekh.*, 1973, (5), 138–140.—Experiments in which buffered 0·4% invert solutions to which 0·2% betaine was added were heated on a glycerine bath at 125°C for 1 hour before dilution and treatment by anion exchange resin showed that while the colorant fractions eluted with NaCl, HCl and NaOH, respectively, had the same spectral properties with and without betaine addition, the inseparable colorant fraction in the control (without betaine addition) showed no obvious peaks or dips in its spectral curve in contrast to that for the same fraction with betaine addition, for which a minimum occurred at 245 nm and a maximum at 264 nm.

* * *

Prediction of molasses sugar from beet analyses. E. REINEFELD, A. EMMERICH, G. BAUMGARTEN, C. WINNER and U. BEISS. *Zucker*, 1974, **27**, 2–15.—From analysis of 58 samples of beet brei and of the thick juice produced from them, an expression has been derived for calculation of molasses sugar Z_M. It takes the form $Z_M = 0{\cdot}343\,(K + Na) + 0{\cdot}094\,N_{Bl} - 0{\cdot}31$, where Z_M is given as % on beet and N_{Bl} is α-amino-N determined by the "blue number" method; K, Na and N_{Bl} are expressed in meq per 100 g beet. Assuming a total of determined losses plus undetermined losses of 0·6% on beet, the expression is expanded to $Z_B = \text{pol} - [0{\cdot}343\,(K + Na) + 0{\cdot}094\,N_{Bl} + 0{\cdot}29]$ where Z_B is the "corrected" sugar content in molasses. Values given by this expression were accurate to within $\pm$ 5%. Brief mention is made of attempts by various authors to calculate thin juice purity from beet analysis, and factors governing the processing value of beet, particularly those affecting carbonatation juice alkalinity, are discussed. It is emphasized that these require more detailed investigation.

* * *

Formation and composition of beet molasses. XIII. Electrolytes, non-electrolytes and average composition. G. VAVRINECZ. *Zeitsch. Zuckerind.*, 1974, **99**, 23–26. Non-sucrose substances are divided by the author into electrolytes and non-electrolytes so as to include unsaturated cations and anions. For electrolyte behaviour two expressions have been developed which give results of identical accuracy: the WAGNEROWSKI-VAVRINECZ equation which takes the form $C = 1 + mA\,(1 - be^{-cA})$, where C = Claasen's saturation index, m = melassigenic constant, A = non-sugar: water ratio, b and c = saturation function coefficients and e=base of natural logarithms; and an equation derived by DAISHEV *et al.* in the form $C = 1 + mA\,(1 - b\gamma)$, where $\log \gamma = -cA$. For non-electrolytes VAVRINECZ has derived the equation $C = 1 - hA$, where h = water extraction constant. Various authors have derived expressions for calculation of the invert sugar effect on sucrose solubility, and tables of values determined by them and used as bases for empirical equations are tabulated. Briefer mention is made of experiments to determine the effect of glucose solution and of molasses N compounds on sucrose solubility. Finally, a probable average composition of beet molasses is indicated on the basis of data from the literature, showing that the sum of the cation equivalents is usually greater than and certainly never smaller than the total sum of anion equivalents, particularly when no allowance is made for amphoteric N compounds.

* * *

Study of the influence of some non-sucrose substances on habit modification of crystallized sucrose. T. H. SHAH and H. J. DELAVIER. *Zeitsch. Zuckerind.*, 1974, **99**, 27–31.—After a review of the literature on the subject (with 28 references), details are given of investigations on the effects of raffinose, fructose, dextran and KCl (glucose, pectin, NaCl and $CaCl_2$ were found not to have any significant effect on the shape of sucrose crystals, pectin causing formation of a sucrose gel even at low concentration). Raffinose, fructose and KCl caused formation of needle-shaped crystals (raffinose having greater effect in this than the other two additives), while dextran caused formation of square crystals which tended to form clusters. Tables of data are presented and some photomicrographs reproduced.

[1] "Osmotic pressure" (Longmans, London) 1913.

Electro-osmotic device for determination of the ζ-potential of muds in sugar manufacture. L. D. BOBROVNIK and O. L. ALEKSEEV. *Izv. Vuzov, Pishch. Tekh.*, 1973, (5), 140–142.—Details are given of a device and its mode of application for determining the ζ-potential of $CaCO_3$ particles.

* * *

Determination of the diffusion coefficient in aqueous sugar solutions by the optical diffraction method. L. P. ZHMYRYA, M. N. DADENKOVA and V. M. LYSYANSKII. *Kharch. Prom.*, 1972, **15**, 59–66.—An optical diffraction method for determining the coefficient of diffusion in solutions of sugars is described and a formula derived from experimental results is used to calculate the coefficient for 35% sucrose solutions at 25°C.

* * *

Migration of certain amino-acids during electrolytic treatment of green syrup and molasses. L. D. BOBROVNIK and G. P. VOLOSHANENKO. *Kharch. Prom.*, 1972, **15**, 75–78.—Results are given of investigations into accumulation of glutamic and aspartic acids and leucine in concentrate obtained during molasses electrodialysis with cation and anion exchange membranes in both slightly alkaline and slightly acid conditions. The study was intended as a contribution to evaluation of means of recovering valuable non-sugars.

* * *

Examination of the electrokinetic properties of calcium carbonate. O. L. ALEKSEEV and M. KH. LIKHITSKII. *Kharch. Prom.*, 1972, **15**, 106–110.—Investigations showed that $CaCO_3$ particles obtained from milk-of-lime have a positive electrokinetic potential the absolute value of which decreases with time to a constant value of 34 millivolts. On the other hand, pectin and the colloid fraction in raw juice have a negative charge which is only slightly governed by pH in alkaline medium. The particles cause overcharging of the $CaCO_3$ when adsorbed by the latter.

* * *

A new exergy diagram for sucrose-water solutions. T. BALOH. *Zucker*, 1974, **27**, 65–72.—After explaining the significance of exergy, entropy, enthalpy and free enthalpy, the author examines the relative value of exergy in the case of one-component and multi-component systems, showing how exergy attains equilibrium with the environment. From equations for calculation of exergy as a function of ambient temperature and solution concentration, values are calculated for aqueous sucrose solution of 94·3 purity in the temperature range 20–140°C at an ambient temperature of 20°C. These are tabulated and also expressed in the form of an exergy diagram, while a Mollier diagram for vapours from aqueous sucrose solutions is corrected for water exergy and reproduced with international units. The new exergy diagram is compared with an earlier diagram and two sample calculations are presented.

* * *

The enzymatic determination of D-glucose and D-fructose in sugar beet and factory juices and comparison of the results with values obtained by the Berlin Institute method. N. KUBADINOW. *Zucker*, 1974, **27**, 72–78.—Results obtained by an enzymatic method based on conversion of the glucose and fructose to glucose-6 phosphate and fructose-6-phosphate by adenosine-5-triphosphate in the presence of hexokinase, the fructose-6 phosphate being finally converted to glucose-6-phosphate by phosphoglucose isomerase, were compared with values obtained by the reduction method used by the Institut für Zuckerindustrie in Berlin. The Berlin method was found to give excessively high values, rising in some cases to double the amount given by the enzymatic method. While the glucose:fructose ratio in thin and thick juice was approx. 1:1, in beet and raw juice it was as high as 4:1, while in boiling house products the ratio was 1:4.

* * *

Kinetics of glutamine decomposition in the presence of lime. D. V. OZEROV. *Sakhar. Prom.*, 1974, (1), 21–23. From a study of the kinetics of glutamine decomposition in the presence of 2% lime and 15% sucrose at 50–100°C, using a model solution approximating to factory juices, an equation was derived from which values were obtained which agreed closely with experimental data obtained by other authors for factory juices. The equation can be used to calculate the degree of glutamine decomposition (given the glutamine content in raw juice) and control it in such a way as to minimize the effect of residual glutamine on the thermal stability of juice in the evaporator.

* * *

Effect of moisture in commercial granulated sugar on its electric conductance. V. E. KRUTIKOVA and A. M. KOSTENYUK. *Sakhar. Prom.*, 1974, (1), 23–26.—Investigations have shown that bulk sugar having a moisture content near to "standard" (30 samples tested had moisture contents ranging from 0·02% to 0·29%) is of high resistivity (10^8–10^{13} ohm.cm^{-1}) and can thus be classed as a dielectric. With reduction in the moisture content (from 0·14% to 0·03%) the resistivity increases, with consequent increase in the electric charge and hence risk of fire during bulk storage and movement, e.g. in pneumatic loading and unloading. The authors therefore consider it necessary to exercise caution in the choice of materials for apparatus coming in contact with dry sugar and call for special means to reduce the electric charge of sugar crystals.

* * *

The application of radio-active trace techniques to the determination of sugar losses on carbonaceous adsorbents. D. GROSS and J. COOMBS. *Sucr. Belge*, 1974, **93**, 3–8.—See *I.S.J.*, 1974, **76**, 187.

reader inquiry service

If you wish to receive further information on the products and services mentioned in the advertisements please fill in the inquiry section of this card and post it to us.

reader inquiry service

Please arrange for me to receive without obligation further details of the products referred to below which are advertised in your ..... 19..... issue.

Advertiser	Product	Page

Signature .....

Block Letters

NAME ..... Date .....

Position .....

Firm .....

Address .....

photocopy service

We are able to supply one photocopy, for research or private study purposes, of most of the original papers abstrated in this journal. It should be noted that these are not translations but are in the original language of publication, which may not be English. Please ask us to quote you the cost of your requirements, indicating whether surface or air mail delivery is to be provided.

additional subscription order

Please send a further copy of your journal each month to the address below, starting with the issue

..... 19.....

Block Letters

.....

.....

.....

.....

.....

Signature .....

Date .....

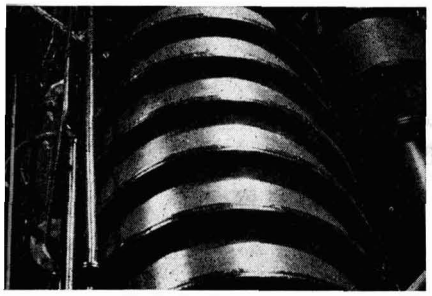
I enclose cheque/draft/M.O./P.O. for £3.00/$10.00.

additional subscriptions

To receive additional copies of *The International Sugar Journal* all you need do is to complete the card with details of the subscription required, and return it with your remittance of £3.00 or U.S. $10.00 for supply by surface mail.

Reader Inquiry Service,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks.
England.

Subscriptions Dept.,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks.,
England.



By-products

Selective substitution of carbohydrate hydroxyl groups via metal chelates. E. AVELA. *Sucr. Belge*, 1973, **92**, 337–344.—A method of achieving selective substitution of the hydroxyl groups in the preparation of derivatives of mono-, oligo- and polysaccharides is described which involves formation of metal chelates of the polyols, under anhydrous conditions, in solvents such as tetrahydrofuran or dimethylformamide. Esterification or etherification can then be carried out and high yields of the reaction products obtained.

* * *

Recovery of yeast from alcoholic fermentations (so-called "rum yeast") and its use for cattle feeding. J. E. DE LA BASTIDE. *Azúcar y Productividad*, 1973, (7), 34–39.—A bulletin originally published in 1948 is reproduced; it describes the recovery of yeast from distillery residues in what was then British Guiana in the 1939-45 war so as to provide a proteinaceous supplement for cattle feeding. Currently in Venezuela there is a similar shortage of protein for animal fodder and it is indicated that yeast from the distilleries might serve a similar purpose.

* * *

A profitable industry based on molasses. R. L. SRIVASTAVA. *Indian Sugar*, 1973, **23**, 217–219.—The author advocates the setting up of a plant for monosodium glutamate production from molasses in India and presents a flowsheet of a fermentation process based on use of *Micrococcus glutamicus* or *Brevibacterium flavum* and yielding a product of 99·5% purity. Investment costs for a plant producing 50–60 metric tons of glutamate a day are indicated.

* * *

Simultaneous production of fodder yeast and alcohol. P. R. PERALTA. *Sugar News* (Philippines), 1973, **49**, 208–211.—Details are given of the process introduced at Central Azucarera de Don Pedro in the mid-1950's and later modified so that yeast production is followed by alcohol production and both products are considered of equal importance. Daily yeast production is 1800 kg (in hot months) or 2700–3200 kg (in cold months) and daily alcohol production is 39,100 litres, for which 142–153 metric tons of molasses is used. Examination of the performance figures shows that yeast yield is lower than figures reported by other authors for yeast obtained from *Saccharomyces cerevisiae*, the summer yields being almost half those in the winter, which are still below expectation. The author suggests the need for extra cooling of the medium during fermentation and calculates the required capacity and costs of a refrigeration plant.

Effect of applied pressure on the density of "amido-pulp" briquettes. M. G. PARFENOPULO and N. E. KARAULOV. *Sakhar. Prom.*, 1973, (9), 29–32.—Tests to determine the effect of applied pressure and liquid content on density of pulp and "amido-pulp" (beet pulp-molasses mixture) are reported and empirical equations derived from the results are presented. Calculated values of density obtained with a given applied pressure agreed with experimental values to within 3–8%.

* * *

Recycling of drying gas in pulp and forage drying plants. Y. GAME. *Ind. Alim. Agric.*, 1973, **90**, 977–986. The thermodynamic efficiency of direct-fired rotary dryers used for beet pulp and other types of forage may be increased considerably by the recycling of drying gases. Heat calculations and graphs are presented which demonstrate this.

* * *

Theory of industrial fermentations. Search for best conditions of operation of a large fermenter. L. LEFRANÇOIS and B. REVUZ. *Ind. Alim. Agric.*, 1973, **90**, 989–1001.—The authors discuss conditions which must apply for growth of single-cell yeasts during indefinitely continuous submerged fermentation in order to avoid the slightest degeneration. They show how these conditions can be met in large fermenters and for high daily production.

* * *

Pulp fermentation with lactic acid bacteria. A. HERMAN and T. KOLANOWSKI. *Gaz. Cukr.*, 1973, **81**, 260–266. Where beet pulp is required as animal fodder in a fresh (i.e. undried) state, it is recommended to inoculate it with lactic acid bacteria to prevent uncontrolled fermentation and loss of nutritional properties. References are made to experiments conducted by various authors and details are given of a plant for lactic acid bacteria culture developed in Poland and first used in Czechoslovakian sugar factories.

* * *

Inversion of hydrolysate mass combined with pentose hydrolysis of bagasse. S. DOBREV, T. SOKOLOV and E. VIDIMSKI. *Khranit. Prom.*, 1973, **22**, (1), 22–27; through *S.I.A.*, 1973, **35**, Abs. 73-1212.—Optimum conditions are tabulated for hydrolysing bagasse with 93% H_2SO_4, according to the Riga method, and experiments are reported on "inversion" of the product (further hydrolysis of polysaccharides) at 130° or 150°C for various times after diluting to e.g. 1% residual acid; the yields of reducing substances

are graphed against time. Inclusion of 15% of the hydrolysate in the mixture for pentosan hydrolysis in bagasse increased the pentose yield per unit volume of apparatus by up to 32%. Neutralization of the acid used is unnecessary when the processes are combined.

* * *

Study on pulp dryers. P. DEVILLERS, J. C. GIORGI and R. GONTIER. *Sucr. Franç.*, 1973, **114**, 477–482.—Comparative measurements were made during a study of pulp dryers in three sugar factories. Analyses were also made of the pulp, and the changes in various constituents (ash, fatty matter, soluble sugar, pectins, hemicelluloses, etc.) during drying are discussed.

* * *

The use of filter cake mud in integral diets for milk production. V. RODRÍGUEZ and S. GONZÁLEZ. *Cuban J. Agric. Sci.*, 1973, **7**, 29–32.—Trials showed that addition of 5, 10 and 15% dry matter as filter cake to the diets of lactating cows did not affect milk production.

* * *

***In vivo* studies of some fermentation patterns in the rumen and caeum of cattle fed on forage and molasses-based diets.** Y. REYES. *Cuban J. Agric. Sci.*, 1973, **7**, 33–41.—Analyses of rumen and caecum contents of cattle fed with forage, forage plus molasses, and concentrates (as control) demonstrated the existence of individual fermentation patterns resulting from the molasses diet and producing high rumen pH, low volatile fatty acids, etc.

* * *

***In vitro* studies on the rate of production of volatile fatty acids in the rumen and caecum of cattle fed on forage and molasses-based diets.** Y. REYES. *Cuban J. Agric. Sci.*, 1973, **7**, 43–49.—Samples taken from the rumen and caecum contents of cattle fed on different diets (see preceding abstract) were incubated and demonstrated differences in volatile fatty acid production from a study of which a complete feeding cycle is suggested.

* * *

Some observations on tannic acid treatment of protein in high molasses/urea diets. L. SAVON, S. BLANCA and J. MICHELENA. *Cuban J. Agric. Sci.*, 1973, **7**, 51–56. A study of the effect of tannic acid in cattle fed on a molasses/urea plus soybean meal diet (3 g per 100 g protein supplement) showed no significant effect on N retention and digestibility or rumen levels of NH_3, volatile fatty acids or α-amino N.

* * *

Molasses as an energy source in low fibre diets for milk production. III. The effect of varying the molasses:grain ratio in a low fibre basal diet. J. CLARK, C. M. GEERKEN, T. R. PRESTON and A. ZAMORA. *Cuban J. Agric. Sci.*, 1973, **7**, 155–167.—Trials are described in which different ratios of maize:final molasses dry solids were fed to milch cows. Increase in molasses reduced daily production and also non-fat solids. Yield of milk fat rose up to 25% molasses and then fell. Fodder intake decreased as the molasses content increased. Rumen fermentation pattern changed, the propionic, butyric and valeric acid content rising with molasses level.

* * *

Molasses toxicity and cerebrocortical necrosis (CCN). H. LOSADA and T. R. PRESTON. *Cuban J. Agric. Sci.*, 1973, **7**, 169–178.—Experiments on pyruvate metabolism in cattle fed *ad lib.* with molasses/urea demonstrated that the toxicity resulting in brain damage[1] arose not through an inability to metabolise pyruvate because of thiamine deficiency, but through an insufficiency of glucose.

* * *

Buffering properties of rumen fluid of sheep fed on a high sugar cane molasses diet. R. J. MARTY and H. K. HENDERICKX. *Cuban J. Agric. Sci.*, 1973, **7**, 191–202. Total volatile fatty acids, inorganic P and buffering capacity in the rumen of sheep were higher when they were fed with hay-concentrate ration rather than with *ad lib.* molasses. Lactic acid contents were similar but the redox potential was lower with the molasses diet, which also produced a high and stable pH.

* * *

The effect of crude sugar on the energy concentrate system for broilers. C. T. GONZÁLEZ, R. RODRÍGUEZ and A. J. FERNÁNDEZ. *Cuban J. Agric. Sci.*, 1973, **7**, 215–218.—Feeding trials showed that it was possible to use raw sugar at high levels in broiler chicken diets either separately or mixed with other diet components.

* * *

The effect of two molasses diets and a cereal diet on the pendulous crop condition in turkeys. S. VALAREZO and T. R. PRESTON. *Cuban J. Agric. Sci.*, 1973, **7**, 219–227.—Molasses diets increased the incidence of this condition which reduces the overall performance of turkeys and produces important losses due to mortality.

* * *

Carbons from sucrose as oxygen electrode catalysts. I. P. KOLESNIKOV, YU. A. TKACH and R. I. KUZINA. *Ukr. Khim. Zhurn.*, 1973, **39**, 1118–1121.—Carbon obtained from analytical grade sucrose by charring at 280–300°C and crushing was then activated in a stream of CO_2 or air under a bed of carbon black at 500–900°C. Measurement of the catalytic and electrochemical activities showed that activation in air was the better method and that activity increased with activation temperature. The carbon is of use as catalyst in electrochemical generator electrodes.

* * *

Production of citric acid on microbiological yeasts. B. SZYMAŃSKA. *Gaz. Cukr.*, 1973, **81**, 297–299.—Surface and submerged fermentation methods for production of citric acid from molasses using *Aspergillus niger* are surveyed, with particular reference to practices in the USSR. Costs are compared.

---

[1] GEERKEN & FIGUEROA: *I.S.J.*, 1972, **74**, 379.

World sugar production estimates 1974/75[1]

BEET SUGAR	*Estimate* 1974/75	1973/74	1972/73
	(*metric tons, raw value*)		
EUROPE			
Belgium/Luxembourg	666,000	797,000	685,000
Denmark	430,000	375,556	349,000
France	3,300,000	3,240,000	3,050,000
Germany, West	2,475,000	2,507,351	2,267,522
Holland	770,000	849,715	772,448
Ireland	156,000	196,557	174,306
Italy	945,000	1,155,556	1,316,665
United Kingdom	870,000	1,070,278	984,926
Total EEC	*9,612,000*	*10,192,013*	*9,599,867*
Austria	354,000	371,000	406,812
Finland	78,000	82,789	93,170
Greece	172,000	161,927	131,470
Spain	620,000	805,556	818,317
Sweden	317,000	270,000	299,000
Switzerland	75,000	79,526	68,424
Turkey	955,000	752,330	829,400
Yugoslavia	600,000	468,751	395,377
Total West Europe	*12,783,000*	*13,183,892*	*12,641,837*
Albania	19,000	19,000	19,000
Bulgaria	200,000	240,000	200,000
Czechoslovakia	765,000	730,000	770,000
Germany, East	520,000	560,000	650,828
Hungary	340,000	326,022	336,966
Poland	1,717,000	1,817,114	1,826,000
Rumania	600,000	580,000	610,000
USSR	9,500,000	9,680,000	8,500,000
Total East Europe	*13,661,000*	*13,952,136*	*12,912,794*
Total Europe	26,444,000	27,136,028	25,554,631
OTHER CONTINENTS			
Afghanistan	5,500	4,880	5,100
Algeria	26,000	25,000	20,000
Azores	8,500	8,000	8,000
Canada	120,000	119,300	127,612
Chile	211,000	129,557	90,779
China	950,000	900,000	850,000
Iran	598,000	570,000	574,216
Iraq	9,000	10,000	10,000
Israel	25,000	13,300	26,667
Japan	310,000	413,666	418,838
Lebanon	12,000	11,778	24,400
Morocco	289,000	219,800	245,800
Pakistan	10,000	9,800	11,446
Syria	20,000	18,000	35,000
Tunisia	6,500	6,100	5,100
United States	2,722,000	2,903,000	3,268,916
Uruguay	55,000	51,000	44,951
Total Other Continents	5,377,500	5,413,181	5,766,825
TOTAL BEET SUGAR	31,821,500	32,549,209	31,321,456
CANE SUGAR			
EUROPE			
Spain	30,000	28,000	31,140
NORTH & CENTRAL AMERICA			
Belize	82,500	89,550	71,956
Costa Rica	210,000	193,000	174,000
Cuba	6,000,000	5,800,000	5,350,000
Dominican Republic	1,250,000	1,214,137	1,192,980
Guadeloupe	90,000	101,000	126,751
Guatemala	343,000	325,000	269,888
Haiti	70,000	69,410	67,596
Honduras	85,000	81,143	68,543
Martinique	20,000	23,000	22,000
Mexico	2,950,000	2,837,372	2,820,873
Nicaragua	170,000	161,861	147,287
Panama	130,000	120,960	99,018
Puerto Rico	220,000	231,000	235,189
El Salvador	250,000	230,000	190,164
USA—Mainland	1,500,000	1,283,000	1,470,000
Hawaii	1,050,000	953,713	1,023,800
West Indies—Barbados*	103,000	111,802	121,735
Jamaica*	400,000	386,000	331,232
St. Kitts*	25,000	23,500	23,896
Trinidad*	180,000	159,520	192,791
Total N. & C. America	15,128,500	14,394,968	13,999,699
SOUTH AMERICA			
Argentina	1,740,000	1,664,686	1,328,959
Bolivia	200,000	189,524	138,604
Brazil	7,500,000	6,933,354	6,162,906
Colombia	850,000	880,000	809,891
Ecuador	305,000	265,000	270,000
Guyana*	400,000	369,778	273,970
Paraguay	78,000	76,286	58,722
Peru	1,029,000	988,000	948,634
Surinam	10,000	8,900	11,415
Uruguay	25,000	23,150	28,276
Venezuela	600,000	561,000	533,111
Total South America	12,737,000	11,959,678	10,564,488
AFRICA			
Angola	80,000	89,000	90,000
Cameroun	26,000	21,333	16,942
Congo (Brazzaville)	40,000	40,000	39,957
Egypt	623,000	695,471	590,000
Ethiopia	144,000	134,064	142,000
Ghana	20,000	16,100	12,000
Kenya	160,000	140,000	117,000
Madeira	2,900	2,778	2,264
Malagasy Republic	110,000	106,700	110,162
Malawi	61,000	48,962	34,416
Mali	10,000	10,000	10,000
Mauritius	715,000	760,782	727,410
Mozambique	300,000	400,000	336,000
Nigeria	43,000	38,982	30,277
Réunion	215,000	239,210	251,052
Rhodesia	265,000	248,000	200,000
Somalia	55,000	50,000	50,000
South Africa	2,000,000	1,867,527	2,035,344
Sudan	110,000	100,000	100,000
Swaziland	195,000	172,651	172,916
Tanzania	130,000	118,000	98,000
Uganda	70,000	70,000	125,000
Zaire	65,000	62,400	45,698
Zambia	73,000	64,620	51,119
Total Africa	5,512,900	5,406,580	5,387,557
ASIA			
Afghanistan	4,000	3,380	4,100
Bangla Desh	20,000	25,000	21,439
Burma	100,000	100,000	116,000
China	2,600,000	2,550,000	2,500,000
India, excl. khandsari	4,600,000	4,433,000	4,289,000
Indonesia	1,059,000	936,628	890,000
Iran	80,000	76,244	69,435
Iraq	12,000	12,000	12,000
Japan	245,000	247,000	234,168
Nepal	9,000	9,000	7,175
Pakistan	520,000	542,342	462,868
Philippines	2,670,000	2,488,900	2,303,807
Sri Lanka	20,000	20,930	13,432
Taiwan	784,000	892,066	780,200
Thailand	1,204,000	926,312	823,445
Total Asia	13,927,000	13,262,802	12,527,069
OCEANIA			
Australia	2,900,000	2,593,000	2,893,000
Fiji	320,000	319,000	320,193
Total Oceania	3,220,000	2,912,000	3,213,193
TOTAL CANE SUGAR	50,555,400	47,964,028	45,723,146
TOTAL BEET SUGAR	31,821,500	32,549,209	31,321,456
TOTAL SUGAR PRODUCTION	82,376,900	80,513,237	77,044,602

* tel quel

[1] F.O. Licht, *International Sugar Rpt.*, 1974, **106**, (26), 1–4.

Brevities

British Sugar Corporation by-products marketing.—A wholly-owned subsidiary with the proposed name of British Sugar Allied Products Ltd. is to be formed by the British Sugar Corporation Ltd. It will market selected non-sugar products, concentrating initially on molasses and will also conduct market research on new products based on beet pulp and molasses.

* * *

Erratum.—In our report[1] on the 16th Session of ICUMSA in Turkey this year, the names of the members of the new Credentials Committee were given incorrectly; they should have read J. A. WATSON and M. FAVIELL.

* * *

Indian sugar industry nationalization shelved[2].—It is reported that nationalization of India's sugar industry has been postponed indefinitely. The Government has placed a report on the matter by a 10-member committee before Parliament and has indicated that it will not take the initiative in nationalizing the industry and will instead leave the matter to the States.

* * *

Indonesian and Brazilian orders for Smith-Mirrlees.—Export contracts worth more than £7·5 million have been won by the Smith-Mirrlees sugar machinery division of Tate & Lyle Ltd. The £6·5 million order placed by P. T. Radjawali Musantara includes the first new sugar factory to be built in Indonesia for more than 20 years. It will have a crushing capacity of 3000 t.c.d. and is due to come into operation in two years' time. A recent survey, financed by the World Bank, of the country's sugar industry recommended the establishment of six new growing sites which, if developed, could increase Indonesia's sugar output by 50%[3]. The second Smith-Mirrlees contract, worth £1,100,000 is for the supply of milling plant for Usina Santa Teresinha in Recife, Brazil.

* * *

Czechoslovakian sugar silos for Rumania[4].—Silos of a novel design have been developed in Czechoslovakia and four units of 20,000 tons capacity have been ordered for Rumanian sugar factories. The silos do not have any central tower so that the entire capacity can be used for storage.

* * *

New sugar factory for Egypt.[5]—A new sugar factory is to be built, producing 100,000 tons annually, which will make Egypt self-sufficient in sugar by 1977 when the factory comes into operation, according to the newspaper *Al Akhbar*. The factory, to cost £35,000,000, will be located at the town of Quoss in Upper Egypt. Egyptian consumption is 750,000 tons annually, which requires about 200,000 acres of cane or about 49,000 more than were planted this year.

* * *

Pakistan sugar factory project[6].—The German Kreditanstalt für Wiederaufbau is to conduct a feasibility study on the possible construction of a new sugar factory in the district of Dadu in Pakistan, to have a production capacity of 25,000 tons of sugar per year. The entire project is understood to involve a cost of DM 34 million.

* * *

Dahomey sugar project[7].—Lonrho Ltd. have undertaken a feasibility study and are to manage the new $60 million sugar estate at Save in the central province of Dahomey. Construction work at the 4500-hectare estate is due to begin in October and the first sugar to be produced late in 1976. The eventual target is 40,000 tons a year.

Bagasse paper in India[8].—Sangli Setkari Sahakari Sakhar Karkhana Ltd., with a cooperative sugar factory at Sangli, have decided to erect a new paper factory for the manufacture of 200 tons of newsprint per day.

* * *

East African sugar imports, 1973[9].—Imports of sugar by the three East African countries totalled 131,796 metric tons in 1973 as against 163,187 tons in 1972. Individual country amounts were: Kenya 77,484 tons in 1973 (103,816 tons in 1972), Tanzania 47,218 tons (50,333 tons), and Uganda 7094 tons (9038 tons).

* * *

Sugar refinery possibility in Guyana[10].—The Guyana Government is studying proposals submitted by the German Democratic Republic for the establishment of a sugar refinery. The proposals were first submitted to the Government at the Leipzig Trade Fair when a Guyana delegation attended the international show.

* * *

Swaziland sugar expansion[11].—The Government of Swaziland has decided that the time is appropriate to take the country's sugar industry a step further by establishing a third sugar cane growing and sugar manufacturing unit in the Lowveld area of the country, where a combination of favourable climate, fertile soils and availability of irrigation water offers good prospects for the success of such a venture. The exact location of the project has yet to be decided but the Government has already put in hand the necessary expert investigations.

* * *

Argentina sugar expansion plans[12].—The sugar industry in Argentina aims to increase annual production from 1·5 million tons now to 2·1 million tons by 1980, with exports rising from 0·5 million to one million tons and domestic consumption from 1·0 million to 1·1 million tons. The increased production will be achieved through improved yields, an increase in the planted area and greater efficiency at the sugar mills. A record crop of 17,600,000 metric tons of cane is forecast for 1973/74[13].

* * *

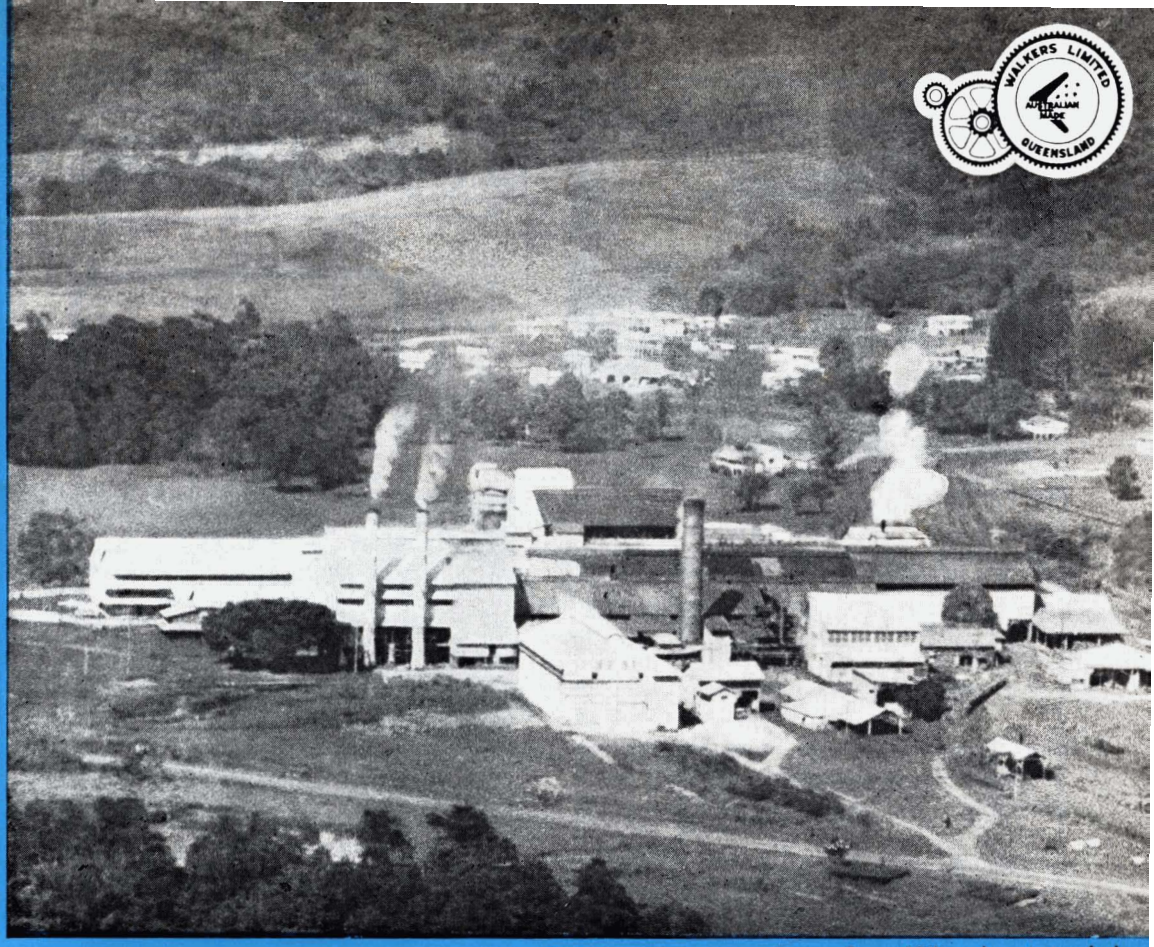
Indonesian sugar factory rehabilitation[14].—It is reported that six factories in East Java are to be expanded with the financial help of the World Bank. The factories concerned are Pesantren, Gempolkerep, Djatiroto, Semboro, Kebonagung and Krebet Baru.

* * *

Yugoslavia sugar production 1973[15].—According to official statistics, sugar production in 1973 reached 424,000 metric tons.

---

[1] *I.S.J.*, 1974, **76**, 259–260.
[2] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (25), 7.
[3] *The Times*, 5th September 1974.
[4] *Czechoslovak Heavy Industry*, 1974, (7), 17.
[5] *Reuters Sugar Rpt.*, 8th May 1974.
[6] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (18), 10.
[7] *Commonwealth Producer*, 1974, (461), 45.
[8] *N.S.I. News*, 1974, **9**, (4), 5.
[9] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (17), ix.
[10] *Barclays International Review*, July 1974, 42.
[11] *Commonwealth Producer*, 1974, (461), 45.
[12] *Bank of London & S. America Rev.*, 1974, **8**, 411.
[13] *Public Ledger*, 13th July 1974.
[14] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (21), 9.
[15] *Zeitsch. Zuckerind.*, 1974, **99**, 452.



Courtesy of Tully Co-operative Sugar Milling Association Ltd.

TULLY MILL

TULLY NESTLES AT THE FOOT OF MOUNT TYSON ON THE TROPICAL COASTAL STRIP, 959 MILES BY RAIL NORTH FROM QUEENSLAND'S CAPITAL CITY, BRISBANE. AN ABUNDANT AVERAGE RAINFALL OF 178 IN. ENSURES HEAVY CANE CROPS AND IN THE SECOND HALF OF 1970, 699,540 TONS OF CANE WERE MILLED WITH A YIELD OF ONE TON OF 94 N.T. SUGAR FOR 7.39 TONS OF CANE.

BUT WHY ALL THE FUSS ABOUT TULLY?

JUST THIS! TULLY WAS THE LAST COMPLETELY NEW FACTORY IN QUEENSLAND AND IT WAS BUILT IN ITS ENTIRETY BY **WALKERS LTD.** TODAY IT IS A MUCH LARGER FACTORY AND EQUIPMENT FROM **WALKERS** HAS PLAYED AN IMPORTANT PART IN ITS EXPANSION.

FOR A COMPLETE FACTORY OR ANY ITEM OF EQUIPMENT

TRY

WALKERS LIMITED

CONSULTANTS
DESIGNERS
ENGINEERS

MARYBOROUGH QUEENSLAND AUSTRALIA

Index to Advertisers

Printed by JOHN ROBERTS & SONS, Salford, Manchester; and published by the Proprietors THE INTERNATIONAL SUGAR JOURNAL LTD. at 23a Easton Street High Wycombe, Bucks. Entered at the New York Post Office as Second-Class Matter.

PRINTED IN GREAT BRITAIN.